Opportunities for Pre-Concentration: Development of a Lab-Scale Evaluation Test

Adrian Dance

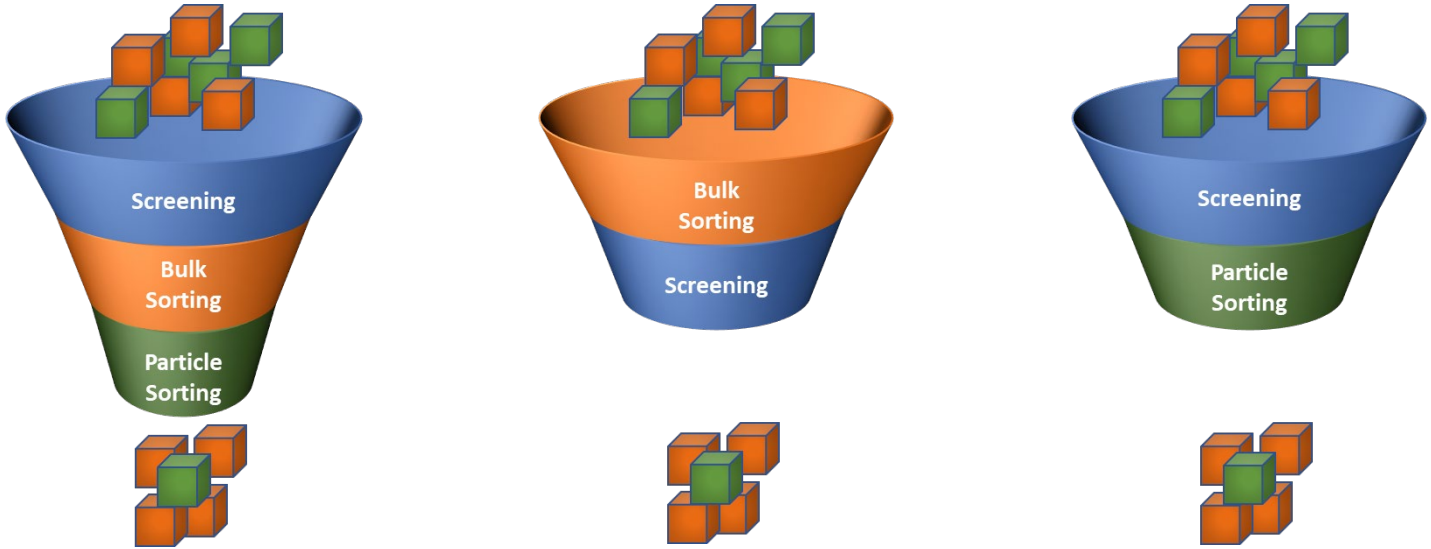
March 1st, 2022

SME MINEXCHANGE 2022 SME Annual Conference & EXPO

srk consulting

What is pre-concentration?

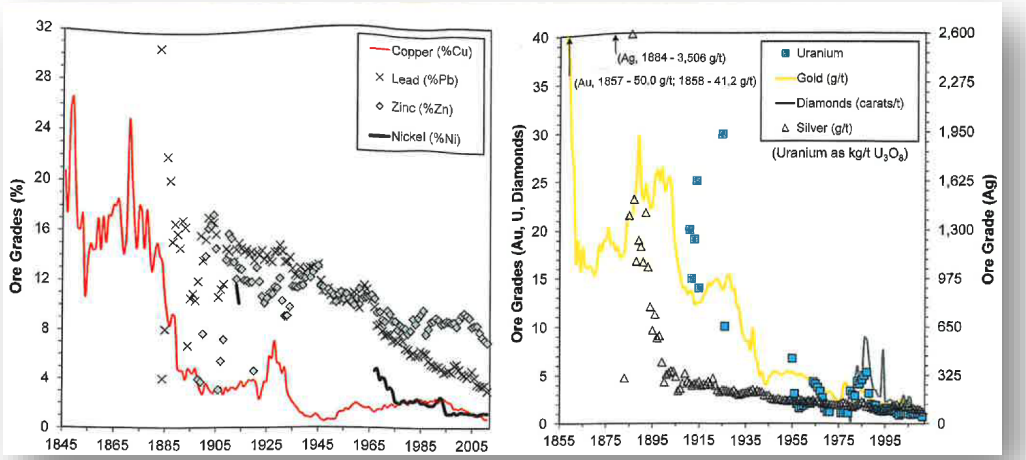
- Focus on methods to upgrade or reject waste when still coarse, dry and transportable (conveyor or truck)
  - any combination of screening + bulk + particle sorting



