Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.18340

Insight into the biogeochemical cycle of Ni in a soil developed under hyperaccumulator species: a combined approach

DR. CLAIRE ANSART, PHD[1], ERIC PAIDJAN[2], EMMANUELLE MONTARGES-PELLETIER[3], CHRISTOPHE CLOQUET[1], SANDRINE ISNARD[4], CÉCILE QUANTIN[5], YANN SIVRY[6] AND FARID JUILLOT[7]

[1]CRPG – CNRS, Université de Lorraine
[2]BIOGECO INRAE – CNRS Université de Bordeaux
[3]CNRS/Université de Lorraine
[4]AMAP – Université de Montpellier, IRD, CIRAD, CNRS, INRAE
[5]GEOPS, Université Paris-Saclay, CNRS, France
[6]Université Paris Cité, Institut de physique du globe de Paris, CNRS, F-75005 Paris, France
[7]ERL IRD 206, UMR 7590 CNRS-MNHN-Sorbonne Université

Presenting Author: claire.ansart@univ-lorraine.fr

Even though nickel is essential for higher plant growth, high concentrations of this metal can be toxic for them. In ultramafic derived soils, nickel concentration can reach the percent level (1), but the vegetation is highly adapted thanks to ecophysiological strategies such as Ni-hyperaccumulation. This behavior leads to a preferential uptake of nickel in the soil by the roots and its transfer to aerial organs via the sap and latex, with for example concentrations reaching up to 20 wt% in *Pycnandra acuminata (2)*, an endemic species of New Caledonia. Such biogeochemical pathways and transfer are suspected to induce Ni-isotope fractionation, especially due to the leaf shedding and litter degradation, roots uptakes and metal complexation with organic matter (3,4), but the extent of this process and the mechanisms involved are debated and not well constrained.

To understand the impact of Ni-hyperaccumulators on the Ni biogeochemical cycle, we compared a soil system developed under hyperaccumulators *Pycnandra acuminata* (PA) with a second system developed under the close relative but non-hyperaccumulators *Pycnandra fastuosa* (PF), both endemic species of New Caledonia. Higher total Ni and phytoavailable Ni contents in soil derived from PA confirm an effective redistribution of the Ni due to hyperaccumulating processes. The soil developed under hyperaccumulating plants displays an enrichment in Ni light isotopes compared to the soil developed under non-hyperaccumulating plants which can be correlated with previous findings showing that PA tissues have a low δ^{60}Ni (5) and suggests the Ni redistribution in the soil from the upper horizon due to leaves shedding and degradation. Further XAS and µXRF analysis will help us to determine a change in Ni speciation in soils and highlights the contribution of organic-bound Ni to the total δ^{60}Ni signatures in soil after cycling across hyperaccumulators.

(1) Trescases, J.-J. (1973) Bulletin - Bureau of Mineral Resources, Geology and Geophysics.

(2) Jaffré et al. (1976) Science

(3) Boyd, R.S. and Jaffré, T. (2001) J. S. Am. Earth Sci.

(4) Zelano, et al. (2020) Plant and Soil

(5) Paul et al. (2021) Plant J.