Si isotopes for tracing basalt weathering in Central Siberia

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To unravel the different sources of silica generated by basalt weathering in Siberia under permafrost conditions, we have measured the Si isotopic composition of i) large and small rivers, groundwater (suprapermafrost flow), soil solutions of the Central part of Permo-Triassic basalt plateau Putorana located in the Central Siberia and ii) the different possible sources of silica in investigated area (bed rocks, soils, rivers suspended matter, plant litters…). Preliminary Si isotope ratios measured on the NuPlasma 1700, expressed as δ^{30}Si relative to NBS28, indicate that all sampled rivers, soil solutions and groundwaters exhibit constant heavy isotopic compositions (with δ^{30}Si values ranging between +1.93 and +2.23‰ for soil solutions and Yagdali river, respectively) that contrast with the light compositions of basaltic bedrocks (+0.3‰), river suspended matter (+0.25‰) and soils (-0.5‰). Among the different Si "solid" sources, only the fresh litter of *Larix gmelinii* (dominating tree in this region) has a composition close to that of soil solutions (+1.5‰). These data are consistent with the results of Pokrovsky et al. [1] suggesting that between 30 and 100% of Si and other major cations annually exported by Central Siberian rivers originate from litter degradation in the uppermost soil horizons. To better approximate the respective contributions of biomass, soil secondary phases and basaltic bedrocks to silica fluxes, the isotopic composition of river Kochechumo has been determined in winter (which accounts for less of 10% of Si annual flux which is believed to originate from bed rocks), spring (60-80% of annual flux with all elements likely to originate from degraded plant litter and organic surface horizon) and summer (20-30% of annual flux with contributions from permafrost ice, litter and soil minerals).

Results of this study imply that most of silica released by Siberian rivers transits through the biogenic pool and that, like in other stable basaltic regions [2], bed rocks-waters interactions account for a small fraction of silica flux. If dissolved organic matter has no direct effect on the dissolution rate of clays and Ca-Mg-bearing “basic” silicates, vegetation can indirectly enhance silica and major cations exportation via i) aqueous silica uptake that maintains a low silica activity in upper soil solutions (and thus a high chemical affinity for clay minerals dissociation reactions) and ii) subsequent silica and cations release during litter degradation at the soil surface.

References

[1] Pokrovky O.S. et al.(2005) *GCA* **69,** 5659-5680.

[2] Ziegler K. et al. (2005).*GCA* **69,** 4597-4610.