

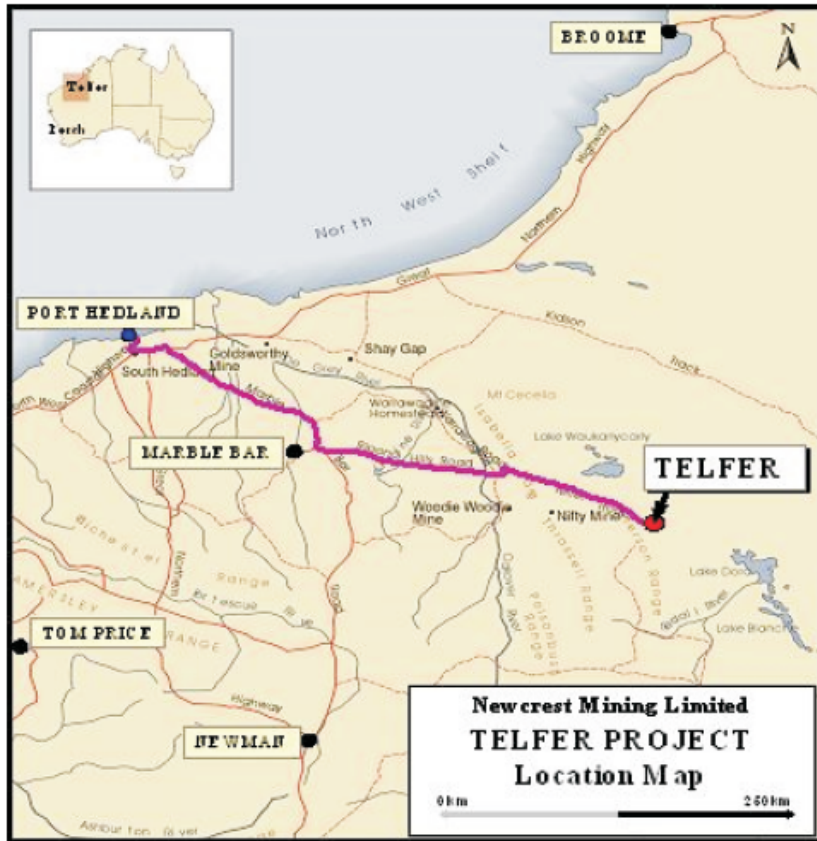
Separation efficiency improvement of a low grade copper-gold flotation circuit

