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Linking carbon and iron cycles by investigating transport, fate and mineralogy of iron-bearing colloids from peat-draining rivers - Scotland as model for high-latitude rivers

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The biogeochemical iron cycle exerts significant control on the carbon cycle[1]. Iron is a limiting nutrient in large areas of the world's oceans and its bioavailability controls CO_2 uptake by marine photosynthesizing microorganisms. While atmospheric iron inputs to the open ocean have been extensively measured, global river inputs have likely been underestimated because most major world rivers exhibit extensive iron removal by flocculation and sedimentation during seawater mixing. Iron minerals and organic matter mutually stabilise each other[2], which results in a 'rusty carbon sink' in sediments[3] on the one hand but may also enhance transport beyond the salinity gradient on the other. Humic-rich, high latitude rivers have a higher iron-carrying capacity[4-6] but are underrepresented in iron flux calculations.

The West Coast sea lochs in Scotland are fed by predominantly peatland drainage catchments, and the rivers entering the sea lochs carry a high load of organic matter. The short distance between many of these catchments and the coastal ocean facilitates source-to-sea research investigating transport, fate and mineralogy of iron-bearing colloids providing a good analogue for similar high latitude fjordic systems.

We use SeaFAST+ICP-MS and Mössbauer spectroscopy to survey trace metal concentrations, with emphasis on iron concentrations, speciation and mineralogy, across salinity gradients. In combination with ultra-filtration techniques, this allows determination of the concentrations and chemical composition of different size fractions of iron-organic matter particles and colloids. We are developing new filtering and enrichment protocols to enable the use of Mössbauer spectroscopy in order to close a gap in the understanding of iron mineralogy in sub-micron particles. Here we will present results from a first sampling campaign in Loch Sunart and its tributaries.

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