Multi-scale stochastic modelling of ore textures at the George Fisher mine, Q...
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EXECUTIVE SUMMARY

GEOLOGY

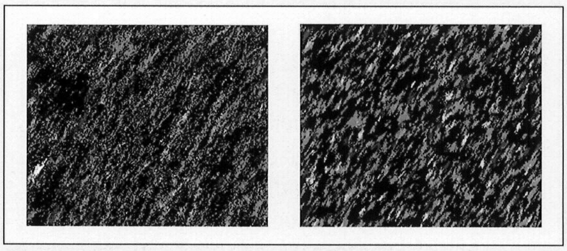
Multi-scale stochastic modelling of ore textures at the George Fisher mine, Queensland, Australia

Traditional planning of mines and scheduling of production is largely based upon the modelling of ore grade. It is known, however, that grade is not the only characteristic that can be taken into account to maximize performance at the processing plant and efficiency of tailings disposal. Ore processing plants respond well to feed that is consistent over time and that has known physico-chemical characteristics, which can be used to improve plant design and performance through the management of plant variables. Ore texture complements grade and influences, or is a measure of, mineral liberation properties, ore grindability, concentrate properties, disposal characteristics, and other properties which collectively characterize the metallurgical behaviour of the ore. Furthermore, in an operational sense, even with the most sophisticated plant control system and mining practices, a response lag occurs between the measurement of an ore processing characteristic and the corrective action required. During this lag time, an opportunity exists to maximize the profit of the resource by introducing a predictive ore control strategy.

The technical literature provides substantial information on the link between ore texture and metallurgical behaviour. If the metallurgical properties of ore and the ore's texture are intimately linked, then the time-dependent variability of ore behaviour in the mill feed is directly related to the space-dependent variability of textures in the orebody. If ore textures can be recognized, measured, and quantified in spatial models, then ore texture models can form the basis for predicting, simulating, and controlling the time-dependent variability of the ore behaviour in the mill feed.

This paper presents an approach to the spatial modelling of ore textures from suitable measurements, thus potentially enabling predictive ore control strategies to be implemented for ore processing. The paper contributes a modelling framework founded upon four factors: definition of ore textures at a practical scale (mesotextures); characterization of spatial continuity of mesotextures; stochastic simulation of mesotextures at a fine scale; and construction of predictive mesotexture models at the required mining scale from the simulated fine-scale textures. For the simulation of ore mesotextures, a new sequential "growth" algorithm extending the so-termed sequential indicator simulation (SIS) is developed. The method mimics a natural process of "informed" growth in a spatial pattern and generates geologically plausible patterns. The figure shows two simulated models of nine mesotextures over an area of 300 by 350 m^2, both based on mesotexture data identified in the core of the same drillhole fan in the George Fisher massive sulphide deposit in Queensland, Australia. The simulated model of ore texture in the figure (left) is generated with the sequential "growth" algorithm presented in this paper. The figure (right) is based on the off-the-shelf SIS method mentioned above and was considered by the mine's geologists as unrealistic for the textures encountered at the mine. Visually, the differences in the two images are clear and due to the ability of the new algorithm to better account for complex, short-scale spatial relations among the mesotexture types.

The above-mentioned new simulation algorithm is shown to be suitable for implementation and excellent in performance, thus potentially assisting with the spatial modelling of ore textures and the implementation of predictive ore characterization and processing strategies.



Ore texture simulation over an area of about 50 by 50 m^2 generated by using the extended SIS algorithm with sequential "growth" (left), and the off-the-shelf SIS algorithm (right)

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