

Can oxygen isotopes in sulphate be used to track the extent of euxinia in ancient oceans? – Insights from modern euxinic systems.

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Marine sulphate oxygen isotope records from the Cenozoic have been interpreted to reflect changes in the aerial distribution of organic-rich sediments and are linked with differences in patterns of oxidative sulphur cycling in organic-rich versus organic-poor sedimentary environments. Euxinic depositional environments, which were likely more common in earlier time periods, may also impact oxygen isotopes in marine sulphate. Specifically, the presence of sulphide in the water column has the potential to drive patterns of oxidative sulphur cycling that are distinct from patterns in systems where sulphide production is restricted to the sediment. Here, we aim to assess what is the effect of the expansion of euxinia in the marine realm on oxygen isotopes in marine sulphate. We present coupled sulphate oxygen and sulphur isotope data from modern euxinic systems with varying sulphate concentrations and use the data to evaluate the relative impact of sulphate reduction versus sulphide oxidation on the oxygen isotope composition of sulphate. We apply the results in a simple box model to explore how the expansion of euxinia in ancient oceans affects the oxygen isotope composition of marine sulphate. Our findings provide insight into patterns of oxidative sulphur cycling in euxinic depositional environments and impacts on oxygen isotope composition of marine sulphate, which will aid in interpretations of marine sulphate oxygen isotope records from ancient oceans.