Newcrest Mining Limited

David Seaman, Peter Manton & Paul Griffin

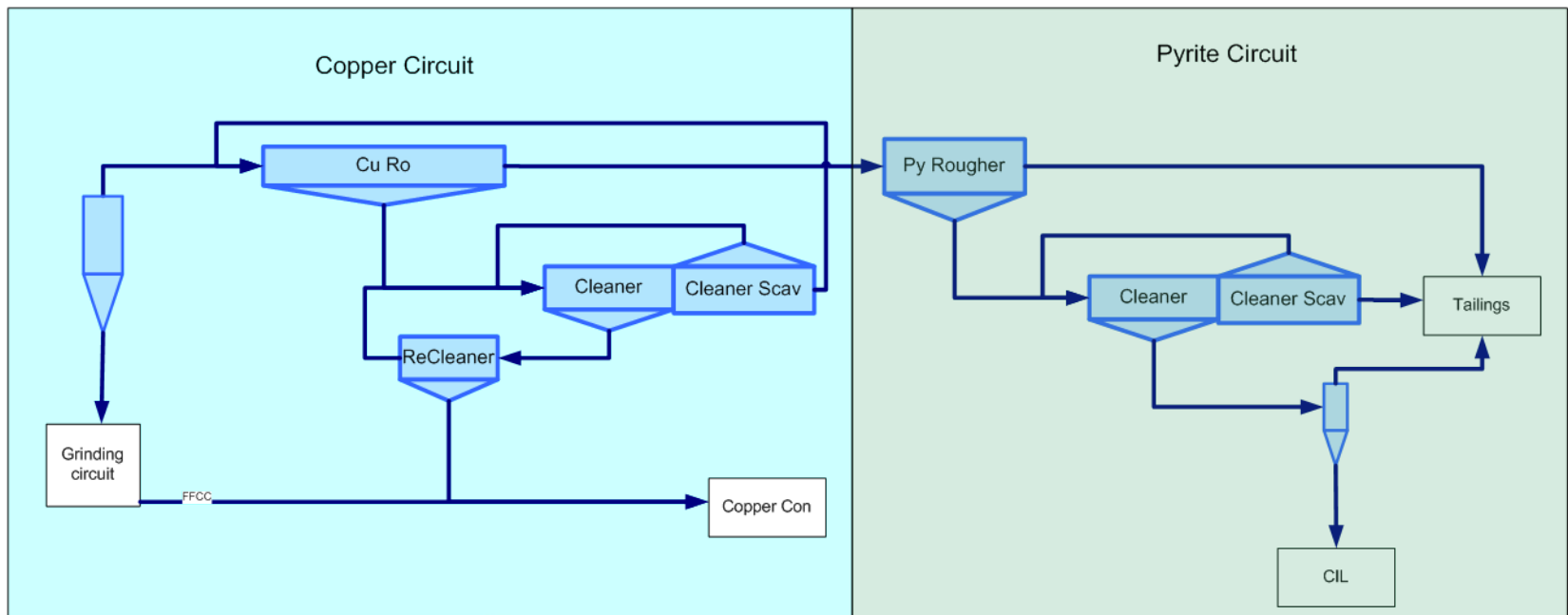
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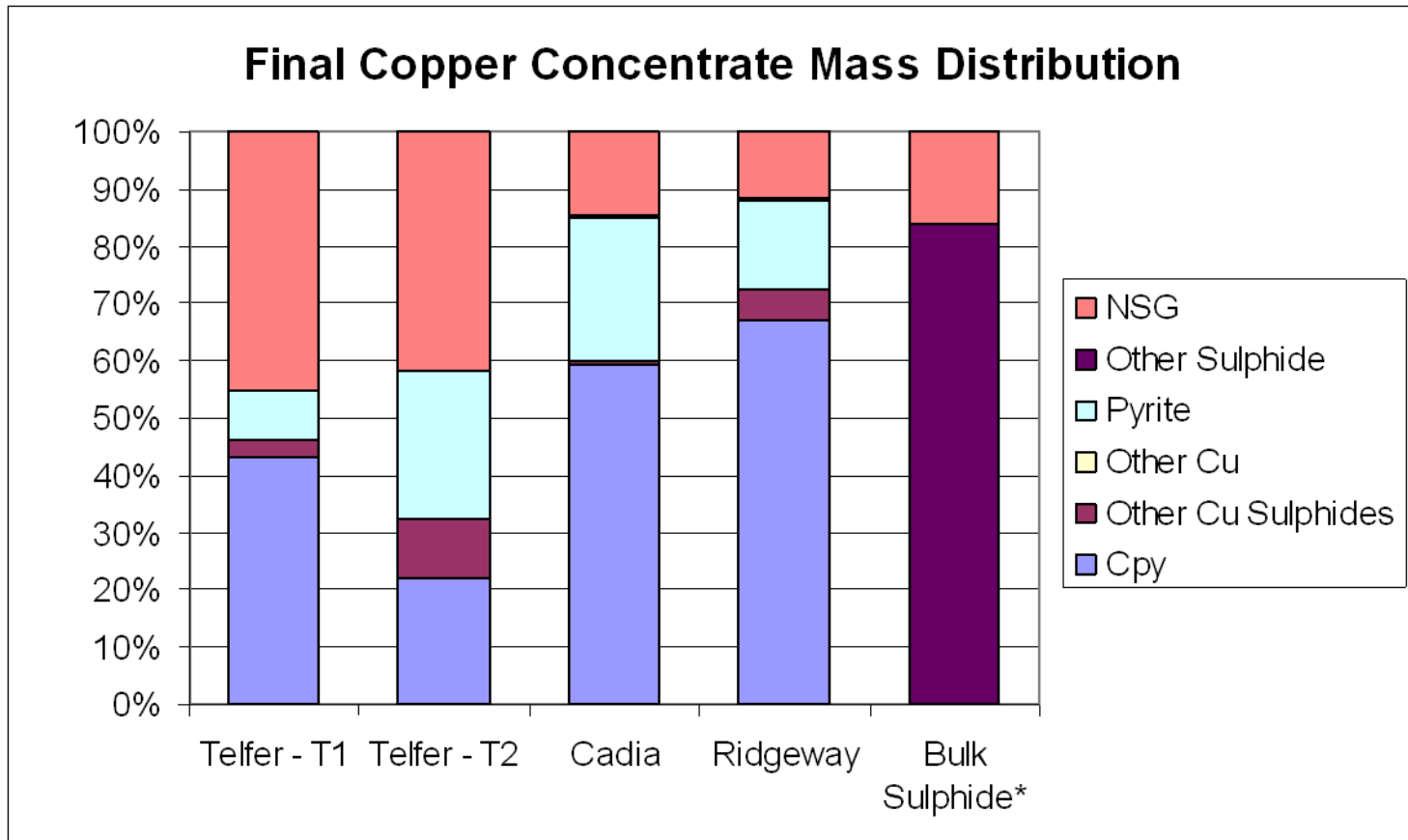


