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Climate of the Past Discussions

Interactive comment on "Deglacial to postglacial history of Nares Strait, Northwest Greenland: a marine perspective" *by* Eleanor Georgiadis et al.

Anonymous Referee #2

Received and published: 10 August 2018

I have read this manuscript with great interest. It uses data collected from a single, strategically located core from Kane Basin to infer changing paleoenvironmental conditions in response to ice sheet recession in Nares Strait from early Holocene to present. The paper is clearly written and well organized. The main data include lithofacies descriptions from visual core descriptions and CT scanning, CT number as a measure of density, grain size data to infer sedimentation processes, and XRF data to infer sediment provenance. The core chronology is based on 13 radiocarbon dates on benthic foraminifera and molluscs. A local reservoir correction of 240 years was applied to calibrate the dates.

Figure 4, the 3.5 kHz chirp profile over the core site shows that the core penetrates the section essentially to acoustic basement which is interpreted to be subglacial till at the

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site, meaning that the core should contain a sequence that includes initial deglaciation, opening of Nares Strait, and continued ice recession from the ocean all along the strait.

I think that the interpretation of the events in Kane2B is reasonable, but there is an alternative interpretation of the sequence of events that also should be considered. In part this stems from a new article that includes new information about early Holocene moraine ages of the Humboldt Glacier:

Early to Late Holocene surface exposure ages from two marineâĂŘterminating outlet glaciers in northwest Greenland Melissa M. Reusche, Shaun A. Marcott, Elizabeth G. Ceperley, Aaron M. Barth, Edward J. Brook, Alan C. Mix and Marc W. Caffee Accepted manuscript online: 13 JUL 2018 12:00AM EST | DOI: 10.1029/2018GL078266

In this paper surface exposure ages indicate that an early Holocene lateral moraine of the Humboldt Glacier was abandoned by 8.3±1.7 ka. Could retreat from this stable position be the source of the increased IRD and other features of unit 3A,B,C rather than being a signal of the opening of the strait? Alternatively, the retreat from the moraine might signal the ice recession that lead to opening of the strait, which would support the argument made in this paper. A connection between retreat from the moraine and opening of the strait was not made by Reusche and others, mainly because in the literature the opening of Nares Strait is suggested to be earlier by some hundreds of years.

An alternate scenario for the stratigraphy of the core is: Unit 1, ice proximal, reflects opening of Nares Strait and Unit 3 represents retreat of the Humboldt Glacier.

Given the uncertainties of the reservoir corrections used all along Nares Strait and through the Holocene, I think it would be useful for the authors to consider this alternative scenario. If the benthic DR in Kane Basin is larger than the 240 years used, then the deeper unit 5 could represent opening of the Strait, which would mean that all of Kane 2B was deposited after the strait opened. Can other arguments about environmental changes one might expect from the opening of the strait be brought to

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bear to support one interpretation or the other? It is clear that the age presented for the opening of Nares Strait by Jennings et al. (2011) is somewhat older than 8.3 ka, even when the higher DR of 335 years is used. In any case, I think it is reasonable to consider an alternative interpretation of the events. In the end, one can favor one interpretation over the other based on the evidence. But I don't think the origin of Unit 3 can be proven with the data shown, especially given the uncertainties in the reservoir corrections and the short time span involved. However, it would be really interesting if the moraine recession, Unit 3, and the opening of Nares Strait were linked.

Minor comments:

P1. Line 8. 8 ka 14C calibrates to 8.7 cal with DR=240 I think. I think the other calibrations of dates from the literature are done correctly with the reservoir correction added back before the dates were calibrated. But it is worth checking. Especially with regard to Figure 6. I missed a description of how the dates were recalibrated. And there might need to be a list of the dates shown on the maps with the 14C age and the cal age along with the references etc.

P2. Line 18. What about St. Onge and St. Onge, 2014?

P3, 6. punctually. . .not sure what you mean.

P3, 7,8. Make this 2 sentences.

P3, 15. Ice arches only block the sea ice. . .and allow the liquid freshwater through.

P3, 17. change 'associated to' to 'outlets of'?

P4, 16, 28. Calculate and use the $\pm$ on the DR.

P4, 31. Change 'drastic' to 'major'?

P6, 7. You may be overinterpreting these thin units. Change 4 to 6 cm. They all appear to be ice proximal and there is variability in the sedimentation along an ice margin that can be reflected in the sediments you have.

P6, 18. Change ‘oscillates’ to ‘varies’?

P6, 23. Evolve, decrease P6, 24. Meltwater plumes and iceberg rafting. P8, 20. And P13, 6. What species were dated? Can these be a mixture of >50 k and contemporaneous forams? It seems unlikely that forams would look fresh after being entrained in a current. This is not very convincing about forams coming from Hall Basin. P9, 1. along with P9, 11. Suggest you delete ‘discretely’. P9, 21. Svendsen P9, 25. Keep the format you were using with the unit name and details at the start of the line. P9, 27. Unit 5 rather than E. P10, 3. Suggest you skip the double negative and say. . .’We rule out hypothesis 3. . . P10 in general. It would be helpful to name the species dated. . .both mollusk and foram when possible. There are some species to avoid and it is useful to have the info.

P11, 6,7. I don’t think the second part of this sentence is right. Suggest you end sentence at ‘strait’. And delete the rest except keep the reference.

P12, top paragraph. I think this part is over interpreted. And there is quite a bit of >800 micron material. Basically this unit just seems ice proximal and does not necessarily suggest the sequence of environments.

P12. Discussion of Fig. 6. How about putting on a through h designations on your panels. Then you can refer to the right panel in your discussion. P12, 20. Change 8.3 to 8.5. 8.5 is what is on the map.

P12, 32. Coarse fraction content is not only influenced by sea ice. I think this is overinterpreted.

P13, 32. Sea ice and ice bergs certainly are not mutually exclusive. I think you are over interpreting sea ice with your grain size data because you have a lot of coarse material in your units. Icebergs carry all grain sizes.

P14, 5. Outset change to onset?

P14, 8. A stretch for you to interpret sea ice here with just the grain size.

P16, first para. Your interpretation is not unique. . .there is at least one other alternative. It is best to explore that. The DR is poorly constrained.

Fig. 3. Add tick marks to the axes. Add the lithofacies units to the depth scale. Fig. 4. Can you remove the interpretation and put it in a panel below? One cannot see the boundaries on the data. Figure 5. why is lithofacies 1 2 boundary listed as 9.1 when an underlying age is 9? Fig. 6. Explain how you calibrated the ages in the map and list the ages in a table with their pertinent information.

Table 2. fix the tick marks and add the date levels where they coincide with the examples of lithofacies.

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