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Assessing the potential of iron-containing byproducts from water purification in the prevention of phosphorus release from lake sediments.

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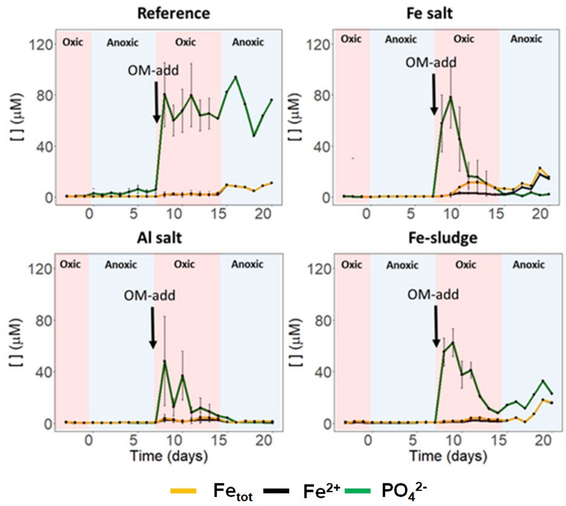

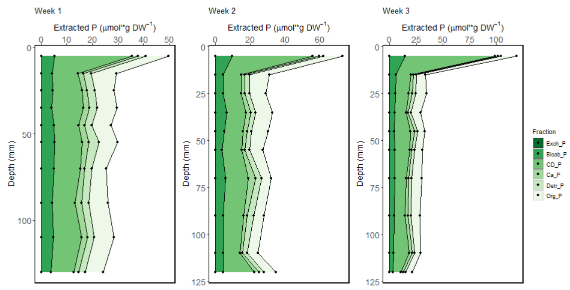

The large-scale use of phosphorus fertilizers in agriculture has resulted in an abundance of phosphorus in aquatic systems. For surface waters this has resulted in increased phosphorus concentrations and a lower water quality. Many European lakes now suffer from harmful algae blooms in the spring and summer. Improving the ecological status of surface waters according to the European Water Framework Directive requires to decrease the phosphorus loading in lakes. However, often the reduction of external phosphorus sources alone is not enough. Internal measures will be required to reach management goals. Conventionally, lake restoration measures are performed using iron or aluminum salts. Although effective, these salts potentially cause problems in weakly buffered lakes. In this study we investigate and compare the efficacy of iron precipitates formed during drinking water purification, in preventing sedimentary phosphorus release.

Sediment was taken from the deep lake *Kleiner Brombachsee* near Nuremburg, Germany. The sediment was mixed and incubated with an amendment of $Al_2(SO_4)_2 \cdot 12\ H_2O$, $Fe(II)Cl_2 \cdot 4\ H_2O$ and an iron-containing byproduct at 70 $g{*}m^{-2}$. The sediment cores were subsequently exposed to weekly oscillating redox conditions. Each day samples were taken from the overlying water. The sediment was analyzed using microsensors and cores were sacrificed, sliced, and subjected to sequential extraction. All three treatments were able to prevent P-release from the sediment. However, upon addition of organic matter and under anaerobic conditions, we found that the iron-containing byproduct was less capable than iron and aluminum salts to prevent P-release from the sediment. Sequential extraction indicates that binding of phosphorus in the sediment was more effective in treatments with iron salts. The nature of the iron species associated with phosphorus immobilization in the sediments should be investigated further.

Although the iron-containing byproduct was slightly less effective than the salts in immobilizing phosphorus, multiple advantages were found: 1) pH and oxygen reduction potential of the overlying water and sediment was not altered and 2) H_2S build-up at the sediment-water-interface was reduced compared to reference and aluminum treated cores. Iron sludge can be an interesting alternative to conventional salts treatments, especially for pH sensitive lake systems.