

Interactive comment on “Origin, burial and preservation of late Pleistocene-age glacier ice in Arctic permafrost (Bylot Island, NU, Canada)” by Stephanie Coulombe et al.

Anonymous Referee #1

Received and published: 16 July 2018

Review of MS TC-2018-114 by Coulombe et al.

In this manuscript the authors present a description of buried massive ground ice at Bylot Island (Nunavut, Canadian Arctic) and results on permafrost cryostratigraphy, ice crystallography, stable water isotopes and cation contents to discuss the origin, burial and preservation of the studied massive ice body. Based on their results the authors conclude that the massive ground ice originates from Late Pleistocene glacier ice that has been buried with glacial sediments. A protective cover of sediments and peat ensured its preservation. The manuscript provides valuable information by adding a case study of buried glacier ice at Bylot Island based on new data. Results, discus-

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sion and conclusions are well supported by figures and references. The implications are relevant as quite some Arctic landscapes are determined by remnants of former glaciations preserved and hidden in permafrost that is vulnerable to climate warming. Melting of these massive bodies may have a significant impact on ground stability, landscape and ecosystem dynamics. On the other hand, buried glacier ice holds potential for paleoclimate reconstruction. All in all, the manuscript addresses a relevant research topic and contributes new and significant information. Hence, it is in general suitable for publication in The Cryosphere. However, there are some smaller issues that prevent me from considering the manuscript as publishable in its present form (see comments below). Hence, the manuscript needs some revision before it can be resubmitted for publication.

Specific comments:

P1L24: The statement on “most of the arctic landscapes. . .” does not hold when you consider the vast landmass of Beringia.

P2L1-7: Please check the references. Apparently, some references are mixed up (i.e. for Antarctica).

P2L30-34: The structure of the sentences can be improved (avoid the parenthesis).

P4L2: How far away is Pond Inlet? Can you mark it in Figure 1?

P4L27: Except for the massive ice samples I assume.

P6L14: Does VWC stand for volumetric water content? Please clarify.

P6L20: Should read mm for long axes.

P7L5-12: For a better overview I suggest to add a table to the manuscript providing the basic statistics for $\delta^{18}\text{O}$, δD , d-excess (max, mean, min, sd), slope, intercept, number of samples for each type of ice/water.

P8L32: The slope of the C93 ice is below the GMWL, too. Are there any information

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on past (ice cores?) and modern slopes (LMWL of IAEA stations?) available for your study region?

P9L2-4: Provide $\delta^{18}\text{O}$ numbers for Barnes ice cap for comparison. In the cited paper no d-excess values of Barnes ice cap are given, so it's not possible to compare your values.

P9L16: Can you provide estimations on the elevation difference for the ice source compared to today with respect to the 3.5 to 4.5‰ in $\delta^{18}\text{O}$? Is there any indication of the age (i.e. more detailed than Late Pleistocene) of the studied buried glacier ice? Given the climate instability known from Greenland ice cores also abrupt climate changes may explain the additional 3.5 to 4.5‰ in $\delta^{18}\text{O}$.

P14L12: Provide an URL for this dataset. Currently it isn't possible to find it.

Figure 1: It would be good to add an additional map (or enlarge the second provided map) of the entire Bylot Island to show the study site in the regional context of Bylot Island and the other sites mentioned the regional setting section (Lancaster Sound, Navy Board Inlet, Eclipse Sound).

Figure 2: What does the red star represent? Please clarify the meaning of the red dots in the left part (isotope and hydrochemistry samples?) and mark the position of the radiocarbon sample.

Figure 8a: It would be good to add d-excess to the figure (maybe replace δD by d-excess). Add the title for the upper x axis. $\delta^{18}\text{O}$ needs superscript.

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