

Clim. Past Discuss., author comment AC5
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Reply on CC3

Tamara Pico et al.

Author comment on "Was there a glacial outburst flood in the Torngat Mountains during Marine Isotope Stage 3?" by Tamara Pico et al., Clim. Past Discuss.,
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Community Comment # 3

Pico et al. present an interesting discussion regarding a glacial lake reconstruction and outburst flood they attribute to a pre-LGM (MIS3) period. This reconstruction is supported by ^{10}Be age calculations from a bedrock upland and glacial lake volume calculations. As previous commenters have mentioned this region is of critical importance for freshwater forcing and represents a region where many outstanding questions regarding ice sheet dynamics and deglaciation persist.

As other commenters have presented detailed discussions, I will keep my comment brief, however, I do share the concerns of the previous commenters and support the issues they have highlighted. Specifically, there needs to be more evidence to convince the reader that the wave-cut bench shorelines are indeed shorelines and that the rounded, imbricated cobbles are indeed the result of an outburst flood and not simply from subglacial meltwater flow, which could have removed any till cover on the bedrock (i.e., a vanished protector: Veillette and Roy, 1995; <https://doi.org/10.4095/202923>) which would affect the inheritance of the bedrock sample. Additionally, as previously mentioned, a more discussion on how the glacial lake was reconstructed and possible inheritance from the ^{10}Be should be explored as other suggested hypotheses seem plausible.

I can appreciate the limited dataset available to the authors, which they fully acknowledge, calling for additional fieldwork in the region. However, until additional data is available, either other hypotheses should be explored, or additional discussions to address the issues presented by other commenters is needed. Again, I fully appreciate the difficulty of this type of investigation and I do hope this discussion sparks future work in this remote region of Canada where little fieldwork has been conducted.

Jessey Rice- Geological Survey of Canada, Ottawa

We thank the comment author for their positive comments and thoughtful feedback. As we stress earlier in our response letter, our study relies on legacy data from a 2003 field expedition, and we do not have data from additional shoreline sites. We nevertheless pushed forward with publishing these data to draw attention to this work, and to highlight the exciting potential for several facets of Quaternary work, including constraining the

configuration of pre-LGM ice sheets, understanding glacial inception, as well as quantifying the timing and amount of freshwater release into the North Atlantic. We have stressed in our current study that attaining such information will be the focus of future field studies.

In response to these comments, and similar ones raised by reviewers and other community comments, we will add the following text:

"Till cover would cause the age assigned to the glacial lake shoreline to be older"

"Evidence for outburst flooding is based on the rounded, imbricated cobbles in inlet channels. We found these deposits in multiple inlet channels leading to the sample site, which we interpreted as a lake shoreline. We hypothesize that the lake level may have fallen rapidly because there is no evidence for bands of lake shorelines at progressively lower elevations. Nevertheless, future work is required to verify such evidence for glacial outburst flooding"

In the methods section we will add the following text:

The lowest elevation wave-cut bench was sampled to avoid possible inheritance of cosmogenic nuclides. We believe that substantial inheritance is unlikely because the sampled wave-cut bench is 3 meters below the highest observed platform elevation (Figure 4C). Because there is a relationship between cosmogenic nuclide concentration and depth, we can calculate the expected inheritance at 3 meters depth.

We use the following equation,

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where N is cosmogenic nuclide concentration, x is depth below the surface, ρ is rock density, and λ is attenuation length. We assume density is 2.9 g/cm^3 and attenuation length is 165 cm.

If we consider the maximum inheritance expected at the surface in the Torngat Mountains region to be 5.7×10^6 atoms/g quartz (340 ky equivalent) (Staiger et al., 2005), the maximum concentration at 3 m depth below surface elevation should be near 2.8×10^4 atoms/g quartz (4.5 ky exposure). If we do not use the maximum concentration found but use a more realistic value found for similar altitudes 1×10^6 atoms/g (0.9 ky exposure), the possible inheritance is within our external age uncertainty of 3 ky.