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To: *Biogeosciences*, editorial board

Leuven, September 26th 2019

Dear Editor,

Herewith we like to resubmit our manuscript on the dinoflagellate response to the Late Maastrichtian Warming Event.

Please find attached a revised version of our manuscript entitled "***Phytoplankton community disruption caused by latest Cretaceous global warming***" submitted by J. Vellekoop, L. Woelders, A. Sluijs, K.G. Miller and R.P. Speijer.

We have received two reviews, the first of which recommended our manuscript to be published with no additional corrections, while the second reviewer had several suggestions concerning the structure of the manuscript, and pointed out a few points where the argumentation could be clarified. We thank this reviewer for the valuable comments, which have been very helpful in improving our manuscript. After thorough revisions, we believe that we will convince the reviewer of our main conclusions.

The main issue raised by the reviewer concerned the difference between the dinocyst assemblages and the benthic foraminiferal assemblages in the post-warming interval, which were not thoroughly explained in our initial manuscript. In our revised manuscript, we have discussed this in more detail, hopefully eliminating any concerns by the reviewer.

We hope that by addressing this point raised by the reviewer and improving our manuscript accordingly, you are able to reconsider this manuscript for publication in *Biogeosciences*.

Below, we include a point-by-point response to the comments of Reviewer 2.

Looking forward to your decision on our manuscript, with best regards,

Johan Vellekoop
Signed on behalf of all the authors

..the difference between the dinocyst assemblages and the benthic foraminiferal assemblages in the post-warming interval is not convincing. On what data is this statement based on? How many data points are we discussing here? Outside of abstract and conclusion, it is only stated briefly on p.7 line 13-15 without any references to a figure.

Answer:

We thank the reviewer for pointing out that we have insufficiently explained this aspect of our data. We have two benthic foraminiferal data points above the LMWE interval, which both are still characterized by a lower benthic foraminiferal diversity, compared to the pre-warming interval, while dinocyst diversity does return to pre-LMWE values. In our revised manuscript, we have clarified this, adding a sentence two sentences on page 7, and a reference to figure 3, which shows the diversity curves of the benthic foraminifera and dinocysts of Bass River.

An inconsistency: P.1 line 11 (kiloyear) vs. p.2 line 10 (kyrs). It can be changed to 350 000 years in both places

Answer: All the term “350 000 years” generates a false sense of precision, we prefer to keep to the term kiloyears. Since “kyr” technically is an abbreviation, we choose to write it out in the abstract. In our revised manuscript, we have included the abbreviation (“kyr”) in the abstract as well.

K-Pg in the abstract is not defined (p.1, line 23)

Answer: corrected.

Please be consistent and use Fig. in the main text *in some places it is spelled in full.

Answer: corrected

I suggest to title the file “Supplementary Information” and label tables and figures Sx (e.g. Fig. S4) and not (SI Fig S4). Following this, in the main text it is enough to refer Fig Sx.

Answer: Ok, adjusted

p.2, line 5: double species

Answer: OK adjusted

p.2 line 7: should be 66.4 – 66.1 Ma

Answer: OK adjusted

Is it Material & Methods or Material and Methods?

Answer: we have changed this to “Material and Methods”

Material & Methods: in this chapter it should be mentioned in which profile the benthic foraminifera were analysed. So far this information is included only in the introduction.

Answer: in our revised manuscript, we have indicated in the Material & Methods that our benthic foraminiferal analyses were performed on the Bass River core.

p.3, line 27: I suggest to include the info on the FAD of these taxa. Secondly, an expression “low numbers” should be somehow defined (i.e. below x% of the total relative/ absolute dinocyst assemblage)

Answer: In our revised manuscript, we have changed this sentence to “With respective first appearance datums of 66.77 and 67.0 Ma, both *P. grallator* and *D. carposphaeropsis* were already well-established before the LMWE (e.g. Williams et al., 2004), but generally occurred in low numbers (usually well below 5% of the total dinocyst assemblage).”

p.4, line 10: “previously published” can be changed to “existing”

Answer: we do not follow the reviewer here. In our opinion, the term “existing data” can be a bit vague. Does unpublished data “exist”? This is particularly relevant here, as there is a lot of data from the industry, which confirms these peak abundances of *P. grallator*, but which is technically not published in peer-reviewed science. When we want to stick to properly accessible and published data, the term “previously published” is preferable.

Results: the results of the foraminifera analysis should be briefly mentioned here.

Answer: in our revised manuscript we have included a paragraph on our foraminiferal analyses in the Results section.

p. 4, line 32 – p.5 line 1: this sentence should be rephrased

Answer: we do not see what is wrong with this sentence: “*Moreover, dorsoventrally compressed gonyaulacoid cysts like P. grallator are typically not considered indicative of high nutrient, low salinity conditions (Frieling and Sluijs, 2018).*”

We do understand that a positive phrasing (“...are considered indicated of...”) is more commonly used, but in this particular case we want to stress that dorsoventrally compressed gonyaulacoids are *not* considered typical for freshwater input, rather than whatever they *do* respond to.

p.5, line 2: this is the first time the foraminifera record is mentioned here and it is not really clear what is this interpretation based on. Please consider to rephrase this part.

Answer: In our revised manuscript, we have included a paragraph on the foraminiferal data in the Results section. In addition, we have now included this sentence “i.e. no peak in either the *Senegalium* complex or in bi- and triserial endobenthic morphotypes, respectively,” in section 4.1.

p.5, line 15-16: The sentence is not really clear. Consider rephrasing to: “In addition, if the high SSTs in late Cretaceous were somehow limiting the productivity, increased temperatures may have further boosted growth rates” (if I understand the meaning correct).

Answer: We have changed this sentence to *“In addition, if the already relatively high sea water temperatures in the late Cretaceous were somehow still limiting productivity, increased temperatures during the LMWE may have further boosted growth rates”*

p.5, line 33 to p.6, line 2: “bloom/blooming” is mentioned really many times here and it disturbs the flow. Please consider to rephrase this part to avoid numerous repetitions. The same for p.7 lines 23-24.

Answer: while we acknowledge that we are using the terms “bloom” and “blooming” quite a lot, unfortunately, there are few (if any?) synonyms for either. We have tried to improve the flow off these sections by changing the structure of some of the sentences.

p.6, line 6-11: This statement needs to be justified better, by perhaps supporting this statement with a reference to a proper figure

Answer: we thank the reviewer for this suggestion. We will refer tot the proper figures (Figs. 2 and 4).

p.7 line 1-2; I suggest to add an age reference here “Likewise, during the Middle Eocene Climatic Optimum, a warming interval which took place XX Ma, dinoflagellate blooms: : :”. It is clear that this is an event from the Eocene, but not all know the age of the event.

Answer: In our revised manuscript we have changed this sentence accordingly, including an approximate age (ca. 40 Ma) and a reference (Bohaty & Zachos 2003).

p.7 line 3: remove T

Answer: OK adjusted

p.7, line 13: “the former Maastrichtian dinocyst assemblages returned” rephrase

Answer: in our revised manuscript, we have rephrased this sentence.

Please check “SI Tables”. The text does not look right in the uploaded file. I suggest to upload all range charts as Excel files (or on <https://www.pangaea.de/>?) instead. It will read so much easier than in the current version.

Answer: For our resubmission, we have uploaded our supplementary tables to www.pangaea.de. <https://issues.pangaea.de/browse/PDI-21692>

