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Scandium geochemistry and resource assessment in New Caledonian Ni-Co laterites

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The growing demand for scandium (Sc), essential for several modern industrial applications, drives the mining industry to develop alternative Sc sources. In such context, significant Sc concentrations (∼100 ppm) were recently reported in several Ni-Co lateritic oxide ores developed after mafic-ultramafic rocks. This contribution examines the distribution of Sc in Ni-Co laterites from New Caledonia, the sixth largest Ni producer worldwide. In Ni-Co laterites, Ni and Co reach maximum grades in the saprock/saprolite and in the transition horizons, respectively. In contrast, maximum Sc concentrations typically occur in the yellow limonite horizon. There, Sc enrichment is interpreted to be largely residual, resulting from the intense leaching of mobile cations during lateritization of the parent rock. LA-ICP-MS analyses indicate that Sc is essentially concentrated in neo-formed ochreous goethite with Sc contents about ten times that of the parent rock. Three main factors control the distribution and intensity of Sc enrichment in laterites derived from peridotites: (i) the initial Sc content of the parent rock, controlled by the relative proportion of olivine and pyroxene, (ii) the development of goethite-dominated, yellow limonite after long-lived tropical weathering, and (iii) the local remobilization of Sc from the uppermost horizons through dissolution/recrystallization of goethite and partial replacement of goethite by hematite, thus leading to downward Sc concentration in the yellow limonite. Because Sc is typically not included in routine analyzes of Ni-Co ores, its distribution, grades and tonnages in existing Ni-Co deposits are usually not assessed. Nevertheless, routinely analyzed elements may serve as geochemical proxies for inferring Sc resources in already assayed Ni-Co deposits. At the deposit scale, Sc is globally well correlated with Al, and the Al-Sc correlation slope corresponds to the initial Sc/Al concentration ratio of the parent rock. For a given deposit, the determination of the Al-Sc correlation may allow to assess the distribution, grades and tonnages of Sc with regards to Ni and Co, using existing block models for Al.