Supplement of Biogeosciences, 20, 929–943, 2023
https://doi.org/10.5194/bg-20-929-2023-supplement

Biogeosciences Open Access EGU

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

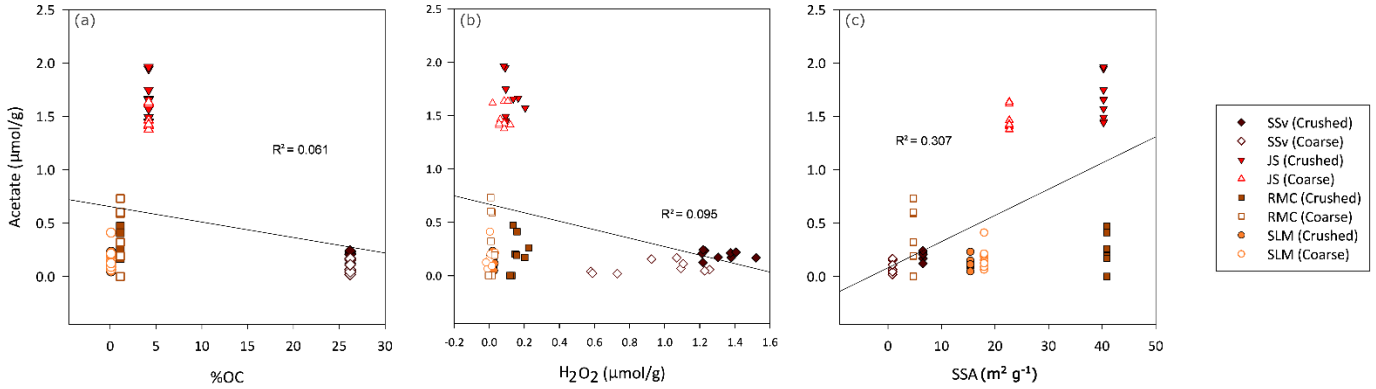

Figure S1 Relationships between acetate concentration (µmol) produced per gram of crushed and coarse samples relative to (a) organic carbon (OC), (b) H_2O_2 and (c) specific surface area (SSA). The concentration of H_2O_2 measured in solution was normalised to gram of sample.

Supplementary B: Calculations to estimate potential NH_4^+ contribution to Robertson Glacier and Longyearbreen subglacial systems

Calculations to estimate daily NH_4^+ contributions are based on Macdonald et al. (2018), using the following equation:

Daily NH_4^+ production (catchment) = ((µmol NH_4^+ g^{-1}) × (flux suspended sediment (SS) g a^{-1}))/ (glaciated area m^2) x (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.

Catchment	**Flux SS (g a^{-1})**	**Area (km^2)**	**Daily NH_4^+ production umol m^{-2} day^{-1} for glaciated area of catchment**	**Daily NH_4^+ demand umol m^{-2} day^{-1} for glaciated area of catchment**
Robertson Glacier	$3x10^8$	1.4	3.5	0.2
Longyearbreen	$15x10^8$	2.5	4.7	* 0.2

* = Published estimates for NH_4^+ 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 km^2) of Robertson Glacier taken from Macdonald et al. (2018)

NH_4^+ m^{-2} day = 6.0 x $3x10^8$/ 1.4 x 1000000 x 365

RMC = 3.5 µmol NH_4^+ m^{-2} day

NH_4^+ 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 NH_4^+: 0.28 x (18.0383/14.0067) = 0.36 µmol NH_4^+ $gdws^{-1}$ 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.

= (0.36 x ($3x10^8$/365))/ 1.4 x 1000000

= <u>0.2 µmol NH_4^+ m^{-2} day</u>

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

NH_4^+ m^{-2} day = 2.9 x $15x10^8$/ 2.5 x 1000000 x 365

SSv = 4.7 µmol NH_4^+ m^{-2} 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.

= (0.36 x ($15x10^8$/365))/ 2.5 x 1000000

= <u>0.6 µmol NH_4^+ m^{-2} day</u>

Supplementary References

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