ASSESSMENT OF REVENUE UNCERTAINTY IN LIFE-OF-MINE PLANNING AT GEORGE FISHER DEPOSIT – QLD, AUSTRALIA

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ABSTRACT

Uncertainty in mineral resources may arise from various factors, including statistical fluctuations, data acquisition, and geological interpretation. In mining, the multi-source nature of uncertainty is categorized into major resource categories to convey the overall risk associated with estimates. However, conventional classification approaches may fail to break down uncertainty into its components, particularly when evaluating risks related to financial outcomes or economic variables. Challenges arise when financial functions depend on indirect or non-geological variables that are frequently overlooked in conventional resource classification frameworks such as revenue functions, metallurgical inputs, and deleterious elements. In this context, this paper explores the impact of large-scale spatial uncertainty on net smelter return, at the George Fisher polymetallic deposit. The workflow integrates both modern and traditional multivariate geostatistical techniques, including simulation, multivariate data imputation, data decorrelation, and histogram uncertainty analysis, to assess revenue risk over the life of mine. In the presented workflow, profit-related variables are simulated individually in a multivariate fashion to preserve the high-order statistics of the original data in the simulated realizations. Revenue uncertainty is evaluated by processing all realizations through technological and financial functions within the context of production volumes. In the deposit, the net smelter return is mainly influenced by three key variables: lead, zinc, and silver. Additionally, metallurgical recovery, expressed as a linear combination of primary and secondary variables such as sulphur, iron, and copper, also contributes to determining the NSR. Overall, the revenue uncertainty generally aligns well with the current resource classification. However, there are instances where higher risk is observed, driven by the variability of secondary variables, the spatial configuration of mining stopes, and the scale of production across the years. The uncertainty in mine planning from 2025 to 2036 is quantitatively assessed at both point and production scales, with an evaluation of the nature of uncertainty and the influence of each variable. This case study demonstrates that a multivariate approach to evaluating revenue uncertainty provides a more comprehensive assessment of financial risk. It offers valuable insights for decision-making by identifying sources of uncertainty that are often overlooked in traditional classification methods.