

## POTENTIAL APPLICATIONS OF BIOMINING FOR *IN SITU* RECOVERY

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### ABSTRACT

Biomining utilises the activity of microorganisms to extract and recover elements of interest from ores and wastes. It has been applied on a commercial scale for the bioleaching of base metals such as copper, nickel, zinc and cobalt from sulfide ores, for the biooxidation of refractory sulfidic gold minerals before cyanide leaching, and for metal recovery from solution through bioprecipitation. Bioleaching has been most commonly implemented in engineered heaps, whereas bioreactors are typically used for the biooxidation of refractory gold-containing sulfide concentrates. *In situ* bioleaching has been explored at some mine sites for the extraction of uranium and base metals. With the depletion of easily accessible shallow ore deposits, the interest to explore the potential of biomining to facilitate *in situ* recovery (ISR) from deep ore deposits has been increasing as an approach to reduce the consumption of chemicals and reduce mineral passivation as compared to chemical leaching. Depending on the mineralogy and commodities of interest, the microbial catalysts may include ferrous iron-, sulfur- and iodide-oxidising, ferric iron-reducing, organic acid-producing, and phosphate-solubilising microbes. Biogenic leaching agents may be generated in above-ground bioreactors and delivered underground for leaching under saturated conditions or regenerated in the subsurface ore body for leaching processes operated under unsaturated conditions. Pre-leaching with water or acid may be required if the ore body is very saline or contains large quantities of acid-consuming minerals. Other considerations for the application of biomining for ISR include the availability of essential nutrients for microbes, and understanding the characteristics of the ore body that may impact microbial growth (particularly temperature and pressure). This presentation will give an overview of biomining mechanisms and microbes that can be utilised for ISR, engineering approaches and examples of some ISR trials that explored biomining.

*Keywords: Biohydrometallurgy; Bioleaching; Biomining; Biooxidation; In situ recovery.*