

We thank reviewer 1 for their comments on our paper. Below we have responded to all their specific comments, which are predominantly on the wording of the text. Reviewer comments are in black and our replies in blue.

On behalf of all co-authors,

Kind Regards,

Stephen Livingstone

Reviewer 1

This is a well-crafted paper. The presentation is already very high quality, both in terms of writing and the visuals. The study is rigorous and the interpretations are well justified by the generated data and analysis. I particularly like how the authors present alternative interpretations that exist in the literature about esker formation, and frame their analysis around supporting one of these. The relationship between esker beads and de geer moraines makes their interpretation seem fairly clear. The beaded esker vs. continuous ridge esker seems to have implications in sediment supply and ice margin history (retreat rates), both topics that are very interesting and well explored.

Thank you for these kind comments.

11, I think “across central Nunavut” lets the reader imagine a much larger area than you actually studied, reword

We have changed to “in central Nunavut”

18, report ages in cal yr BP

Done.

24, no need to write “former” before Laurentide Ice Sheet. It is already defined as a former/Pleistocene ice sheet. Change here and throughout.

We have removed former and also searched and changed throughout the rest of the manuscript.

25, the tense of the writing shifts around. Already in the abstract, authors write in first person, here there is a switch to third person “are hypothesized” I suggest leaving all in first person.

We have changed to the first person here to be consistent with the rest of the abstract.

48, change beads to bead

Done.

66, relief does not have units of asl, that’s elevation

Deleted asl.

70, do crag and tails need bedrock, can they wholly form in till?

Crag-and-tails do need bedrock by definition. We have reworded to make this clearer.

73, awkward to say Keewatin Ice Divide and later say that its location shifts, reword

The Keewatin Ice Divide (KID) by definition represents the last position during deglaciation, not during the LGM. Lee et al., (1957) who defined the KID considered it as “the zone occupied by the last glacial remnants of the Laurentide Ice Sheet west of Hudson Bay”. All the other ice divide positions are in Keewatin but cannot be termed “KID”. To make this clear though we have rephrased as “the final location of the Keewatin Ice Divide.

Lee, H.A., Craig, B.G. and Fyles, J.G., 1957. Keewatin Ice Divide. Geological Society of America, Bulletin 68, 1760-1761.

79, This might be a stylistic thing in writing because it appears here and elsewhere, maybe it is a British thing (sorry, as an American I may follow different rules, subtle different), but is the word “on” required between “ice masses” and “either side”? I see this grammatical situation several times in this ms.

We have changed to include the “on” as per the suggestion.

115, I would find this paragraph more helpful if there was added clarification of patterns above and below marine limit. It is in there I think, or maybe it is in the next paragraph, but being clear about where the ML is and how features are different above and below – with just a touch more clarity – would be useful.

We agree that this could be more clearly defined, and have added an additional sentence in the paragraph below, where we clarify the differences in bead morphology and pattern above the marine limit – “Above the marine limit, beads are almost exclusively mound-shaped and tend to be smaller and form less coherent and more widely dispersed chains.”

194, not “only” because you said previously that 10% occur above the marine limit

We have deleted “only”.

201, “on” either side, as mentioned earlier.

Done.

203, sentence beginning with “In particular” needs some attention

To make this easier to read we have numbered the key lines of evidence and shortened it slightly with the final summary presented as a separate sentence.

261, “on” either side, as mentioned earlier.

Done.

274, “relatively” in place of “relative”

We mean relative in that that chronology cannot be tied to absolute ages; – it is a floating chronology. This idea of relative vs absolute chronology has precedent in glacial geomorphology (e.g. relative ages based on cross-cutting relationships of drumlins/lineations). However, we agree this maybe lacks clarity and so to make clearer have simplified the sentence by deleting relative and changing to “...could be used to produce an annual chronology of ice-margin retreat.”

304, “provide” no s

Done.

319, “farther” better here than “further”

Done.

370, extra parenthesis

The extra parenthesis has been deleted.

371, check punctuation with use of however

We have modified to “This is probably not surprising, however, given...”

370, hereabouts, could mention (or not, your call) any implications about glacial erosion rates. Note of course that ultimately that’s what is implied here, perhaps even more specifically quarrying rates (as opposed to abrasion, which produces fines that might leave the system as suspended load).

Although we would have liked to take this additional step to discuss erosion rates, on reflection, we think this would be too large a step as we do not know the size of the whole catchment area. Although we can say something about the width over which the conduit influences (based on esker spacing), we do not know how far up-ice the conduits extended (which might depend on ice thickness, water inputs, hydraulic potential etc.) as the beads only provide information about marginal deposition. We therefore prefer not to extend the analysis to erosion rates.

377, marine-terminating, no need of “former”

Deleted former.

380, would the broad ice margin here really slow down when it is above the marine limit – hard to imagine that water depths would have been deep enough to have a major influence on calving, nor that overdeepenings or pinning points (which typically come with high relief areas) would significantly offer significant control on ice dynamics?

Besides, can your method of reconstructing retreat rate not reveal rates of recession when the ice terminus was in water vs on land?

This is a good point although not one we can readily test as although beads do occur above the marine limit they are considerably more sporadic (esker ridges tend to dominate), making it challenging to derive accurate retreat rates in the terrestrial sector. In addition, even if the water were shallow, we might still expect the ice to melt faster compared to if it was terrestrially terminating (e.g. from observations of icebergs, where they often undercut at the waterline). We therefore retain the idea that the switch to a terrestrial margin could have caused a slowdown in retreat (based on the cessation of calving as a process for removing mass) but note that this is one of a number of reasons that could explain the switch in morphology.

402, esker beads instead of eskers beads

Done.

402, more mixed voice (first person and third person interspersed)

Done, we have moved to just first person here.

411, another “either side” grammatical thing

Done.

421, another “former” LIS

Deleted.

427, provides no s

Done.

428, deposited “during” each melt season

Done.

434, former

Deleted.