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Investigating phosphorus uptake in anoxic and sulfidic surface sediments with 33P radiotracer experiments

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Phosphorus (P) is a key nutrient for marine organisms. Enhanced P availability in the water column can fuel algal blooms and the development of bottom water anoxia. Recently, it was suggested that micro-organisms in sediments overlain by anoxic and sulfidic bottom waters might take up dissolved P and form Fe(II)-P minerals, thereby enhancing P removal.

In this study, we investigated the uptake of P in surface sediments with 33P radiotracer experiments. The sediments were recovered from the anoxic and sulfidic deep basin of the Black Sea and, for comparison, from the adjacent oxic shelf. Results suggest a very fast sedimentary uptake of 33P at all sites but in particular for sediments from the oxic shelf. At all sites, most 33P was sequestered in the citrate-dithionite-bicarbonate-(CDB)-extractable sediment P fraction. No significant differences with abiotic controls were observed, implying that micro-organisms were not directly involved in the P uptake. Whereas 33P uptake by the oxic shelf sediment was likely controlled by sorption of 33P to iron(Fe)-(oxyhydr)oxides, the nature of the CDB-extractable P fraction in the deep basin sediments remains unclear. We discuss whether authigenic formation of Fe(II)-P minerals or fast adsorption of P to calcites may explain our findings.