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Putting the “GEO” back in front of GEOmetallurgy: Importance of early implementation of quantitative mineral system characterisation, classification and modelling.

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ABSTRACT

Truly integrated, quantitative, 3D GEOmetallurgical (or mineral system) characterisation, classification and 3D modelling can, and should, provide a cradle to grave unifying link across the exploration and mining value chain. All too often, spatially representative (quantitative) characterisation and modelling of a mineral system is delayed until feasibility stage, incurring a significant opportunity cost.
The application of robust GEOmet characterisation methods, and principals, early in the project lifecycle (at exploration stage) adds significant value to ground selection, exploration and Mineral Resource estimation outcomes, long before there is a need for metallurgical test work. The value of this early provision of quantitative 3D mineralogy models is compounded at project feasibility stage, and continues to compound over the entire project lifecycle, delivering cost savings, improved decision making and early warning of issues and opportunities.

The inputs are comparatively inexpensive. Routine 4 acid ICP-MS geochemistry (the key component for spatially representative prediction of ore and gangue mineralogy throughout the mineral system), SWIR spectral mineralogy, selective petrography and XRD, and appropriate routine quantitative drill hole data capture (oriented structure, magnetic susceptibility, density, pXRF, acid fiz, rock hardness and quality core photography) in addition to high quality standardised geological logging & mapping. Yet many of these costs are all too often deemed too extravagant at the exploration and resource drill-out stage.
The authors present a Chilean Coastal Range Cu-Au-Mo case study, where routine application of these methods to all drilling from the exploration-stage delivered 3 new discoveries, a complete change in the exploration model from IOCG to Porphyry-related breccia, ultimately leading to a maiden porphyry Cu discovery, de-risking and fast-tracking of feasibility stage metallurgical test work through early characterisation, classification and 3D modelling of deposit characteristics.
A second case study, of a complex Sn-fluorite-Cu-W skarn, demonstrates the value of quantitative GEOmet characterisation of all drilling in a complex zoned mineral system, where the true mineralogical variability within the system cannot be measured by a few selectively drilled metallurgical test work holes at feasibility stage.