Basalt weathering and plant recycling in permafrost-bearing watersheds of Central Siberia: A multi-isotope approach (Si, Mg, Ca, Zn, and Cu)

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Understanding the elements cycles within the boreal and subarctic watersheds is of primary importance for assessing the consequences of climate warming on elements fluxes from the land to the Artic Ocean. Chemical weathering and elements fluxes in the basaltic region of Central Siberia is highly distinctive because of the presence of permafrost conditions and the extremely large seasonnality in terms of water discharge and biological productivity.

From previous studies we know that the transfer of elements and their speciation (dissolved versus colloidal) within these watersheds is strongly dependent on both the season and the size of the watershed. The spring flood period is marked by a sharp concentration decrease of soluble elements while organic carbon and insoluble elements strongly increase. During the base flow period of winter, the concentrations of soluble elements increase regularly.

Whereas the main hydrochemical features of Siberian rivers have been constrained, the quantitative contribution of the main end-members bearing pools (bed rocks, soils, river suspended matter, organic litter, fresh vegetation) to overall dissolved river load still remains uncertain. Here we present a synthesis of Si, Mg, Ca, Zn and Cu stable isotope measurements in different mineral, organic and aqueous pools of permafrost ecosystems to unravel the different sources of elements exported from the watershed. Results indicate the important contribution of vegetation (larch needles, mosses, dwarf shrubs) and help to reveal the contribution of carbonates and sedimentary rocks within large river systems.