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Reflections on support design in geotechnically challenging group conditions: a case of Zimbabwean great Dyk platinum mining

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ABSTRACT

Falls of ground pose costly hazards to personnel and equipment and thus measures should be taken to prevent them. The stability of excavations is ensured by good support design and sound mining practices. This research endeavours to analyse and improve the support systems used in geotechnically challenging ground conditions for Great Dyke platinum mines by analysing the current support systems and recommending effective support system thereof. Various techniques were used to determine the quality of ground conditions, predict the rock mass behaviour and to identify the appropriate support system. An analysis of the current ground control methods and their limitations was also undertaken. The reflections showed that the current support system and mining practices in geotechnically poor grounds need to be modified to improve safety and productivity. Stoping overbreak is influenced by poor ground conditions and the explosives currently used. The use of emulsion is recommended to replace ANFO. Redesigning of pillars through a reviewed design rock mass strength is also recommended taking into cognisance the current rock mass data. Pillar staggering was also seen as the best practice in geotechnically poor ground conditions in a bid to limit exposure. An evaluation of the current tendon system indicated an opportunity for improvement following comprehensive empirical and analytical design techniques. A new support system was recommended, taking into consideration cost-benefit analysis to clamp overlying layers as well as the catastrophic wedges. Barring down using pinch bars in poor ground was seen as a risky and time-consuming exercise, hence the use of mechanical scalers is recommended to achieve zero harm and to meet production targets. Smoothwall blasting is recommended in poor ground to minimize hangingwall damage. The results gathered and analysed showed that, technically, emulsion explosives are beneficial but the increase of operational cost down-weighs them. However, in solution to the problem which prompted this research, the author suggests the mines to take up emulsion as it promotes safety at higher productivity in terms of tonnage output. Other recommendations include the use of hydrological surveys to determine groundwater levels and implement corrective measures. Both empirical and numerical modelling approaches need to be utilized in determining the optimum support. Additional support is also recommended where there is pillar robbing and pillar scaling to increase the pillar strength. Poor support design and poor mining practices pose danger to employees, resulting in loss of profitable reserves and entrapment of expensive mining machinery thereby culminating in additional capital costs and reduced life of mine.