

Belemnite Geochemistry from Albstadt-Pfeffingen (Middle Jurassic, Baden-Württemberg, Germany)

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Belemnite calcite is an important source of stable isotope ($\delta^{18}\text{O}$, $\delta^{13}\text{C}$) and element (Fe, Mg, Mn, S, Sr) proxies with potential for high-resolution quantitative reconstructions of palaeoenvironments and seasonality since Urey *et al* (1951). Belemnites are also a very important archive for environmental reconstructions of the early Toarcian; it is important, however, to study their calcite over intervals of comparative environmental stability to assess the meaning of proxy data extracted from their calcite. Here, we report on recent developments on geochemical proxies derived from belemnite rostra from Albstadt-Pfeffingen, a potential GSSP for the base of the Callovian, in Baden-Württemberg.

For this study, 30 belemnite rostra from different beds were examined from the *Keplerites kepleri* biozone of the lowermost Callovian. Multiple samples were extracted from the same rostrum in order to obtain data on temporal variations. Two separate analytical procedures were conducted for this study: firstly for stable isotopes and secondly the trace elements. The samples were analysed using an ICP-OES and ICP-MS, respectively. The samples were screened for diagenetic alteration using El/Ca ratios and cathodoluminescence microscopy. Specimens with Fe/Ca > 1 mmol/mol and Mn/Ca > 4 mmol/mol were omitted from palaeoclimate reconstructions (Fig. 1).

Palaeotemperature estimates derived from $\delta^{18}\text{O}$ measurements imply a warming trend during the earliest Callovian. For many groups of carbonate secreting animals, Mg/Ca ratios have been proposed as potential tracers for seawater temperatures. Belemnite calcite Mg/Ca ratios have been put forward as temperature proxy, but the robustness any belemnite Mg thermometer remains to be tested and its validity has been questioned by various studies (e.g. McArthur *et al*, 2007; Li *et al*, 2013). None of the studied belemnites in the studied section showed a correlation between Mg/Ca and $\delta^{18}\text{O}$ (Fig. 2). The use of Mg/Ca is therefore considered to be an unreliable palaeotemperature indicator for Lower Callovian belemnites.

This is relevant to the TOAE as belemnites from the event often show a correlation between $\delta^{18}\text{O}$ and Mg/Ca, so the relationship between two proxies is still up for debate.

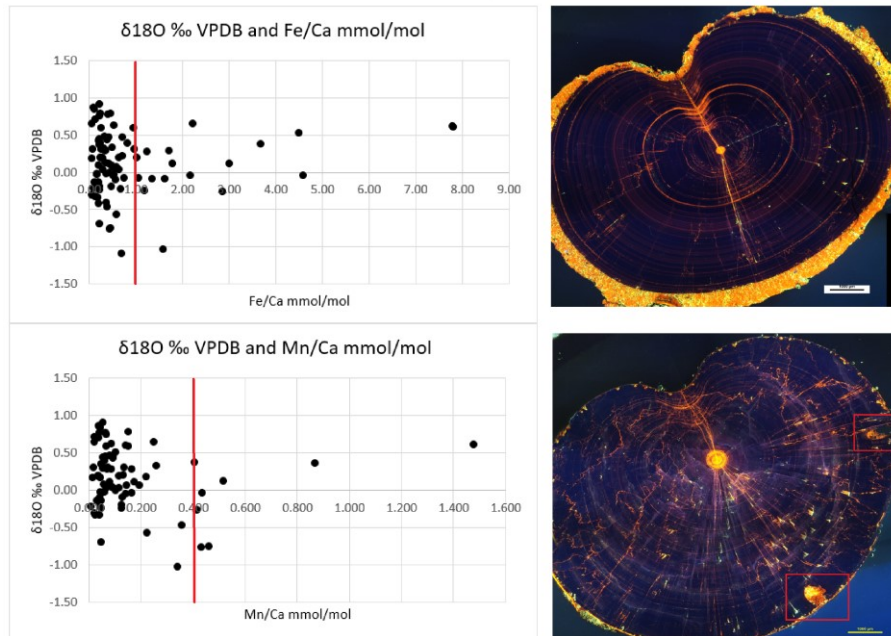


Fig. 1: Elemental/Ca ratios (Fe/Ca and Mn/Ca) and cathodoluminescence were used to screen for diagenetic alteration.

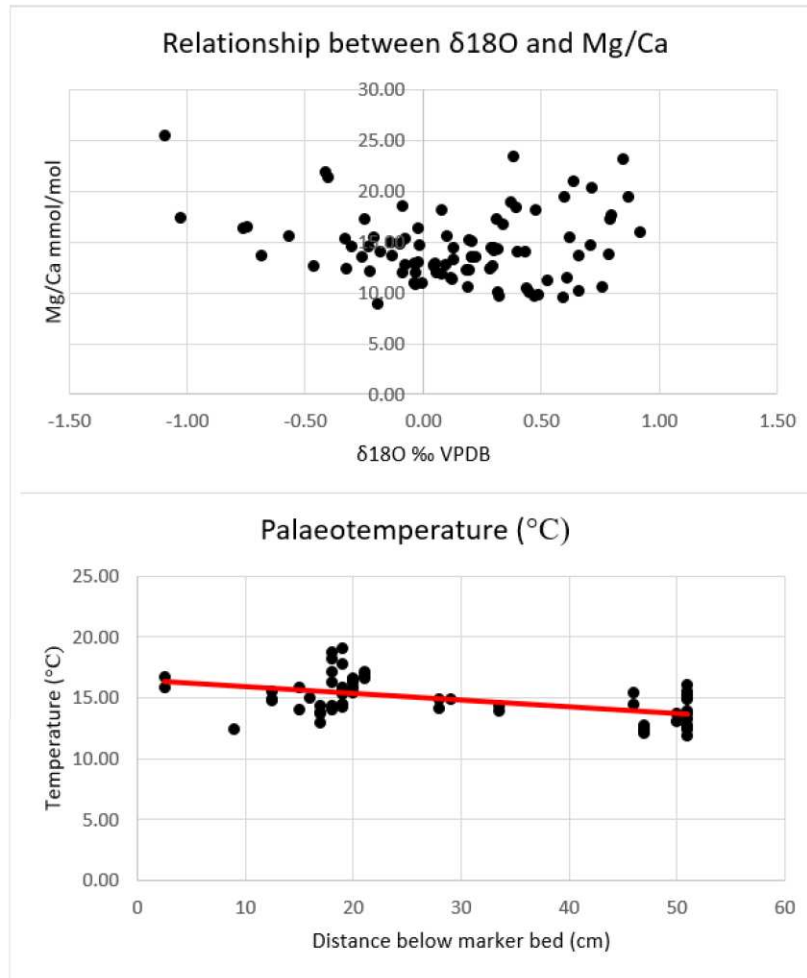


Fig 2: Results obtained from the belemnite rostra from the Albstadt section.

References

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