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Interactive Comment

Interactive comment on "Freshwater discharge controlled deposition of Cenomanian-Turonian black shales on the NW European epicontinental shelf (Wunstorf, North Germany)" *by* N. A. G. M. van Helmond et al.

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We thank Professor Gale for his positive and constructive review. We will reply to his comments below and aim to revise the manuscript accordingly.

Reviewer's Comment: This is an important paper, as it uses a multidisciplinary approach in order to tease out the respective controls of temperature and hydrology through OAE2, in relation to the orbital signal. The results are convincing and interesting, and attribute much of the anoxia to variation in the hydrological cycle driven by precession, separate from a cooling event. There are however unanswered questions surrounding the Plenus Cold Event, which could be usefully addressed. Firstly, the precise timing of this event is in some doubt; the original description was based on rather sound isotopic (heavy d18O excursion) and faunal evidence, and showed the event extending from Bed 4-8 of the Plenus Marl, exactly coincident with the range of the boreal belemnite Actinocamax. However, Jarvis et al. 2012, fig. 8 used rather poor quality (probably diagenetically compromised) oxygen isotope data (Eastbourne, Grobern) to extend the event down to the lower part of the carbon excursion. I know that one of your authors is unhappy about this. I see that your sampling around this level is a bit sparse (Fig. 6), but it looks as if the 86 Tex cold event is entirely above the Plenusbank. Some discussion of this would be really useful. A few more samples would be even better, but beyond the scope of this paper. The precision of timing is quite critical to interpretation.

Author's Reply: Determining precise correlations of the Plenus Cold Event between sites remains a challenge. In three more complete, published TEX86 records across the Plenus Cold Event, ODP 1260 (Forster et al., 2007), ODP 1276 (Sinninghe Damsté et al., 2010) and Bass River (van Helmond et al., 2014) the cooling in TEX86-based SSTs starts before the first maximum in the carbon isotope excursion. At Bass River the termination of this cooling phase is concurrent with the first maximum in the carbon isotope excursion, while for ODP 1260 and 1276, the cooling event continues till after the first maximum in the carbon isotope excursion (i.e., the isotopic-plateau phase). In Wunstorf the cooling event seems to take place after this first maximum, exclusively. This implies that either the cooling event is diachronous, or the various phases within the carbon isotope excursion are diachronous between sites. Although these two hypotheses are not mutually exclusive, the latter may be considered more likely since numerous factors may offset individual carbon isotope records from the global exogenic CIE related to OAE2 (e.g., Sluijs and Dickens, 2012); records based on compound-specific analyses (e.g., Sinninghe Damsté et al., 2010) may yield signals closer to global exogenic trends than bulk records. At present, we consider it not possible to correlate any site at a resolution better than 104 years.

During our study, we analyzed more samples across this interval at Wunstorf; unfortunately we had to exclude most of the resulting data as the samples did not yield sufficient molecular fossils to generate reliable TEX86-based sea-surface temperature reconstructions (SSTs; Section 4.1.1). None of the generated data (including the excluded analyses) indicates that cooling was associated with the lower part of the carbon isotope excursion. As you indicate, the cooling, as far as high-resolution correlations are feasible, seems to correlate to a level above the Plenusbank, which seems to be conflicting with the extension of the Plenus Event to the lower part of the carbon isotope excursion by Jarvis et al. (2012; Fig. 8). We will incorporate the above discussions in the revised manuscript.

Reviewer's Comment: You should also refer to Zheng et al. 2013 EPSL .doi.org/10.1016/j.epsl.2013.05.053i, who described a negative neodymium isotope excursion also coincident with the Plenus Cold Event, and attribute this to the incursion of a northerly water mass. Discussion of this paper in the light of your results would be helpful and interesting.

Author's Reply: In the revised version, we will discuss the incursion of a northerly water mass as derived from the negative neodymium isotope excursion by Zheng et al. (2013), and the (even more recent) trace-metal anomaly that has been linked to the incursion of a boreal water mass by Eldrett et al. (2014).

Sincerely,

Also on behalf of all authors,

Niels van Helmond

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Interactive comment on Clim. Past Discuss., 10, 3755, 2014.