Geophysical log applications to geological and geotechnical assessment

B. Zhou[1]

1. Senior Principal Research Geophysicist, CSIRO Mineral Resources, Brisbane, QLD 4069.
Email: Binzhong.Zhou@csiro.au

Keywords: Geophysical logs, geotechnical characterization, rock strength

ABSTRACT

Geophysical borehole logging, which measures various in-situ petrophysical parameters, can be used not only for qualitative interpretation such as strata correlation, but also for geotechnical assessment through quantitative data analysis. It can play an important role for safe and productive mining operations. Unexpected geological and geotechnical mining conditions have resulted in significant loss of production in some mines in Australia and other countries. In general, geotechnical data are obtained by analyzing drill cores and chips from boreholes. However, coring is expensive and in many cases the core cannot be fully recovered. In such a case, geophysical logging could be an alternative way to provide the required information from non-cored boreholes. This provides for either a substitution of diamond drilling or an extension of drilling programs within the same budget, based on the fact that non-cored holes are cheaper to drill.

Here we will provide various applications of geophysical logs such as the estimation of the strength of intact rock or the unconfined (or uniaxial) compressive strength (UCS), automated lithological/geotechnical interpretation, geophysical strata rating and other parameters. These derived parameters could provide input to control of geological and geotechnical models. This could assist site geologists and planning and production engineers predict and manage mining conditions on an ongoing basis. Both conventional logs such as density, natural gamma and sonic, and less common logging data such as full waveform sonic, televiewer and the SIROLOG spectrometric natural gamma logging data are examined for different applications. Although the examples used here are mainly for coal mining applications, but they can be equally applied to hard rock metalliferous mining such as iron ore mining.