

Interactive comment on “Neoglacial trends in diatom dynamics from a small alpine lake in the Qinling Mountains of central China” by Bo Cheng et al.

Bo Cheng et al.

a.mackay@ucl.ac.uk

Received and published: 18 December 2019

We would like to take the opportunity to thank the three reviewers for highlighting some very important generalisations in our interpretations of changing diatoms, guilds and beta-diversity. We have taken on board all their comments, but this has necessitated some substantial changes to the manuscript. 1. We have moved away from discussing beta-diversity and resources in general because (i) beta-diversity has so many different meanings to different disciplines, and (ii) the reviewers were right to point out that talking about resources in general in a palaeo paper was too vague. 2. We have restructured the discussion somewhat, where we now (i) interpret the major changes to species in

C1

an environmental context; (ii) discuss what changes to the diatom guilds might mean, before (iii) finally using this information to inform changes in compositional turnover (which is one form of beta-diversity). 3. In the original version of the manuscript we had undertaken PCA of the genera, but barely talked about these in the results. We have decided to remove the PCA of the genera from the revised version. 4. However, we have included TOC as an extra proxy (as all reviewers made a comment on only looking at diatoms), and this has been very useful in interpreting carbon sequestration in the lake during the neoglacial.

Other general changes:

• Aifeng Zhou is now a co-corresponding author along with Anson Mackay
• Keywords are more reflective of the revised manuscript

Reviewer 2 comments

Reviewer 2 found some of the interpretation “a bit vague” and lacked a “multiproxy approach”. These two broad comments are similar to Reviewer 1, and we have addressed both. The former comment has been tackled by being more explicit what we mean when we talk about diatom responses to changing resources – see comments to R1 above, and changes made throughout the text, highlighted under track changes. And the latter comment has been addressed now by adding in TOC data (see Fig 5c).

Specific comments:

Line 70: Describe what is beta-diversity. Response: As identified by R1, we have added in further clarification on beta diversity (eg P3, lines 81-84). Because the term now means different things to different groups of scientists, we refer to the data more specifically as compositional turnover (P3, Lines 88-90)

Line 77: What do you mean by elevation-dependent warming? Response: We have provided greater explanation: , “i.e. the amplification of warming at higher altitudes” P3, Lines 69-70

C2

Line 97: Don't really like the term global warmth...is there another way to say this? â€” Done: have changed to "globally warmer temperatures".

Line 99: "less monotonic" – is that the right term? Thought monotonic was used to describe sequences...? â€” Done – we have simplified this sentence to read "The extent of cooling varied regionally, being most pronounced in the extra-tropical northern hemisphere (Marcott et al. 2013)." (P4, Lines 105-106)

Line 110: Define LIA â€” Done

Line 115: Define ASM â€” Done

Line 124: What do you mean by ecological guilds? â€” Response: This is defined in the methods in Section 2.2, P8-9, Lines 188-198

132: On what account is it a biodiversity hotspot? Describe â€” Response: We have added in more detail: "...as a refuge for both Tertiary plants (Zhang et al. 2017) and the vulnerable Giant Panda (Fan et al. 2014)." (P5, Lines 134-136)

Line 141: Describe what you mean by Larix forest - what species? what climate/soil conditions do they require? Etc â€” Response: we have added in detail – P6, Lines 144-146:

Line 142: More detail on the lake itself would be good. Has the lake ever been studied before? Any more bathymetry of the lake? What is its riparian/shoreline vegetation? Is it in a small, steep catchment? Does it have macrophytes in its shallow waters? Is it dimictic/polymictic etc? Or is knowledge extremely limited here? â€” Response: we actually have very little information on the lake, due to its remoteness. We have included what extra info that we have. We observed no shoreline macrophytes (it was winter when the lake was visited, and frozen over), but we measured surface water pH at 6.84, using a YSI ProDSS multiparameter water quality meter. (P6, Lines 146-150)

Line 155: Which country is Beta Analytic? â€” Done: USA

C3

Line 224: Don't quite follow the sentence. Do you mean 120 of the species were rare? â€” Done: we have rephrased

Line 316: State specifically how and why the change in catchment vegetation would have altered delivery of allochthonous material? Increased or decreased? â€” Response: We agree with the statement that more detail needs to be given as to whether allochthonous material increased or decreased with shift in vegetation. But as highlighted in R1 above, the relevance for this for YHC site is not clear – we have deleted this statement therefore

