

Heavy metals records offshore Haifa Bay, Israel

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Anthropogenic heavy metals (HMs) discharge into coastal waters from land based sources has risen significantly, especially in industrially developed urbanized bays and estuaries. Flooding events, turbidites, wave action, currents, adsorption/desorption and biological processes influence transport, resuspension and settling of HMs in bays and their eventual transport to the open sea. In marine sediments, anthropogenic HMs are linked to effluent discharge from waste treatment plants, heavy industries and mining operations as well as atmospheric deposition to the sea surface (e.g., power-plant coal burning emissions, dust). Haifa Bay (HB), as a case study of an industrial bay in Israel, has been a hotspot of HMs contamination since the early 20th-century. In this study, we focus on transport of HMs from HB and try to reconstruct its contamination history from short sediment cores. Seven cores were collected along the 60m isobath west of HB and two were collected ca. 50km and 100km NW of HB at 1400m and 1800m bottom depths, respectively. Core samples were dated by ²¹⁰Pb (CRS age model) and analyzed for particle size distribution and organic matter content. Total content of selected depth horizons and the labile fraction (weak acid leach) of all samples were analyzed for major and trace elements concentrations and many for Pb isotopic ratios. Top core concentrations of HMs were very low along the southern part of the 60m isobath, while further north, concentrations were semi-constant with several enrichment and depletion peaks. Fluxes of HMs revealed similar trends for Zn and Pb in each core, but rates varied between cores at common depths. Positive correlations observed between major elements and anthropogenic HMs are linked to terrestrial contamination sources. Lead isotope ratios for the deep core samples are mostly affected by atmospheric deposition. In shallower cores, Pb isotope ratios are of natural terrigenous source with slight deviation towards a mixing line of Israeli petrol sources. The significant variations in HMs profiles are associated with both anthropogenic and natural activities around HB in recent history. These events include the Aswan Dam inauguration, construction and expansion of Haifa-Port and breakwater, and annual rainfall transition between flooding and dry-years.