Isotopic and trace element seasonality in Cretaceous Rudist Bivalves (Hippuritida): Tracing Cretaceous Seasonality

DE WINTER, N.J.[1], SNOECK, C.[1], SKELTON, P. W.[2], HUCK, S.[3], CLAEYS, PH.[1]

[1] Analytical, Environmental and Geo-Chemistry (AMGC), Vrije Universiteit Brussel (VUB), Pleinlaan 2, 1050 Brussels, Belgium.
[2]Department of Environment, Earth and Ecosystems, The Open University, Walton Hall, Milton Keynes, MK7 6AA, United Kingdom
[3]Institut für Geologie, Leibniz Universität Hannover, Callinstraβe 30, D-30167 Hannover, Germany

Rudist bivalves (Order Hippuritida) were major shallow water carbonate producers during much of the Cretaceous, leaving an extensive fossil record though this time period. The outer shell layer of rudists consists of diagenetically stable fibrous prismatic low-Mg calcite and its composition has been used to reconstruct paleo-climate parameters on a sub-annual resolution. In this study, a novel method of trace element analysis by laboratory micro X-Ray Fluorescence (μXRF) is applied to quickly obtain high-resolution (25 μm spot-size) trace element (e.g. Mg, Al, Ca, K, Fe, Zn, and Sr) profiles through a series of rudist shells spanning a period from the Barremian to the Late Campanian. The use of a range of specimens throughout the Cretaceous allows comparison of shell geochemistry and paleoclimate through important climate events, such as the Ocean Anoxic Events and the Albian-Cenomanian transition, providing the link between short and long timescale Cretaceous paleoclimate reconstruction. The evolution of paleo-seasonality through these events as well as through the Cretaceous is discussed. This extensive comparison of the chemical signature shells from different rudist species will further allow constraining of their ecological conditions and will shed light on vital effects that influence the chemical composition of the shell during growth.

The μXRF data are combined with Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) and stable carbon and oxygen isotope analysis in order to discuss the significance of the μXRF trace element profiles for the study of paleo-seasonality through the Cretaceous. Comparison of μXRF and LA-ICP-MS data shows the reproducibility of both methods for the measurement of trace element profiles in carbonates, while a combination of μXRF mapping and cathodoluminescence illustrates how the μXRF method can be used to detect diagenesis in fossil bivalve samples.