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Distinct iron isotope signatures in suspended matter in the northern Baltic Sea; implications for cycling of organic carbon and phosphorus

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Two distinct groups of iron isotope signatures can be identified both in river water and in the Bothnian Bay, northern Baltic Sea. Particles and colloids with negative iron isotope signatures (enriched in the light isotope) are mobilised in the riparian zone during high discharge. Due to high concentration of DOC the oxidation of Fe(II) is incomplete, and un-oxidised Fe(II) is associated with Fe(III)-OH and OC (organic carbon), forming Fe(II,III)-OC colloids, and particles, with a negative iron isotope signature. Colloidal iron with a negative signature is a labile fraction that transforms during freshwater transport. Photo reduction of Fe(II,III)-OC particles and colloids will release Fe(II) and reduce Fe(III) to Fe(II), and formed Fe(II) is oxidised forming Fe(III)-OH colloids with a heavy iron isotope signature. Phosphorus and organic carbon are to different extent associated to these two suspended iron complexes during transport and early diagenesis. Flocculation of negative Fe(II,III)-OC colloids produce negative Fe(II,III)–OC particles, without changes in the isotopic composition. Most of the suspended iron is rapidly removed below 1.0 psu, due to flocculation and sedimentation. Negative Fe(II,III)-OC particles may serve as an efficient ‘rusty sink’ for organic carbon, when deposited in the coastal zone.