Biogeosciences Discuss., 6, C732–C736, 2009
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Biogeosciences Discussions

Interactive comment on "A dynamic climate and ecosystem state during the Paleocene-Eocene Thermal Maximum – inferences from dinoflagellate cyst assemblages at the New Jersey Shelf" *by* A. Sluijs and H. Brinkhuis

Anonymous Referee #1

Received and published: 16 June 2009

GENERAL COMMENTS:

The paper by Sluijs and Brinkhuis provides abundant new information on the paleoenvironmental significance of cyst-forming dinoflagellates during the Paleocene-Eocene Thermal Maximum (PETM), an extreme greenhouse interval of the Earth's history. Particular emphasis is given to identifying the factors that govern the distribution of the *Apectodinium* plexus, a group of dinoflagellate cysts with a distribution pattern that is intimately linked with the PETM. Through the integration with information from other, previously published paleoenvironmental proxy data (i.e., TEX-86 paleothermometry,

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grain-size distribution, magnetic susceptibility), and supported through statistical methods (CCA, PCA), the authors successfully aim at further refining our understanding of the series of events that characterize this extreme warming event.

Overall, I consider the paper to be well suited for publication in "*Biogeosciences*". With regard to its scientific significance, I consider it to be of very high quality: The paleoenvironmental information that the authors deduce from dinoflagellate cyst assemblages on the New Jersey shelf represents a significant step forward in the use of fossil dinoflagellate cysts as proxies in paleoceanography and paleoclimatology. The applied methods appear well selected, and the results are thoroughly discussed. With regard to the quality of presented results, I found it somewhat difficult to decipher the information on some of the figures (specifically, Figs. 2a-b and 3a-b) because these are only available in a very small size (possibly due to the layout of "Biogeosciences Discussion", in which case this limitation would obviously not be within the responsibility of the authors); otherwise, the quality of the figures is very high. The text is generally well structured and well written – my only criticism here being that some sentences are quite long and sometimes somewhat convoluted, with the result that readers may lose track of what the authors are trying to convey. The title clearly reflects the contents of the paper, as does the abstract.

SPECIFIC COMMENTS:

Introduction, Line 5: I suggest to add a reference to the IPCC report here.

Introduction, Line 15: Please specify on the warming: Do you mean globally, or in the high latitudes, or in the tropics?

Material, Line 12: „closer to the paleoshoreline" – than what? I presume that it is meant with respect to Bass River, but please rephrase in order to maximize clarity.

Processing and Analyses, Line 14: I suggest to add a reference to Pross and Schmiedl (2002, Marine Micropaleontology 45, 1-24) here because that paper presents a pa-

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leoenvironmental interpretation of Paleogene dinoflagellate cyst assemblages based on principal component analysis, which makes it a precursor of the work of Sluijs and Brinkhuis.

Dinocyst distribution patterns, Line 13: „Just prior to the onset of the PETM“ – how much earlier (in kyrs) is meant here? Please specify.

4.1.1, Temperature, Line 1: To substantaite this statement, please give reference for an observation of this phenomenon in Recent dinoflagellate (cyst)s.

4.1.3, Heterotrophy, Lines 17-19: The sentence states that „several authors“ have suggested heterotrophy for Apectodinium, but only one reference (i.e., Bujak and Brinkhuis, 1998) is cited. Because the paleoecology of *Apectodinium* is a major issue of the entire paper, I would like to see more references of papers that comment on the potentially heterotrophic nature of *Apectodinium*.

4.1.3, Heterotrophy, Page 5174, Line 9: This increase in nutrient availability in shallow-marine settings should be documented palynologically by an increase in the pollen and spore flux (as a result of an enhanced hydrological cycle). Do the authors see such a signal in their data? I realize that they comment on this phenomenon later in the manuscript, but I suggest to discuss this aspect here.

A variable climate state during the PETM?, first paragraph: Please make clear (in this paragraph and elsewhere) if you are dealing with relative or absolute (i.e., cysts per gram) abundances.

Synthesis/concluding remarks, Lines 24-26: Although the authors clearly indicate that they are entering the realm of speculation here, they may be taking things a little too far here. Is there any analogy for such a scenario elsewhere in the geological record? If yes, this would have the potential so seriously strengthen their case. How about shifts in atmospheric circulation patterns resulting from the overall warming as a potential cause?

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Sections 4.11, 4.1.2, 4.1.3, 4.2, and 4.3: These sections – and thus the clarity of the entire ms – might benefit from brief summaries given after each individual sections.

TECHNICAL CORRECTIONS:

Introduction, Line 17: Replace „measured“ by „documented“.

Material, Line 13: Replace „indicated“ by „indicates“.

Material, Page 5168, Line 5: Replace „in“ by „by“.

Dinoflagellate cyst ecology and grouping of taxa, Line 24: Replace „chemophysical“ by „physicochemical“.

Page 5169, Line 3: Delete „and differences in those details“.

Page 5169, Line 9: „first-order“.

Page 5169, Line 10: „physicochemical, not „physiochemical“.

Page 5170, Line 4: Delete „of“.

Page 5170, Lines 8-12: Sentence too long!

Page 5169, Line 24: „Prior to the PETM, assemblages both at Wilson Lake and Bass River are dominated...“.

Page 5172, Line 4: „quasi-global“. Also, delete comma in front of *Apectodinium*.

Page 5172, Lines 9-10: Cut into two sentences.

Page 5172, Line 20: Add „at that time“ after „taxon“.

Page 5173, Line 22: Delete „suggesting that they are related“.

Page 5176, Lines 6-9: Long sentence, please divide into two sentences.

Page 5176, Line 21: Replace „But“ by However,“.

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Page 5178, Line 1: „associated to the precessional cycle“.

Page 5178, Line 16: „invoke“.

Page 5179, Line 20: „Milankovitch“.

Page 5179, Line 22: Delete „do“.

Page 5180, Line 21: Delete „s“ in „cysts“.

Page 5181, Line 25-27: Give references for stratigraphic occurrences.

References: It appears that the journal title „Palaeogeography, Palaeoclimatology, Palaeoecology“ is consistently abbreviated as „Palaeogeogr. Palaeocl.“ Is this (which strikes me as rather unusual) really the format of *Biogeosciences*? Please check.

Table 1: Please delete the „a“ in front of many comments in the „Description“ column. In the column „Remarks“, please replace „not truly outstanding“ by „not truly clear“. Also, please rephrase the last stement in this column („tentative correlation, not truly“ – is this supposed to be a complete statement?).

Interactive comment on Biogeosciences Discuss., 6, 5163, 2009.