

Clim. Past Discuss., referee comment RC1
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Comment on cp-2021-132

Anonymous Referee #1

Referee 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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The manuscript by Pico et al. reports evidence of a pre-LGM (Last Glacial Maximum), ice-dammed proglacial lake in the Torngat Mountains in Labrador, with two cosmogenic exposure ages of a wave-cut platform at the lake shoreline. The record, albeit incomplete, provides important evidence of ice-free conditions in the Torngat Mountains during MIS 3, which is contrary to many previous reconstructions of pre-LGM ice sheets and assumptions of the location of ice-sheet inception prior to the LGM. The data are worth publishing as they represent an important limit on ice-sheet extent prior to the LGM. The manuscript is written well, will be of broad interest in the paleoclimate community, and is appropriate for *Climate of the Past*. The following comments are suggestions for providing more context and perhaps more geologic information regarding the existence of the pre-LGM lake, which would help to motivate future work on the geologic record of the area as the authors repeatedly state is necessary.

While the geomorphology of the lake shoreline and the cosmogenic ages of the wave-cut platforms are well supported, the evidence of one or more outburst floods from the lake is relatively unclear in the manuscript. Most ice-dammed lakes are unstable and are known to drain and refill, the authors do not report any direct geologic evidence of outburst flooding. This may be a result of the subsequent glaciation in the area and the removal of any geomorphic or sedimentary evidence of outburst floods through lake outlets, which are more abundant (and perhaps better preserved) for ice-dammed lakes that existed in Canada during deglaciation. The authors should provide more geologic evidence for outburst floods from the lake, or a more detailed explanation of the why they believe the lake drained via outburst floods.

Finally, the volume of the lake should include some additional considerations of uncertainty given the unclear shape of the damming ice margins during MIS 3. The reported lake volume is based on some detailed consideration of the effects of isostatic rebound, but does not report the uncertainty of the lake volume calculation based on the presumed ice margin positions. This should be taken into account in paragraphs from lines

301-318 to more appropriately limit the potentially contribution to Heinrich Events during MIS 3.

Line by line comments:

Line 67: reference for the marine oxygen isotope data?

Line 82 (and elsewhere): should the names of glacial lakes be capitalized, as in Glacial Lake Koroc? They appear to be considered proper nouns in other literature and are capitalized in the paragraph on lines 180-191.

Lines 129 and 130: use of "constraints" here and elsewhere. Editors may suggest replacing this with "limits".

Lines 133: change "previous unpublished" to "new"?

Line 134: this is the first appearance of "pre-LGM glacial lake Koroc" (unless my PDF reader is mistaken). Two considerations: (1) add the name of the lake to the abstract, (2) perhaps give the lake a unique name? It appears to be distinct from the younger Glacial Lake Koroc, with a much higher shoreline elevation and presumably much deeper, and perhaps should have a unique name.

Figure 3 - The caption indicates that the boxed area with a white dashed outline is the assumed area of the lake, but it is unclear what the label "assumed glacial lake boundaries" means.

Lines 196-200: Is it possible to provide more geologic information about the lake shorelines? If so, considering showing a map with the location of the landforms and sediments representing flow into the lake, or a map that traces out the distribution of shoreline deposits and/or landforms representing the lake. The existence of the lake would be strengthened by more details about its record.

Lines 203-206: the relative location of the two samples is unclear. This should be explained here. Any photos of the sample sites would be worth including in the paper or in the supplement. The photos in Figure 4 show examples of the wave-cut benches but do not specify the sample locations.

Line 205: is the channel in Figure 4A an inlet or outlet channel? If an inlet, the authors should elaborate on how this channel and any associated deposits are indicative of an outburst flood.

Line 220: should the reference be "Willenbring and Staiger, 2005"?

Lines 232-234: More information is needed to justify the assumed duration of ice cover. It would be good to include at least a few sentences about the basis of the "apparent exposure age" given on lines 232-234. This is warranted given the potential uncertainty of the duration of ice cover, as it is the only limit on it. Additionally, the preservation of wave-cut platforms suggests cold-based ice at the sample site, but the authors do not explicitly state this. Consider doing this in the Methods paragraphs, as there appears to be sufficient evidence for it and it alleviates at least one concern about the exposure history of the site.

Line 260: change "presently" to "at present" or "currently"

Lines 255-268: Provide some estimate of uncertainty in the lake volume calculation given the unknown ice margin positions.

Line 301: This would be an appropriate place to add some explanation of why the lake drained as outburst floods (see general comment above).

Line 308: would it be possible to add to Figure 3A or 3B the flow direction of water when the lake drained?

Line 407, 409: it would be more appropriate to state "the first direct on-land evidence for a proglacial lake", because the evidence of an outburst flood not reported in the paper.

Line 420: change "tease out" to "resolve"?