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The early Toarcian anoxic event: what the beginning and the end of the story are?

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The early Toarcian anoxic event (T-OAE) and the associated biotic crisis have received much attention in the last decade. However, the events forewarning the crisis as well as its aftermath are still poorly known. The T-OAE coincides with a prominent carbon isotope negative excursion (T-CIE) that is preceded by an excursion of similar intensity at the Pliensbachian-Toarcian boundary (Hesselbo et al., 2007). The onset of T-CIE occurred some 700 kyr later than the end of the Boundary-CIE (Suan et al., 2008a). This succession of events demonstrates that the T-OAE was a complex suite of environmental perturbations.
In this work, we focused on calcareous nannofossil assemblages occurring in the Peniche section (Portugal) during the Boundary-CIE with the aim to understand if calcifying plankton reacted in a similar/different way to the two CIEs. Also, two sections and one borehole located along a W-E transect, along the NW-Tethyan shelf (in the Yorkshire coast, in the E Paris Basin, and in Mecsek Basin, respectively), were investigated to assess which way calcareous nannoplankton recovered after the crisis, and if the recovery was a synchronous event.
The production by nannoplankton collapsed during the T-CIE, as demonstrated by the lowest absolute abundance of nannofossils measured in Peniche and other studied sites (Mattioli et al., 2008). Besides this nannofossil abundance decrease, also the size of the incertae sedis Schizosphaerella test was drastically reduced (Suan et al., 2008b). If a similar size decrease is also recorded during the Boundary-CIE, calcareous nannofossil abundances are very high, and assemblages seem not to record an environmental stress.
The study of the calcareous nannofossil assemblages along a W-E transect in the NW-Tethyan shelf shows a progressive, but significant decrease in abundance fluxes from W to E, and the lowest fluxes are recorded in the Mecsek Basin that was closer to the oceanic Tethys. A progressive re-colonization of the lower photic zone by deep-dweller nannofossil taxa, mainly Crepidolithus crassus, is observed in the aftermath of the anoxic event, but this re-colonization occurred earlier in the Mecsek Basin, probably because of more effective marine connections with the open-ocean.
This set of data indicates that: (1) environmental deterioration was recurrent until it reached its acme during the T-OAE; (2) post-crisis recovery of surface water environments was not synchronous, depending on palaeoceanographic conditions occurring within the western Tethys. Our scenario implies an intrinsically long-lasting suite of events and argues in favour of long-lasting CO2 degassing, most likely related to the emplacement of the large igneous province of Karoo-Ferrar as the main cause of the Toarcian environmental perturbations.

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