Albian shallow-water sedimentary archives: elemental evidence of major perturbations?

***Coimbra, R.*[1,2,*], Horikx, M.[3], Huck, S.[3], Heimhofer, U.[3], Immenhauser, A.[4], Rocha, F.[1], Dinís, J.[2], Duarte, L.V.[1]**

*1) GeoBioTec, Departamento de Geociências, Universidade de Aveiro, Portugal, *E-mail: rcoimbra@ua.pt*
2) MARE, Departamento de Ciências da Terra, Universidade de Coimbra, Portugal
3) Institut für Geologie, Leibniz Universität Hannover, Germany
4) Institute for Geology, Mineralogy and Geophysics, Ruhr Universität Bochum, Germany

Geochemical data from Albian hemipelagic successions as well as their shallow-water counterparts have been increasingly reported, mainly focusing on carbon-isotope records across black shale deposits and the significance of OAE 1b and 1d (Early and Late Albian) as stratigraphic tie points. But the elemental record is a widely under-explored tool, even more so when applied to coastal sedimentary archives. These challenging settings offer complex natural depositional dynamics added to potential diagenetic overprint, but a careful multi-proxy approach helps to extract valuable paleoenvironmental information.

The São Julião section (Lusitanian Basin, Portugal) spans across marly, carbonate and sandstone-rich coastal-marine deposits of Early Albian to Early Cenomanian age, representing fluctuations between terrestrial and shallow-marine depositional environments. Major and trace elements (Ca, Mg, Sr, Fe and Mn) were investigated by means of a thorough statistic data management (double PCA). No signature for major paleoenvironmental perturbation could be identified. Instead, four well differentiated geochemical clusters were obtained and contrasted with independent petrographic, geochemical and mineralogical information. Mixed-carbonate siliciclastic and limestone samples were established as the best preserved, whilst the elemental signature of the siliciclastic intervals and partially dolomitized limestones was significantly affected.

Mixed carbonate-siliciclastics and limestone facies allowed interpreting relative sea-level fluctuations, also providing paleoclimatic information. The influence of the globally long-term sea-level rise reported for Albian times was recognized along the studied succession, superimposed by local to regional shorter-term fluctuations. During lower sea-level stands, sharp increase of Fe and Mn concentrations in relation to continental input agreed well with periods of enhanced hydrological cycle and consequent increased weathering on adjacent lands. In contrast, higher sea-level inferred for late Albian to early Cenomanian times was accompanied by warmer and more arid climatic conditions. Changes in dominant carbonate mineralogy are invoked to explain higher Sr and Ca content, as a result of increased aragonite contribution during warmer conditions.

The highly variable and partially obscured elemental record was fully accounted for, providing reliable information on regional to global climate and sea-level fluctuations, but far from the influence of major perturbations recorded in more distal marine areas.