

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.

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Responses to Reviewers Comments

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

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the discussion somewhat, where we now (i) interpret the major changes to species in 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 1:

Reviewer 1 has two points of general criticism. First that we should develop the assumption that temporal changes in diatoms are linked to lake-catchment resource availability, which in itself is related to climate variability. Second, that we show no other palaeolimnological data such as TOC.

The first set of comments are really interesting, and have highlighted us to new literature by Rimet et al. 2019, and Passy & Larson 2019, including the role that turbulence may play in influencing alpine diatom communities. We have taken on board other factors that may influence diatom communities in an alpine setting throughout the text. Rather than providing a new suggested paragraph on temporal beta diversity (linked to Korhonen et al. 2010), we have provided greater clarification on the form of beta-diversity used in this study. In fact, as now stated in the text, we have chosen to discuss our data in the form of compositional turnover, to avoid the confusion that the term beta-diversity can now have, given all its different meanings (sensu Anderson et al. 2011).

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Specific comments have all been addressed:

Page 2, line 56: for consistency with the rest of the manuscript, use Medieval Climatic Anomaly (not Optimum) – Done

Page 3, line 76: delete “however” – Done

Page 3, lines 82-83: rephrase such as: : : but provide their habitats to many iconic species that are also vulnerable – Done, P3, Line 73-74

Page 3, line 86: : : where long-term historical and/or instrumental records are – Done

Page 4, line 102: add a reference about the driver of the NH cooling – Done. Marcott et al. 2013, P4, Line 107

Page 4, line 108: correct spelling of climatic – Done

Page 4, line 115: spell in full Asian Summer Monsoon (ASM) as it here mentioned for the first time in the text – Done

Page 5, lines 127-128: from where this big assumption comes from? Is diatom diversity always linked to resources? Also need to be more specific about the resources: is it just nutrients, light? What about the other factor: habitat availability, grazing by invertebrates? – Response: we have deleted the sentence related to this assumption, as the reviewer is right, it is a very big assumption, and we have not demonstrated its validity.

Page 5, line 144: (in legend for Fig. 1): change central Asia by central China. – Done

Are subalpine meadow (as written in the text, line 141) and tundra the same type of vegetation? – Response: No they are different; we have deleted “tundra” from the legend of Figure 1

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Page 6, line 163: From what it is written I assume that the core was sliced at 1-cm intervals: please specify and also give the actual number of samples analysed – Done

Page 7, line 167: it's divinylbenzene (DVB), not bivinyll – Done

Page 7, line 168: the concentration unit should be in nb of spheres per volume, ml or cm³ but not cm², right? – Correct – this should have been spheres/cm³

Page 7, line 171: add the registered symbol ® after Naphrax, Zeiss Axiostar Plus – Done

Page 7, line 184: siltation is also an important factor that promote motile benthic diatoms over attached forms (e.g. Battegazzore et al. 2004; Dickman et al. 2005). – Response: We have added in reference to siltation, using the Battegazzore reference: P8, Line 196

Page 7, line 192- 193: a log-linear contrast PCA. I'm not familiar with this technique, please explain in one sentence how different it is from “conventional” PCA and what are the advantages – Response: Into P8, Lines 205-206, we have added in the clause, which also necessitates a new reference: “(appropriate for closed relative abundance data (Lotter and Birks,1993)) was undertaken. . .”

Page 8, line 207: give a reference for the C2 program – Done: added in Juggins 2014)

Page 10, line 228: Puncticulata is a redundant generic name. Use Lindavia (see Nakov et al. 2015). – Done

Page 10, line 250: you forgot a few words: : : while high profile and motile diatoms are persistently – Done

Page 11, line 256 (legend of Fig. 3): rephrase such as: Only diatoms with abundance greater than 3% are shown – Done

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Page 12, Figure 3: It would be useful to group the diatom species according to their ecological guild. â€” Done

In Fig 3, Correct spelling of *Staurosira construens*, change *Puncticulata* to *Lindavia* â€” Done

Page 14, Fig.5: correct spelling for “centered” â€” Done

Page 15, line 303: : : dominated by species belonging to the Fragilariaceae â€” Done