Rising interest in pre-concentration

- **Bulk vs. particle sorting**
  - development in sensors (XRT, laser, colour, XRF, induction)
  - faster response times = higher capacity
  - lower-grade orebodies
  - need to reject waste material – reduce waste handling/ storage

- **Industry-wide**
  - base metals, precious metals
  - industrial products



Current testing protocol

- **Driven by equipment manufacturers**
  - evaluates machine performance
  - large, composite samples
  - pre-sized to suit machine conditions
    - *scalped fines, 3:1 size range, 10mm up to 70mm*
- **To meet these criteria**
  - half barrels of drillcore
  - limited characterisation of feed and/ or products
- **Testing is NOT independently done**
  - like other metallurgical test procedures

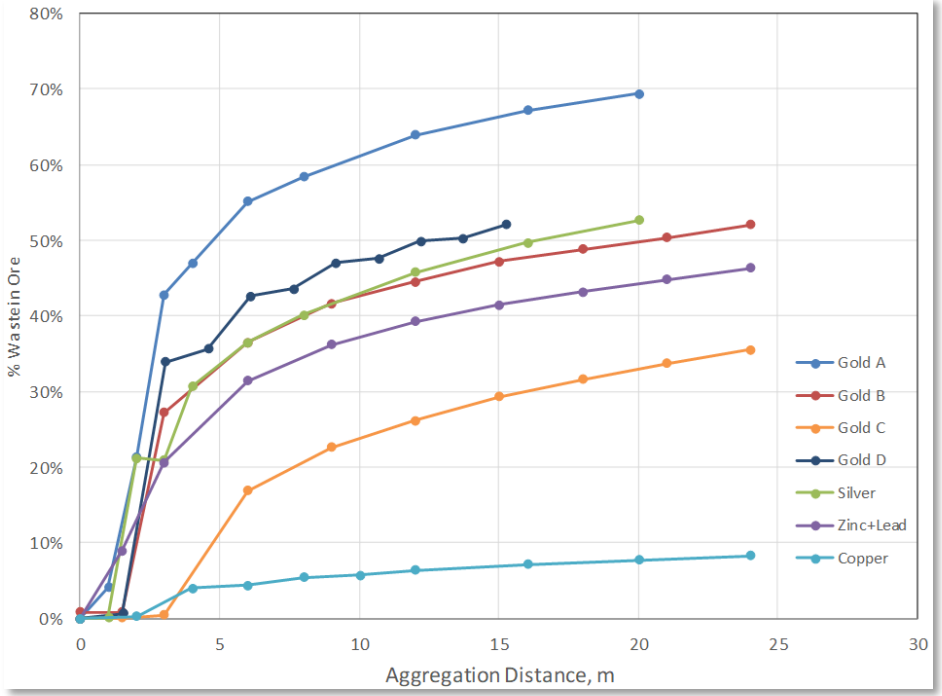
www.steinertglobal.com

Gaps in knowledge

- **Limited information on ore characteristics**
  - % fines bypass & upgrading
  - material balance of metal deportment **by size**
    - *"What is the effect of different size fractions, machine conditions?"*
- **No information on orebody variability**
  - cannot afford collecting large samples for testing
- **How evaluate at study stage**
  - when only material available is ½ drillcore (HQ or finer)?
- **Difficult to provide QP support**
  - without standardised test on representative samples

