The formation and transport of iron in the Lena River: Insights from microscopy and modelling.

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Boreal rivers are crucial when seeking to understand the transport of iron into the Arctic Ocean. Previous studies of boreal river systems shows iron to be hosted in: *i)* complexes with soil organic matter, iron-organic colloids, *ii)* inorganic particles-colloids, (oxy) hydroxides, *iii)* truly dissolved (<1 kDa) iron-organic complexes.

Transmission Electron Microscopy (TEM) was used to analyse the particulate (>0.22 μm) and colloidal (<0.22 μm) phases in the Lena River system in NE Russia. Samples were collected from major tributaries and the main channel in July 2012 and June 2013, following the spring flood. TEM observations were supported by geochemical analysis of the bulk particulate, colloidal and dissolved fraction. The particulate fraction was leached to separate the identified iron phase and results were compared with Visual MINTEQ modelling.

For all samples our data show that >55% of iron occurs in the particulate fraction. In contrast the >50% of DOC occurs in the truly dissolved (<1 kDa) fraction. The particulate and colloidal iron is mainly present in the form of ferrihydrite and not observed to be complexed with DOC. This is contrary to observations in other boreal rivers. In tributaries draining the Verkhoyansk Moutain Range, and South Aldan Shield, which are areas with low DOC concentrations, the particulate ferrihydrite associates with aluminosilicates. Whereas, in tributaries draining the Central Siberain Plateau which is dominated by wetlands, forest and high DOC, particulate ferrihydrite associates with autochthonous organic matter. Evidence from leaching and modelling shows that tributaries drainng the Central Siberian Plateau, contain the highest proportion of ferrihydrite. We propose that ferrihydrite has two main origins in the Lena River catchment area: abiotic precipitation in tributaries draining mountainous terrain and biologically mediated precipitation in tributaries draining the low lying wetlands and forest.