

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.

M. Fritz (Referee)

michael.fritz@awi.de

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The manuscript provided by Coulombe et al. investigates the origin of massive ground ice in permafrost of Bylot Island (Nunavut, Canada). The authors argue that it is necessary to differentiate the origin of massive ground ice to model its spatial distribution and abundance for further landscape sensitivity analyses in times of permafrost thaw and landscape change. The manuscript presents detailed description of physical and geochemical properties of supposedly buried glacier ice. Field observations on cryostratigraphy and lithology are combined with laboratory analysis of grain-size distribution, ice crystallography, stable O-H isotopes and cation concentrations of the massive

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ice and surrounding sediments including intrasedimental ice and ice wedges.

Based on own data and under consideration of existing literature on buried massive ground ice, the authors conclude that Bylot Island contains remnants of Pleistocene glacier ice that survived the last deglaciation. They suggest an englacial origin rather than a basal ice facies which is more common within the Wisconsin Arctic moraine belts. This conclusion is very likely to be true because contemporary glaciers are close and offer an excellent object to compare ice structures and englacial debris of relict and contemporary glacier ice. Finally, the authors discuss geomorphic processes that led to the burial and preservation of the ice.

The present study is of great interest to the Arctic research community in a context of recent warming, which is particularly strong in the high Arctic. Active layer deepening and increased activity of slope processes, (i.e. active layer detachments, thaw slumping and thermoerosion) expose such buried ice and will initiate landscape changes and associated effects on the ecosystems through lateral matter mobilization and surface disturbance.

The authors present original data and provide a thorough description of the methods. In general, this topic and the presented data are of interest for readers of The Cryosphere and especially for researchers studying permafrost and especially ground ice as environmental archive. The language is generally good and the figures and tables, in most cases, usefully complement the text.

There are some points that prevent the manuscript to be published as it is. I suggest the manuscript to be accepted after minor revisions.

General comments:

Please provide good arguments why you have measured major cations only and not anions? Both would be necessary to get a comprehensive understanding of the ion composition and water origin. What about standard parameters such as electrical con-

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ductivity and pH measurements?

The results are sometimes written in past tense and sometimes in present tense. Especially in 4.1 they are in past tense throughout and suddenly in 4.2 present tense pops up. Make sure you use one tense throughout.

The manuscript is rather short, which I personally like, but it contains more than 100 references although it is clearly not a review paper. The authors should find a way to consolidate and shorten the reference list a bit.

Sedimentological data is provided in figures 9 and 10. Since Figure 9 already provides information on gravel-sand-mud percentages and on skewness and sorting, Figure 10 does not add a lot of new information and can be removed. This would lead to a better balance of text vs. number of figures/tables.

All the original measurement data on stable isotopes, cation concentration, grain-size properties and crystallographic data as well as the calculated parameters such as slope, D-excess etc. should go into a table into the supplement of the paper or archived in PANGAEA before final publication of the manuscript.

Specific comments:

For specific comments see also the annotated and attached pdf-file.

Michael Fritz (Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research)

Please also note the supplement to this comment:

<https://www.the-cryosphere-discuss.net/tc-2018-114/tc-2018-114-RC2-supplement.pdf>

Interactive comment on The Cryosphere Discuss., <https://doi.org/10.5194/tc-2018-114>, 2018.