Telfer Flotation Overview

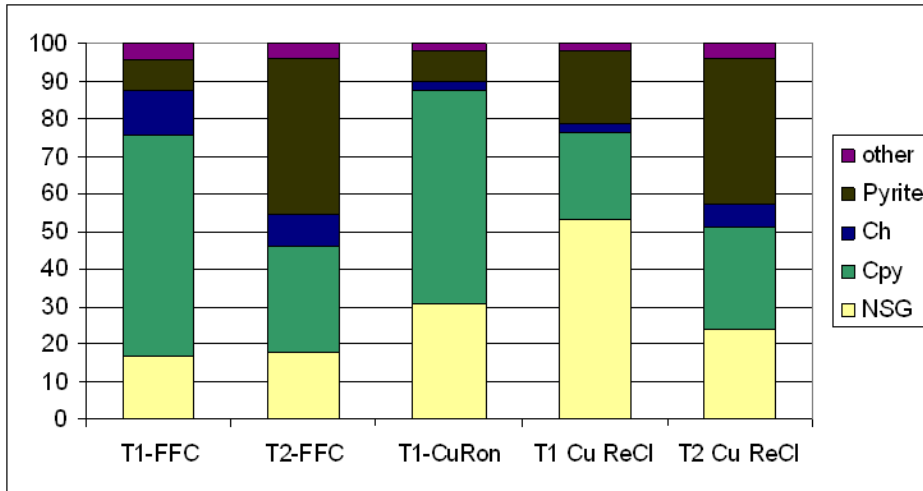
- Dual train (underground and open pit) ~ 23Mtpa
- Typical head grades – 0.1-0.2 % Cu; 1-2g/t Au; 1-5% Sulphur
- Gold distribution – free gold/copper minerals/Pyrite (~5g/t)
- Copper minerals – Predominantly Chalcopyrite and Chalcocite
- Copper concentrate produced - ~16% Copper



