

Biogeosciences Discuss., referee comment RC1  
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## Comment on bg-2021-39

Anonymous Referee #1

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Referee comment on "Sediment and carbon accumulation in a glacial lake in Chukotka (Arctic Siberia) during the Late Pleistocene and Holocene: combining hydroacoustic profiling and down-core analyses" by Stuart A. Vyse et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-39-RC1>, 2021

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This article aimed to provide reconstructions of sediment accumulation rates as well as sediment and carbon budgets from a 6.5m long lacustrine sediment core of a NE-Siberian Arctic glacial lake. The authors combine biogeochemical, sedimentological and radiocarbon data in high resolution with hydroacoustic data to derive sediment stratigraphy, volumes, and infill budget. A crucial point of the paper is the estimation of the annual accumulation rates of carbon with the sediment and the quantification of the total carbon pool. These results are compared with other circum-arctic and sub-arctic lake types, which is pretty exciting.

I read the manuscript with interest. I think the article lives from the combination of various methods, especially the classic multiproxy approach with hydroacoustic exploration, for budgeting the carbon lake sediment inventory. The latter is still relatively seldom carried out, especially for arctic lakes. The manuscript is already in good condition. However, I think a few more in depth discussions could be strengthen the paper and I have some minor comments and suggestions for improvement.

### Introduction

- Line 67: Here and later, this unpublished study is cited very often, even in Fig.9. I understand that it is sometimes necessary to relate your own data to data collected in parallel by the working group that are not yet published elsewhere. However, these works are difficult to verify. In any case, these references should be removed, especially if there are other citations in the line. However, I leave the decision whether these references can be left in the article to the editor.

### Study area

Figure 1: The inlet map in 1a and labels are hard to read and could be a little larger

## Material and methods

Line 184: I think it would be helpful and interesting if the other elements could be presented in the supplement, especially because only a relatively small selection was made at the end for discussion.

Line 189: I don't quite see the advantage of log transformation of the data, especially in terms of comparability with other studies. Please clarify.

## Results

Figure 3: Please enlarge labels and legends

Line 305 – 310: It is really impressive to see such a good age model, which is only made up of bulk ages and depends on low levels of organic matter in the sediment, but reflects an almost continuous and seamless stratigraphy for the last 30,000 years. The authors are discussing sediment mixing or re-deposition of organic material from the catchment area here already, but only for two inverse ages. How can you rule out mixing and rearrangement of older (and/or younger) organic matter from the catchment area for the rest of the stratigraphy? Can we always assume the actual sedimentation age here? I think a little more explanation on this in the discussion chapter would be useful.

## Discussion

Later the authors discuss wind-driven shoreline erosion and sediment redistribution during the Holocene as well as heightened availability of catchment sediments by increasing active layer thickness. They also explain the complex morphology of the lake basin, in particular the primary inflow in the south and the associated presence of a large alluvial fan. I don't want to doubt all of that, but I would like to see a little more critical examination of the dating results and the sedimentation history of the lake.

Section 5.2.1 and Line 616: I think in this context that the authors should also briefly discuss the completely different environmental and catchment area conditions of boreal, thermokarst, and glacial lakes.

Figure 8: Please enlarge the inlet labels. Also, what is the meaning of the red bar for Alberta?

Line 642: What is the meaning of this sentence. Isn't that just the other way around? What is meant here by inorganic detritus?

Line 685: Please change to "aeolian pathways"

Supplement:

I cannot find Figure S5 and Figure S6 referenced in the text.