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Climate of the Past Discussions

Interactive comment on "Multiproxy evidence of the Neoglacial expansion of Atlantic Water to eastern Svalbard: Does ancient environmental DNA complement sedimentary and microfossil records?" *by* Joanna Pawłowska et al.

Anonymous Referee #1

Received and published: 10 April 2019

This paper presents an interesting multiproxy dataset to document the paleoceanography near Svalbard and compares traditional sedimentary and microfossil proxies with a novel approach involving ancient environmental DNA. As such, the dataset certainly deserves publishing, but I have some comments/reservations about the age model and the discussion of the results. The discussion has some writing-technical issues. In several cases the own results are presented, without clear arguments supporting the interpretation (e.g. P12, L9–11 & L28–30; P15, L12–15) but rather followed by a literature review. The own results need to be better used to document the paleo-

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ceanographic/ environmental signal that is gained from this new site and data, before comparing to the literature. Figures integrating the own results with key records from previous studies is also advised.

Major comments

First of all, the raw data needs to be made publicly available and/or presented with the manuscript. Needed are tables that list unique sample labels and relevant metadata such as core coordinates, sampling depths, measured data for each proxy (sedimentology, foraminifer assemblage data, stable isotopes and aDNA), etc.

Age model. The ages used for the age model seem arbitrary. What is the argument to choose 1500, 2700 and 7890 yr BP? Those ages are not the average of the 2sigma calibrated yrs BP. The most up-to-date radiocarbon calibration (Calib 7.1) was not used. Why? There is 9 cm sediment between 2700 and 7890 cal yr BP (43.5–52.5 cm), or a sedimentation rate of 0.0017 cm/yr assuming a constant sedimentation rate. Have you considered the possibility of a hiatus? Are there changes in the sedimentology/lithology? Additional dating could help solve this issue. Using your proxies to support the age model (P10, L23), make your environmental interpretation become circular. You need to separate the age model from the environmental proxies.

Methods. This type of study (aDNA) is still very new in paleoceanography and more details about the aDNA method would be useful. For example, a short account of the bioinformatics (how were sequences translate to OTUs) would be advisable, rather than referring to other papers. How did you determine that the aDNA was in fact ancient?

Discussion. You write in the results section (P7, L18-20): “However, the extremely low time resolution between 9 cal ka BP and 4 cal ka BP precluded making any general conclusion about that interval. Therefore, the manuscript focuses only on the last 4 cal ka BP (the Neoglacial).” It is not clear where the 9 and 4 cal ka BP come from? The only “certain” ages are 7890 and 2700 cal yr BP (but see my comments above)

measured in samples that are only 9 cm away from each other, and thus showing an extremely low time resolution. With only 2 samples analysed in this interval, this is clearly not sufficient to warrant the lengthy discussion (P10–12) on the interval prior to 2700 yr BP. While the fossil assemblages and aDNA may give valuable information about the environment, it is not possible to say something meaningful with regard to timing of events in this interval. That would require analysis of additional samples and 14C dates (but preferably a record with a higher sedimentation rate).

Higher current speeds (i.e. P.11, L5) can strongly influence paleoceanographic records. What is the effect of bottom water currents on the microfossil and aDNA records here? Could this bias your interpretation?

Do the foram assemblages, and diatom and foram DNA assemblage data show a change supporting the interpreted shift from polynya conditions to densely packed sea ice environment at 2700 cal yr BP?

The AW pulses at 2.3 and 1.7 cal kyr BP show an opposite pattern in foraminifer flux and abundance (Fig. 3, lower two panels): low at 1.7, while high at 2.3 cal kyr BP. Why are these such different patterns to AW pulses? How does this compare to the aDNA records?

You claim an increase in fresh phytodetritus and/or phytoplankton blooms (e.g. P16, L4), but do you actually document this? It seems this is being inferred from the foram assemblages. More cautious wording is advised here.

How does the aDNA signal reflect sea ice cover? You refer to the genera Navicula and Thalassiosira as occurring in sea ice, but these genera also occur elsewhere. For example, Thalassiosira is very diverse in temperate regions (Hoppenrath et al. 2007, Eur. J. Phycol.). Did you identify Thalassiosira species that occur in sea ice, or does the aDNA data not allow to classify to species level?

Several studies in the region are mentioned in the discussion (e.g. Sarnthein et al.

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2003, Rasmussen and Thomson 2014, Knies et al. 2017), some of which apparently show comparable signals. This should be discussed in more detail (i.e. what is comparable), and preferably supported by a clear figure showing the key-proxies from those studies that show similarities with the own records.

Minor comments

P5 – sampling. The core was sampled every cm and at 5 cm for aDNA. Were all other proxies also analysed at 5 cm or at 1 cm? A list/table with raw data would help answer this question.

P5, L8&11. aDNA sampling interval at 5 cm – repetition. It would be more informative to have a list of the sample depths.

P6, L16. Please list these 27 levels. And provide raw data.

P6, L22. What is the primer length?

P8, L23. Specifiy “certain species”.

P9, L23. Please specify the being and end of the time intervals.

P10, L21 (and throughout). Please remove ST_1.5. You analysed only one core in this study, so that does not have to be repeated.

P11, L17. Codominant – be careful with this term, as it means that the species/groups are equally dominant. Is that always the case?

P12, L9–11. What does this mean in terms of environment/paleocenaography?

P12, L28–30. As above. It would help to put P13, LL4–8 first in the paragraph.

P13, L12–14. What data that you present do you base this interpretation on?

P13, L15. Which diatom aDNA sequences? Could these be transported (currents) rather being than reflection of local production?

P14, L2. . . . are not [a] coherent. . .

P14, L9. This is speculation.

P14, L24–34. It is not clear what the conclusion is from this list of examples.

P15, L12–16. it is not clear what are own results and what comes from literature.

P15, L16. The IP. . . (capital)

P15, L25. Can you identify the LIA in your record?

P16, L4. Did you actually prove phytoplankton blooms occurred or rather that benthic forams responded to changes in environment and productivity?

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