

Ni isotopes fate in an ultramafic complex

RATIE G.^{1,2}, JOUVIN D.¹, GARNIER J.², ROUXEL O.³,
MISKA S.¹, GUIMARAES E.², SIVRY Y.⁴,
MONTARGES-PELLETIER E.⁵, ZELANO I.⁴
AND QUANTIN C.¹

¹Univ. Paris Sud, UMR 8148 IDES, CNRS, Orsay, France

²UnB, IG/GMP-ICC Centro, Campus Universitario Darcy Ribeiro, Brasilia-DF, Brazil

³IFREMER, Unité Géosciences Marines, Plouzané, France

⁴Univ. Paris Diderot, Sorbonne Paris Cité, IPGP, UMR 7154, CNRS, Paris, France

⁵Univ. Lorraine, UMR 7569 LEM, CNRS, Vandoeuvre-lès-Nancy, France

Although Ni has proven to be significantly fractionated in terrestrial samples¹⁻², leading to an enrichment in ⁶⁰Ni of the oceanic ferromanganese crusts, no environmental studies has been realized yet. The present study aims to confirm the potential of natural Ni isotopes to better understand the Ni biogeochemical cycle and, in this case by focusing on the Barro Alto ultramafic (UM) complex (Goias, Brazil).

This massif was submitted to an intense lateritic weathering and lateritic profiles are naturally rich in Ni. Moreover, UM massives, due to their economic importance, have been widely studied, for the natural Ni biogeochemical cycle and for their deep transformations due to mining and smelting activities. Thus, both natural (rock, ore, soil) and anthropogenic (slag, ash) materials have been investigated.

Isotopic analysis were realized on a Neptune MC-ICP-MS at the Ifremer (France)². Ratios are normalized with the Ni standard NIST SRM-986. Isotopic signatures obtained for the reference materials Nod A1 (1.11‰±0.03‰), Nod P1 (0.38±0.03‰) and BHVO-2 (0.01±0.02‰), are consistent with previous studies.

Results from natural Ni geochemical cycle include bedrock samples (0.28±0.08‰), ore samples, both saprolitic and lateritic (from -0.60 to 0.30‰) and soil samples (from -0.19 to -0.02‰). A global trend of depletion of heavier isotopes is observed ($\Delta^{60}\text{Ni}_{\text{Soil-Bedrock}} = -0.47\text{‰}$), confirming an export of heavier isotopes in the dissolved phase.

Anthropogenic samples were also investigated, as Barro Alto is an exploited massif. The mixed ore introduced in the process has a value (0.05‰) within the range of the saprolitic and lateritic ores measured previously. Ferronickel and ashes have a very close isotopic composition (0.04‰), consistent with a high yield of Ni in these samples (ashes have 2% Ni concentration), while slags are enriched in heavier isotopes (0.15‰). This pyrometallurgical process produces only small isotopic fractionation but further investigations have to be realized on nearby non-UM potentially impacted soils.

[1] Gall *et al* *EPSL* 2013, ² Gueguen *et al* *GGR* 2013