Author answers to reviewers comments on "Reconstruction of Holocene oceanographic conditions in the Northeastern Baffin Bay" by Katrine Elnegaard Hansen et al.

John Andrews (Referee) andrewsj@colorado.edu

We are very grateful to John Andrews for his effort and time to review our manuscript and for his highly beneficial comments and suggestions.

This is a solid contribution to our increasingly detailed knowledge of changes in the oceanographic and glacial conditions in Baffin Bay and especially along the W Greenland margin.

I do wonder about the continued use of a 140 ± 30 yr ocean reservoir correction without some statement or recognition that this undoubtedly changed throughout the Holocene as shown by several papers using the Iceland tephra as key markers (e.g. Ericsson, Kristjansdottir)—because of that it seems to me sensible to use a OCR=0 and a larger error estimate. That being said I doubt that this would make any substantial changes in their chronology or conclusions.

The reservoir age and its possible variability in the Holocene is indeed an important issue. We decided to use the same reservoir age correction as other similar studies in the area (e.g. Lloyd et al., 2011, Perner et al., 2012, Jackson et al., 2017), as described in the manuscript. Because of the potentially changing reservoir age in the Baffin Bay throughout the Holocene, we do not draw any vast conclusions on paleoceanographic and environmental changes down to a centennial time scale. We have added a sentence to the chronology methods description to acknowledge the possibility of a varying local reservoir age, see lines 174-176.

Key aspects of the paper are the plots (Figs. 4 and 5) of the down core changes in the % of foraminifera (section 3.3). The paper identifies (p. 10) ". . .four ecozones. . .." Which are identified on those two figures. However, I saw no discussion on how these 4 zones were identified. Were they identified by the "eyeball" method, constrained clustering, or. . ...?

We agree that this was not stated clearly in the manuscript. The four ecozones were indeed identified by visual interpretation of the species abundance and the boundaries were placed where major changes occurred in the benthic foraminiferal assemblage data. This has now been added to the revised manuscript, please see lines 236-239.

The paleoenvironmental interpretation (Section 4) is primarily based on the foraminfera and I wonder would it not be more efficient to directly combine section 3.3 and 4 as the discussions of the Ecozones are inferring aspects of climate.

This is definitely a possibility, but although the paleoenvironmental interpretation is indeed primarily based on changes in the benthic foraminiferal assemblages, it is also based on the XRF record of the core. Also, we prefer not to mix results and interpretation in the same section. Consequently, we have decided to keep sections 3.3 and 3.4 separated from section 4 to keep a clear distinction between the description of the results and the interpretation of the record.

In terms of the changes in the Holocene marine climate this paper, and I admit others that I have been a co-author on, neglect to mention the work in the 1970's and 1980's on the importance of marine mollusk faunas that were sampled and dated, often as part of efforts to date glacial isostatic uplift of the West Greenland and East Baffin Island coastal areas. I am thinking in particular of the first appearance of Mytilus

edulis—the blue mussel (see refs below and references therein). On the east coast of Baffin Island Mytilus edulis invaded coastal waters ~8.2 ka 14C (~8.7 cal ka) and was present until about 3 ka.

Another set of data that is worth looking at are the dates on the influx of wood to SW and W Greenland coasts carried around Greenland in the East Greenland and then West Greenland currents. These data would add important details that could be included on the summary figure Figure 8. On this figure and in the text they might consider what the effect might have been of the series of meltwater and sediment discharges through Hudson Strait (e.g. Barber et al., Jennings et al.,).

Thanks for pointing this out. The timing of the occurrence of M. edulis on east Baffin Island matches well with the interpretation of our foraminiferal assemblages. We have now included the reference to the marine mollusk studies to our discussion (see lines 553-559).

We have also added the role of the deflection of the Transpolar Drift on the pathways of Arctic Ocean waters i.e. via the gateways of the Canadian Arctic Archipelago (westward deflection) and via Fram Strait, derived from the distribution of driftwood. There is a correlation between more driftwood found in the CAA during the Neoglacial compared to Greenland, implying that the Transpolar Drift advected more cold Arctic Ocean water through the CAA, see lines 706-709.

We have added additional references from Jennings et al., (2015) and Barber et al., (1999) linked to meltwater introductions from the Laurentide Ice sheet to the Labrador Sea and thus affecting the deep-water formation here, see line 524-525.

I often think that the detailed XRF-based geochemistry available is a method looking for answers. It would be interesting to compare the XRD mineral compositional data with the XRF data to gain a more detailed understanding of both (this was proposed and a method outlined by Eberl in the program “Hand Lense” USGS).

Thank you for your suggestion. A XRD mineral compositional dataset could indeed be valuable, but we have not yet performed such analyses, and we believe it would not significantly alter the main conclusions of our paper. We will keep this in mind for a follow-up study.

Conclusions: I enjoyed reading this paper. It provides valuable data to the growing body of literature documenting the complex of glaciological and oceanographic changes that effected the NW and W Greenland shelves and by inference the “downstream” margins of Baffin Island.

Thank you!

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