

Phosphorus burial in vivianite in three boreal lake sediments in Finland

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Permanent phosphorus (P) burial as the ferrous iron (Fe(II))-P mineral vivianite in lake sediments has been a recent research theme among studies into lacustrine nutrient dynamics [1, 2]. Vivianite formation in eutrophic lakes may play an important role in reducing internal P loading [3]. However the conditions controlling vivianite formation are not well constrained, since porewater supersaturation alone does not guarantee the presence of vivianite [4].

In this study we investigate the prevalence of natural vivianite formation in three contrasting lakes in SW Finland. The lakes (Köyliönjärvi, Pyhäjärvi and Vähäjärvi) are generally shallow with the deepest basins of 13 m, 26 m and 3 m, respectively. Each lake has clayey and sandy catchment soils and the area comprises intensive agriculture and forestry. However Lake Köyliönjärvi and Lake Pyhäjärvi are eutrophic while Lake Vähäjärvi is oligotrophic, leading to potentially contrasting sediment biogeochemical dynamics. Sediment profiles (0-30 cm) were sampled by taking one core from the deepest basin with HTH/Kajak and slicing *in situ* at 1 cm resolution for bulk geochemical analysis and P speciation. Porewaters were extracted by RhizonsTM for analysis of P, dissolved metals and ammonium. An additional core of undisturbed sediments was taken for micro-XRF analysis.

First results of the micro-XRF analysis show indications of vivianite formation in the sediments of the eutrophic lakes Köyliönjärvi and Pyhäjärvi. For example, clusters of Fe, manganese (Mn), and P are co-located at a depth of 27-30 cm of Lake Pyhäjärvi sediment (Fig. 1), resembling previous observations of manganous vivianite in boreal lakes [2]. Moreover, porewater data confirm supersaturation with vivianite at this depth. The results to date suggest that vivianite plays an important role in P burial in the sediments of agriculturally eutrophied lakes in this area.

Figure 1. 2D map of micro-XRF analysis of Fe, Mn, and P in the sediment of Lake Pyhäjärvi. Brighter colors show higher concentration.

References

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