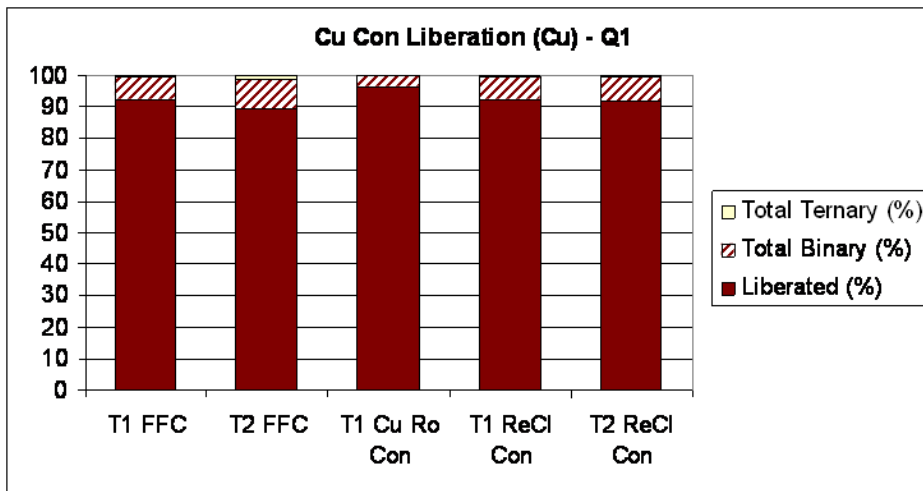
Copper Concentrate Mineralogy



Copper Concentrate Mineralogy

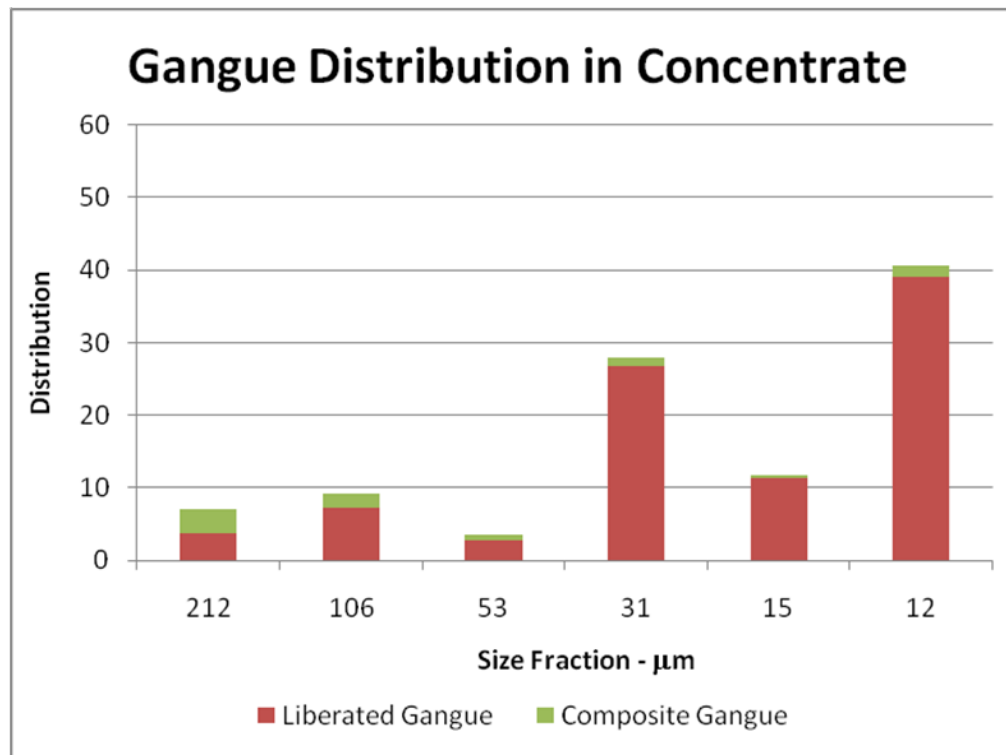


- Significant quantity of liberated NSG diluting copper concentrate
- Copper minerals well liberated
- Opportunity to replace NSG with Pyrite
 - improve gold recovery
 - Increase copper concentrate grade



