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Extracting seasonal oceanographic changes from Late Albian bivalve shells: A multiproxy multispecies approach

Stefan Huck (1), Niels de Winter (2), Rute Coimbra (3), Philippe Claeys (2), and Ulrich Heimhofer (1)

(1) Leibniz University Hannover, Institute of Geology, Hannover, Germany (huck@geowi.uni-hannover.de), (2) Free University of Brussels (VUB), Analytical, Environmental and Geochemistry (AMGC) Department, Brussels, Belgium, (3) University of Aveiro, GeoBioTec, Department of Geosciences, and University of Coimbra, MARE, Earth Sciences Department, Portugal

Cretaceous rudist bivalve shells have been shown to faithfully record inverse cyclic changes of oxygen isotope ratios and Mg contents, which are interpreted to represent seasonal temperature changes of the ambient sea water (Steuber, 1999). Estimating the impact of salinity changes on the rudist shell oxygen isotope composition at a given setting, however, is still problematic and calls for a calibration of oxygen-isotope based sea surface temperatures by means of additional palaeothermometers (e.g. clumped isotopes or TEX86). Moreover, a metabolic control on the isotopic composition of the low-Mg calcite rudist shell cannot be completely ruled out, as no modern analogues of these extinct bivalves exist.
In order to disentangle the influence of palaeoenvironment, diagenesis and 'vital effects' on the rudist shell geochemistry, the current study compares highly resolved multi-proxy (stable isotopes, trace elements) sclerochronological records of different Late Albian bivalve taxa (requieniid and radiolitid rudists, pectinids, chondrodonts and oysters) derived from the same proto-North Atlantic palaeoenvironmental setting in Portugal (Lusitanian Basin, Horikx et al., 2014). In contrast to classical methods such as ICP-OES, the here applied micro-XRF scanning technique allows to simultaneously measure a variety of elements, which help to (i) distinguish between natural and diagenetic enrichments of indicative elements such as iron and manganese and to (ii) identify the influence of palaeoenvironmental changes (SST, nutrients, salinity etc.) on bivalve shell growth (see de Winter et al., 2017). A multivariate statistical approach is presented to identify the influence of differential diagenesis on these multi-proxy records.

In particular, the comparison of rudist and pectinid sclerochronological records is a very promising approach, as pectinids have living analogues and therefore much more is known about the metabolic control on the shell geochemistry. This in turn will help to better understand the palaeoecology of rudist bivalves and how these animals recorded palaeoceanographic signals in their shells.

References

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