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Climate of the Past Discussions

Interactive comment on "A seasonality trigger for carbon injection at the Paleocene-Eocene thermal maximum" *by* J. S. Eldrett et al.

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General comments Moderate to major revisions

Please find enclosed my review concerning the ms. "A seasonality trigger for carbon injection at the Paleocene-Eocene thermal maximum"submitted to Climate of the Past by Eldrett et al. CPD-9-5837-2013.

This manuscript presents carbon isotope data performed on TOC and palynological results from a core drilled in 1991 in the Central North Sea that exposes late Paleocene and Eocene sediments (mudstones and heterolithic sands of the Forties fan system). Carbon isotope data and the occurrence of the dinoflagellate Apectodinium augustum are used to determine the CIE onset. Palynofloral assemblages allow the authors to

propose temperature and precipitation reconstructions using a bioclamatic analysis, the NLRs method. The manuscript aim is to evidence an enhanced seasonality prior to the onset of the CIE.

The topic is suitable for Climate of the Past and the manuscript is well-written. The palynological data are very impressive and offer new insights on temperatures and precipations fluctuations at the Palaeocene-Eocene boundary in Europe.

However, I agree with first reviewer C. Jaramillo that the manuscript in its present state has some weakness when dealing with the stratigraphic interpretation. The C-isotope record from well 22/11-N1 appears to be complex and the initiation of CIE difficult to plot. Apectodinium "acme" is also somewhat problematic: it may pre-date the CIE (Sluijs et al., 2007) or may eventually be recorded after the CIE in some locations.

Having reading C. Jaramillo comments and Eldrett answer, I agree that the CIE and PETM should be recorded there, due to the occurrence of A. augustum, but I have still some questions and I think the authors should again produce a more detailed discussion on this point before publication of this (very) nice data set. In short, I am impressed and very interested by the palynological data interpreted as paleoclimatic proxies, but not convinced that the core records at its base, unequivocally, a pre-CIE event. ——— ——————————————————————— Specific comments

1-"Stratigraphic" discussion In order to improve this stratigraphic point, I think the manuscript should include:

- in the text, some biostratigraphic elements detailed by the authors in their reply to C. Jaramillo - Fig.2 should include A. augustum distribution along the core, together with the total abundances of Apectodinium ("acme"). This will be more informative to readers.

2-A pre-CIE seasonality trigger? The C-isotope record is marked by a slight positive trend (2285 to 2273 mbsf) followed by a slight negative trend begining around 2273-

2272 mbsf. Supplementary data show Apectodinium augustum , if I am not mistaken, to appear just at this stratigraphic position, at 2273 mbsf. Why the onset of CIE could not be placed there, instead at 2264 mbsf? The authors mentioned in their reply that Apectodinium augustum is a strict marker of the PETM, but they placed the base of CIE above the first occurrence of this marker... If the base of CIE is placed at 2264 mbsf, then the main changes in CMMT and WMMT values downcore are more or less coeval to the initiation of the CIE and the data set do not testify for a pre-CIE seasonality trigger. Could you comment on this point?

3-Organic matter composition and C-isotope curve shape

I am quite convinced that the long-term slight decrease in 13C from base of core onto 2230 mbsf is probably not linked to bulk organic matter changes. However, organic matter composition changes may be involved in the somewhat erratic aspect of the 13C curve above 2225 mbsf. You could probably use your palynological/palynofacies slides to discuss a little bit more this possibility... Are there documented changes in bulk organic matter composition (Wood fragments inputs associated with the inferred erosional pattern? AOM fluctuations?).

4-MAT and MAP fluctuations

Your palynological record show nice trends or local discrepancies that you do not comment in so much details.

For instance:

-CMMT and WMMT values show a warming onto 2235 mbsf, and then a relative decrease of temperatures, followed by a sudden decrease in WMMT around 2218 mbsf. -CMMP show a quite regular increase onto 2225 mbsf, whereas WMMP rather show 3 peaks inbedded in a plateau. -The third peak zone in WMMP around 2230-2218 mbsf is associated to high but also low values of CMMP.

Could you comment on these trends/differences? Have they been observed elsewhere

within the PETM? What could be their paleoclimatic meaning(s)?

Point-by-point corrections

1 Introduction -Line 24: ..oxidation of terrestrial...

2.2 Palynofloral assemblages -line 22: Icacinaceae: in opposite to other groups, the type of plants related to Icacinaceae is not indicated within the text with reference to fig. 2. Please indicate it to be more informative for readers that are not palynologists.

2.3.2 Precipitations reconstructions -lines 12 and 18: see also Garel et al. (2013, Paleo3) for enhanced precipitation in the Dieppe-Hampshire Basin during the PETM based on delta D values. This is nearest to you core location. Garel et al. (2013) also evidenced an increased in Pediastrum algae at base of PETM, associated with enhanced humidity as testified by delta D values.

3. Conclusions

-line 10: increased seasonality just before the CIE has already be inferred to my knowledge by Collinson et al. (2007, 2009) using charcoal distribution and by Tipple et al. (2011) and Garel et al. (2013) using delta D values. You should mention it, although I fully agree that your work offers a very nice and impressive improvement in distinguishing directly warm and cold months using palynology.

You should also have a look on the recent paper (2014) by Pujalte et al. that deal with the broad view of sea-level changes and paleoclimate evolution across the P/E boundary.

Hoping this would be helpfull to the authors and hoping to see this nice work soon published after further discussions,

Johann Schnyder, Lecturer, University Paris 6, France.

Interactive comment on Clim. Past Discuss., 9, 5837, 2013.