

The influence of colloidal organic matter on iron and iron-phosphorus cycling in an acid bog lake¹

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Abstract

The relationship between iron and phosphorus and the relationship of these elements to colloidal organic matter (COM) was studied in a meromictic acid bog lake by chemical characterization, filtration and in situ dialysis, and in situ experiments with labeled components.

Bathophenanthroline (BPN) reactive ferrous iron existed in true solution (dialyzable) in constantly anaerobic monimolimnetic water; in the aerobic epilimnion reactive ferric iron was of colloidal size. Intermediate depths, oxygenated only during spring, contained two forms of ferrous iron reactive to BPN: dialyzable ferrous iron (Fe^{2+}) and colloidal Fe(II) which may have originated through in situ reduction of colloidal reactive ferric iron and may be present as a COM- Fe^{2+} complex.

The amount of COM influenced the fate of dialyzable Fe^{2+} (92% of total iron) and dialyzable $\text{PO}_4\text{-P}$ (85% of total phosphorus) present in anaerobic strata before aeration. Aeration with soluble organic matter present (COM absent) resulted in the formation of colloidal nonreactive ferric iron (84% of total iron) and 65% colloidal $\text{PO}_4\text{-P}$, while aeration with 26 mg liter⁻¹ COM resulted in only 36% colloidal, nonreactive ferric iron and 19% colloidal $\text{PO}_4\text{-P}$. COM apparently masks the cationic properties of colloidal ferric iron and retards the formation of nonreactive Fe(III), allowing most of the $\text{PO}_4\text{-P}$ to remain free in solution and biologically available.