Barremian-Turonian episodes of accelerated global change in Mexico

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During Cretaceous times Mexico constituted a key area of the western margin of the proto-North Atlantic, since it marked the transition between the open oceanic basin and the Western Interior Seaway. In this study, an integrated approach combining sedimentological, petrographic, biostratigraphic, geochronological, mineralogical and geochemical analyses provide information about the record and paleoenvironmental conditions of several episodes of accelerated global change spanning the Barremian-Albian interval in north and central part of the country. The OAE 1a (early Aptian) is recorded in several shelfal (Cupido Formation) and basinal sections (Lower Tamaulipas-La Peña formations). It is associated with the episodic arrival of detrital material and nutrients and the subsequent development of eutrophic conditions. Variable redox conditions and a phase of alkalinity are associated with this event. A negative C-isotope excursion correlatable with the Intra-Furcata Negative Excursion (late early Aptian) is also a remarkable feature of the investigated sections. This fact confirms its use as a global chemostratigraphic marker for the Aptian record. Two stratigraphic intervals enriched in organic matter and equivalent to the Aparein (latest early Aptian) and Noire (earliest late Aptian) levels are also recorded in the La Peña Formation. The deposition of the Aparein Level occurred under climatically induced eutrophic marine conditions, coincident with a global warming trend that resulted in the stratification of the water column; while the Noire Level was deposited under eutrophic marine conditions that resulted from a local upwelling system. The OAE 1b set interval is recognized by a long-term negative C-isotope excursion during the Aptian-Albian transition in the middle part of the La Peña Formation. It is punctuated by short-term negative spikes that show values and positions similar to those associated with the Jacob, Kilian, Paquier and Leenhardt episodes. This anoxic events occurred during warm and humid conditions that caused intense biogeochemical weathering and runoff, and resulted in density stratification of the water column and organic matter burial in sediments. Finally, the OAE 2 (Cenomanian-Turonian) is recorded in organic-rich pelagic facies of the Agua Nueva Formation showing the faunal turnover linked to this event. High marine productivity, partly controlled by intrabasinal vocanic ash-fall, favored anoxic-dysoxic bottom water conditions during the anoxic event, and more oxygenated waters thereafter. In general, such oxygen-depleted conditions fostered bacterial sulfate reduction in sediments. Maximum value of sulfur isotope fractionation within the OAE 2 is related to a higher organic matter burial and sulfate availability. This fact confirms the proposal of a global mechanism that controlled the S isotope signature during this event.