

Controls on $\delta^{98}\text{Mo}$ in modern ferruginous and euxinic sediments and porewaters

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The molybdenum isotope signature ($\delta^{98}\text{Mo}$) of sediments and sedimentary rocks have been used to elucidate modern and past redox conditions, respectively. The difference between molybdenum sequestration mechanisms in euxinic and ferruginous environments imparts different sedimentary $\delta^{98}\text{Mo}$ and Mo concentrations. At present however, we have an incomplete understanding of the processes that generate these isotopic signals in different redox environments. East Anglian salt marsh pond sediments contain ferruginous and euxinic geochemical conditions that can be spatially separated by less than 10 m. We present a dataset comprising the sedimentary pore fluid and bulk digested solid Mo concentration and $\delta^{98}\text{Mo}$ in both environments. Our results demonstrate that porewater $\delta^{98}\text{Mo}$ varies from -0.5 to 3.0‰ and sediment $\delta^{98}\text{Mo}$ varies from 0.9 to 2‰ in euxinic ponds. This is despite similar concentrations of aqueous sulfide ($0.5\text{--}2.0$ mM) well in excess of the 11 μM switchpoint required for quantitative tetrathiomolybdate formation. We suggest Mo adsorbed to iron oxides in the salt marsh sediment can be released during reductive dissolution by sulfide under euxinic conditions. This process could produce sediment and porewater $\delta^{98}\text{Mo}$ lower than the seawater source. The large variability of $\delta^{98}\text{Mo}$ in these sediments has implications for the viability of using $\delta^{98}\text{Mo}$ to trace euxinic conditions in the geological record.