Lithium isotope fractionation at the soil–plant interface

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Lithium abundances and isotope compositions were determined for an extensively studied site in the Krušné hory Mts. in order to search for previously unknown stable isotope fractionations of non-nutrient trace elements between soils and vegetation cover (Picea *sp*., Fagus *sp*.). In the soil profile, Li contents decrease from ~60 ppm at 40–80 cm depth to 20 ppm at 0–10 cm depth und to 6 ppm in the uppermost organic layer (Oi+Oe) whereas sup-ppm Li levels were consistently found in roots, stem and needles. Stems have the lowest Li contents of all analyzed tree compartments. The Li contents show tight positive linear correlation with Mg both in soils and trees but less defined correlation with other alkali elements (Na, K). Soil, developed on granitoid bedrock, appears to reflect its magmatic precursor with only limited modification through weathering or fluid circulation. Roots of both Picea *sp*. and Fagus *sp*. show no significant difference relative to δ^7Li of underlying soils despite different rooting depth (shallow for Picea, deep for Fagus). In contrast, stem wood of both species consistently shows significant enrichments in ^{7}Li relative to roots and soils (cf. [1]); in particular, δ^7Li difference of >16‰ has been found for Picea stem and roots. It thus appears that stem may fractionate Li isotopes significantly, irrespective of botanic classification or taxonomy of the corresponding species (gymnospermous, angiospermous) but the extent of this fractionation may depend on qualitative characteristics of the wood, such as proportion of xylem and phloem, structural bonding of celulose etc. In either case, the data require more complex examination of interaction between plants and substrate with respect to different rooting depths, chemistry, bottom water flow, nutrient availability etc.

Overall, the results are best explained by low utilization of Li in biological matter despite modest bioavailability of Li from grown substrate. Whether or not net ^{7}Li enrichments in plants are a general feature remains unconstrained but it could be consistent with positive Li–Mg correlation in plants and high δ^{26}Mg in wheat that has been found to result from preferential uptake of heavy Mg from the nutrient supply into plants [2].

[1] Lemarchand *et al.* (2010) *GCA* **74**, 4612–4628. [2] Black *et al.* (2008) *Env. Sci. Tech.* **42**, 7831–7836.