Towards an improved holostratigraphy of the Ypresian Clays

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Abstract

The early Eocene greenhouse world is characterized by a succession of orbitally-controlled global stable carbon isotope excursions (CIE's), of which some are associated to abrupt climate changes and perturbation of marine ecosystems. These unique events allow a detailed global chemostratigraphic correlation, even within dissimilar environmental settings. Here we aim at deciphering the stratigraphic signature of the successive early Eocene hyperthermals in the shallow marine context of the southern edge of the North Sea Basin.

The Paleocene-Eocene thermal maximum (PETM) has already been identified in the lagoonal Tienen Formation, representing the earliest Eocene of Belgium (Steurbaut et al., 2003). The Belgian Basin also contains a relatively complete, rather fossiliferous and well-studied marine lower Eocene succession (the classical Belgian Ypresian Clays). The thickness of these heterogeneous Ypresian silts and clays reaches almost 120 meters in the Belgian Geological Survey Kallo core, which is used for a regional stratigraphic framework. Nannoplankton subzonations (e.g., Steurbaut 1991), foraminiferal bioevents (e.g., King, 1991) and benthic foraminiferal associations (e.g., Willems, 1980; Willems and Moorkens, 1991) have been utilized for regional biostratigraphic correlations, yet their (eco)stratigraphic meaning remained unresolved and might be related to these global warming events.

The stable isotope record ($\delta^{13}C_{org}$) and sequence stratigraphic interpretations of the Kallo core highlight the relationship of the basin-wide observed distinct lithologic and biotic events, within this succession of multiple CIE's in the Belgian Ypresian deposits. This chemostratigraphic approach enables a reappraisal of the existing holostratigraphic overviews of the Belgian Ypresian Clays and the creation of an up-to-date age model, linking the regional depositional setting with the global Eocene climate evolution. Our data emphasize the potential application of hyperthermal event stratigraphy to correlate over a wide range of different environmental settings in the North Atlantic Ocean and adjacent basins, and to understand the spatial heterogeneity of climate changes in these shallow-water settings.