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Malformations of calpionellid loricas recorded in Upper Jurassic and Lower Cretaceous pelagic carbonates of the Western Carpathians, Western Balcan, Mexico and Cuba - a tool for paleoenvironmental interpretation

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Characteristic morphology and assemblage composition of of ancient planktonic ciliate protozoan loricas made of them a favourable tool for interregional correlation. They are playing a key role in the biostratigraphy of Upper Jurassic/Lower Cretaceous sequences not only in areas lacking in ammonites. Detailed comparative analysis of calpionellid associations along all the Tethys shows variations in relative species abundance, variability, diversity changes and also in variability of their lorica structure. As oligotrophic organisms, they were sensitive to environmental perturbations such a change of the water temperature, chemistry, salinity and the nutrient supply. Mass occurrence of these microfossils was associated with shallow basins and with intrashelf elevations. These enviroments were characterized by a permanent current regime positively influencing the nutrient input. It is worth to mention, that the abundance and size of calpionellid loricas decrease towards the open sea - they are less frequent in deep basins, being very rare or seldom in reefal and lagoonal settings or in proximal settings with permanent river-influenced elevated nutrient level and with changes in surface water chemistry. Two diversity maxima were recorded within the Intermedia and the Oblonga subzones and two crisis were observed at the end of the Colomi Subzone and at the beginning of the Murgeanui Subzone. During the last mentioned events, deformations (aberrant morphology) were documented in Crassicollaria, Tintinnopsella and Praecalpionellites loricas (Reháková, 2000; Lakova and Petrova, 2013; López-Martínez et al., 2015). Teratological (malformed) tests may coincide either with metal poisoning or with salinity changes. Global climate changes could have been evoked by active volcanoes noted at this time (Casellato and Erba, 2015). Oxygen isotope data signalized late Tithonian cooling followed by a warming at the beginning of the Berriasian (Weissert and Erba, 2004). Huge portion of siliclastic input which was documented during the Late Tithonian and Valanginian could indicate tectonic activity combined with rised humidity and with the eustatic sea-level drop (Michalík, 2007). Rapid decrease of oligotrophic nannoconid abundance correlable with the extinction of calpionellids has been interpreted as the Cretaceous first biocalcification crisis (Erba and Tremolada, 2004). Thus, thinning and deformation of calpionellid loricas could have been associated with distant volcanic effusions producing metallic contaminants and salinity variations.

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