Implementation of Three-Dimensional Blast Movement Modelling to Reduce Dilution at a Sub-Saharan Copper Mine

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ABSTRACT

Blasting is a fundamental process in mining, fragmenting rock for excavation and subsequent processing. Blasting results in blast movement however, relocating mineralisation from its in-situ position to a post blast location. Understanding this blast induced movement is important to grade control and reducing dilution and ore-loss; factors which greatly influence the economics of any open pit operation.

At Mine A, there is a 38% dilution factor on average incurred between the reserve model and the grade received at the mill (F2). They key contributing factor that was identified was the procedure of inferring hand drawn polygon boundaries on in-situ ore-waste boundaries and sliding them in 2D along the x and y planes to account for blast movement. Blast movement is a 3D phenomenon and sliding polygons does not account differential horizontal and vertical movement, or account for varying flitch boundaries. Furthermore, sliding polygons assumes in-situ density, volume and grade apply to the post blast polygons, which is incorrect.

A 3D methodology was implemented at Mine A with the aim of reducing the F2 dilution factor. OrePro 3D™ software uses blast data to create a reactive vector field throughout the entire blast volume that accounts for differential and variable movement, accounting for movement along the x,y and z planes. The vector field is then used to move each of the centroids in the in-situ grade control model to its post blast location. The moved model is then analysed and an algorithm is used to generate the ore polygons with the maximum value.

This paper presents the grade control methodology at Mine A and associated challenges with a specific focus on blast movement. The application of a 3D blast movement solution is then described. Using OrePro 3D™, the likely causes of the dilution factor are determined and accounted for.