

Carbonate platform evolution across the Cenomanian/Turonian boundary (Akrabou Formation, Southeastern Morocco)

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The Cenomanian-Turonian transition represents one of the major paleoenvironmental perturbations of the Cretaceous, characterized by global sea-level highstands, widespread marine transgression, and Oceanic Anoxic Event 2 (OAE2). Across North Africa, the transgression promoted the establishment of an epicontinental carbonate platform over previously continental domains, represented in southeastern Morocco by the up to 100 m thick Akrabou Formation.

The Akrabou Formation evolves from shallow-water bioclastic wackestones and packstones with abundant micrite into deeper water laminated lime mudstones with calcareous plankton, fish debris, and ammonite-bearing nodules, and then again to shallow benthic carbonate production. In the upper part, high-energy conditions are reflected by coarser cross-bedded levels, while peritidal facies at the top mark platform emersion and the re-establishment of continental siliciclastic sedimentation. Biostratigraphic data place the Cenomanian-Turonian boundary shortly after the maximum deepening phase.

Stable isotope analyses ($\delta^{13}\text{C}$ and $\delta^{18}\text{O}$) performed on bulk carbonates reveal a broad positive $\delta^{13}\text{C}$ excursion reaching +5‰ VPDB within the lower shallow-water interval, consistent with the global isotopic signature of OAE2 (Jarvis et al., 2006). This trend is followed by a rapid decrease to values around -2‰ VPDB within the laminated deeper-water interval, and by a subsequent return toward positive values up to +2‰ VPDB in the upper shallow-water deposits. Isotope data from the primary fibrous calcite of oyster shells display comparable trends, with slightly heavier values, supporting preservation of the $\delta^{13}\text{C}$ primary depositional signal.

We suggest that the laminated interval recorded a temporary retreat of shallow-water carbonate production under environmental stress likely related to rapid transgression and enhanced nutrient supply. This platform retreat postdates the peak positive carbon-isotope excursion (see also Wang et al., 2021), suggesting an environmental response not directly linked to OAE2, but rather controlled by basin-scale processes operating after the event. However, the crisis was not irreversible, as benthic carbonate communities recovered and platform sedimentation resumed.

Jarvis I. et al. (2006) - Secular variation in Late Cretaceous carbon isotopes: a new $\delta^{13}\text{C}$ carbonate reference curve for the Cenomanian-Campanian (99.6-70.6 Ma). *Geol. Mag.*, 143(5), 561-608, <https://doi.org/10.1017/S0016756806002421>.
Wang J. et al. (2021) - Controls on timing of Cenomanian-Turonian organic enrichment and relationship to the OAE2 event in Morocco, North Africa. *Mar. Pet. Geol.*, 128, 105013, <https://doi.org/10.1016/j.marpetgeo.2021.105013>.