Critical metals mobilization and enrichment associated with Fe isotope fractionation in Ni laterite deposits, Sulawesi island, Indonesia

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Ni laterite deposits, formed by intense chemical weathering of ultramafic rocks under tropical climate, are important Ni resources and also potential targets for other critical metals (e.g., Co, Sc, PGE). Ni laterite deposits are well developed on the peridotites in Southeast Asian countries, such as Philippines and Indonesia, which have been the major Ni supply sources in recent years. However, few systematic studies have been carried out for Ni laterite deposits in these countries. In order to understand chemical weathering processes involving enrichment of Ni and other critical metals, we investigated the geochemistry and Fe isotopic compositions of 4 Ni laterite profiles developed on peridotites with different degrees of serpentinization in Soroako area and Pomalaa area, Sulawesi island, Indonesia.

The result of elemental transfer calculation of major and minor elements using Ti as an immobile element shows that Si and Mg display absolute losses in the profiles at all the Hills. Conversely, the other major elements such as Fe and Al show middle to high gains in limonite horizon and Ni shows high gains in limonite or saprolite horizon as well as high gain of PGE (Pt+Pd) in the limonite horizon. The highest gain of Fe, Ni and PGE in the profile were found in the profile of Petea Hill, which may indicate that the intensity of chemical weathering is extremely high. The measured δ^{56}Fe values show slight variations among the profiles, except for the Petea Hill. At this Hill, whereas limonite horizon tends to show isotopically lighter δ^{56}Fe values (avg. -0.07‰) than that of the bedrock (-0.02‰), the saprolite horizon shows heavier δ^{56}Fe values (avg. +0.03‰). This suggests that Fe isotopes may fractionate in a Ni laterite profile where high enrichments of Ni and PGE accompany a high gain of Fe due to intense chemical weathering.