In situ experiments on the dissolved and colloidal state of iron in an acid bog lake[1]

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Abstract

A sampler and an analytical and characterization scheme were developed to investigate the chemical and physical state of iron in a highly stained acid bog lake (North Gate Lake). Iron fractions were chemically separated by reactivity to bathophenanthroline (BPN) after specific digestion procedures. Physical separation by anaerobic in situ filtration (450 nm) and in situ dialysis (4.8 nm) resulted in three size classes: particulate, colloidal, and dissolved.

Inorganic, nonreactive species of iron [e.g. $Fe(OH)_3$] represent minor amounts of the total iron in North Gate Lake, in contrast to lakes of pH 6–8. In situ radiochemical analyses revealed that colloidal reactive ferric iron predominates in the oxygenated epilimnion, while dialyzable or dissolved ferrous iron increases with depth. Unlike iron, organic matter is present in a nontransient colloidal state. In acid (pH 4–5) bog lakes ferric iron may be colloidal not as an inorganic complex (OH^-) but as reactive Fe^{3+} by complexation with the colloidal organic acids.

After thermally induced mixing with anaerobic waters, ferric iron is reduced and dissolved; however some of the BPN reactive iron remains colloidal, suggesting the presence of a residual ferrous organic complex.