



Analysis of heavy metals, carbon and nitrogen in anthropogenically influenced sediments in the Stockholm Inner Archipelago

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Industrialisation and human activities during the previous century has increased the emission of heavy metals and nutrients like nitrogen and carbon into the environment. The metals enter terrestrial and aquatic environments through several pathways, like atmospheric deposition and point as well as nonpoint source release to surface water. The stable isotopes of carbon and nitrogen can be used when tracing sources of carbon and nitrogen in sediment and water.

In this study, sediment samples were taken in the water near (site 1), downstream (site 2) and upstream (site 3, 4 and 5) of the outflow of the treated waste water from a waste work near Stockholm, Sweden. A gravity corer was used for sampling. The sediment was cut into centimetre slices, freeze-dried and digested in a microwave oven in the presence of nitric acid, and analysed for metals with ICP-AES, Varian Vista AX. Subsamples were analyzed for the total content and isotopic composition of carbon and nitrogen using a Carlo Erba NC2500 element analyzer coupled to a Finnigan Delta Plus mass spectrometer.

Enrichment factors (EF) for each metal have been calculated with Al as a conservative element, and deeper sediment from the area as baseline. At the depth of 2 cm the EF of Cr, Cu, Ni, Pb, V, and Zn at site 1 are: 3, 5.4, 2.1, 6.7, 2.2, 8.6; Site 2: 1.2, 3, 0.8, 5.3, 1, 3.8; Site 3: 1.3, 2.6, 0.6, 4.7, 1.2, 2.1; Site 4: 1.7, 4.5, 0.8, 33, 1, 5.2; and Site 5: 4.6, 11, 1.3, 22, 1.3, 10. At the same depth, the isotopic signal of carbon and nitrogen, $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$, (per mil) at site 1 are: -23, 17; Site 2: -26, 8.3; Site 3: -24, 6.4; Site 4: -25, 7.4; and Site 5: -26, 8.7.

With regards to the carbon and nitrogen content in the sediment, site 1 is influenced by the waste work. The sediment at site 1 has also increased EF values of Cr, Cu, Ni, V, and Zn compared to sites 2, 3, and 4. However, the importance of the waste work at site 1 is subject to further investigations since even site 5 shows elevated EF values for some elements.