A geometallurgical study of gold at Kusasalethu mine, South Africa


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Synopsis

- The Witwatersrand goldfields and RSA Economy (Figure 1);
- The economic viability of current and future gold production;
- Opportunities for novel improvement and optimization strategies in gold mining and processing.

Figure 1. History of Witwatersrand Basin gold production rate [8].
AIM OF THE STUDY

- 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 2).

Figure 2. Geographical location of Kusasalethu Gold Mine (Photo and Map: Manie Keyser)
Sequential grid layout

Alternate and more economically favorable technologies used in other industries:

- High Pressure Grinding Rolls (figure 3);
- Heap leaching (Figure 4);

Use of modern analytical equipment (e.g. MLA, QEMSCAN, LA-ICP-MS, X-ray CT)

Figure 4. Basic Heap leach process diagram [3]  
Figure 3. Inter particle bed breakage [1]

FIG 5- Gold grain from the 10-mm-diameter core. a) Actual grain recovered after HF and HNO3 acid digestion of the silicate and sulfide matrix; b) HRXCT model of insitu gold grain from Blob3D analysis [7]
Proposed project

- Explores whether certain types or geometallurgical domains of the VCR and selected Witwatersrand gold ores.
- Integrated approach using geology, geometallurgy, process mineralogy will be applied with the following objectives:

  • Identify and sample different geometallurgical domains in the Elsburg reefs and VCR at Kusasalethu which are theoretically suitable for heap leaching;
  • 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);
  • Perform a full mineralogical characterization of the reef types
Reference List