

Behaviour of critical elements, Au and PGE in the Ni-Co lateritic profile, Goongarrie, Western Australia

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The Goongarrie Ni-Co project is 70 km northwest of Kalgoorlie, Western Australia. It contains a global resource of Ni-Co laterite (60Mt at 1% Ni and 0.07% Co). The Goongarrie deposit extends over a strike length of 7.5 km and averages approximately 800m wide and 40m thick. The Ni-Co laterite deposit is formed by weathering of serpentized dunite belonging to the komatiitic Walter Williams Formation. There is no known magmatic sulfide mineralisation associated with this unit, which has a strike length of over 100 km. The Ni-Co laterite profile is 40-150m thick along the Pamela Jean and Elsie North shear zones. The laterite profile is dominated by goethite, hematite and halite with stratigraphic horizons have quartz, gibbsite, chromite, magnetite and lithiophorite. Serpentine minerals, chlorite, magnesite, dolomite and talc dominate the lower part of the profile. The Ni-Co laterite profile is overlain by lacustrine clay and calcareous soil that consists of quartz, feldspars, calcite, alunite and kaolinite.

Laser ablation ICP-MS mapping showed that Cr, Ti, V, Sc, Sb and Y are associated with Fe oxides, whereas Ni, Co, Li, Mo, W, Zn, Ce and Pb are associated with Mn oxides. Silver and Cl occur together as fracture filling AgCl. Gold is concentrated at the base of the Ni-Co laterite profile as pure, cavity-filling microcrystalline aggregates. Chromite occurs in two types: the first is zoned with variations in Cr, Fe, Al, Mg, Ti, Mn and V, and the second is intensely sheared with cataclastic texture and a matrix of talc and chlorite. The first hosts inclusions of Ni sulphides and arsenides, whereas the second hosts Ni, Co, Cu, As, Sb, Ru and Os sulphides, Pt arsenides and Pd-Bi-Sb tellurides. Selenides of Au, Ag and Hg are associated with millerite and exist as cavity fillings in silicates and carbonate. Laser ablation ICP-MS mapping showed that millerite contains Cu, Co, As, Bi, Te, Sb, Ag, Fe, Pb, Pd, Ru, Os and Au.

Bismuth, Te and PGE are immobile in the Ni-Co laterite and are the potential pathfinder elements for Ni exploration. Chromite is the best indicator mineral for Ni sulphide fertility in Goongarrie.