

Interactive comment on “Microbial processes in the weathering crust aquifer of a temperate glacier” by Brent C. Christner et al.

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Please note pages/lines referenced by the authors are to revised text

1. Comments from Referee: “My main suggestion for improvement is related to the presentation of the sampling procedure in the boreholes, which I think is a crucial part of the study. I am sure most readers would like to have a better visualisation of how samples were obtained by having some photos and/or a schematic figure (either in the main paper or as supplementary information). I have no doubt that the study has captured well the weathering crust microbial processes. The data of microbial composition provides some solid evidence of a different community in the WCA compared to the surface community, and some more information in the methods would help to make

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this point clear”.

Author’s response: We agree with this suggestion.

Author’s changes in manuscript: A new figure has been included in the revised manuscript (Supplementary Figure 1 in revision) that includes a schematic of the approach we used for sampling and an image of a water sample being retrieved from one of the boreholes.

2. Comments from Referee: “Page 4, line 16 – Please specify how the boreholes were monitored. I think this will also help to clarify the first paragraph of the results section.”

Author’s response: Science personnel were on site daily from approximately 9 AM to 6 PM local time (i.e., during the diurnal peak of surface melt water production). The content of each drained borehole was examined daily (detailed inspection each morning after arriving on site and then periodically through the day). During the 2014 and 2015 sampling periods when it was verified that water was percolating laterally and collecting in the boreholes, each was monitored at no less than hourly intervals when personnel were on site.

Author’s changes in manuscript: Additional information about how the boreholes were monitored has been added to the text (Pg 4, lines 18-22).

3. Comments from Referee: “Page 8, line 18 – please specify the volume of the serum vials.”

Author’s response: The water was collected in 30 mL serum vials

Author’s changes in manuscript: This information has been added to the text (Pg 8, line 23).

4. Comments from Referee: “Last paragraph of page 17 – Maybe it is worthy to mention/reinforce the fact that the sample used for those incubations has a relatively high proportion of Cyanobacteria/plastids. Nevertheless, the cell number increase during

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the oxygen consumption experiment indicates a strong bottle effect during the incubations. It would be good if this can be further discussed in line with the calculations in the first paragraph of page 18.”

Author’s response: These important points were not sufficiently emphasized in the manuscript.

Author’s changes in manuscript: In the revision, the high abundance of phototrophic taxa inferred in the near-surface samples is referenced directly with respect to the oxygen consumption results (Pg 17, lines 29-30). We also revised the text to acknowledge that ex situ assays inevitably involve sampling disturbances and may provide conditions that allow microorganisms to reproduce at higher than in situ rates (i.e., the “bottle effect”; Pg 18, lines 9-10).

5. Comments from Referee: “The literature on microbial processes at the very ice surface provides quite often evidence for organic carbon accumulation, which in turn results in the darkening of the ice. Is it possible for the authors to make inferences (based on the incubation experiments and microbial community composition of the WCA) whether the WCA microbial processes could have a role on surface activity (e.g., via recycling of nutrients that become available to surface organisms as the ice ablates exposing WCA communities at the surface)?”

Author’s response: While we mention how biogeochemical processes on the ice surface may influence those occurring in the WCA, the reverse scenario was not mentioned.

Author’s changes in manuscript: A sentence has been added to the concluding paragraph (Pg 20, lines 26-27) stating the possibility that biomass turnover in the WCA may also mineralize and mobilize nutrients that fertilize biological activities on the ice surface.

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