Mass-dependent fractionation of strontium isotopes by tree uptake

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Although the measurement of $^{87}Sr/^{86}Sr$ isotopic ratio variations between natural materials has been possible for decades, only recent advances in mass spectrometry have allowed the detection of Sr isotopes mass-dependent fractionation. Only few studies to date have suggested mass-dependent fractionation during plant uptake by comparing $\delta^{88}Sr$ between plant tissues and the related bulk soils and rocks underneath [1, 2] or between plant tissues and the exchangeable pools of soils from the same site [3].

We check for any variation of Sr isotopes between rocks, soils and trees on seven Spanish forest stands on contrasted rocks (silicate and calcareous rocks). On each stand, we chose a representative set of samples. We measured the $^{87}Sr/^{86}Sr$ ratio and $\delta^{88}Sr$ value of bulk soils and rocks, the corresponding available pools and in the wood of old living trees growing on them. We also compared the $\delta^{88}Sr$ in wood from different species of living trees to look for any species-dependent differences. In total 15 pine and 32 oak trees were analysed. Our results show that plants take up their nutrients, and consequently Sr, from the soil exchangeable pool. The $\delta^{88}Sr$ values in oaks are always lower than the $\delta^{88}Sr$ values of the exchangeable Sr in soils indicating a preferential uptake of the lighter ^{86}Sr isotope from the available nutrient source. A significant difference in the $\delta^{88}Sr$ of pines and oaks is underlined: the higher $\delta^{88}Sr$ values in pines compared to oaks suggest a weaker preferential uptake of light Sr by pine species. Experimental studies measuring $\delta^{88}Sr$ in rock-soil-plant compartments have to be done in order to identify the processes affecting the Sr isotopes fractionation.

[1] Bullen & Chadwick (2016) *Chem. Geol.* **422**, 25-45. [2] de Souza et al. (2010) *Geochim. Cosmochim. Acta* **74**, 2596–2614. [3] Andrews et al. (2016) *Geochim. Cosmochim. Acta* **173**, 284-303.