

Multi-scale investigation applied to Ni laterite ore deposits : Impact of discrete fractures on Ni mineralization

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Laterite nickel-ore formation in New Caledonia is classically assumed to be governed by supergene processes, and downward migration of waters with Ni-enrichment at the basis of the laterite profile. However, Ni-ore distribution's heterogeneity seems to have been favoured by secondary processes controlled by the combined effects of inherited tectonics, geomorphological evolution and hydrologic systems since the primary laterite formation. Fluid flow and mass transfer processes are not purely downward at low-temperature conditions, but can also be related to lateral fluid circulations, and local drainage along damaged zones in the vicinity of faults ([1], [2], [3]). This study aims to investigate through sample description and comparison with outcrop scale the impact of discrete fractures on the Ni distribution at different scales.

We use XRF mapping coupled with tomographic analysis on a core sample where different alteration stages have been observed. The goal is to characterize the Ni redistribution inside the sample with the progression of the alteration front, and its impact on the dissolution and reprecipitation process. Sub samples taken at different parts of the core sample with different alteration stages are also studied to precise the location of Ni mineralization and redistribution at smaller scale. Different focuses of the sub samples are made with SEM analysis, to better describe key locations of the dissolution and redistribution processes.

Furthermore, fracture network is extracted from tomographic analysis, and petrographic analysis is carried out on sub samples with different alteration stages to characterize the changes of porosity and permeability with alteration.

Major element oxide concentration profiles (NiO, Fe₂O₃, MgO, SiO₂) are also measured on the sample to characterize the geochemical evolution with alteration.

Results are then compared at three different scales: outcrop, core sample and sub sample, to examine the multi scale tendency of the redistribution process in relation with the spatial distribution of fractures.

References

[1] Cathelineau et al. (2016a), *Mineralium Deposita*, pages 1–16.

[2] Cathelineau et al. (2016b), *Mineralium Deposita*, 51 (2):271–282.

[3] *Myagkiy et al. (2019), Geochemistry, Geophysics, Geosystems*, 20, 1425–1440