The Cenomanian–Turonian Oceanic Anoxic Event 2 and the Late Turonian-Coniacian Event in the Mexican Interior Basin

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In the modern ocean, deoxygenation is a major consequence of climate change induced by eutrophication and expansion of oxygen minimum zones. To better understand the exact mechanisms that promote the development of anoxia requires observations not available at human time scale, and therefore demand the study of intervals of rapid warming in the geologic past. During the Cretaceous Period, massive submarine volcanism during the construction of Large Igneous Provinces gave rise to the development of several episodes of widespread oxygen-depleted waters and enhance organic carbon deposition, including the Cenomanian-Turonian Oceanic Anoxic Event 2 (OAE 2) and the Late Turonian-Coniacian Event (LTCE). In this study, we reconstruct climate and oceanographic conditions in the Mexican Interior Basin during these events, a key area that connected the Western Interior Seaway to the equatorial Atlantic Tethyan water mass. To accomplish this, we applied an integrated multi-proxy approach that includes sedimentological, microfacies, mineralogical and geochemical data from an upper Cenomanian–lower Coniacian section.

Organic-rich sediments were accumulated during the initial stage of OAE 2 and the middle stage of LTCE (Hitchwood Event), under increasingly warm and humid conditions, as evidenced by high chemical index of alteration (CIA) values. High detrital index (DI) values coupled with high phosphorus mass-accumulation rates suggest that this scenario increased detrital and nutrients fluxes. Eutrophic-anoxic/dysoxic marine conditions are corroborated by the highest TOC values coinciding with significant enrichments in redox- and productivity-sensitive trace elements. Moreover, they are supported by the abundant presence of radiolarians and filaments in the OAE 2 interval, and the occurrence of opportunistic foraminifera in the LTCE interval. Oxygen-depleted bottom waters are also indicated by Mo–U systematics and a small-sized population of pyrite. The onset of the Mexican Orogen tectonic uplift together with upwelling intensified the transference of nutrients and enhanced organic matter burial during the initial stage of OAE 2. In the mid-OAE 2 δ¹³C trough interval equivalent to the Plenus Cold Event, bioturbated sediments with low TOC values accumulated during a short episode of cold climate conditions reflecting the southward flow of boreal water throughout the Mexican Interior Basin. The minimum δ³⁴S_py value occurring within the OAE 2 interval in the Mexican Interior Basin is lower than elsewhere due to a local increase in sulfate concentrations.