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Application of stochastic orebody simulation techniques to assess geological volume and grade uncertainty for gold reef deposits

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I ABSTRACT

This dissertation discusses the use of stochastic orebody modelling techniques for assessing geological uncertainty associated with gold mineralisation at Geita Gold Mine in Tanzania, and proposes a practical methodology that can be applied to similar studies. As part of the pre-feasibility stage studies for underground mining at Geita, stochastic simulations were required to assess the geological uncertainty associated with isolating (modelled) high grade lenses that occur within the known low grade mineralisation currently targeted for underground mining. Two different simulation techniques are applied in this research: Sequential Indicator Simulation to generate lithofacies realisations from which to assess ore category boundaries and shapes for use in quantifying volumetric uncertainty; and Direct Block Simulations to simulate gold grade realisations from which to assess grade uncertainty. This study identified potential upside and downside mine planning scenarios for volumes and total metal content from the ore category and grade simulations respectively. The findings of the results demonstrated that the high grade zones are much more broken up and discontinuous than the currently modelled high grade shape. The current business case uses a probabilistic high grade shape based on a single grade indicator and a probability choice of 50 percent as the threshold for high grade. The results of the study consider a simulation of possible outcomes based on the same threshold grade indicator and hence quantify the uncertainty or total geological risk. This geological risk may be introduced to mine designs, production schedules and NPV predictions The stochastic workflowdeveloped can be applied to analogous deposit types to assess the risk related to geological uncertainty. The work includes a description of practical considerations to be accounted for when applying the techniques.

Keywords: **stochastic orebody modelling, geological uncertainty, mine planning**