No effect of hypolimnetic aeration on the P cycling of Lake Sempach: A re-evaluation of a well-accepted concept

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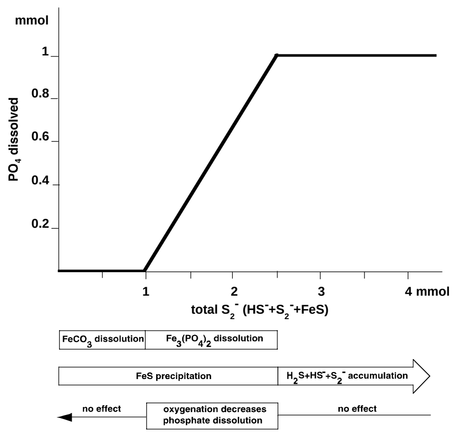
To lower the trophic state of Lake Sempach, a eutrophic lake in Central Switzerland, its external phosphorus (P) load has been decreased and its hypolimnion has been aerated. Based on more than fifteen years of experience we conclude that the reduction of the external P-load resulted in a corresponding decrease of the lake's P concentration. However, contrary to our initial expectations, increased hypolimnetic dissolved oxygen (D.O.) concentrations

1. did not affect the P release from sediments during summer, and
2. did not result in an increased permanent P-retention.

These observations warrant a re-evaluation of the well-accepted management strategy of decreasing the lake internal P cycling by maintaining an aerobic hypolimnion and sediment surface:

1. We show that irrespective of permanent oxic conditions in the hypolimnion the sediment/water interface remained anoxic during summer, due to continued high sedimentation rates of organic matter. This explains why oxygenation did not affect the temporal P release from the sediment.
2. We discuss how the Fe:P ratio of the settling seston may affect the permanent P retention as a result of oxygenation.



References

Gächter R. and Wehrli. B. (1998), Environ. Sci. Technol. **32**: 3659-3665

Fungal influence on mineral dissolution and metal mobility: mechanisms and biogeochemical relevance

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In the terrestrial environment, fungi are of importance as decomposer organisms and plant symbionts (mycorrhizas), playing important roles in carbon and other biogeochemical cycles. Fungi can interact with metals and minerals in various ways depending on the metal/mineral species, organisms and environment, while metabolic activities can also influence metal speciation and mobility. Such interactions between fungi and minerals are of fundamental importance to biogeochemical cycles including those of C, N, S and P which are important elements required for plant, fungal and other microbial growth. Certain mechanisms may mobilize metals into forms available for cellular uptake and leaching from the system, e.g. complexation with organic acids, other metabolites and siderophores. Metals may also be immobilized by, e.g. sorption onto cell components, exopolymers, transport and intra- and extracellular sequestration or precipitation. Because of these properties, fungi can promote rock weathering and contribute to the dissolution of mineral aggregates in soil through the excretion of H^+, organic acids and other ligands. They may also play an active or passive role in mineral formation through the nucleation of crystalline material onto cell walls, resulting in the formation of biogenic micro-fabrics in mineral substrates. The relative importance of such apparently opposing phenomena of solubilization and immobilization are key components of biogeochemical cycles for toxic metals, whether indigenous or introduced into a specific location, and fundamental determinants of fungal growth, physiology and morphogenesis. Furthermore, some processes are of relevance to environmental bioremediation. This contribution seeks to highlight selected physico-chemical and biochemical mechanisms by which fungi can interact with minerals and transform potentially toxic metal species between soluble and insoluble forms, and to draw attention to the biogeochemical significance of these processes.