Heterogeneity analysis

- **SRK developed method**
  - Bob McCarthy
    - *review vertical drillhole assays*
    - *define "waste in ore" & "ore in waste"*
  - can identify target areas for testing
    - *sample collection follows heterogeneity review*
- **Ore characterisation**
  - collect samples at ore/ waste, waste/ ore boundaries
  - ½ core samples 50kg or less



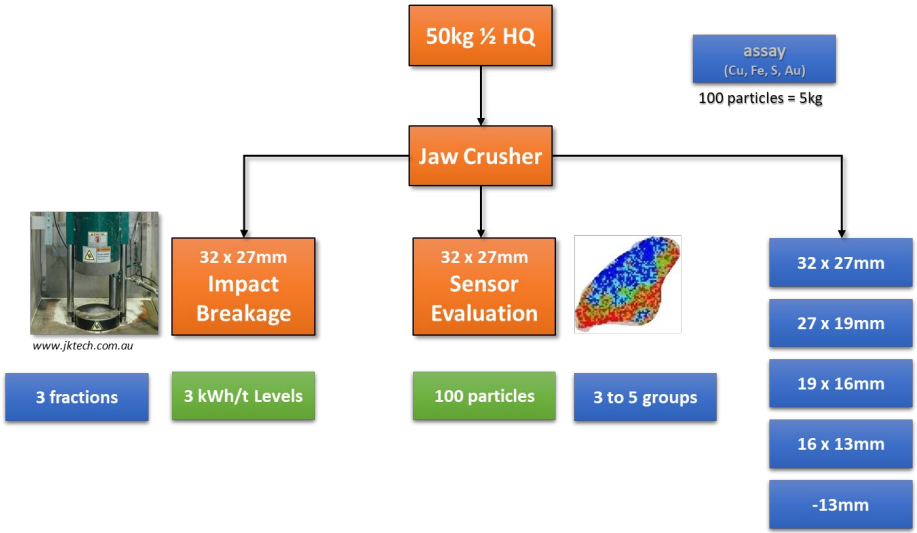
McCarthy, 2020

Test protocol

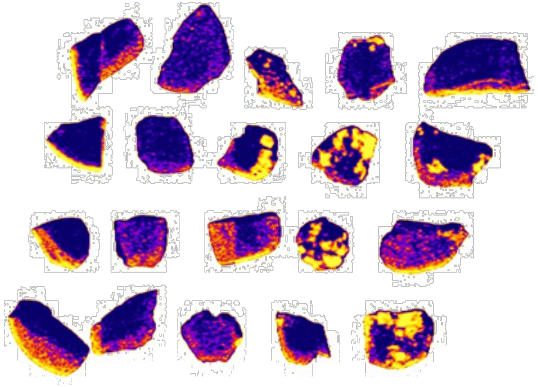
- Use sensor(s) to rank particles
- assays will determine if metal deports preferentially

- **Objectives**
  - done at independent, commercial lab
  - inserted into current met testwork program
    - *½ core samples of 30kg to 50kg each*
- Relative ranking of amenability
- **Follows existing impact breakage testing**
  - low specific energy breakage on narrow size fractions
    - *0.1kWh/t to 2.5kWh/t*
    - *include assay-by-size on broken products*

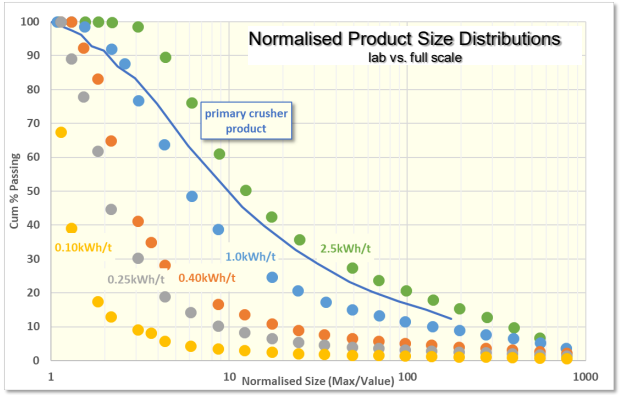
- **Supplement with sensor testing**
  - 27x32mm (1 to 1¼ in)
  - 100 particles grouped in categories
    - *lowers assay costs*

