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Interactive comment on "Plants in movement – Floristic and climatic characterization of the New Jersey hinterland during the Palaeogene–Neogene transition in relation to major glaciation events" *by* Sabine Prader et al.

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The authors investigated a palynological sequence from eastern North America spanning the Oligocene Miocene boundary in order to infer climate evolution over this time interval, possible movements of vegetation units along an altitudinal gradient, and to compare this with major glaciation events during this time. Climate reconstruction uses a nearest living relative approach and altitudinal vegetational shifts are investigated by the relative contribution of so-called "artificial vegetation units" to the entire palyno-assemblage. Some pollen taxa are documented using LM and SEM.

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This paper is not ready for publication. There are problems with presentation of the data (inappropriate pollen diagram) and general problems (coding of vegetation units). However, if the authors are willing to undertake a full revision I do see a potential for this paper to become a valuable contribution to Biogeosciences. I start my report with a few general comments followed by specific remarks.

General comment 1: I think you should provide a full pollen diagram. The present way of presenting the pollen data is not acceptable, especially since you want to trace possible correlations with climate change. It may be that rare exotic elements disappear from the pollen record at some point, but this is not seen in your very cryptic diagram. Secondly you must indicate hiatuses in Figures 2–4. It looks very odd as it is.

In this context I also wonder how you distinguish Larix from Pseudotsuga, and Tsuga canadensis from T. caroliniana. Please explain. Further, I wonder about the presence of Cedrus in E North America. This finding would need to be verified using SEM.

General comment 2: In Supplement S3 plant taxa are assigned to vegetation units and this assignment has implications for inferring altitudinal shifts of vegetation units (in response to cooling/warming). To my knowledge, it is impossible to score each taxon for one particular vegetation unit. Just taking Flora of North America it is clear that many of the reported taxa have wide ecological ranges and occur in more than one vegetation unit: A few examples are Pinus (2, 5 and 7), Apiaceae (4 and 7), Artemisia (1, 2, 6, 7), Ericaceae (1-6), Fabaceae (1-7), Hamamelidaceae (4, 5, 7) etc. I think this must be corrected.

I also wondered about the vegetation unit “Cupressaceae”. These may include almost everything, from swamp forest to sand dunes, to mixed mesophytic forest, to rocky cliffs etc.

General comment 3: relates to section 3.3, line 25 It would be very illuminating to know which changes in taxon composition/pollen frequencies accounted for this purported drop in temperature. Also for the section further down on climate fluctuations, it would

be helpful to name the taxa that account for changes in temperature parameters.

General comment 4: relates to section 4.2, lines 15, 16 Even if just taking extant pines of E North America a great number of different ecologies are encountered: Forest, sandy soils, sand dunes, bogs, and typically occurring in flatwoods. The latter would correspond to your vegetation unit 5, I think, sand dunes to VU 7 etc. The same is true for oaks, especially if you have sections Quercus and Lobatae both well-drained and wet soils forests are equally possible environments. You may want to update to the current classification of Quercus (Denk et al. 2017).

General comment 5: page 7, line 29 Something is wrong here. The modern distribution of Fagus grandifolia is just exactly in E North America. Not precisely on the coast but close to it. Check in GBIF. See also Bennet 1985, J. Biogeography. I would expect fairly high percentages of Fagus pollen in a modern pollen diagram. Was Fagus less common during some of the time intervals investigated by you?

General comment 6: relates to section 4.3 I must admit that I had hard times reading this part. p. 8, line 16: Which Pinaceae? On the pollen diagram I see Pinus and Cathaya – Cathaya is more like a mesophytic element and fits well into vegetation unit 4. Also consider that "several conifer taxa may also have been part of hammocks within peat-forming vegetation (e.g. Cathaya, Sequoia, Taiwania) and of raised bogs (Sciadopitys; Schneider, 1992; Dolezych & Schneider, 2007)." [from Denk 2016]. All in all, I am not convinced by the claimed correlation between glaciations and fluctuations in the palynological record investigated for this study. Again, I think the entire pollen profile must be presented, and if the authors want to make a case for shifts in some Pinaceae taxa reflecting cooling or warming then this should be illustrated based on a detailed pollen diagram.

General comment 7: Aspects of the paper that are insufficiently addressed in the current version Biogeographic aspects could be discussed when making use of the full pollen diagram. For example, I noted that Eotrigonobalanus, "Eleagnus", and Cedrus

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provide links to Europe. Eucommia, Cathaya, Sciadopitys provide geographic links with East Asia but were widespread in the N Hemisphere during the Cenozoic and . Cedrelospermum and Eotrigonobalanus are extinct taxa. Are these taxa represented in all time slices covered by this study, is there a pattern of extinction? How does the pollen assemblage studied here compare to the Brandon Lignite?

I also noted that the Fagus pollen you figure is very interesting: it has a long and narrow colpus reaching almost to the poles of the grain. This is typical of subgenus Engleriana and the most distinct species Fagus grandifolia within subgenus Fagus.

Specific comments: Throughout the text: It is early Eocene, middle Miocene, etc. not Early Eocene, Middle Miocene

Page 1, line 15. “altitudinal spatial and long-term temporal vegetation migration” Very much information in one sentence. I don’t understand what you mean with "altitudinal spatial" Are you assigning taxa to vertical vegetation zones? Same with "long-term temporal". Perhaps better to just say long-term.

Page 1, line 18. “To infer possible topographic palaeovegetation movements” Does this mean the same as “altitudinal spatial” above. This is very confusing, please re-phrase.

Page 1, line 23. “Biotic responds to environment change” change to: Biotic responses to environmental change.

Page 2, line 9. 20 or 23?

Page 7, line 6. “rule out that this extinct lineage” change to: rule out that Trigonobalanopsis

Page 7, line 14. “had a greater ecological range” change to: had a wider ecological range

Page 7, line 29. “persistent” do you mean “common”?

Page 7, line 31. “Contrary to Fagus and its spatiotemporal distribution, the Atlantic east

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coast is currently a hot spot. . .” Please re-phrase.

Page 8, line 1. “where Carya became the prevalent genus” Please re-phrase.

Page 8, line 13. Do you want to say that the maritime setting of your sample sites buffered possible regional climate change. And that this could explain the weak signal in the palynological record?

Page 8, lines 27, 28. Please re-phrase.

Page 9, line 1. “might” or: is?

Page 9, lines 17, 18. “a contrasted spatiotemporal distribution ...” This does not make sense, please re-phrase. What exactly do you want to say? Same for “enhanced floral turnover”. Please re-phrase.

Page 9, lines 25 ff. Please re-phrase. And re-think the possible movements.

Figure 4. Oxygen isotope curve. You may want to colour warming and cooling trends using red and blue. This would make it easier to read the figure.

Supplement, Plate S4-ii. “Eleagnus” looks similar to Boehlensipollis hohli from Rupelian to Aquitanian strata of France, Belgium, and Poland (Sittler et al., 1975; Stuchlik et al., 2014). Affinities are possibly with Eleagnus but possibly also with other genera. Still, you have a nice example of a European-E North American disjunction here.

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