

Interactive comment on “Basal thermal regime affects the biogeochemistry of subglacial systems” by Ashley Dubnick et al.

Anonymous Referee #2

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This article by Ashley Dunnick and co-authors considers basal thermal regime as a governing mechanism for acquisition of solutes and microbial biomass into the basal ice. Somewhat unsurprisingly, basal thermal regime plays an important role in subglacial biogeochemical processes. Through a comparison of the basal ice from three polythermal and one cold based glacier, to the respective overlying ice, it is found that cold based glacier's basal ice is of similar composition to its overlying ice, while polythermal basal ice is enriched with solutes derived from the substrate material, microbes and metabolic products. It is highly warranted and useful that the comparison between cold and polythermal basal ice has been quantified. To my knowledge, this is the first study that explicitly makes this comparison.

The strengths of this paper lie in the meticulous sampling strategy, where overlying

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and basal ice were carefully delineated and distinguished. Furthermore, this study uses appropriate field sampling and analytical techniques. It would have been useful to compare between a cold based glacier with similar bedrock geology to the three polythermal glaciers. Nonetheless, the study still makes an interesting contribution.

Overall, the paper is well-structured. However, I have a couple of major concerns about the sample analysis and findings. Furthermore, I have a few comments on the writing style and formatting.

Methods:

1) The analytical methods, as presented, are relatively sparse, especially in relation to the analytical procedure for SRP, TDN and TDP. It would be useful to include a description of the digests performed and the recovery. It would also be useful to understand if any reference material or standards were used and the outcome of this.

Findings:

2) The concentrations reported for DOC in Table 1 appear to be less than the LoD, in numerous cases. Additionally, there is a discrepancy between the LoD cited in text and in the table. Naturally, it is highly problematic if the concentrations reported are lower than the LoD. The statistical differences and comparison between basal and overlying ice, referred to in the results and discussion, would have to be amended. If authors wish to keep DOC data included in this exercise, they need to make it clear to the reader that their DOC data is of good quality, by providing transparent details on the methodology, as well as appropriate use of CRMs.

Writing Style/ Formatting:

3) The abstract and introduction's wording should be tightened to maintain clarity and flow. There is a considerable number of lists. Often lists of factors, studies or processes are lengthy and the point can become lost. Amending this will help the research aim (in line 46) to be stated more clearly. Currently, the importance of this line is lost. The

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meaning is lost elsewhere, for example in lines 28 through to 31.

4) Additional reference to important literature, especially that relating to microbially mediated chemical weathering, could be made in the introduction. Similarly, the discussion is sparsely referenced, particularly in the first paragraph.

5) In the introduction, it would be useful to include a few additional lines on the importance of this study. Why should the broad readership of BG care about this study? I know that the majority of this study may be lost on the readership, due to the intricacy of the comparison specifically relating to glacial systems. As such, the importance of this work for the BG's audience needs to be clarified.

6) There is some repetition in the methodology and introduction— especially in relation to the field sampling and the definition of warm/cold basal ice.

7) Table 1 is rather lengthy and unclear, it may be useful to split the table up into its component parts (chemistry, in/organic nutrients and microbes) or to reformat the table.

Technical corrections/comments:

1) Is the use of 'warm' and 'cold' in quotations necessary throughout? I feel it is not, as long as you state early on that these are the terms you are going to use.

2) The definition of cold based and warm based glaciers is repeated throughout the paper – it is only really necessary to define these terms once.

3) Consider revising the word 'parent' in 'parent ice' - this could lead to inference that the basal ice is always of younger age, which is not necessarily true. As such, this phrase may be slightly misleading. Consider revising throughout. If you choose to use parent ice – this should be defined and used consistently.

4) There are many sentences which are poorly constructed, with use of multiple 'and/s', 'and/or' and 'also/s'. Often, this disrupts clarity and flow. Please consider revising.

5) Line 32 - are you missing a reference related to subglacial microbial mediated chem-

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ical weathering?

6) Consider rephrasing line 39 for clarity – the first sentence is a little unclear, I think you may be missing a word.

7) Line 44 274 - too many spaces.

8) Line 259, this would be an appropriate place to reference the Wadham (2016) study.

9) Line 274 - consider rephrasing the sentence starting with 'Because...'

10) Line 289, although production and consumption of autochthonous OM are mentioned in Wadham (2016), I think there are other more appropriate references for this point.

11) The font size of the figure captions vary.

12) Please, standardized units throughout. For example, currently, there is a mixing of DOC units mg L⁻¹ and ppm.

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