

Mineralogical Controls on Gold Extraction

A Comparison of Leaching Techniques on South African Ores

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Mounting pressure, due to social and environmental concerns associated with cyanide extraction, as well as the decrease in available free milling gold deposits, continually complicates metallurgical processing of gold ores. The need for advancements in this field call for research and the introduction of alternative extraction processes.

Samples from several gold deposits, from various localities in South Africa, have been collected to evaluate their refractory nature, response to cyanide, and mineralogical controls on amenability to alternative extraction methods. These deposits; Mponeng's Ventersdorp Contact Reef (VCR), Fairview and Barbrook, Barberton, Pilgrim's Rest, and Consolidated Murchison, span a range of ore types and mineralogies. These include free milling, complex, and refractory ores. Complex mineralogies are defined by the presence of various reagent consuming and preg-robbing materials, while the presence of gold compound minerals, as well as sulphide-bound gold, result in refractory ore types.

Understanding of the mineralogy of each deposit and its influence on gold extraction (not only in terms of cyanide extraction, but also alternative techniques, such as thiosulphate, thiourea and chloride leaching) is paramount to effective extraction. Examples of deleterious mineralogies include base metal sulphides, specifically significant levels of pyrite, chalcocite, and chalcopyrite in Pilgrim's Rest, and antimony minerals such as stibnite and berthierite in Consolidated Murchison. In addition, solid solution gold or discrete gold compound minerals, as found in Barberton deposits and Consolidated Murchison, reduce accessibility, and thus extraction.

In evaluation of each deposit, cyanide leaching was undertaken and maintained at marked conditions. Cyanidation was then used as a standard, against which, other leaching methods were evaluated. Under certain mineralogical conditions, alternatives to cyanide, which are typically uneconomic, may outperform the cyanide leaching method.