Characterisation of the Coniacian-Santonian boundary at Olazagutia (GSSP, Spain) and Ten Mile Creek (USA): evidence of diachronism?

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Abstract

The latest significant Cretaceous carbon cycle perturbation occurred during the Coniacian-Santonian interval. Even if the term of OAE3 (Oceanic Anoxic Event) is often used, this event is not a real global oceanic anoxic and not synchronous event, but reflects more a change in local conditions. The mechanisms and palaeoenvironmental conditions leading to and through this event are poorly known, more particularly the marine phosphorus cycle and changes therein, and the climate conditions. This study focuses on bulk rock and clay mineralogy, phosphorus and carbon isotope geochemistry, high-resolution biostratigraphy, to decipher changes in climate and primary productivity. Two sections from different palaeogeographic areas characterised by different paleodepths were studied. These investigated sections were proposed as candidates for the base Santonian global boundary stratotype section and point (GSSP): Olazagutia (NW Spain) and Ten Mile Creek-Arbor Park (Texas, USA). The first one was finally ratified in 2013, and the base of Santonian stage was defined by the first occurrence of the inoceramid *Cladoceramus undulatoplicatus*. However, in the Olazagutia section, a strong diachronism is observed between the inoceramid *C. undulatoplicatus* and the nannofossils *A. minimus*, *C. obscurus* and *L. cayeuxii*, suggesting that the occurrence of *C. undulatoplicatus* appears to occur significantly above the Coniacian-Santonian boundary, and its first occurrence appears to be environmentally controlled. Indeed, in both sections, the first occurrence of *C. undulatoplicatus* is coeval with phosphorus increase indicative of more mesotrophic conditions. But contrary to the Olazagutia section, the first occurrence of C. *undulatoplicatus* is synchronous with the first occurrence of *A. minimus* in the Ten Mile Creek section.

New data based on Sr isotopes performed of inoceramid shell from Olazagutia GSSP and the Ten Mile Creek sections, will be provided in order to confirm or not the diachronism of the first occurrence of *C. undulatoplicatus*.

Palaeoclimatic reconstruction shows that climate shifted from humid to relative drier conditions near the Coniacian-Santonian boundary, followed by a return to more humid conditions

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during the Santonian. Fluctuations in total phosphorus contents appear mainly to have been driven by changes in detrital input and consequently by the climate change observed in both Spain and Texas sections.

Keywords: Cretaceous, Coniacian, Santonian, GSSP, Inoceramid, Sr isotopes, Palaeoclimate