Page 15, line 304: replace “growing well” by “dominating the assemblages” â€” Done

Page 15, line 306: on the abundance of fragilarioids: â€” Done

Page 15, line 307: add “(Russia)” after “Eastern Sayan mountains” â€” Done

Page 15, lines 310-319: This explanation about the decline of *Stauroforma* is not entirely convincing. First the catchment of the lake appears treeless as it is located above the treeline (as shown on Fig. 1). In that case, how the mentioned shift from a deciduous-conifer forest to a steppe forest would have impacted the soils of the lake catchment if no forest was there in the first place? â€” Agreed: we have removed this sentence

Then you need to be more specific than just saying “related to the provision of resources linked to catchment changes around the lake”. Could the reduced input of DOC may be linked to deeper, longer permafrost instead of shift in catchment vegetation? (as the authors have suggested themselves on lines 423-424 but for the upper part of the record). â€” Response: we have tried to be more nuanced here, and have made the observation that highest *Stauroforma* and TOC occur together, so its presence may be linked to the lake being dystrophic at the time. See new text in Section 4.1, P 15, Lines 329-338

Page 16, line 329: use replaced instead of replacing â€” Done

Page 16, line 341: Why are you comparing your results with winter temperature? Sum-

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mer temperature would be more relevant for benthic diatoms. Also note that summer temperature may have been relatively high in Northern China during the “Roman Warm Period” as suggested by the pollen reconstruction by Stebich et al. (2015). â€” Response: we had not seen the Stebich et al. 2015 article, so as suggested we have replotted their mean temperature of the warmest month in our multi-archive Figure 6, and included relevant interpretation in the text. (e.g. see P15, Lines 334-335)

Page 17, legend of Fig. 6. Replace “Chinese” by “central China”. â€” Done

Fig 6: The number for each curves are wrong, should be 6a, 6b, 6c, etc: : : instead of 7a, 7b, 7c: â€” Done

Page 17, line 364: correct spelling of climatic â€” Done

Pages 18-19: For consistency and to make it easy to found the features that are discussed on the diagrams, please give all the ages in cal yrs BP, not just in CE calendar. â€” Done

Page 19, line 419: replace “important” by abundant Page 20, â€” Done

Page 20, line 427: give a reference about the ecology of *Denticula subtilis* â€” Done: we have actually re-focused the ecology here, as other studies have found it to be linked to elevated conductivity, e.g. Antoniadou et al. (2005): see P22, Lines 463-467

Page 20, line 446: is a bit confusing: was aridity declining or on the contrary increasing, as the curve for reconstructed precipitation (Fig 6d) would suggest? â€” Done – sorry, yes aridity was increasing. We have corrected the text

Page 20, line 448: delete “of the” after around the time â€” Done

Page 20, lines: 448-450: what about the 2-sample shift from *Stauroforma* to *Lindavia*+*humidophila*? â€” Response: We have added in extra discussion at the end related to this period, P 23 Lines 488-492.

Page 21, line 465: rephrase such as: Increased summer precipitation during the MCA

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as inferred from nearby records (here add references!) resulted in increased diatom fluxes – Done

General comment on adding in more data. – Response: unfortunately we do not have any geochemical data, but we do have measurements for total organic carbon, and these have now been added to methods, results, and implications in discussion.

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.

Anderson, M.J., Crist, T.O., Chase, J.M., Vellend, M., Inouye, B.D., Freestone, A.L., Sanders, N.J., Cornell, H.V., Comita, L.S., Davies, K.F. and Harrison, S.P., 2011. Navigating the multiple meanings of β diversity: a roadmap for the practicing ecologist. *Ecology letters*, 14(1), pp.19-28.

Juggins S (2014) C2 version 1.7.7: software for ecological and palaeoecological data. University of Newcastle

Lotter, A.F., Birks, H.J.B., 1993. The impact of the Laacher See tephra on terrestrial and aquatic ecosystems in the Black Forest, southern Germany. *Journal of Quaternary Science* 8, 263-276

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