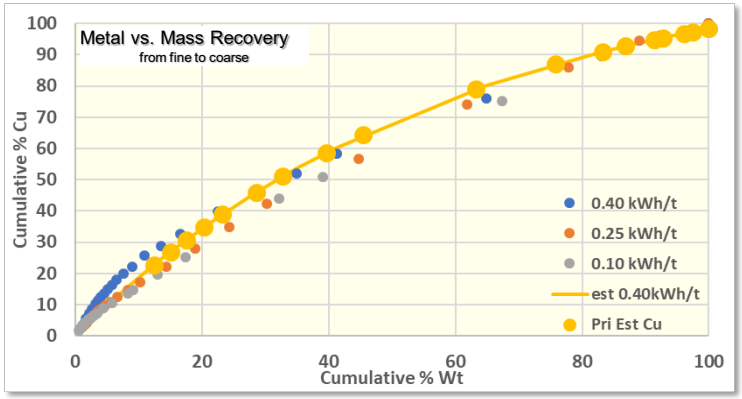


Test outputs



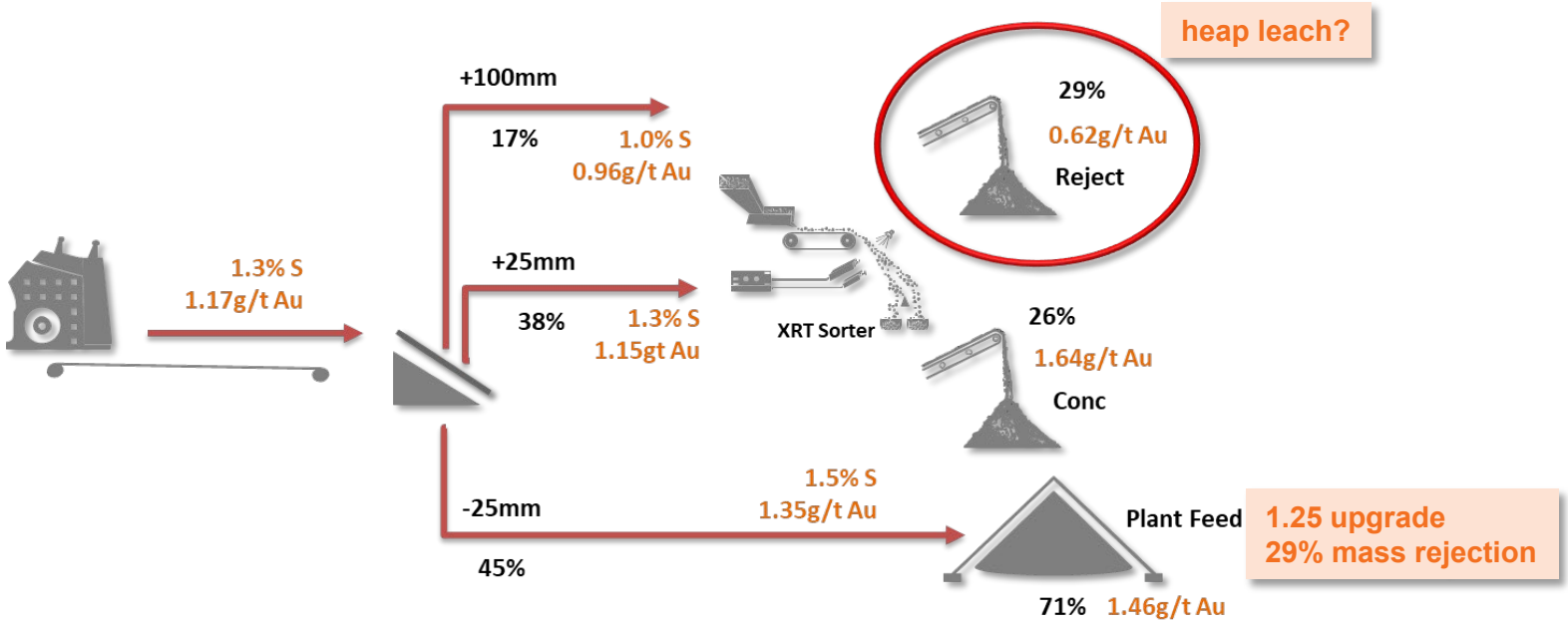
- **Normalised product size**
  - mapped to actual blasting and crusher product distributions
  - can generate metal vs. mass recoveries from screening alone
  - add sensor performance on coarse particle stream after screening





