Multicomponent Mine to Mill Optimization Applied to Iron and Gold Ores

B. Bonfils[1], *W. Valery*[2], *A. Jankovic*[3], *E. Tabosa*[4], *P. Holtham*[5], *K. Duffy*[6]

1. Senior Process Engineer, Hatch, Brisbane, QLD. Email: benjamin.bonfils@hatch.com
2. Global Director - Consulting and Technology, Hatch, Brisbane, QLD. Email: walter.valery@hatch.com
3. Principal Consultant, Hatch, Brisbane, QLD. Email: alex.jankovic@hatch.com
4. Senior Process Engineer, Hatch, Brisbane, QLD. Email: erico.tabosa@hatch.com
5. Senior Consultant, Hatch, Brisbane, QLD. Email: peter.holtham@hatch.com
6. Senior Process Engineer, Hatch, Brisbane, QLD. Email: kristy.duffy@hatch.com

ABSTRACT

The benefits of Mine to Mill optimization have been understood in the industry for many years. If well executed, with a structured methodology, the throughput of the overall operation can be maximised using the existing equipment while minimizing operating costs. The impact of the final grind size (predicted by *JKSimMet*) on downstream processes can also be evaluated by understanding the trade-off between throughput, costs and recovery.

However, while *JKSimMet* is suitable for predicting throughput and size distributions for comminution and classification, it cannot track minerals or elements. Therefore, to optimise the process from mine to concentrator in terms of recovery and concentrate grade, as well as throughput, the processing flowsheet is also created in *Limn* and integrated with the output from *JKSimMet*.

Limn is an add-on for Microsoft's Excel software, allowing the user to draw the process flowsheet and specify size fractions and mineral components. Models for each process (e.g. gravity, magnetic, flotation) are developed based on recovery-by-size data obtained during plant surveys. When a comminution stage is integrated into the recovery circuit, comminution models are developed with component specific breakage rates. *Limn* then calculates stream size distributions of each component, head assays, total solids and water flow rates, as well as the flow rate of each component in each size fraction.

This paper describes the application of integrated *JKSimMet* and *Limn* simulation to Mine to Mill optimization of two operations: one treating iron ore by magnetic separation and flotation, and the other treating gold ore by gravity concentration and flotation. Four components were tracked in the iron ore case (Fe, FeO, Si and gangue) and two in the gold case (gold and gangue). Integrated simulation allows, for example, evaluation of the impact of different potential locations of flash flotation on gold circulating load on a size-by-size basis.