Molybdenum dynamics in sediments of a seasonally hypoxic coastal marine basin

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Molybdenum (Mo) enrichments in marine sediments are a common indicator of the presence of sulfide near the sediment-water interface and can thereby record historic bottom-water oxygen depletion.

Here, we assess the impact of temporal changes in manganese (Mn) cycling and bottom-water oxygen on sedimentary Mo dynamics in a seasonally hypoxic coastal marine basin (Lake Grevelingen, the Netherlands). High resolution line scans obtained with LA-ICP-MS and discrete sample analyses reveal distinct oscillations in Mo with depth in the sediment. These oscillations and high sediment Mo concentrations (up to ~130 ppm) are attributed to deposition of Mo-bearing Mn-oxide-rich particles from the overlying water, the release of molybdate (MoO_4^{2-}) to the pore water upon reduction of these Mn-oxides, and subsequent sequestration of Mo. We show that the latter process only occurs in summer at sites where sulfide concentrations near the sediment-water interface are elevated.

Cable bacteria have previously been demonstrated to be present at our study sites in winter and spring and to strongly impact the cycling of iron (Fe), sulfur (S) and manganese (Mn) in the sediment [1, 2]. We suggest that cable bacteria can enhance the seasonality in sediment Mo records by contributing to remobilization of Mo as MoO_4^{2-} during oxic periods and by enhancing the pool of Mn-oxides in the water column and surface sediment by dissolving Mn-carbonates. The broader implications of our findings for other marine systems will be discussed.

[1] Seitaj et al. (2015) *Proceedings of the National Academy of Sciences of the United States of America* 112, 13278-13283. [2] Sulu-Gambari et al. (2016) *Geochimica et Cosmochimica Acta* 192, 49-69.