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Sedimentary trace metals: improving proxies for deoxygenation in coastal European seas

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Deoxygenation in response to eutrophication and climate change in coastal systems is increasing worldwide. Low oxygen conditions cause the chemical transformation of redox-sensitive trace metals (e.g. molybdenum and uranium) in seawater, and their subsequent transport to the sediment. Sedimentary trace metal contents can therefore be used as a record of changes in bottom water oxygen conditions allowing the history of deoxygenation to be reconstructed. However, most trace metal studies have focused on strongly reducing and sulfidic settings, leaving mildly reducing and oxygenated (but eutrophic) settings vastly understudied. Currently, it is unknown to what extent existing trace metal redox proxies are applicable to reconstruct oxygen conditions in coastal zones experiencing mild deoxygenation, despite the fact that such areas occupy vast stretches of the coastal oceans. Here, we study trace metal enrichments in 13 European coastal marine sites with varying bottom water redox conditions and depositional environments. Our data demonstrates that sedimentary molybdenum and uranium contents are sensitive to deoxygenation across a range of settings, although the mechanisms of enrichment may vary. Improved understanding of molybdenum and uranium dynamics in mildly reducing coastal settings will facilitate the development of reliable and widely applicable molybdenum and uranium-based redox proxies.