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Phosphorus cycling and carbon burial in low-oxygen marine settings: Insights from modern basins

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Variations in marine phosphorus (P) cycling are known to strongly affect the marine carbon and oxygen cycles on various time scales. Here, we show in detail what can be learnt from recent field and modeling studies of phosphorus cycling in organic-rich sediments formed under anoxic bottom waters in the Baltic and Mediterranean Seas. We specifically discuss the mechanisms of recycling and burial of phosphorus in the sediment and the processes contributing to the formation of organic-rich layers.

Our results indicate that organic P is the major sink for reactive P in sediments under anoxic bottom waters in both systems – despite enhanced regeneration of P from organic matter. In the Baltic, there is also evidence for permanent sequestration of P in inorganic minerals in some of the deepest areas. Results of reactive transport modeling highlight the time-dependence of the benthic release and burial of P and the burial of organic carbon upon transition into and out of bottomwater anoxia. Release of P from Fe-oxides is quantitatively most important in the initial stages of anoxia. Model results also show that both enhanced primary productivity and enhanced preservation of organic matter under anoxia contributed to the formation of the organic-rich layers in the Baltic and Mediteranean.