Geophysical Research Abstracts
Vol. 19, EGU2017-4359, 2017
EGU General Assembly 2017

Cretaceous honeycomb oysters (Pycnodonte vesicularis) as palaeoseasonality records: A multi-proxy study

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Pycnodonte or "honeycomb-oysters" (Bivalvia: Gryphaeidea) is an extinct genus of calcite-producing bivalves which is found in abundance in Cretaceous to Pleistocene fossil beds worldwide. As such, Pycnodonte shells could be ideal tracers of palaeoclimate through time, with the capability to reconstruct sea water conditions and palaeotemperatures in a range of palaeoenvironmental settings. Only few studies have attempted to reconstruct palaeoclimate based on Pycnodonte shells and with variable degrees of success (e.g. Videt, 2003; Huyge et al., 2015). Our study investigates the shell growth, structure and chemical characteristics of Maastrichtian Pycnodonte vesicularis from Bajada de Jaguel in Argentina and aims to rigorously test the application of multiple palaeoenvironmental proxies on the shells of several Maastrichtian Pycnodonte oysters for palaeoclimate reconstruction.

The preservation state of four calcite shells was assessed by fluorescence microscopy, cathodoluminescence and micro X-Ray Fluorescence (XRF) mapping. Their shell structure was investigated using a combination of XRF mapping, high-resolution color scanning and microCT scanning. Long integration time point-by-point XRF line scanning yielded high-resolution trace element profiles through the hinge of all shells. Microdrilled samples from the same locations on the shell were analyzed for trace element composition by ICP-MS and for stable carbon and oxygen isotopes by IRMS.

Preservation of the calcite microstructure was found to be of sufficient quality to allow discussion of original shell porosity, annual growth increments and pristine chemical signatures of the bivalves. The combination of fluorescence and cathodoluminescence microscopy with XRF mapping and microCT scanning sheds light on the characteristic internal "honeycomb" structure of these extinct bivalves and allows comparison with that of the related extant Neopycnodonte bivalves (Wisshak et al., 2009). Furthermore, high resolution trace element and stable isotope records allow discussion of the degree to which Pycnodonte shells record their palaeoenvironment and can be used to reconstruct past sea water conditions.

Preliminary results indicate that stable isotope and trace element ratios in Pynodonte shells record different seasonally changing sea water conditions in the Maastrichtian and reconstructed temperatures are consistent with results from clumped isotope analysis on the same shells and TEX86 analysis on the surrounding rocks. This multi-proxy study sheds light on the shell structure of Pycnodonte oysters, their chemical signature and growth pattern and investigates the expression of palaeoenvironmental proxies in the pristine shell calcite of these bivalves. This investigation shows the potential of using fossil Pycnodonte bivalves as a new archive for palaeoclimate reconstruction on a seasonal scale over a wide range of palaeolatitudes from the Cretaceous until the Pleistocene.

References

Huyghe et al. (2015) J. Geol Soc 172.5: 576-587.
Videt (2003) Diss. Université Rennes 1.
Wisshak, et al. (2009) Deep-Sea Res Pt I 56.3: 374-407.