Varved sediments as records of past changes in Fe dynamics?

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A handful of recent studies report on strong increases in iron (Fe) concentrations in freshwaters in northern Europe. As an essential micronutrient Fe is tightly connected to the biogeochemical cycling of C, N and P in aquatic ecosystems. Hence, understanding the drivers behind these trends is of major importance. We hypothesized that Fe is increasing due to lakes becoming less efficient as Fe sinks. The ongoing climate change with increasing precipitation has resulted in faster flushing rates through lakes, and potentially a reduced sedimentation rate of Fe. Moreover, Fe forms stable precipitates with sulfides during reducing conditions. Hence, the declining S deposition may have resulted in less Fe binding in sulfides in sediments today than during peak S deposition.

We expected that the impact of climate and atmospheric S deposition on Fe dynamics in lakes would be preserved in the lake sediment. We analysed Fe abundance (ICP-MS and μXRF) and speciation (x-ray absorption spectroscopy) in varved lake sediments in order to establish Fe accumulation mechanisms and rates. By correlating Fe speciation to past changes in hydrological flushing rates and S deposition we have addressed the question whether Fe is increasing due to lakes becoming less efficient as Fe sinks.