

The Cryosphere Discuss., referee comment RC2  
<https://doi.org/10.5194/tc-2022-120-RC2>, 2022  
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## Comment on tc-2022-120

Anonymous Referee #2

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Referee comment on "The collapse of the Cordilleran–Laurentide ice saddle and early opening of the Mackenzie Valley, Northwest Territories, Canada, constrained by  $^{10}\text{Be}$  exposure dating" by Benjamin J. Stoker et al., The Cryosphere Discuss., <https://doi.org/10.5194/tc-2022-120-RC2>, 2022

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The paper by Stoker et al. addresses the timing of continental glaciation in northwestern Canada during the last deglacial period using surface exposure dating and modeling results.

Overall, I find this paper to be well written and provides a fairly comprehensive assessment of the glacial history, prior data, and prior work on the ice history in this region. The data itself are a nice contribution to the existing data and I think warranted for publication. To me, the authors have done a nice job in both presenting their new work and putting it into the context of existing datasets. Please see my line comments for mostly minor suggestions. Some of the questions I have regarding the Bayesian modeling are a little more major as are the reporting of information regarding the  $^{10}\text{Be}$  ages, calculations, and lab procedures.

Line Comments:

Line 53: Early  $^{36}\text{Cl}$  dates - how many dates were presented in the earlier work? Perhaps say.

Line 59: "On the all-time" - this is colloquial and hard to understand what is meant. Consider rephrasing.

Line 65: "Dipstick" - define this for the reader.

Line 79: "True" - what is meant by true? Can you define this better for the reader?

Line 98: HF - include the percentage since presumably not concentrated.

Line 103: The carrier concentration needs to be included for replication purposes. Very important.

Line 112: The blank values need to be stated. I suggest included them in both the text and supplemental to help the reader understand the precision of the measurements.

Lines 117-118: Again, what are all these uncertainties? Please state them (%) to help the reader understand how each is incorporated in the measurements.

Line 134: What did Cuzzone et al. find? State what is meant by "minimal".

Line 135: Model resolution – what is meant by suitable resolution? The models that were used in Cuzzone et al. will have the same resolution for this location. I don't think resolution should factor into any of this or be a justifiable reason to not do it. There is also statistically downscaled data for North America that could be used, so it might in fact be better than the model used in Cuzzone et al.

Lines 164-165: How does the spatial scale factor into the Bayesian model and the priors? It is clear when doing an elevational transect with the  $^{10}\text{Be}$  ages but how do the authors account for the  $^{14}\text{C}$  ages coming from different locations. Elevation and simple horizontal retreat of the margin will control the timing and it isn't clear to me how it all fits together. I realize this is challenging to explain but I do think it worth trying to explain this to the reader. The supplemental Figures 7 and 8 are just the line code from Oxcal which really isn't that helpful for parsing this all out. At the moment, I don't think a reader could reconstruct what the authors have done and/or the assumptions being made.

Line 158: General comment on the Bayesian modeling – what are the uncertainties being used in the model for both the  $^{10}\text{Be}$  and  $^{14}\text{C}$  ages? Presumably, the authors are using the external uncertainties for the  $^{10}\text{Be}$  but this isn't made clear in this section. More information would be useful.

Line 299 and Figure S2: Many of the boulders selected for this study are fairly small and several look like they are being exhumed. The authors should discuss this either in the methods or results about the potential implications. Or, alternatively, give the reader some sense if this is problematic or not (e.g. boulder height plotted versus age by location or in general).

Figure S2: It might be better to break these photos into locations either as new figures or into rows.

Line 275: I find this statement a little circular. It assumes the regional deglaciation a priori and then uses it to argue for relatively minor affects. 40km is quite large when considering it in the context of the elevational sampling being done – one may even argue that the elevation changes are quite small themselves, thus top-down elevation dates could in fact be synchronous or even out of order within the uncertainties. I think the authors need to better justify why this is in fact a minor issue – the surface slope of the ice may be a good place to argue and/or the modeling.

Line 282: What does vetted mean? Try to be more exact and descriptive for your reader.

Lines 358-359: I don't recommend phrasing things this way unless the authors have made some considerable effort reaching out to L. Tarasov or the authors of the Reyes et al. paper. Did the authors in fact contact the authors? Otherwise, it is just calling them in published form. Please reconsider.

Lines 370-372: While I don't disagree with the authors argument about the Arctic data and it being appropriate (or not). I do think they need to justify things slightly better – the 47 samples may fit the elevation and ages ranges but the spatial changes in the production rate can be quite high because for a variety of reason (e.g. geomagnetic, snow, atmospheric, etc. affects). It would be useful if the authors provided some sense of where these sites are located relative to their own site. Clearly the Reyes et al. paper used the Arctic sites for this very reason so it would help the reader to understand the why the choice for this paper was made as clear as possible.

Line 460: Corbett et al. 2019 reference is missing. Also, there are several other papers that could be cited here including Koester et al. and Barth et al. from the New England areas where dipsticks have been used to determine the timing of glacial retreat and presumably sea level contributions.

References in general: many references are missing. Please do a thorough review to make sure you have all of them and all extra ones are removed.

Line 488: Data should never be made available on request. Please provide all data in free, online repository following FAIR and journal data standards.

Figure 2: Make the text bigger in the figure – hard to read for us oldies. Try to make clear what is new data from this study and what is existing data from others. Some of the radiocarbon ages say "0.0 and null" for the uncertainty. Is this correct and if it is 0.0 make it another decimal and if null, you need to explain what this means.

Figure 3: Are these  $^{14}\text{C}$  or  $^{10}\text{Be}$  ages? If the latter, which I know they are, make sure to

keep the symbols the same as you have in Figure 1. Text is hard to read – consider making larger. It’s also hard to know what is transect or not – can you make an inset for the elevational transects that demonstrates the ages with elevation? This would help the reader understand the spatial and elevation data.

Figure 4: Need some reference to where the data were collected. Maybe plot the points where the ages are from on the map.

Figure 5: Label the ages on the surface elevation profiles for the ice sheet. This will help the reader out a bit.

Figure 6: Part C is missing from the figure. I am somewhat confused on final results of the Bayesian modeling. It seems to have picked the most improbable sections of the ages at each of the sites. I think this is largely related to the primary assumption that the dates need to be younger with lower elevation. Or, alternatively, the ages are too uncertain or there are inheritance/exhumation issues with the data to correctly apply this assumption for the Bayesian modeling effort. As reported in this figure (e.g. part A), it would mean that the age tails are the most probable age for four of the PDFs which seems very unlikely to me. This should be addressed. Perhaps this gets clarified once we can see figure C.

Figure 9: I’m not sure if this figure is relevant to the main paper.

Table: the authors should provide a data table for input into Cronus (Balco et al. 2008). This will allow the reader to easily replicate their work and if production rates or scaling change, easily adjust those data into the future. This should be standard policy for all

work using this or any calculator. The exact input files should be provided. Apologies if I overlooked it.