Fe-OC aggregates from headwaters to the estuary: The story of Fe-isotopes

SARAH CONRAD[1*] & JOHAN INGRI[1]

[1]Luleå Univ. of Technology, Department of Civil, Environmental and Natural Resources Engineering, Division of Geosciences and Environmental Engineering, SE 97187 Luleå, Sweden, (*correspondence: sarah.conrad@ltu.se) / johan.ingri@ltu.se)

Recent findings show that Fe plays a significant role in stabilizing organic matter in costal sediments. Studies of terrestrial Fe-OC aggregates can shed light not only on mechanisms of carbon and Fe cycling, but also how these aggregates influences trace metal and P cycling in coastal sediments. We have studied Fe-isotope signatures in suspended particles (> 0.22 μm) in the Råne Estuary in the northern Baltic Sea (Sweden). Suspended particles in the estuary show a heavy isotope signature during winter (0.064 ‰), whereas spring flood values are lighter (-0.048 ‰). In summer the particles are enriched in the heavy istopes (0.350 ‰). In the northern Baltic Sea the suspended particles have a heavier ∂^{56}Fe signature than in the Råne Estuary (up to 0.671 ‰).

Two groups of Fe aggregates, with different Fe-isotope signatures, are formed in the boreal landscape. Hence, temporal variations in the suspended Fe-isotope signature in organic rich rivers and estuaries can be explained by a mixture of two end-members, pure Fe(III)-oxyhydroixides and co-precipitated Fe(II,III)-OC aggregates. Co-precipitated Fe(II,III)-OC aggregates show a light Fe-isotope signature and Fe-oxyhydroxides show heavy Fe-isotope signatures. The light signal disappears rapidly due to salt-induced flocculation towards the open Baltic Sea.

This study suggests that ∂^{56}Fe can be used as a tool to trace and characterize Fe-OC aggregates during transport from soil, via headwater streams and rivers, along the estuary, to coastal sediments.