

ABSTRACT

Due to the technological advancements, there have been a tremendous development in the mining sector in the cavings and mine design models that allow mining method applications to reach greater depths. The global mining challenges have been ushered into an era where many choices are available to exploit minerals in open pit or underground systems. The most favourable mining method amongst the available options is the one that is safe and has highest economic returns.

The decision of using open pit, underground mining or both is determined by the geometric characteristics of the minerals being mined. Open pit is often considered easier to exploit than underground mining in terms of safety, flexibility, recovery rate, working environment and economics. However, as the open pit continue to deepen, a transition decision will prevail either to mine push back or sink a shaft for going underground.

Venetia mine is a diamond producing operation, currently mining open pit a kimberlite orebody and in the process of transition from Open Pit (OP) to Underground (UG). Open pit activities are planned to cease in 2021. This study aims to investigate the mining method selection for Kimberlite Orebody 01 (K01). Previous studies conducted for the underground mining method selection project proposed the block caving mining method to exploit K01. In this study, the rigid assumption on the mining method presents a risk to the project. The challenge with block caving in K01 is the narrow orebody width with highly discontinuous nature of contacts. The narrow width is limiting the caving radius to maximum of 30m with the narrowest area in the eastern part to be 20m. However, this put Venetia underground project in the transitional zone thus not stable but definitely not caving.

Data analysis was done using Rock Mass Rating (RMR) and Modified Rock Mass Rating (MRMR) classification systems. The results of the geotechnical analysis were compiled into seven kimberlite facies. The calculated MRMR for Dark Volcaniclastic Kimberlite (DVK) facie is 45 and hydraulic radius is 35m. While the MRMR for Country Rock Brescia (CR) is 44 with hydraulic radius of 29m. The DVK facie constitute 92% of the kimberlite facies in K01 deposit which classified as strong and stable for caving.

The lesser material from Coherent Kimberlite (CK) and CR are weak and constitute 8% of kimberlite facie in K01.

Expected geotechnical conditions for DVK_HARD Intact Rock Strength (IRS) which is over 100MPa and DVK_MID IRS which is between 50MPa and 100MPa have significant impact on the mining method selection. Results of the analysis performed in the study indicate a competent ore body which require pre-drilling for caving to occur. Stress induced scaling and weathering are predicted in weaker lithological domains. Based on the study results, sub level caving mining method should be implemented for the project and care must be taken to control dilution and mud rush.