Impact of natural reoxygenation on the sediment geochemistry in a euxinic Baltic Sea basin

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The Baltic Sea is characterized by the world's largest human-induced anoxic and sulfidic (euxinic) water mass. Natural ventilation of the deep euxinic basins in the Baltic Sea solely depends on large-scale episodic inflow events from the North Sea. Such events occurred in 2014 and 2015 when substantial amounts of saline and oxygen-rich water entered the Baltic Sea. Water column records from monthly monitoring indicate that this resulted in the reoxygenation of the deep euxinic waters of the Eastern Gotland Basin from March 2015 onwards and a major decline in water column phosphate.

In this study, we assess what proportion of the change in water column phosphate can be explained by sequestration in the sediment. We present geochemical data for the porewater and sediment at six sites along a water depth gradient in the Eastern Gotland Basin collected in June 2016. At the time of sampling, oxic bottom waters were only observed at the four deepest sites. Here, our data indicate a penetration of oxygen into the sediment of less than 2 mm and enrichments in Fe-oxyhydroxides and associated phosphorus in the surface sediments.

However, the increase in Fe-bound phosphorus due to reoxygenation of the basin cannot explain the observed decline in water column phosphate. We discuss the factors controlling sediment phosphorus sequestration upon bottom water reoxygenation and the fate of the phosphate in the water column of the Eastern Gotland Basin following North Sea inflows. We also discuss the implications of our findings for geoengineering projects that aim at adding oxygen to the bottom waters in the euxinic basins of the Baltic Sea.