

Interactive comment on “Productivity response of calcareous nanoplankton in the South Atlantic to the Eocene Thermal Maximum 2 (ETM2)” by M. Dedert et al.

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Dear M. Dedert and colleagues:

It's Midsommer holiday in Sweden . . . so perusing the literature and happened to come across the submission the day you submitted. Saw the title, so had to read . . . and then felt obligated to make a few comments, hopefully constructive. I have not made any comments on the methods, the results, or the first two sections of the discussion. Think of this as a broad-brush review from an interested reader, and I trust the formal referees and others to help with the details.

Jerry Dickens

C895

First off, the approach is interesting and the topic is important. I also particularly appreciate the recognition that selective dissolution during the hyperthermals likely impacts the calcareous microfossil record. I think this is very obvious with foraminifera assemblages across certain sites during the PETM.

General Comments (in no particular order)

1/ Page 2090, Lines 3-7: This should be rewritten for three reasons (all which stem from current arguments and problems with interpretations regarding the PETM). See also in specific comments.

First, the magnitude of the $\delta^{13}\text{C}$ excursion depends on the carbon-bearing phase examined and the location (e.g., see map in Nicolo et al., 2007), much like for the PETM.

Second, the low in carbonate in marine sedimentary records across ETM2 probably results from two different processes, depending on location. In the deep-sea, it mostly relates to carbonate dissolution; however, in shallow marine environments, it mostly relates to carbonate dilution (Nicolo et al., 2007). Again, this is the same as for the PETM.

Third, there is no evidence that the CCD shoaled during ETM-2, although this was almost assuredly the case. That is, there are no deep-sea sites that show a true clay horizon across ETM2 that I am aware of. However, there are now multiple sites in different basins that suggest a significant rise in the lysocline across the event (e.g., Leon-Rodriguez and Dickens, P3, 2010).

1a/ Following the last comment, there needs to be some careful rewording concerning carbonate dissolution, lysocline and CCD throughout the manuscript. (2092, Line 17;

2/ Paragraphs 3 and 4 of the Introduction seem “out of order”.

3/ It is not clear in the text (e.g., 2092, Line 14 or in Figure 2 where the carbon isotope record for the site comes from.

C896

4/ Somewhere within this manuscript the concept of carbon injection location and rate need to be considered. By this, I mean two things: there is no evidence to suggest that CO₂ was added directly to the atmosphere; all indications suggest the rate of carbon injection during all hyperthermals was much slower than at present-day (e.g., most recently, Cui et al., Nat. Geosci., in press). In other words, if carbonate production did not change during these events, it does not imply that it will not be affected in the near future. This is a delicate topic and needs to be framed accordingly.

5/ Comparisons to the PETM are particularly interesting, because the community ultimately wants to compare records across events with different rates and magnitude of carbon injection. This aspect could be expanded and made clearer. Specifically, how do the records compare (ideally at Walvis Ridge)?

6/ Care needs to be taken in regards to the magnitude of change. For example, in the abstract it states "... slightly elevated productivity during ETM2. This high productivity phase ...". Then again, in the discussion (p. 2104) there is "did not change significantly" followed by an entire section on mechanisms for the change. This reads like as if the change was modest at best but demands some special explanation anyhow.

7/ When discussing enhanced weathering, this clearly occurs during the PETM, although much of the evidence is for elevated physical weathering (i.e., excess supply of sediment to margins), presumably linked to changes in the hydrological cycle. The same phenomenon may apply during ETM2 (Nicolo et al., 2007).

8/ Would have been great to see the work extended across H-2.

9/ Figure 1 is mostly a blank world with the site of interest. Maybe enhance this by showing other sites where ETM2 has been documented? (A now outdated version is in Nicolo et al., 2007).

10/ There are quite a few little things that can be changed in the writing. For example:
Specific Comments

C897

– Page 2090 – Line 2 (and throughout): Check "tense" when describing the past. It seems to me this should be "was" not "is".

Lines 4-6: I would add a sentence here, something like: "An open issue during these events was the response of primary production in surface waters of the ocean, especially including carbonate-secreting organisms." Now the "stage" is set. Then follow by "To examine this at a site in the South Atlantic during ETM-2, ..."

Line 9: Use "because" instead of "since" (you are not conveying time here).

Line 22: Change to "... interest in potentially analogous events ..."

Lines 23-24: This is awkward as written.

Lines 24-4: Somehow I think what you want to convey is: "Pronounced and geologically rapid rises in pCO₂ likely occurred during a series of short-term events in the early Paleogene, known as "hyperthermals". These events were marked by prominent negative excursions in δ¹³C and carbonate dissolution on the seafloor (REF). The most distinct ... The next most prominent was ..."

– Page 2091 –

Line 11: Change "was ... key ... producer" to "were ... main ... producers".

Line 14: Not sure what "scales" means here.

Line 17 (and throughout): Avoid Latin abbreviations in the middle of sentences.

– Page 2092 –

Line 14: Split this sentence. I think you want to say something like "... and a return. This was caused by ... and subsequent net removal of some of this carbon."

Etc.

Interactive comment on Clim. Past Discuss., 7, 2089, 2011.

C898