Nickel-hyperaccumulating plants from the serpentine soils of Brazil: vegetation control on Ni isotope fractionation

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Ultramafic derived (UM) soils are characterized by low nutrient soils, a low Ca:Mg ratio, and high metal contents such as Ni, Co and Cr. Vegetation growing on these soils are highly adapted and include both Ni-(hyper)accumulating species and tolerant ones. Today, about 400 hyperaccumulating Ni species are listed and Ni content can be very high, up to 25% in the latex of *Pycnanddra acuminara*, a New Caledonia tree. This study aims at identifying the potential role of Ni hyperaccumulating plants on the Ni biogeochemical cycle in surface, by using Ni isotopes.

A set of Ni-hyperaccumulating and Ni-tolerant plants as well as topsoils have been sampled on the UM complexes of Barro Alto and Niquelândia (Goiás State, Brazil). Three Ni-hyperaccumulating plants have been collected: *Justicia lanstyakii, Heliotropium aff. salicoide, Cnidoscolus aff. urens*, as well as one Ni-tolerant plant, *Manihot sp*. Whole-plant isotopic compositions have been determined, and compared to those of bulk topsoils and DTPA-extractable Ni.

Topsoils exhibit δ^{60}Ni values from – 0.30 ± 0.06 ‰ to + 0.15 ± 0.05 ‰. DTPA extractable Ni in topsoils ranges from 95 to 623 mg/kg, i.e. 0.9-4.9% total Ni, and was found to be isotopically heavier than corresponding topsoil (from – 0.30 ± 0.05 ‰ to + 0.59 ± 0.08 ‰). δ^{60}Ni values for Ni-tolerant plants exhibit enrichment in Ni heavy isotopes in aerial parts, while similar δ^{60}Ni values of roots, stems and aerial parts suggests that no significant fractionation occurs during Ni-uptake for Ni-hyperaccumulating plants. Moreover, aerial parts (i.e. leaves and flowers) from all plant analyzed show the largest Ni contents and the heaviest δ^{60}Ni values up to 1.21 ± 0.05 ‰. The enrichment in heavy Ni isotopes in leaves (- 1.05 ± 0.03 ‰ < $\Delta^{60}Ni_{soil\text{-}leaves}$ < - 0.06 ± 0.12 ‰) may lead to a heavy Ni input in the litter during organic matter restitution. Nickel uptake by Ni-tolerant and Ni-hyperaccumulating plants is probably not negligible, and may modify both the Ni isotope composition at the soil-plants interface and the Ni overall cycle in surface.