Line 321: Not a clear sentence. Did limiting resources become more limited? Or more resources became more limited? â€” Response: We have deleted this sentence

Line 323: "deterministic processes become more important" - more important than what? What do you mean by deterministic processes? â€” Response: Here we have clarified that deterministic processes become more important than stochastic ones. Deterministic processes here are ones related to niche selection. See P17, Lines 374-379

Line 330: What "resources"? Be specific. â€” Response: we have rewritten and reorganized the start of the Discussion

Line 342: Again, be more specific about what "resources" you mean and why and how this increased the prevalence of high profile diatoms. â€” Response: we have rewritten and reorganized the start of the Discussion

Line 387: Is this a worthy comparison if the soils and altitudinal differences are dissimilar? If so, why? This could be a good opportunity to highlight the importance of lake and catchment characteristics is shaping the response of lake ecology to large-scale spatial and temporal drivers of change. â€” Response: we have deleted comparison to this other site, as it was a bit random, and given catchments differences, may well not have been a robust comparison to make

C4

Line 395-6: Don't understand what you mean by "several interacting, time-transgressive forcings", please be clear and describe what you mean. $\hat{\text{A}}$ Response: we have added information: "... , including reduced solar activity during the late 17th century (Shindell et al. 2001), increased volcanic activity during the early 19th century (Brönnimann et al. 2019) and reduced Gulf Stream flow (Lund et al. 2006)." P20, Lines 430-433

Line 411: What is K+ a proxy for? Please describe for readers who may not know $\hat{\text{A}}$ Response: we have added in extra text + reference - , "...given that potassium is likely sourced from central Asian dust via long-range transport to the Greenland ice sheet (Meeker and Mayewski 2002)" P21, Lines 450-452

Line 414: What do you mean by phenological records? $\hat{\text{A}}$ Response: we have added "beginning of tree flowering" P20, Line 415

Line 421: What are these conditions? Be specific. $\hat{\text{A}}$ We have deleted this sentence.

Line 422: How does cold conditions and extended ice cover decrease these planktonic diatoms? Be specific. Changes to turnover events? Nutrient supply? $\hat{\text{A}}$ We have deleted this sentence

Line 428: What do you mean by "resources" here? Nutrients? Be specific. $\hat{\text{A}}$ Response: we have actually re-focused the ecology of *D. subtilis* here, as other studies have found it to be linked to elevated conductivity, e.g. Antoniadou et al. 2005): see P22, Line463-465.

Line 434: Again what do you mean by "resources" becoming more available? Be specific. $\hat{\text{A}}$ Response: we have rephrased as "...increased competition among species (Larson et al. 2016)" P22, Lines 473-474

Line 436: Why is this important? Describe. $\hat{\text{A}}$ We have deleted this sentence

Line 448: "time of the"..? $\hat{\text{A}}$ Corrected

C5

Line 453: What is "their"? Be clear $\hat{\text{A}}$ We have deleted this sentence

References used:

Antoniades, D., Douglas, M.S. and Smol, J.P., 2005. Benthic diatom autecology and inference model development from the Canadian high arctic Archipelago 1. *Journal of Phycology*, 41(1), pp.30-45.

Brönnimann, S., Franke, J., Nussbaumer, S .U., Zumbühl, H. J., Steiner, D., Trachsel, M., Hegerl, G. C., Schurer, A., Worni, M., Malik, A., Flückiger, J.: Last phase of the Little Ice Age forced by volcanic eruptions. *Nat. Geosci.* 12, 650-656, 2019.

Meeker, L.D. and Mayewski, P.A., 2002. A 1400-year high-resolution record of atmospheric circulation over the North Atlantic and Asia. *The Holocene*, 12(3), pp.257-266

Stebich, M., Rehfeld, K., Schlüßler, F., Tarasov, P., Liu, J., Mingram, J.: Holocene vegetation and climate dynamics of NE China based on the pollen record from Sihailongwan Maar Lake. *Quat. Sci. Rev.*, 124, 275-289, 2015.

Interactive comment on *Clim. Past Discuss.*, <https://doi.org/10.5194/cp-2019-85>, 2019.

C6