

Interactive comment on “The effect of precipitation rate on Mg/Ca and Sr/Ca ratios in biogenic calcite as observed in a belemnite rostrum” by Clemens Vinzenz Ullmann

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Many thanks for this review.

Referee 2 critically points out that this study relates to the signals of only one fossil and that these findings are therefore of limited extent.

It is true that the data for this study – even though > 300 ICP-OES analyses were conducted – relate only to a single rostrum. Despite the self-consistent results verified by three profiles compared to a reference profile and tentative support from geochemical profiles measured for other belemnite species it is at present not self-evident that a generalization of these patterns is possible. Given the consistency of the dataset and

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independent support from other lines of carbonate research I am confident, however, that this pattern holds.

I intended this study to be a proof-of-concept, to introduce a biomineralization system which deserves further research and to point out where I see synergies between research on abiogenic and various biogenic calcite archives. I would be delighted to see my initial results reproduced in other belemnite species and – if possible – tested in other biogenic calcite archives as well.

There is one particularly thrilling outcome I see in the presented dataset: If the temperature dependence of the precipitation rate forcing on Mg, Sr and other elements can be constrained more precisely, my approach yields a novel palaeotemperature proxy (section 4.1). This temperature proxy would be independent of seawater chemistry and much more robust against diagenesis and easier to measure than clumped isotopes: Once it is known what the rate forcings on elements like Mg, Sr and Li during coprecipitation with calcite are at various temperatures, one can potentially establish an overconstrained system for the two unknowns, 1) absolute precipitation rate and 2) temperature.

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