

Hydrogeochemistry in the drainage system of the Kebnekaise massif

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Summary

Proper understanding of mechanisms conditioning hydrogeochemistry and ecology of alpine and other high mountainous areas is most wanted in modern earth system science and Global Change research (e.g. EAWAG, 2002). Although the critical role of such areas for the hydrological cycles and river discharge dynamics has long been recognized, detailed knowledge on the geochemical and biological dynamics is still scarce.

Recent field studies in the Tarfala Valley and the lake system downstream (Ladtjojaure and Paitasjärvi) have provided crucial baseline infor-

mation (Figure 1a, b) to our investigation of “Hydrological alterations with river damming in northern Sweden: Implications for weathering and river biogeochemistry” (Humborg *et al.* 2002). The samplings demonstrate that major dissolved elements and total organic carbon (TOC) are enriched within a few kilometers downstream from the Tarfala Valley, where the vegetation is dominated by shrub and brushwood (Figure 2a). Thus, the presence of vascular plants appear to be a decisive factor affecting the chemical weathering rate of pulverized bedrock matter, formed by glacial action and other erosion processes.

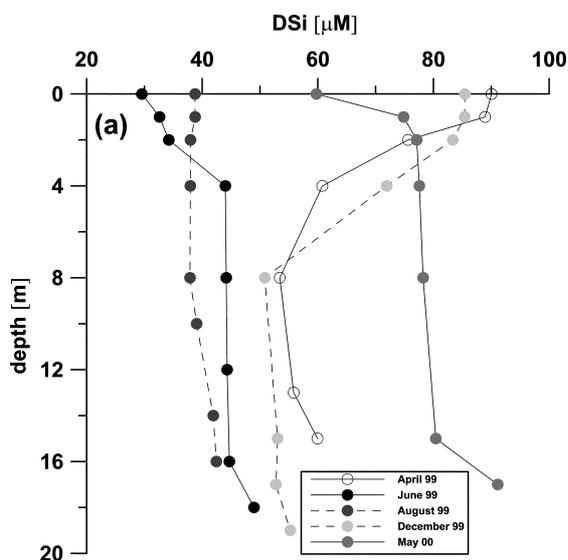


Figure 1a. Annual variation of dissolved silicate (DSi) concentration versus depth in Lake Paitasjärvi in 1999–2000 (from Humborg *et al.* 2002).

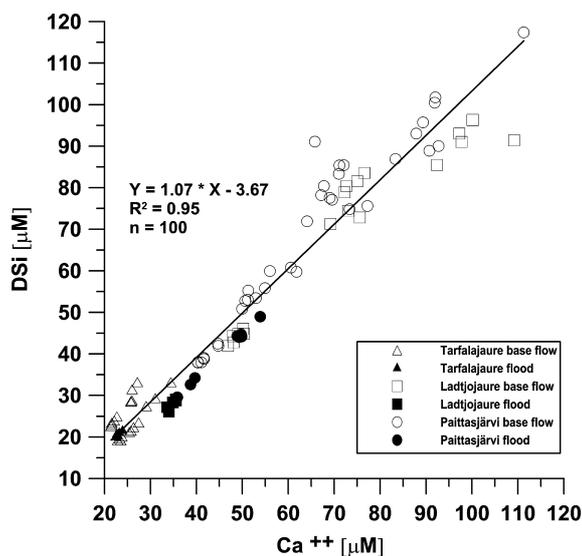


Figure 1b. Dissolved concentration of silicate (DSi) versus calcium (Ca) in the lakes of Tarfalajaure, Ladtjojaure and Paitasjärvi (from Humborg *et al.* 2002).

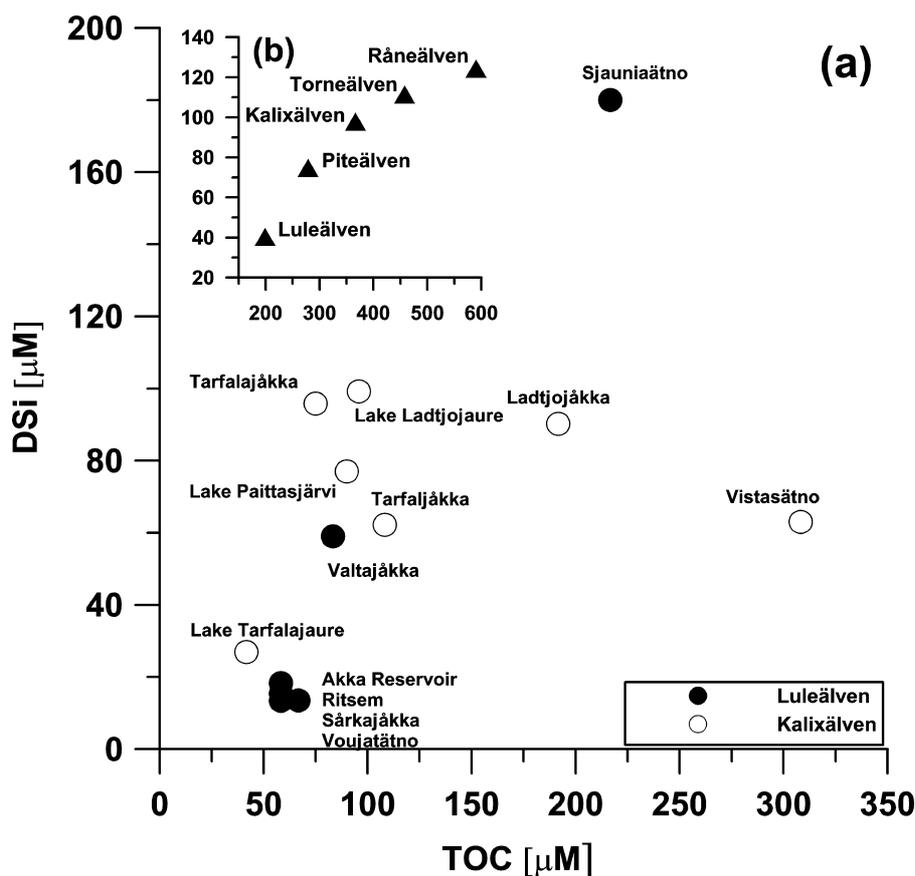


Figure 2. Dissolved silicate (DSi) concentration versus concentration of total organic carbon (TOC) in (a) water draining the Kebnekaise massif during base flow (unfilled circles). For comparison, records from headwater streams of the regulated River Luleälven are reported (filled circles), and inset figure (b) shows long-term mean values at the river mouths of the major rivers in northern Norrland (from Humborg et al. 2002).

This conclusion is suggestive in combination with complementary records from other areas in northern Sweden (Figure 2a), not least river mouths (Figure 2b). In fact, our data on silicon implies that Quaternary changes in the vegetation coverage of glacial and periglacial areas might significantly altered the inputs to the global Ocean of elements limiting marine biological production.

References

EAWAG 2002. Alpine streams. *EAWAG News* 54: 1-32.

Humborg, C., Blomqvist, S., Avsan, E., Bergensund, Y., Smedberg, E., Brink, J. and Mörth, C.-M., 2002. Hydrological alterations with river damming in northern Sweden: Implications for weathering and river biogeochemistry. *Global Biogeochemical Cycles* 16, xx-xx.