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A Process Mineralogy Approach for Direct Leaching of Precious Metals from the UG2 Ore in the Bushveld Igneous Complex

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The Platinum Group Metal (PGM) industry currently relies on the traditional crush-mill-float-smelt and pressure leach extraction for ore processing. However, this approach is not always applicable to all ore types. Direct cyanide leaching has emerged as a cost-effective and environmentally friendly alternative to the traditional extraction method, particularly for low-grade or mineralogically complex PGE-bearing ore deposits. The effectiveness of direct cyanide leaching stems from cyanide's strong affinity for metals, enabling the formation of complexes with heavy metals at low concentrations and facilitating effective metal recovery.

Cyanide leaching offers several advantages over traditional methods in the extraction of PGMs. It ensures high recovery rates when the system is optimised. Additionally, direct leaching reduces treatment expenses by eliminating intermediate steps like flotation and smelting, resulting in overall cost savings. Direct cyanide leaching has a higher solid-to-water ratio, reducing the amount of water consumed, and making it more environmentally friendly. Furthermore, the flexibility of cyanide leaching enables mining companies to process mineralogically complex and low-grade ores.

This study explores the potential use of cyanide direct leaching for recovering PGMs from UG2 ore, building upon previous research and addressing the limitations by investigating the effect of elevated temperatures and the addition of oxidants to enhance leach kinetics and extraction levels. By assessing these parameters along with the mineralogy and texture of the ores, this research seeks to optimise cyanide leaching processes, improving both efficiency and sustainability in PGM extraction from challenging ore deposits.