Behaviour of Cr and its isotopes in laterites and implications for Ni laterite formation

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Laterites form during periods of intense tropical to semi–arid weathering. Tectonic setting, climatic conditions, availability of water and redox processes are the main factors that control the evolution of a laterite deposit and, when developed on ultramafic rocks, they can result in the formation of economically important nickel deposits. Oxidative weathering results in the breakdown of primary mineral phases such as olivine that contain Ni as well as abundant Cr. Oxidative weathering also leads to isotope fractionation of Cr, producing a mobile Cr^{6+} pool that is enriched in ^{53}Cr and leaving behind a ^{53}Cr depleted isotope signature in the rock. Deciphering $\delta^{53}Cr$ pathways during the lateritisation process can therefore help to identify alteration and lateritisation mechanisms and may be a useful tracer for supergene Ni enrichment.

The recently excavated Ni laterite formation in Piauí, NE Brasil, has been developed on dunite rock under semi-arid conditions and consists of a Fe–oxide rich, clay silicate deposit, which is domintaed by secondary silica. Local shear zones and fractures within the weathering profile have allowed the infiltration of meteoric water and play a major role in the supergene Ni enrichment, as they contain clay minerals that have high concentrations of Ni of up to 5 wt% together with high concentrations of relatively immobile elements such as Ti, Sc, Th, Nb, Zr and the LREE. In addition to their chemical distinctness compared to the host laterite, their spacial arrangement controls the position and distribution of high grade Ni ores within the laterite with concentrations of up to 3 wt% Ni. Analysis of Cr isotopes is underway; this will give insights into the redox conditions during lateritisation and information about redox–controlled processes during the supergene Ni enrichment.