

Belemnite clumped isotope record: Mesozoic seawater T and $\delta^{18}\text{O}$

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Belemnite rostra provide an excellent biological archive for the reconstruction of Jurassic and Cretaceous seawater temperatures and oxygen isotope composition. Well-preserved belemnite rostra are common to find in Mesozoic sediments and it is postulated that belemnites precipitate their inner guard in apparent oxygen isotope equilibrium with ambient seawater.

Here, we present a compilation of published and unpublished clumped isotope measurements performed on >50 belemnite rostra. Specimens were collected from over ten locations that cover high, middle and low paleolatitudes. The age of each specimen was constrained using ammonite biostratigraphy. The investigated rostra were screened for signs of alteration with a combination of trace element analyses, CL, SEM and EBSD. All clumped isotope measurements were performed at the Goethe University, Frankfurt, in at least four replicates.

Lower Cretaceous belemnites collected from the Vocontian Trough, France, exhibit unreasonably high (~40°C) but consistent temperatures that point to solid-state reordering. Ambient seawater temperatures derived from the clumped isotope measurements of well-preserved belemnites range between 15–30°C, while corresponding reconstructed seawater $\delta^{18}\text{O}$ values are between -2–2‰ VSMOW. Our data compliment and improve existing records for the evolution of Jurassic and Cretaceous seawater temperatures, provide estimates for seawater $\delta^{18}\text{O}$ and allow for the reconstruction of latitudinal thermal gradients during the Valanginian.