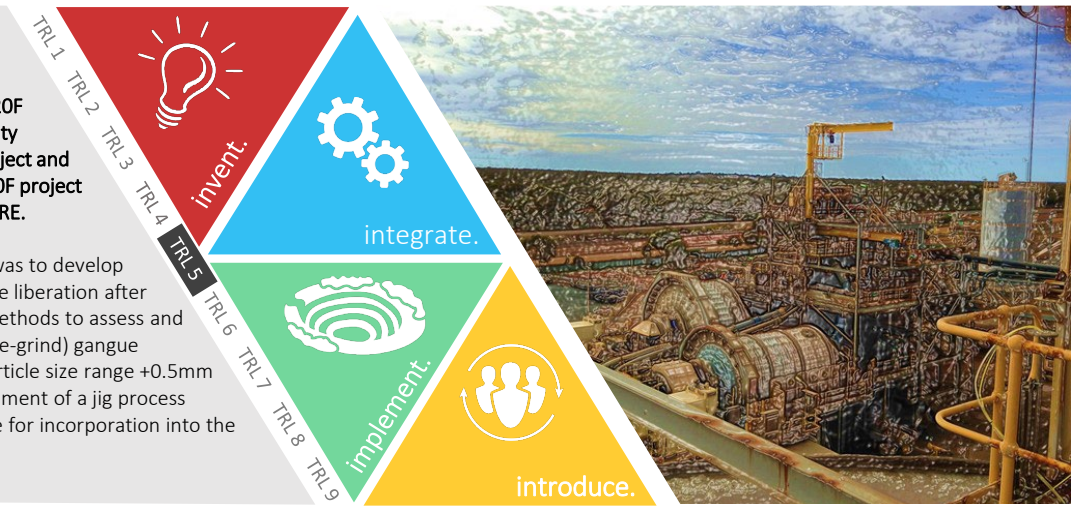
PROGRAM 3:
EXTRACT

Optimising post-crush liberation for preconcentration and mineral exposure for heap leaching

PROJECT P3-005

This project related to the Gangue Rejection activities of the Amira P420F Project. Preconcentration amenability was first examined in the P420E project and this work continued during the P420F project with significant support from CRC ORE.

The main objective of this project was to develop methodologies for assessing gangue liberation after tertiary crushing, and to develop methods to assess and rank the potential of post-crush (pre-grind) gangue rejection for specific ores in the particle size range +0.5mm to 5mm. This also enabled development of a jig process model for gangue rejection suitable for incorporation into the Integrated Extraction Simulator.



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Background

The gangue rejection amenability test (GRAT) for ore characterisation has been developed to identify the intrinsic properties of an ore that render it amenable to coarse particle gangue rejection in the size fraction range of ~4.75 to 0.3 mm. The project originally targeted testing of at least three ores however, upon completion of the P420F project, 11 different ore types had been tested. Given multiple tests have been conducted on three of the 11 ores, this yields a total of 20 unique data sets for interrogation in the database.

Results highlighted differences in responses based on the influence of ore type, crushing mode, liberation and separation device. Results also demonstrated that different liberation patterns will result from changes in ore type and crushing mode. These results can be used to optimise a gangue rejection flowsheet for a given ore.

Method

The standard method developed and applied, Gangue Rejection Amenability Test (GRAT), is a sequential sink-float procedure using heavy media separations as a proxy for liberation of gold from the gangue. This ideal separation describes an intrinsic characteristic of the ore and not the ability of a separation device to recover that material. The GRAT methodology which was initially developed with the Ballarat ore data set, has had progressive improvements during the processing of subsequent ores. This method uses a propriety blend of lithium tungstate salts (known as LST) to separate from 2.95 to 2.55 in increments of 1.0 units of specific gravity (SG). Testing was performed at Curtin University and Gekko Systems in Ballarat. It was intended that further improvements to the method may be identified by externals laboratories to decrease the cost and time for the GRAT procedure.

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Project Leader:	Dr Teresa McGrath, Curtin University
Timing:	June 2016 – June 2019
Participants:	Amira Global, Curtin University

Dashboard

With the support of CRC ORE, a "Dashboard" was created for interpretation of each of the GRAT results for all of the ores (and crushing modes) in the project database. This provides a visual interpretation of the separation results as a function of particle size and separation specific gravity..

The Curtin University's Gold Technology Group holds a master version of the Dashboard containing the results for all ores tested while each company has been issued a version containing their results only. It is anticipated that the addition of data sets and improvements to the Dashboard will be ongoing into the Amira P420G project and beyond.

Results in the GRAT database have demonstrated a varying relationship between the grade of each product size fraction and density mass as a function of the fine crushing mode (SelFrag®, high-pressure grinding roll (HPGR), cone and vertical shaft impactor (VSI) crushing mechanisms) selected for comminution.

Outcomes

Objectives achieved include:

- Development of an ore characterisation test to determine gangue rejection amenability.
- Application of the ore characterisation test to a variety of ore types with results available for benchmarking in a global database.
- Investigation of the influence of ore type, crushing mode and liberation on gangue rejection amenability.
- Evaluation of a variety of density-based separation devices for gangue rejection of gold ores (some aspects are ongoing as student research projects).
- Development of an Excel-based gangue rejection model.

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Optimising Resource Extraction