The Kimmeridgian-Tithonian boundary in the Boulonnais, with emphasis on paleoclimate and stable isotope correlations

Roel Verreussel*†[1], Isabel Van Der Hoeven‡ , Nicolas Tribovillard§ , Armelle Riboulleau¶ , Bas Van De Schootbrugge‖ , and Nico Janssen**

[1]TNO Geological Survey of the Netherlands – Netherlands

Abstract

The coast near Boulogne-sur-Mer offers excellent exposures of a nearly complete Upper Jurassic succession of sandstone units alternating with mudstone units. One of these units is the 25m thick, mudstone-dominated Argiles de Châtillon Formation (ACF) that straddles the Kimmeridgian-Tithonian boundary. These shallow-marine deposits represent a proximal lateral equivalent of the more distal marine Kimmeridge Clay Formation. The ACF is composed of two subunits that each contain an organic-rich interval (ORI). The two conspicuous ORI's have been linked to either periods of high sea level or greenhouse warming. The ACF was sampled for palynological and stable isotope analyses (δ13Corg) in order to provide age constraints and a better understanding of the climatic and environmental mechanisms that governed the organic matter accumulations. The carbon isotope records were used to correlate the ACF from the widely-spaced Boulonnais sections with the Kimmeridge Clay Formation from southern England and show that the upper part of the ACF in the most complete Cran aux Oeufs section correlates to the upper part of the *Autissiodorensis* ammonite Zone (*Irius* Subzone) and to the *Elegans* ammonite Zone. The correlation contradicts published biostratigraphic accounts on the ACF that suggest that the *Irius* Subzone is absent in the Boulonnais region. The palynological results enable a twofold subdivision of the ACF: the lower half displaying cooler and more humid climatic conditions and the upper half displaying warmer and more arid conditions. The climate change appears to mark the Kimmeridgian–Tithonian boundary. The palynological results show that the lower ORI was deposited under suboxic to anoxic stratified conditions. For the upper ORI, there are no indications of stratified conditions. Within this thicker ORI, cyclic variations are observed in the δ13Corg trends, the total organic carbon and in the distribution of amorphous organic matter. These cycles line up with humid-arid cycles which are derived from the palynological analyses and are likely alternating on a _˜100 kyr eccentricity timescale. Under the most humid phases of these overall arid climate conditions, sulfurization of carbohydrates was the dominant control on organic matter preservation. The onset of this climate-controlled process that drives organic matter enrichment in the Tithonian can be recognized on a basin-wide scale.

*Speaker
†Corresponding author: roel.verreussel@tno.nl
‡Corresponding author: isabel.van.der.hoeven@nioz.nl
§Corresponding author: nicolas.tribovillard@univ-lille1.fr
¶Corresponding author: armelle.riboulleau@univ-lille1.fr
‖Corresponding author: B.vanderSchootbrugge@uu.nl
**Corresponding author: nico.janssen@tno.nl

Keywords: Kimmeridgian, Tithonian, Boulonnais, palynology, stable isotopes