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Stochastic delineation of potential sulphide exploration targets of the Sierra Norte project

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ABSTRACT

Introduction: Sierra Norte is an IOCG mining project located in the Atacama Region that aims to process oxides by leaching and solvent extraction/electrowinning and sulphides by concentration. This study presents the results of a definition of potential areas with sulphides contents in the Sierra Norte Project, integrating geological information from drill holes and geophysical data.

The Sierra Norte team carried out a brownfield exploration program in the nearby of the 'Carmen Paulina' area, which has a high level of geological characterization. The program includes surface mapping, diamond drilling, and 35 geophysical lines of magnetometry and electrical methods, including resistivity, conductivity, and chargeability. The geophysical lines are located both in Carmen Paulina and in the surrounding exploration areas.

A key physical property is the chargeability, which represents the recovery time of a material after applying an electric charge. This property increases with the presence of sulphides; therefore, it is useful to infer the existence of such a type of mineralization. Additionally, the Sierra Norte team developed a proxy approach of sulphide presence using the same electric methods but applied on drill hole core samples.

Methodology: considering the core sample information, it is possible to relate physical properties (resistivity, chargeability, and susceptibility) with the geological logging and the copper and iron contents. The relationships so obtained between physical properties and Cu-Fe mineralized areas can be extrapolated to the exploration areas where only geophysical information is available.

Given the diverse nature of information in terms of source and availability, geostatistical simulation was used to integrate the geophysical, structural, and drill hole information to delineate potential exploration targets. In detail, a truncated Gaussian model was used to simulate the sulphide domain, then the copper and iron contents were jointly simulated inside this domain (Figure 1). In the former simulation, the geophysical information was used to define the prior probability of sulphide presence, while in the latter simulation, it was used as a covariate of the copper and iron contents.

Results and Conclusions: the results show six potential targets with a higher conditional probability of belonging to the sulfide are and higher expected copper and iron contents (Figure 2). They provide

rich information to rank the different targets in terms of expected resources and their associated risk. The approach and results were useful to assist, confirm, and quantitatively support the exploration plan and the location of future drill holes.

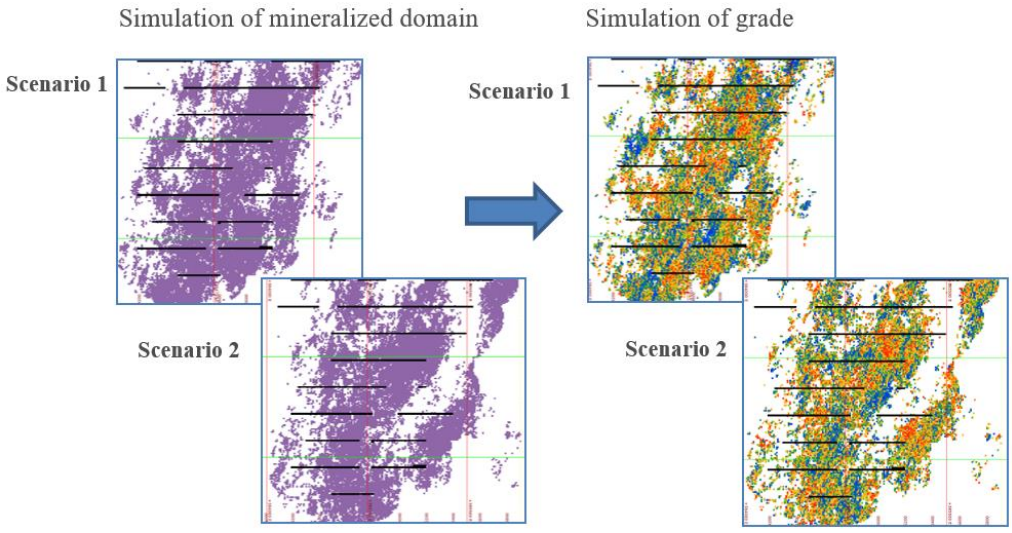

Figure 1 Two-stage simulation: mineralized sulfide domain (left) and copper grade (right). One hundred simulated scenarios are generated, but only two of them are displayed.

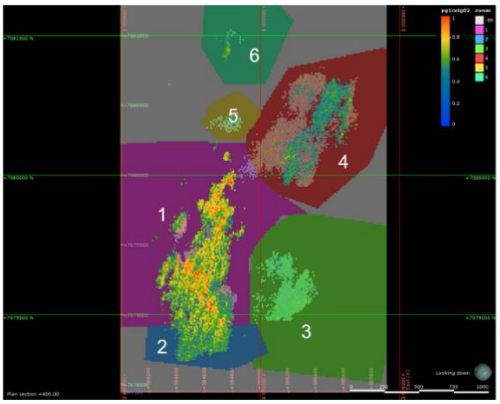

Figure 2 Areas with the different probability of being mineralized, based on 100 scenarios conditioned to drill hole data and geophysical information.