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Is the Coniacian-Santonian OAE3 a real and global anoxic event ? Insights from Spain, Texas and Egypt

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Several oceanic anoxic episodes (OAE) occurred on a worldwide scale throughout the Cretaceous. They are defined by the widespread accumulation of laminated organic-rich sediments and coincide with a positive excursion in δ13C. The Coniacian-Santonian OAE (= OAE3) is less well known and appears less expressed than the early Aptian and latest Cenomanian OAEs. This OAE appears not to be truly important on a global scale but was more dependent on local or regional conditions, as suggested by the paleogeographic distribution of organic-rich sediments. These are mainly restricted to the equatorial and South Atlantic basins and the Western Interior Seaway, and therein mostly to shallow-water settings and epicontinental seas. The mechanisms and paleoenvironmental conditions leading to and through OAE3 are poorly known, particularly with regards to the marine phosphorus cycle and changes therein, and to the climate conditions in general. Specifically, in our study, we focus on bulk and clay mineralogy, phosphorus, carbon isotopes, high-resolution biostratigraphy, and changes in climate and primary productivity. Several sections from different paleogeographic areas at different paleodepths were studied. Two sections were investigated, are candidates for the global boundary stratotype section and point (GSSP), Olazagutia (NW Spain) and Ten Mile Creek-Arbor Park (Texas, USA); an additional section was analysed in Gabal Ekma (Sinai, Egypt), which exhibits several layers enriched in organic matter associated with extensive bonebeds. In the Olazagutia section, the inoceramid Platyceramus undulatoplicatus, which marks the base of Santonian, occurs well above the Coniacian-Santonian boundary indicated by nannofossil biostratigraphy, and its first occurrence appears to have been environmentally controlled. In Texas, several bentonite layers have been recognized just above the proposed Coniacian-Santonian boundary, which may provide a more accurate age. Based on a weathering index and mineralogy, similar climate changes are observed in all sections. The climate shifted synchronously from humid to relative drier conditions near the Coniacian-Santonian boundary, followed by a diachronous return to more humid conditions during the Santonian. Fluctuations in total phosphorus contents appear mainly driven by changes in detrital input and consequently by climate in Spain and Texas, whereas in Egypt they were controlled by anoxia and phosphogenesis.