Rare earth element geochemistry in an iron-rich nickel laterite from New Caledonia

PAULINE DEVEZ[1], JESSICA BONHOURE[1], OLIVIER POURRET[1]

[1]UniLaSalle, Beauvais, France (olivier.pourret@unilasalle.fr)

Rare earth element (REE) distribution has been investigated in a weathering profile from New Caledonia. Combination of bulk rock geochemical elemental data with mineral characterization reveals a remarkable evolution. The studied lateritic profile develops on serpentinized ultramafic rocks. It corresponds to a hydrous Mg silicate profile [1]. A progressive development of a well-differentiated lateritic regolith is observed under a seasonally humid climate in an area with low relief. Tectonic (i.e., uplift) allows leaching and reaction/exchange of Ni that yields hydrous Ni-Mg silicates. Hydrous Mg silicate deposits form in the coarse saprolite, with Ni concentrated in varieties of minerals informally defined as garnierite (>1%) where Mg is replaced by Ni. Indeed, Ni is leached from the oxides zones from the fine saprolite and its accumlation in hydrous Mg silicates occurs deeper in the coarse saprolite (e.g. lizardite to garnierite). Moreover, other critical elements are concentrated in the surrounding laterite (e.g. Co, Cr), mainly driven by redox processes [2]. These pprocesses are further investigated through the study of REE distribution as a tracer. Indeed, REE are more concentrated in the pisolitic layer and the limonite relative to the fine saprolite, correlated with the presence of iron oxide and clay respectively. Compared with the upper continental crust abundances, these strongly weathered zones are enriched in Heavy REE and show various Ce anomalies (used as a redox proxy). Cerium anomaly is clearly higher in the oxidized zones (pisolitic layer and red laterite). The same is observe in similar environments in the world. In lateritic profiles of Madagascar [3] an enrichment in clay, Mn oxides and REEs and a positive Ce anomaly are located in the oxidized soil. In laterites above ultramafic complexes of Brazil, the oxides (Mn, Co, Cr) and Ce concentrations are located at the base of the laterites [4].

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