DEPARTMENT OF MINING ENGINEERING RESEARCH

Some rock engineering aspects of multi-reef pillar extraction on the Ventersdorp Contact Reef

Mining in the Carletonville area of the Witwatersrand Basin predates 1934. Owing to the depletion of highergrade ore, the current activities focus increasingly on the extraction of lower-grade secondary reefs, as well as remnant extraction. Of particular interest is multi-reef remnant extraction. Numerical modelling was conducted to investigate some rock engineering aspects of remnants being understoped on a secondary reef horizon. An analysis of the stress evolution in the middling between two reef horizons indicated that a zone of high major and low minor principal stress develops between the two reefs. This indicates a high risk of violent shear failure. Some pillars were nevertheless successfully understoped in the past and a study was conducted to better understand this phenomenon. An "extended" energy release rate concept introduced by Napier and Malan (2014) proved to be useful for investigating this problem. It was found that bedding planes and lithology appear to play a role in the stable dissipation of energy in multi-reef remnant geometries. The study indicated that the stope convergence and the various energy components are affected by the presence, position and properties of a bedding plane. The energy solutions are complex and sometimes counterintuitive. Care should be exercised when modelling specific cases. The modelling was nevertheless valuable as it indicated that energy dissipated on weak layers may reduce the risk of violent failure in a multi-reef mining scenario. Additional work is required to investigate if crushing on the reef plane plays a prominent role when mining these remnants.

Prof Francois Malan and JC Esterhuyse



UNIVERSITEIT VAN PRETORIA UNIVERSITY OF PRETORIA YUNIBESITHI YA PRETORIA

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