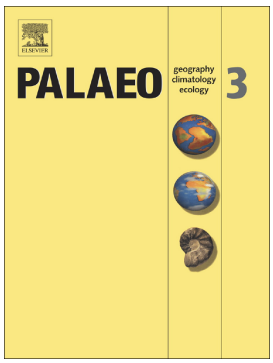

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Tropical seasonality in the late Campanian (Late Cretaceous): Comparison between multiproxy records from three bivalve taxa from Oman

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Abstract

Geochemical proxy records from calcite shells of bivalves constitute an important archive for the reconstruction of palaeoenvironmental conditions on sub-annual timescales. However, the incorporation of these trace element and stable isotope proxies into the shell is influenced by a multitude of physiological and environmental factors that need to be disentangled to enable reliable reconstruction of palaeoclimate and palaeoenvironment. In this study, records of multiple proxies in three bivalve taxa from the same late Campanian locality in Oman are used to study the expression of various geochemical proxies in relation to each other and to the palaeoenvironment. Micro-X-Ray Fluorescence mapping allows the localization, discussion and evasion of diagenetically altered parts of the fossil shells. X-Ray Fluorescence line scanning calibrated with Laser Ablation Inductively Coupled Plasma Mass Spectrometry is used to measure trace element profiles through well-preserved calcitic parts of the shells. Records of stable carbon and oxygen isotope ratios of shell calcite are combined with these high-resolution trace element concentration profiles to study sub-annual variations in shell chemistry and reconstruct changes in the palaeoenvironment of the bivalves on a seasonal scale. Spectral analysis routines are used to detect cyclicity in stable isotope ($\delta^{18}O$ and $\delta^{13}C$) and trace element (Mg/Ca, Sr/Ca, S/Ca and Zn/Ca) records. Differences in seasonal expression between these chemical proxies and between individual shells are discussed in terms of the relative influence of palaeoenvironment and potential species-specific physiological effects. Stable oxygen isotope ratios between shells suggest a local palaeotemperature seasonality of 8°C around an annual mean of 28°C, with the shell of the rudistid *Torreites sanchezi milovanovici* yielding slightly higher average temperatures. The discussion of the application of various Mg/Ca palaeotemperature calibrations on Mg/Ca records in these bivalve species emphasizes the complexity of using trace element proxies in extinct bivalve species. It shows that long-term changes