**Climate
of the Past**
Discussions

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.

Anonymous Referee #1

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General comments:

In this manuscript Cheng et al. investigate how climate change impacted the late Holocene diatom communities from a small alpine lake located in the Qinling Mountains in Central China. There are very few studies on past climate from that important mountain range in central China and the diatom data presented here are a valuable addition. In addition, the authors are proposing an interesting interpretation of the diatom sequence mainly focused on trends in beta-diversity and shifts in ecological guilds. I believe this paper represent a valuable contribution towards our understanding of how climate change affect alpine lake ecosystem, and more particularly how this

is expressed in a sedimentary diatom sequence (which is a widely use proxy in palae-olimnological studies). This study is however a little at the border line for the scope of Climate of the Past as it doesn't provide a climate reconstruction (all palaeo-climate data are taken from previous publications) and it is assumed that all observed changes in the diatom sequence are driven by climate (which may be true but unlikely).

In addition to specific comments (see below), I have only two points of general criticism that I think the authors should address. 1. I think the authors should develop more their the general assumption (page 2, lines 53-54 and many other instances in the text) that the observed diatom shifts and trends in temporal beta diversity should be primarily attributed to changing lake-catchment resource availability that would be themselves associated to change in climate, especially summer monsoon precipitation and temperature. The authors should maybe add a paragraph in the introduction discussing in more details temporal beta diversity (e.g. Korhonen et al. 2010). Also what kind of resources are we talking about? Are the authors referring to nutrients (which one: phosphorus, nitrogen, carbon, silica, micro-nutrients?) or light conditions, or habitat availability? Generally, I think the situation is more complicated as factors not necessarily linked to climate such as turbulence (Rimet et al. 2019), grazing by herbivory and micronutrients (e.g. Passy & Larson 2019), long-term evolution of the soils on the catchment and of the water supply (Engstrom et al. 2000) may also drive the trends observed in diatom composition and diversity. A recent study by Rimet et al. (2019) actually suggest that turbulence, due to wind on exposed shores and also linked to short water renewal time, greatly favor pioneer species (like Achnanthidium minutissi-mum) and is the primary factor that influence diatom communities composition in small Alpine lakes.

2. Apart from diatoms, no other proxy indicators are proposed. I am very surprised that no geochemical data, such as magnetic susceptibility, TOC content, grain size were measured from the core, even simple measurements such as loss-on-ignition are not given. Such data could help interpret the diatom data and verify hypotheses such

as for example the possible shift in vegetation on the catchment that is proposed as an explanation for the decline in Stauroforma from ∼3000 yrs BP. I think the authors should provide some of this data if they are available.

Specific comments: Page 2, line 56: for consistency with the rest of the manuscript use Medieval Climatic Anomaly (not Optimum) Page 3, line 76: delete "however" Page 3, lines 82-83: rephrase such as:... but provide their habitats to many iconic species that are also vulnerable... Page 3, line 86: ...where long-term historical and/or instrumental records are ... Page 4, line 102: add a reference about the driver of the NH cooling Page 4, line 108: correct spelling of climatic Page 4, line 115: spell in full Asian Summer Monsoon (ASM) as it here mentioned for the first time in the text 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? Page 5, line 144: (in legend for Fig. 1): change central Asia by central China. Are subalpine meadow (as written in the text, line 141) and tundra the same type of vegetation? 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. Page 7, line 167: it's divinylbenzene (DVB), not bivinyl... Page 7, line 168: the concentration unit should be in nb of spheres per volume, ml or cm3 but not cm2, right? Page 7, line 171: add the registered symbol $^{®}$ after Naphrax, Zeiss Axiostar Plus 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). 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. Page 8, line 207: give a reference for the C2 program Page 10, line 228: Puncticulata is a redundant generic name. Use Lindavia (see Nakov et al. 2015). Page 10, line 250: you forgot a few words: ...while high profile and motile diatoms are persistently... Page 11, line 256 (legend of Fig. 3): rephrase such as: Only diatoms with abundance

greater than 3% are shown. Page 12, Figure 3: It would be useful to group the diatom species according to their ecological guild. Correct spelling of Staurosira construens, change Puncticulata to Lindavia Page 14, Fig.5: correct spelling for "centered" Page 15, line 303: ...dominated by species belonging to the Fragilariaceae... Page 15, line 304: replace "growing well" by "dominating the assemblages" Page 15, line 306: ...on the abundance of fragilarioids... Page 15, line 307: add "(Russia)" after "Eastern Sayan mountains" 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? 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). Page 16, line 329: use replaced instead of replacing Page 16, line 341: Why are you comparing your results with winter temperature? Summer 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). Page 17, legend of Fig. 6. Replace "Chinese" by "central China". The number for each curves are wrong, should be 6a, 6b, 6c, etc... instead of 7a, 7b, 7c... Page 17, line 364: correct spelling of climatic 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. Page 19, line 419: replace "important" by abundant Page 20, line 427: give a reference about t he ecology of Denticula subtilis. 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? Page 20, line 448: delete "of the" after around the time Page 20, lines 448-450: what about the 2-sample shift from Stauroforma to Lindavia+humidophila?

Page 21, line 465: rephrase such as: Increased summer precipitation during the MCA as inferred from nearby records (here add references!) resulted in increased diatom fluxes...

References used in this review: Battegazzore,M.; Morisi,A.; Gallino,B.; Fenoglio,S. (2004). Environmental quality evaluation of Alpine springs in NW Italy using benthic diatoms. Diatom Research 19(2): 149-165. Dickman, M.D., Peart, M.R., Wai-Shu Yim, W., (2005). Benthic Diatoms as Indicators of Stream Sediment Concentration in Hong Kong. Int. Rev. Hydrobiol. 90, 412-421. Engstrom,D.R.; Fritz,S.C.; Almendinger,J.E.; Juggins,S. (2000). Chemical and biological trends during lake evolution in recently deglaciated terrain. Nature 408: 161-166. Korhonen J.J., Soininen, J., Hillebrand, H. (2010). A quantitative analysis of temporal turnover in aquatic species assemblages across ecosystems. Ecology 91(2): 508-517. Nakov,T.; Guillory,W.X.; Julius,M.L.; Theriot,E.C.; Alverson,A.J. (2015). Towards a phylogenetic classification of species belonging to the diatom genus Cyclotella (Bacillariophyceae): transfer of species formerly placed in Puncticulata, Handmannia, Pliocaenicus and Cyclotella to the genus Lindavia. Phytotaxa 217 (3): 249-264. Passy, S.I., Larson, C.A. (2019). Niche dimensionality and herbivory control stream algal biomass via shifts in guild composition, richness, and evenness. Ecology e02831 Rimet, F., Feret, L., Bouchez, A., Dorioz, J.-M., Dambrine E. (2019). Factors influencing the heterogeneity of benthic diatom communities along the shoreline of natural alpine lakes. Hydrobiologia 839: 103-118. Stebich,M.; Rehfeld,K.; Schlütz,F.; Tarasov,P.; Liu,J.; Mingram,J. (2015). Holocene vegetation and climate dynamics of NE China based on the pollen record from Sihailongwan Maar Lake. Quaternary Science Review 124: 275-289.