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Climate of the Past Discussions

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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The manuscript by van Helmond et al. provides novel palynological and organic geochemical records across OAE 2 from Wunstorf, LSB. Their main conclusions are 1) orbitally (precession)-forced enhanced precipitation and run-off led to cyclic black shale formation in the region and 2) the Plenus Cold Event is characterized by decreasing SSTs in the region, interrupting black shale deposition. The manuscript provides elegant new data across OAE 2, is well written, and the interpretation provide novel insights into OAE 2 and hence the manuscript is more than suitable for publication in

Climate of the Past. I have however some comments that need to be addressed before publication.

The main issue is that the authors base their first (and main) conclusion on the high concentration of pollen and spores in black shales. Although they argue that preferential degradation is driving their BIT-index and complicates their TEX86 record (which I concur), the influence of degradation on their palynological records is discarded based on the presence of a thin-walled dinocyst (Paleohystrichophora infusorioides). I find it hard to believe that BIT is (completely) driven by preservation, but that this had no impact on the pollen and spores, which we know can be heavily influenced by preferential degradation (see various papers of G. Versteegh). Im not an expert in dinoflaggelates, but is this thin-walled dinocyst a commonly used indicator of preservation in the Cretaceous? The authors don't give a reference that would justify the use of this dino as preservation indicator. As far as I can see their main conclusions relies on this single line of evidence against preservation so I strongly urge the authors to provide additional evidence that preferential preservation is not primarily driving the observed changes in pollen and spores accumulation across OAE 2. In addition, the evidence/reasoning in favor of fluvial input versus aeolian is also weak (lines 12-18 on page 3770). Is there any other evidence that could favor one of the two mechanisms? If not, based on the current data I don't think you can rule-out aeolian input, especially because you are pretty far away from land.

Additional comments: Page 3757: The authors state that they can disentangle the impact of warming, hydrology, and productivity (lines 2-6), but their results indicate it's hydrology combined with productivity that led to black shale formation (lines 22-25) (and their TEX data also indicates a super greenhouse climate). So they don't really disentangle the individual contribution of these parameters to OAE 2. I suggest rephrasing the beginning of the abstract.

Page 3578 Line 25: rephrase sentence.

Page 3760: Line 20: TOC of 2.8 % is not rich in TOC. Elevated TOC levels would a better phrasing.

Page 3761: Line 20: change organic molecules into biomarkers

Page 3762: Line 1: Which solvent volumes were used for the columns? Line 2: What was the selection for apolar samples based on? And how many samples? Line 18: Rephrase Line 18: Give the m/z's.

Page 3763 Line 1-2: It is an assumption that crenarchaeol mainly originates from marine thaumarchaeota. It is also found in soils and the usage of the BIT-index is complicated by many factors. Please elaborate a bit more on the limitations of BIT.

Page 3764: Line 5: Again, how was this selection made and how many samples did you look at? Why weren't all samples used for TEX86 measured on the GC-MS to infer the thermal maturity for each TEX86 data point? Some sections are characterized by large variations in hopane distributions across OAEs. You have the fractions, so I don't understand why not all samples were run on the GC-MS to assess the maturity. Did I miss something? I urge the authors to measure all samples on the GC-MS. Or at least plot the C31 hopane $\beta\beta$/($\alpha\beta$+$\beta\alpha$+$\beta\beta$) of all the measured samples in figure 2 and 6. Also show the S/R ratio. Are the samples all immature enough to be confident in your TEX86 estimates? Line 5: C31 17β(H), 21β(H) hopane. Line 7: Even if you don't have detectable amounts of $\alpha\beta$-hopanes (but see next comment), the $\beta\beta$/($\alpha\beta$+$\beta\alpha$+$\beta\beta$) ratio can still be «1 if you have $\beta\alpha$-hopanes. Line 8: Blumenberg and Wiese (2012) do report (C31) $\alpha\beta$ (and $\beta\alpha$) -hopanes in their samples (Fig. 6 of their manuscript). So do you really only have $\beta\beta$-hopanes in your samples and if so, why are the results different from the previous study?

Page 3767 Line 20: In my opinion, there is no significant cooling if you take out the one data point at $\sim$ 47 m from figure 6c. So the whole story of a $\sim$ 5oC cooling during the Plenus cold event is based on one single data point. I suggest deleting the section(s) that deal with cooling during the Plenus cold event or at least mention that this is based

on very few data points. I concur with the other reviewer that a few more TEX86 data points during the event would be ideal to confidently identify a cooling, although Im not sure whether the high BIT values prevents the authors from doing this.

Page 3768 Line 19: Can you elaborate a bit on the possible TEX86 errors you mention.

Page 3770: Line 12-14: Could your P/G ratio also be driven by preferential degradation, just as the BIT-index is?

Page 3771 Line 8: Did anybody ever imply that SSTs were driving the cyclic deposition of organic matter?

Lastly, I'm wondering why the proposed forcing for black shale deposition (precession) leads to back shale deposition during OAE 2 alone. Wouldn't orbital forcing by a "constant" forcing, independent of the occurrence of an OAE? What is special to OAE 2 that the orbital forcing triggers black shale deposition and not before or after the event? I urge the authors to discuss this issue in the revised version.

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