



Evidence of authigenic vivianite formation in a recent lake sediment due to an iron amendment

Matthias Rothe (1), Thomas Frederichs (2), Michaela Eder (3), Andreas Kleeberg (1,4), and Michael Hupfer (1)
(1) Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), Berlin, Germany, (rothe@igb-berlin.de), (2) Department of Geosciences, University of Bremen, Bremen, Germany, (3) Department of Biomaterials, Max Planck Institute of Colloids and Interfaces, Potsdam, Germany, (4) present adress: State Laboratory Berlin Brandenburg, Germany

Pore water chemistry and equilibrium calculations indicated supersaturation of the ferrous iron phosphate mineral vivianite throughout the upper 30 cm of the iron-rich lake sediments of dimictic lake Groß-Glienicker See, Berlin (Germany). Phosphorus (P) bound in the crystal lattice of the mineral is supposed to be immobilized since vivianite is stable under anoxic, reducing sedimentary conditions. Thus, vivianite formation can be an important process contributing to P retention during early diagenesis. Application of a heavy-liquid separation enabled to identify vivianite by means of X-ray diffraction. Electron micrographs showed spherical nodules consisting of platy- and needle-shaped crystal aggregates with diameters between 50 and 120 μm . Inclusions of diatom shells and other organic debris confirmed the authigenic origin of the dark blue coloured nodules. Vivianite deposits were restricted to the upper 22 cm of the sediment although supersaturation even increased in subjacent pore waters. The high enrichment of vivianite aggregates after sediment preparation combined with magnetic hysteresis measurements allowed to assess the significance of vivianite formation for P burial in aquatic systems. From our results we conclude that vivianite formation was triggered by an artificial iron amendment more than 20 years ago that aimed at reducing the P content of the lake's water body. Furthermore, our results indicate that vivianite formation is located closely beneath the sediment-water interface and that equilibrium calculations, i.e. supersaturated pore water, alone cannot serve as a reliable predictor for the in situ formation of vivianite.