Ore formation drives ore extraction: Economic geology is the foundation for geomet

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The complexities of ore formation, emplacement, and alteration directly influence the effectiveness of ore extraction yet are not generally included as inputs to process development, design, or build. Spatial geological variability translates into period-based response variability that commonly results in cost overruns and lost revenue. The direct links among ore body knowledge, economic geomet, and effective extraction constitute a life-of-project platform for addressing key value parameters. It is necessarily based on fundamental principles of economic geology and ore formation, and transforms ore body understanding into ore body appreciation for most effective operation over time and in 3D. Simplistically: the way the ore got in influences the way it gets out. Knowledge of geological processes such as grain boundary surface energy, microfracture mineralogy, inclusion geochemistry, sequence stratigraphy, facies transitions, and magmatic crystallization paths add considerably to understanding and predicting the spatial distribution of ore and of waste and the physical characteristics that impact extraction.

In practice, geomet is a loosely constrained, user-defined application viz what it is, why it is needed, and how it is implemented. Thus the metallurgical usage is more akin to process mineralogy, and the mining usage is focused on ore upgrading. Neither adequately considers the spatial geological importance of ore body controls on effective extraction. Geometallurgists do rely on quantitative mineralogical data, integrating mineralogy into comminution and flotation programs. They correctly state that since we mine minerals, and not grades, simple grade-based resource models ignore the complexities of mineralogy and texture. Economic geologists know that in fact we mine rocks, not minerals or grades, and rocks exist in known geological relationships in time and space, appreciation thereof adds value through integration with the mine plan, schedule, extraction circuits, and sustainability. The most effective geomet programs in Chile, for example, were developed and driven by geological, not metallurgical, teams with a history of geomet process development in terms of spatial mineralogical and geological characteristics.

Undersampling, undertesting, and ineffective use of quantitative analytical tools are keeping geological risk factors out of economic assessments and decision making. Linking technical and financial models is a challenge. Knowledge is ineffective unless it can be quantitatively integrated into life-of-project value models. With geological inputs, uncertainties are reduced to more acceptable levels with predictable ranges in throughput and recovery, cut off grades, and sustainability indicators, all geologically driven and directly impacting revenues and costs. Current innovative research assumes orebody understanding a priori and is aimed at mill design, ore grade engineering, energy, and data integration, through better software, modeling, simulations, and tests. Orebody drivers and uncertainties are the domain of economic geology to quantify and integrate. It does not help that the greatest barrier to integration is lack of communication, identification of common goals, and team work. A clear focus on geologically founded value, throughout the life of the project, is the only way to integrate ore formation with ore extraction and create a more effective way to mine.