

Application of Pluri-Gaussian Simulations and Conditional Simulation for geological modelling and estimation of a nickel deposit in New Caledonia

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ABSTRACT

In New Caledonia, the ophiolites were hydrated during the obduction. This hydration, associated with a metamorphism, led to a serpentinization of the ophiolites. The peridotites have been weathered under the tropical climate, which enriched the nickel along the weathering profile, especially the saprolites.

In some parts of New Caledonia, the weathering is only partial, and in the saprolite horizon, the coarse saprolite alternates with the fine saprolite, the laterite and the bedrock. In this deposit, the description of the saprolites is made in a one-meter interval. Each lithology (laterite, fine saprolite, coarse saprolite and bedrock) is represented by a proportion of occurrence within the meter, without giving the exact location of the lithology inside the meter. From here, an explicit geological modelling is difficult to achieve. Moreover, the proportion of each rock type is zero in more than 40% of the samples, making a simulation difficult. Indeed, a gaussian anamorphosis is needed prior to running the simulations, and this function must be bijective. A pluri-gaussian approach is more appropriate with a preliminary 10cm discretization of the samples: a unique lithology is assigned to each 10cm sample. Then, the results of the pluri-gaussian simulations are transferred to a 1m support and the rock proportions are calculated for each meter. Thanks to the pluri-gaussian simulations, the risk associated to the geological modelling is assessed.

The density is not constant in this orebody and depends on the lithology. Nickel accumulations are calculated by multiplying the density with the nickel grade. A co-simulation of nickel accumulations and the density is run for each pluri-gaussian simulation. A risk is assessed at this stage and enables two levels of uncertainties: on grades and on geological modelling. These uncertainties can change the decisions regarding pit limits and production schedule and, consequently, impact the financial outcomes.