Example:

- **Medium-grade gold project: screening & XRT sorting**
  - all results from 30 to 50kg ½ core sample



Applications/ uses

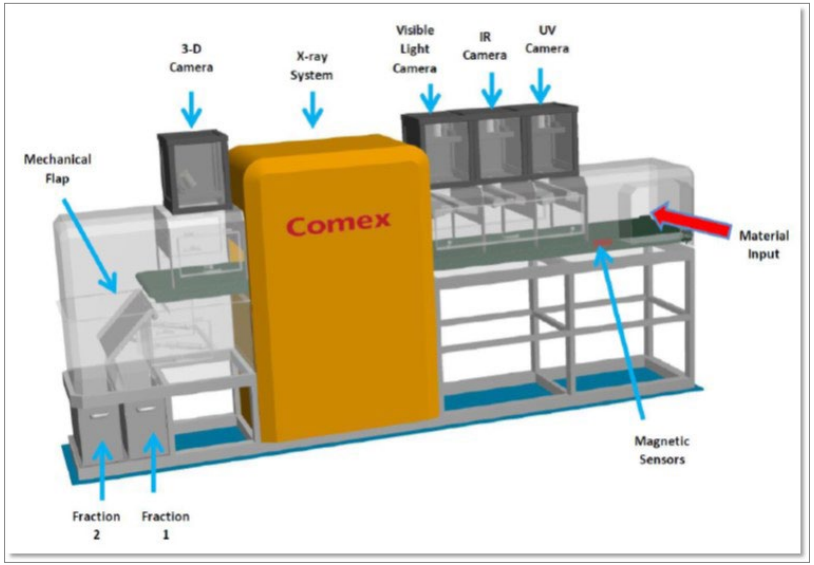
- **Detailed information for economic analysis**
  - no need to assume average response from single test results
  - no unknowns such as fines bypass after 1 or 2 stages of crushing
  - what fractions are best for sorting? fines bypass vs. higher sorter capacity?

- **Quantify variability within orebody**
  - ranking of different ore zones/ areas (adjacent to geological structures)
  - provides method for sample selection ("*How many samples are needed?*")

- **Provides good basis for QP support on studies**
  - standardised test and evaluation method
    - *currently being used by SRK in support of scoping and PEA studies*

Next phase of development

- **Complete independence**
  - commercial lab units for multi-sensor evaluation
  - analysis of scanned images more ‘transparent’
- **Comparison with full-scale**
  - scale-up methods developed
- **Test sample mass reduction**
  - lower cost and faster turnaround time



www.comex-group.com

Summary

- **Metallurgical testing needs to include coarse waste rejection**
  - at PEA/ scoping study stage
- **Plan for ore/ waste segregation**
  - by-product stream of rejected/ diverted material
  - when it's coarse, dry, and conveyable
  - eliminate waste before it incurs power and water costs
  - minimise tailings management facilities
- Standardised **lab test developed**
  - ½ core samples to match current comminution test requirements
  - allows for quick, cost-effective assessment (ranking tool)
  - simulate pre-concentration circuits involving crushing, screening, and particle sorting

Thank You

Adrian Dance PEng, PhD
Principal Metallurgist
SRK Consulting

adance@srk.com
+1 604 235 8506

Opportunities for Pre-Concentration: Development of a Lab-Scale Evaluation Test

SRK Consulting Canada Inc.