

EGU25-15336, updated on 06 May 2025

<https://doi.org/10.5194/egusphere-egu25-15336>

EGU General Assembly 2025

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Glacial flour: Investigating the nutrient potential of Greenland's subglacial sediments

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This study investigates the potential of glacial flour (fine-grained debris) as a nutrient source. Weathered glacial debris is a key source of essential macro- and micronutrients (N, P, Si and Fe) to subglacial environments and downstream aquatic systems – including freshwater lakes, rivers, and fjords – via glacial runoff. To further understand nutrient cycling in these environments, we conducted a two-year incubation experiment using glacial sediments collected from a glacial outlet near Ilulissat, Greenland. The experiment examined the distribution of nutrients between dissolved phases in pore water, overlying water, and particulate forms bound to sediment surfaces. After incubation, 200 μM Si, 0.7 μM NH_4^+ and 0.1 μM P were measured in the pore water, showing that saturated subglacial sediments with long rock:water contact times are a source of available dissolved nutrients, despite the absence of freshwater influx. We also assessed the impact of sediment crushing on nutrient release. A 10-minute, high-energy crush and subsequent extraction with ultra-pure water led to a 9-fold increase in Fe, a 47-fold increase in Si and a more than 600 times increase in P in solution. These findings underscore the importance of glacial sediments as a source of Si, P, N and Fe to subglacial ecosystems.