Application of High Resolution Geophysics to Mining

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ABSTRACT

This paper focuses mainly on the development of in-mine geophysics as a discipline within South Africa. The concepts elucidated, however, have applicability to all situations where a drive to concentrated and highly mechanized mining is occurring.

Geophysics in the past has concentrated mainly on finding new mineral deposits at the exploration stage of a project. With the advent of higher resolution/shorter range techniques, however, geophysics is being applied increasingly to the mining operation itself. The goal here is to provide information on the condition and geometry of an ore body and the surrounding rock, to the accuracy required for advance mine planning.

Development of this geophysical technology has coincided with a drive to mechanized and concentrated mining in South Africa. These mining approaches in theory, deliver a far more cost-effective operation, principally due to the limited area which is developed, and the continuous nature of the operation. A drawback, however, is that they are relatively inflexible and thus require that the ore body and rockmass conditions be known far more accurately than for conventional mining.

This paper explores the ability of high resolution geophysics to provide the required information pertaining to the ore body and rockmass conditions, and examines ongoing developments in this field. The concepts presented are also elucidated by means of case studies, mostly from South Africa. A key consideration is that the information requirements are very specific to the particular mining environment. Related to this is the fact that high resolution geophysical techniques are highly environment-specific in their performance. The main consequence is that a suite or "toolbox" of geophysical techniques must be used in tandem to ensure general applicability. This toolbox concept is key to the successful implementation of high resolution geophysics, and is discussed in detail during the paper. Techniques discussed include radio tomography, ground penetrating radar, seismic reflection, and seismic tomography.

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