Application of 3D reflection seismic methods to mineral exploration

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Seismic exploration for mineral deposits is often tested by excessively complex structures, regolith heterogeneity, intrinsically low signal to noise ratio, ground relief and accessibility. In brown fields, where the majority of the seismic surveys have been conducted, existing infrastructure, old pits and tailings, heavy machinery in operation, mine drainage and other mine related activities are further challenging the application of seismic methods and furthermore increasing its cost. It is therefore not surprising that the mining industry has been reluctant to use seismic methods, particularly 3D for mineral exploration, primarily due to the high cost, but also because of variable performance, and in some cases ambiguous interpretation results.

However, shallow mineral reserves are becoming depleted and exploration is moving towards deeper targets. Seismic methods will be more important for deeper investigations and may become the primary exploration tool in the near future. The big issue is if we have an appropriate seismic "strategy" for exploration of deep, complex mineral reserves. From the existing case histories worldwide we know that massive ore deposits (VMS, VHMS) constitute the best case scenario for the application of 3D seismic. Direct targeting of massive ore bodies from seismic has been documented in several case histories. Sediment hosted deposits could, in some cases, can also produce a detectable seismic signature. Other deposit types such as IOCG and skarn are much more challenging for the application of seismic methods. The complexity of these deposits requires new thinking. Several 3D surveys acquired over different deposit types will be presented and discussed.