Disappearance of the Saccocoma-dominated microfacies: the cause and timing in light of the paleoenvironment evolution in the Transdanubian Range (Hungary)

Damian Lodowski*[1,2], Ottilia Szives[3], and Jacek Grabowski[2]

[1]Faculty of Geology, University of Warsaw – Poland
[2]Polish Geological Institute - National Research Institute – Poland
[3]Hungarian Natural History Museum – Hungary

Abstract

The disappearance of the *Saccocoma*-dominated microfacies (*Saccocoma* MF) is one of the most characteristic biotic events observed within the Jurassic/Cretaceous transition beds of the numerous successions of the Western Tethys. In the Transdanubian Range (Hungary), these planktonic crinoids start to vanish near the M19r/M20n magnetic chrons boundary (Lodowski *et al.* 2022); coeval event may be followed in the Velykyi Kamianets (Grabowski *et al.* 2019), as well as in other sections of the Pieniny Klippen Belt (Michalík *et al.* 2011). Even though - due to scarce microfacies reports - the exact age of this process cannot be precisely determined in case of the Southern Alps, according to Martire *et al.* (2006) the *Saccocoma*–rich facies also disappear within the upper Tithonian. Lodowski *et al.* (2022) considered that the process of *Saccocoma* MF demise started in between the NCE I and NCE II nannofossil calcification events (see Bornemann *et al.* 2003 and Casellato 2009). This coincidence suggests that the changes contributing to NCEs, such as climate, atmospheric pCO2, and Mg/Ca ratios may also have been important for saccocomids.
In this study, the process of the *Saccocoma* MF demise is compared to the record of paleoclimate, paleoredox and paleoproductivity changes across the Tithonian–Berriasian of the Transdanubian Range (Hungary). Paleoenvironmental framework was interpreted basing on geochemical data and statistical analyses of calcareous nannofossil communities; these account for a signal of climate aridization during the late Tithonian, as well as seafloor hypoxia combined with increased rates of nutrient burial during this time. Such conditions are interpreted here as driven by perturbations in combined system of atmospheric-to-marine circulation, when weakened monsoons resulted in less efficient Ekman transport, hence weaker monsoonal upwelling (De Wever *et al.* 2014). As a consequence, restricted mixing of the water column driven both the seafloor hypoxia and disruption in the "nutrient shuttle" mechanism. Importantly, the "fertility crisis" during the late Tithonian is clearly evidenced by nannofossil data: the NCE IIA event was documented as an evolution and explosion of *Nannoconus* sp., what also points to more oligotrophic (in relation to early Tithonian) surface waters. Consequently, the vanishing of *Saccocoma* is thought to result from insufficient – for these organism – amount of micronutrients in the upper ocean, which likely arose from climate-related oceanographic perturbations.

*Speaker

References:

Bornemann, A., Aschwer, U., Mutterlose, J. (2003) The impact of calcareous nannofossils on the pelagic carbonate accumulation across the Jurassic–Cretaceous boundary. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **199**, 187–228.

Casellato, C. E. (2009) Causes and consequences of calcareous nannoplankton evolution in the Late Jurassic: implications for biogeochronology, biocalcification and ocean chemistry. Ph. D. Thesis, *Universita degli Studi di Milano*, 122 p., Milano.

DeWever, P.D., O'Dogherty, L., Goričan, Š. (2014) Monsoon as a cause of radiolarite in the Tethyan realm. *Comptes Rendus Geoscience*, **346**, 287–297.

Grabowski, J., Bakhmutov, V., Kdýr, Š., Krobicki, M., Pruner, P., Rehakova, D., Schnabl, P., Stoykova, K., Wierzbowski, H. (2019) Integrated stratigraphy and palaeoenvironmental interpretation of the Upper Kimmeridgian to Lower Berriasian pelagic sequences of the Velykyi Kamianets section (Pieniny Klippen Belt, Ukraine). *Palaeogeography, Palaeoclimatology, Palaeoecology*, **532**, 1–29.

Lodowski, D.G., Pszczólkowski A., Szives, O., Főzy, I., Grabowski, J. (2022) Jurassic–Cretaceous transition in the Transdanubian Range (Hungary): integrated stratigraphy and paleomagnetic study of the Hárskút and Lókút sections. *Newsletters on Stratigraphy*, **55**, 99–135.

Michalík, J. (2011) Mesozoic paleogeography and facies distribution in the Northern Mediterranean Tethys from Western Carpathians view. *Iranian Journal of Earth Sciences*, **3**, 10–19.
Tremolada, F., Bornemann, A., Bralower, T. J., Koeberl, C., van de Schootbrugge, B. (2006) Paleoceanographic changes across the Jurassic/Cretaceous boundary: The calcareous phytoplankton response. *Earth and Planetary Science Letters*, **241**, 361–371.

Keywords: J/K transition, climate, redox, productivity, paleoecology, carbonates, western Tethys