Warming-driven nannofossil crisis in the early Toarcian of northern Spain

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The early Toarcian (Early Jurassic) was characterized by significant seawater warming, a transgressive peak, and a mass extinction event, which affected many different groups of marine organisms. Furthermore, major perturbations in the global carbon cycle have been inferred based on the negative carbon isotope excursion that is recorded in rocks and organic matter. A quantitative analysis of early Toarcian calcareous nannofossil assemblages from the Camino section (Basque-Cantabrian Basin, northern Spain) was performed to interpret the paleoenvironmental changes that occurred during this time interval. A total of 28 smear slides were prepared, and 300 nannofossils were counted from each smear slide. The nannofossil data were treated statistically, and the results were compared to the stable isotope data.

During the earliest Toarcian, the nannofossil assemblages were dominated by *Schizosphaerella punctulata*, *Calcivascularis jansae*, and *Lotharingius hauffii*, which are deep, intermediate, and shallow-dwelling taxa, respectively, (Casellato & Erba, 2015) and probably thrived in rather cold waters. The progressive decrease in the relative abundances of *S. punctulata* and *C. jansae* coincided with a progressive increase in paleotemperatures, as indicated by the $\delta^{18}O_{bel}$ values and higher percentages of *Biscutum* spp. and *Similiscutum* spp., which are shallow, meso-eutrophic taxa (Casellato & Erba, 2015), and *Calyculus* spp., an intermediate-dweller that could thrive under low-salinity conditions (Mattioli *et al*., 2008) when seawaters were warmer. Coinciding with the highest temperatures and around the extinction boundary, the "*Schizosphaerella* crisis" occurred, *C. jansae* became extinct, and the nannofossil assemblages were dominated by *Lotharingius* and *Crepidolithus* species, opportunistic (Fraguas *et al*., 2012) and shallow and deep-dwellers, respectively (Mattioli *et al*., 2008), which probably occupied the abandoned ecological niches of *S. punctulata* and *C. jansae*.

These results suggest a clear relationship between the increase in paleotemperature and changes in the nannofossil assemblages, confirming the hypothesis of Fraguas *et al*. (2012). However, possible changes in other paleoenvironmental parameters cannot be discarded.

This work was supported by the Spanish research project CGL2015-66604-R.

References

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