

Causal or casual link between the rise of nanoplankton calcification and an abrupt tectonically-driven atmospheric CO₂ decline in the Late Triassic?

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On the basis of a global carbon-climate numerical model, we reconstructed atmospheric carbon dioxide concentrations over the first 60 million years of the Mesozoic. Our analysis indicates that PCO₂ declined from more than 3000 ppmv to less than 1000 ppmv, with a drastic drop during the Late Triassic. The fast northward drift of Pangaea exposed a large continental surface to warm and humid equatorial climate, thus promoting CO₂ consumption through weathering. This massive drawdown of atmospheric CO₂ is consistent with sedimentological and geochemical data of the rock record and correlates with the primary radiation of calcareous nanoplankton, a biological revolution shifting the global carbonate sink from shallow water environments to the open oceans. Our numerical model shows that at time, tectonics, via weathering, increased the pH of the oceanic surface waters by 0.3 units, corresponding to a 50 % decrease in H⁺ concentration. This may have provided the ultimate environmental trigger which unlocked the newly oxidized Mesozoic open oceans to pelagic nanobiocalcification.

Towards a mechanistic understanding of Mo isotope fractionations

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Mo isotopes have great potential as a paleoredox indicator, particularly in terms of quantifying the spatial extent of different redox conditions [1, 2]. This arises due to differing isotopic fractionations associated with oxic and anoxic deposition. Compared to seawater, δ⁹⁷Mo is depleted by ~2‰ in oxic sediments, associated with adsorption to ferromanganese oxides [3]. By contrast, sediments deposited under euxinic conditions exhibit little to no fractionation, due to near-complete removal of Mo from solution [2].

Several uncertainties are, however, currently restricting the potential of Mo isotopes as a tool for paleoenvironmental reconstruction. In particular, the isotopic compositions of Mo in depositing minerals and during redox-promoted mineral transformations are poorly constrained. Thus a mechanistic understanding of Mo isotope fractionations during syn- to early-diagenesis is currently lacking.

We have investigated the isotopic fractionation of Mo during different mineral uptake pathways in order to add to the small experimental dataset. Our focus is on fractionations during redox transformations involving iron-based phases, including those upon Mo interaction with Fe oxides and their sulphide-promoted reductive dissolution. This is a key process affecting Mo cycling in the environment. Mo isotope fractionations will be reported for a series of highly-controlled sulfidation experiments. Preliminary results exhibit species dependant fractionations. The findings add to our understanding of Mo isotope fractionations under differing diagenetic conditions and their relation to the currently existing Mo-isotope data for ancient sediments.

[1] Poulson *et al.* (2006) *Geology* **34**, 617-620. [2] Arnold *et al.* (2004) *Science* **304**, 87-90. [3] Siebert *et al.* (2003) *Earth & Planet. Sci. Lett.* **211**, 159-171.