Effect of decreasing sulphate concentrations on iron mobility in soils

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In the last couple of decades a strong increase in surface water iron (Fe) concentrations has been observed in Northern Europe. Since organic soils are a major source of Fe to surface waters it is important to understand what governs iron mobility in soils. Reduction of Fe(III) and sulphate (SO_4^{2-}) produces FeS that precipitate from solution, which would reduce Fe mobility. It has therefore been proposed that declining atmospheric sulphate deposition is a factor behind increasing Fe mobilization from soils. The present study tested this hypothesis in a microcosm experiment, where soil slurries were exposed to two different concentrations of SO_4^{2-} and monitored for Fe, dissolved organic matter (DOC) and water chemistry at oxic and anoxic conditions over 83 days. Contrary to expectations Fe concentrations were higher in high SO_4^{2-} treatments and there were no indications of SO_4^{2-} reduction. In the absence of FeS precipitation, the difference in pH between SO_4^{2-} treatments was likely the most influential factor, with Fe being more soluble at low pH. Interestingly fungal growth in oxic treatments caused a sharp increase in Fe concentration, which could have been due to active Fe reduction by fungi through Fenton reactions. In all this study does not support that reduced atmospheric sulphate deposition is a major driver behind the observed increase in surface water iron concentrations.