INTRODUCTION

The Witwatersrand goldfields are almost depleted and associated with significant mining costs due to the increasing depth of mining (~4km). The economic viability of current and future gold production in South Africa is currently being questioned. There is a need for novel improvement and optimization strategies.

This study will explore whether certain types or geometallurgical domains of the Ventersdorp contact reef (VCR) and Elsburg reefs may be amenable to underground heap leaching and is limited to Kusasalethu Gold Mine (Carletonville, South Africa; Figure 1).

The VCR is the primary gold ore exploited at Kusasalethu mine, whereas the Elsburg reef is a secondary source of gold. Gold mineralization of both the Elsburg and VCR (Figure 2) is associated with sulphides (e.g. Pyrite-hosted) although there is limited knowledge on the exact mineralogy of these two reefs at Kusasalethu.

There is a need for novel improvement and optimization strategies.

Geology of Kusasalethu

The VCR gold is in quartz veins hosted in biotite gneisses of the Hartbeespoort Supergroup and is associated with pyrite (Figure 2a,c). The VCR gold is hosted in quartz veins and is associated with pyrite. The VCR gold is hosted in quartz veins and is associated with pyrite.

Process mineralogy & geometallurgy

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Proposed project

This geometallurgical study explores whether certain types or geometallurgical domains of the VCR and selected Witwatersrand gold ores at Kusasalethu gold mine may be amenable to underground heap leaching. In order to explore this idea, an integrated approach using geology, geometallurgy, process mineralogy will be applied with the following objectives:

1. Identify and sample different geometallurgical domains in the Elsburg reefs and VCR at Kusasalethu which are theoretically suitable for heap leaching;
2. Compare the effect of breakage mechanism on the particle fracture network and gold liberation using a set of coarsely crushed samples (HPGR vs. cone crusher);
3. Perform a full mineralogical characterization of the reef types (i.e. effect of Particle size, mineral proportions, gold association with other minerals: Textural and mineralogical relationships and mode of occurrence);
4. Using a series of column leach tests, determine what effect the formation of auriferous particles and geometallurgical domain is upon gold extraction.