

Interactive comment on “Younger Dryas ice-margin retreat in Greenland, new evidence from Southwest Greenland” by Svend Funder et al.

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We are grateful for the comprehensive comments from referee David Roberts, which we will address in a revised manuscript and in the notes below.

Incorporating other local records would have given a different deglacial history: We don't quite understand this comment. We believe that we have discussed all relevant records and their relationship with our data for each of our study sites. Balancing own results and review, the inheritance problem, and mismatch with coastal records: We discuss our new data in relation to new published data on the YD, both from land and shelf. Therefore, our paper provides a mixture of new results and review, which we are pleased to see that the other reviewers think is relevant and interesting. Thus, we prefer

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to keep the current structure of the discussion, but will try to further include the new data into the discussion in the revised manuscript. We acknowledge the inheritance problem, as noted in our response to Nicolas Young, and will make adjustments in a revised manuscript. As to the mismatch with coastal records see notes below.

Specific comments Ice margin on inner shelf: what is unexpected is that it retreated during the YD. We have reformulated this sentence to make it more clear.

Rationale behind sites: The rationale of selecting the six sites on the inner shelf is to constrain the time when a contiguous ice margin on the shelf broke up and gave way to discrete ice streams in transverse troughs. We discuss our new data in relation to new published data on the YD, both from land and shelf.

Aquatic as opposed to glacial (which is widespread on the shelf to the north). We will specify the categories differentiated in the report by Roksandic (1979).

Retreat of the ice to the coast constrained to 11.5 to 10.5ka: As noted in comments to Richard Alley, there is large variation in the timing of deglaciation of the outer coast in Greenland, ranging from Allerød to Early Holocene, and the localities we sampled were under-explored. However, we agree that offshore work is highly needed to pin-point the timing of initial deglaciation after LGM and subsequent ice margin history until landfall, but that is beyond the scope of our contribution.

We will redraw Fig. 1b to show the location of dates in greater detail..

Statistical approach: If the uncertainty of the individual ages overlap we use them to calculate a mean age. If not, we identify them as outliers. Given the small sample size – 3 samples per site, we have not used more sophisticated methods to identify outliers, but we will keep this advice in mind in future work.

Combining the new data with pre-existing ages: We have compared our new data to existing data from nearby areas. However, all of the other sites are located tens of kilometers away (at a minimum) and it seemed unjustified to calculate a mean age. We

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did not use our new data to calculate retreat rates between the outer coast and the present ice margin as we feel this would be a different story, and anyway it would be just two points.

Buksefjord and Fisknenæsset: the comments raised about these two sites are very similar to the comments raised by Nicolas Young. We have addressed them in our response to his comments. Fisknenæsset. . . . local deglaciation at 10.6 - 10.5 ka: These minimum-constraint ages are from a trough 50 km to the north - considered to be the very last to be vacated of ice in this part of Greenland, postdating the deglaciation of the adjacent areas with several millenia (Weidick, 1976). Considering the large variations in YD ice margin behaviour, even between neighbouring troughs, and the early deglaciation of the shelf to the south we do not find our deglaciation ages out of line with previous studies, but we will discuss these data, and the “mismatch” between our data and those from the coast in greater detail.

Avigaat: We agree this is very poorly constrained as stated in the manuscript (and shown by the large uncertainty in fig. 3).

Paamiut: As noted in the text, the previous 11.7 ka ¹⁰Be date from the outer Kuanersoq trough dates thinning of the ice stream in the outer fjord, not deglaciation of the coast. Retreat from the shelf trough and into the fjord was dated by extrapolation by the authors to c. 11.0, so there are no overlapping ages.

Sermiligaarsuk based on one date: yes, we agree, this is not a robust deglaciation age. Averaging with other local deglacial ages, calculating retreat rates? We're not sure we completely understand this comment. True that our sample sites are just one point on several paleo-flowlines of the ice sheet, and we have a limited ability to gain knowledge on ice history before and after the timing of ice retreat at each of our sites.

ice steams sitting in the troughs later than the peripheral interstream areas: we need to go into more detail about this, with reference to previous studies, such as Roberts et al. 2009.

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Moraines on the outer to mid shelf (Hellefisk and Fiskebanke) . . . not directly related to the coastal deglacial story that form the basis of the paper: We don't agree. We mention the moraines because it has been suggested frequently that they are related to YD readvance/stillstand. Recent studies – also disregarding ours – suggest that they are metachronous, and in some places indeed from YD, but deglacial. Therefore, we favor keeping this part in the revised manuscript.

dating of GZW's on the continental shelf. See comments above

“ . . . discussion is largely divorced from the study . . . ”: We believe that this part of the discussion is important as it sums up the current knowledge about the climate forcing during YD and provides an explanation of the ice margin behavior during YD cooling. See also comment to Richard Alley.

We are grateful for this opportunity to discuss our results, and will work the comments into a revised manuscript.

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