Geochemical characteristics of proglacial meltwater from Storglaciären, Kebnekaise massif, Sweden

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Summary

The potential significance of effluent glacial water (Sydjåkk) as a source of dissolved and particulate species to downstream ecosystems has been studied near the terminus of a valley glacier (Storglaciären), in the Kebnekaise massif of Sweden. The fieldwork was carried out in a three-week period 25 July–14 August, 2000, covering normal melt conditions as well as a flood following heavy rain.

The concentration of suspended matter showed a 25-fold variation, peaking prior to the maxim water discharge of the flood period. Based on evaluations of the average chemical composition of suspended matter in the effluent water, a basaltic provenance was demonstrated, with hornblende as the dominant mineral phase. Analyses of the dissolved species in the water sampled revealed two main groups; one low concentration cohort primarily formed by the three elements of Al, Fe and Ti (CV>50%), and one high concentration group, composed by Ca, Mg, Na, K, Si, Si, Cl, HCO_3 and SO_4 (CV≤13%, except Cl=49%). In the group of cations, Ca was found to have highest mean concentration (54.6 μM) followed by Na (18.7 μM). Among the anions, HCO_3 dominated with a mean concentration of 82.6 μM followed by SO_4 (31.3 μM). A similar concentration was recorded in dissolved Si (33.0 μM).

In order to relate dissolved species to weathering processes, the atmospheric solute input was calculated, using two different approaches. When comparing these two approaches, only small deviations were found in Ca, Mg, Na and K. This contrast to SO_4, which to 99% was related to a bedrock origin (direct Cl normalized comparison), whereas calculations based on atmospheric precipitation data indicated a 74% bedrock origin. The elements of Ca, Mg and K appear to be strongly related to the underlying bedrock, while 40% of the dissolved Na seems to be of seawater origin.

Analysis of dissolved nutrient concentrations, demonstrated low concentration levels of NH_4 (0.032–0.25 μM) and NO_2/NO_3 (1.6–3.4 μM), as well as PO_4 (0.25–0.28 μM), implying a molar Redfield N/P ratio of 7.1–12.5, suggesting an initial nitrogen limitation in the effluent glacial water.