Supplement of

Abrasion of sedimentary rocks as a source of hydrogen peroxide and nutrients to subglacial ecosystems

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**Supplementary A: Acetate concentration in solution, normalized to grams of sample in incubation experiments plotted against potential contributing variables**

Figure S1: Relationships between acetate concentration (µmol) produced per gram of crushed and coarse samples relative to (a) organic carbon (OC), (b) H₂O₂ and (c) specific surface area (SSA). The concentration of H₂O₂ measured in solution was normalised to gram of sample.

**Supplementary B: Calculations to estimate potential NH₄⁺ contribution to Robertson Glacier and Longyearbreen subglacial systems**

Calculations to estimate daily NH₄⁺ contributions are based on Macdonald et al. (2018), using the following equation:

\[
\text{Daily NH}_4^+ \text{ production (catchment)} = \frac{(\text{µmol NH}_4^+ \text{ g}^{-1}) \times (\text{flux suspended sediment (SS) g a}^{-1})}{(\text{glaciated area m}^2) \times 365}
\]

This is a first order estimate, and will likely overestimate the actual amount, since it assumes all the suspended sediment is of the rock type used for our incubation experiments.

No suspended sediment flux has been measured for Mercer Subglacial Lake (SLM) and thus these calculations were not extended to the SLM samples.

<table>
<thead>
<tr>
<th>Catchment</th>
<th>Flux SS (g a⁻¹)</th>
<th>Area (km²)</th>
<th>Daily NH₄⁺ production umol m⁻² day⁻¹ for glaciated area of catchment</th>
<th>Daily NH₄⁺ demand umol m⁻² day⁻¹ for glaciated area of catchment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robertson Glacier</td>
<td>3x10⁸</td>
<td>1.4</td>
<td>3.5</td>
<td>0.2</td>
</tr>
<tr>
<td>Longyearbreen</td>
<td>15x10⁸</td>
<td>2.5</td>
<td>4.7</td>
<td>0.2</td>
</tr>
</tbody>
</table>

* = Published estimates for NH₄⁺ demand by subglacial microbes at Longyearbreen or nearby locations are not available in the literature to the best of the authors’ knowledge, thus ‘0.2’ was used for illustrative purposes.

Calculations:

**Robertson Muddy Carbonate RMC**: Suspended sediment flux (300 t km⁻² yr⁻¹) and area (1.4 km²) of Robertson Glacier taken from Macdonald et al. (2018)

\[
\text{NH}_4^+ \text{ m}^{-2} \text{ day} = 6.0 \times 3 \times 10^9 / 1.4 \times 1000000 \times 365
\]

\[
\text{RMC} = 3.5 \text{ µmol NH}_4^+ \text{ m}^{-2} \text{ day}^{-1}
\]

NH₄⁺ demand can be calculated using same equation, but substituting the N oxidation values from Boyd et al. (2011) = 0.28 µmol N gdws⁻¹ day⁻¹. (gdws = grams dry weight sediment)

First convert N to NH₄⁺: 0.28 x (18.0383/14.0067) = 0.36 µmol NH₄⁺ gdws⁻¹ day⁻¹.
Since the NH$_4^+$ demand is already a daily value, then it is only necessary to divide the annual suspended sediment flux by 365 to produce a daily flux, rather than multiply the area by 365.

\[
\frac{(0.36 \times (3 \times 10^9/365))}{1.4 \times 1000000} = 0.2 \text{ µmol NH}_4^+ \text{ m}^{-2} \text{ day}
\]

**SSv** - Longyearbreen suspended sediment (1500 t km$^{-2}$ yr$^{-1}$) and area (2.5 km$^2$ in 1990) values from Etzelmüller et al. (2000)

\[
\text{NH}_4^+ \text{ m}^{-2} \text{ day} = 2.9 \times 15 \times 10^9/2.5 \times 1000000 \times 365
\]

\[
\text{SSv} = 4.7 \text{ µmol NH}_4^+ \text{ m}^{-2} \text{ day}
\]

Since the NH$_4^+$ demand is already a daily value, then it is only necessary to divide the annual suspended sediment flux by 365 to produce a daily flux, rather than multiply the area by 365.

\[
\frac{(0.36 \times (15 \times 10^9/365))}{2.5 \times 1000000} = 0.6 \text{ µmol NH}_4^+ \text{ m}^{-2} \text{ day}
\]
Supplementary References

