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Mineralogy and Deportment of Nickel, Cobalt, and Scandium in the Laterite Deposits of Sebuku Island (SE Kalimantan, Indonesia)

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As nickel (Ni), cobalt (Co), and scandium (Sc) play crucial roles in driving essential technologies for sustainable energy and transportation, Indonesian laterites have emerged as prominent sources or potential sources for these metals. In the present case study, new geological and mineralogical data on the laterites from Sebuku Island (SE Kalimantan, Indonesia) are presented.

The Sebuku ore deposits extend over an area of more than 30 km^2 and contain a JORC-compliant resource of ~390 Mt at 42.5 wt.% Fe, 0.9 wt.% Ni, and 0.15 wt.% Co. Orebodies are mostly limonitic and oxide-dominant. They were formed by the weathering of Jurassic-Cretaceous ophiolites. Although mining has been underway since 2006 (primarily for iron ore), limited mineralogical and geochemical data exist, hindering the optimization of beneficiation processes and the efficient recovery of Ni, Co, and Sc.

Typical laterite profiles at Sebuku include a weathered bedrock composed of serpentinized dunites and harzburgites, overlain by a saprolite zone ranging from 0.2 to 7 meters thick, a yellow limonite zone spanning 2 to 8.5 meters, and a red-limonite zone measuring 1 to 3.5 meters thick. These soil horizons exhibit complex relationships amongst each other, characterized by irregular boundaries, lenticular interbeds, and lateral variations.

X-ray diffraction (XRD) and mineral liberation analysis (MLA) data reveal a complex ore mineralogy, encompassing oxides and oxi-hydroxides such as goethite, gibbsite/bayerite, chromite, various iron oxides (maghemite, hematite, magnetite), manganese minerals (asbolane and lithiophorite), and silicates comprising serpentine/talc, chlorite, pyroxene, garnet, quartz, and smectites. Combined MLA, electron probe microanalysis (EPMA), and X-ray fluorence (XRF) allowed us to determine the deportment of Ni, Co, and Sc in those minerals. Based on these new findings, potential beneficiation strategies are being developed, with the ultimate goal of enhancing the efficiency of the existing processing flowchart and recovering strategic metal by-products (i.e., Sc).