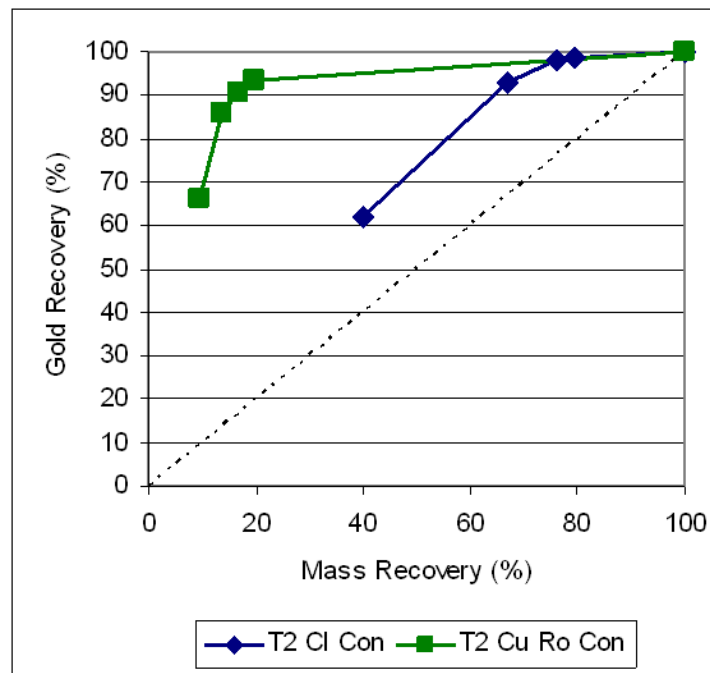
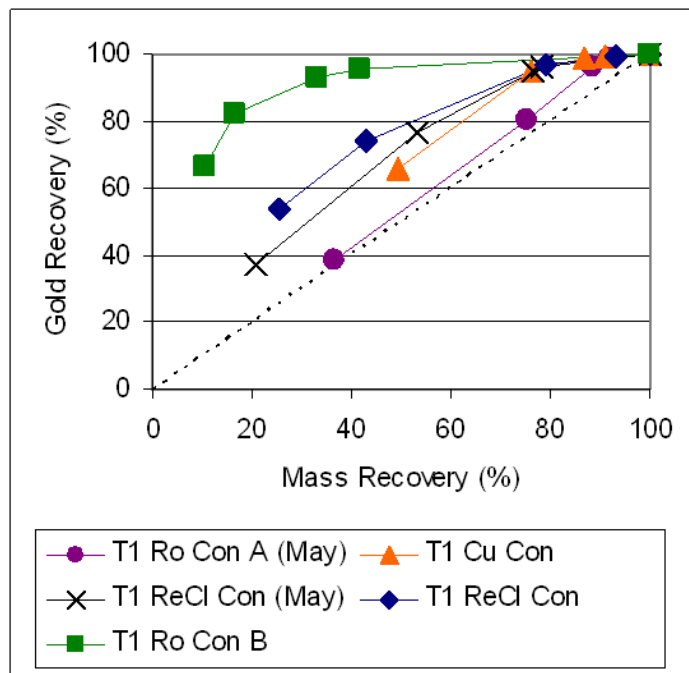
Gangue Characteristics – Size

- Predominantly fine and well liberated
- Mostly Quartz & Feldspars



Mechanism of Gangue Dilution

- Dilute “Hot” Flotation tests - ~5% solids



- 20% of Mass (NSG) can be rejected by further cleaning with negligible change to overall recovery
- NSG is not being recovered by true flotation

Cleaning Circuit limitations

- Cleaner cells heavily loaded
- Cells have insufficient launder capacity
- Residence time constraints do not allow for further dilution in cleaners to reduce entrainment

	%solids	τ (min)
Cu Ro	34.3	15.0
Cu Cl	10.5	13.6
Cu Cl Scav	9.2	14.4
Cu ReCl	10.1	20.7



Cu Recleaner Cells

Reconfiguration of the Cleaning Circuit

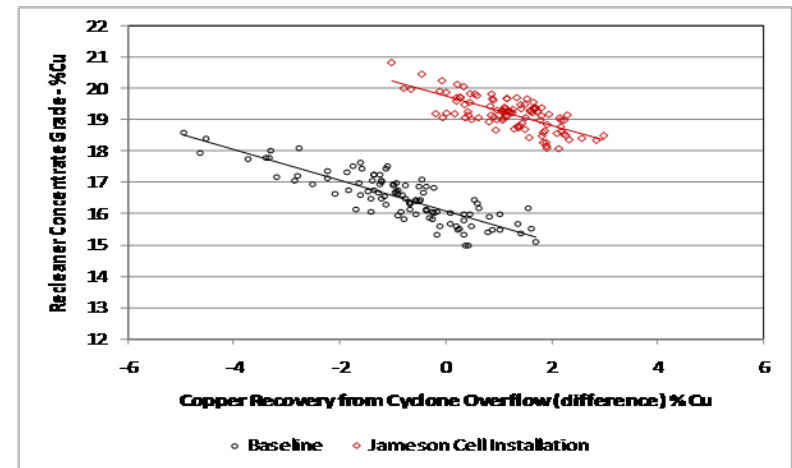
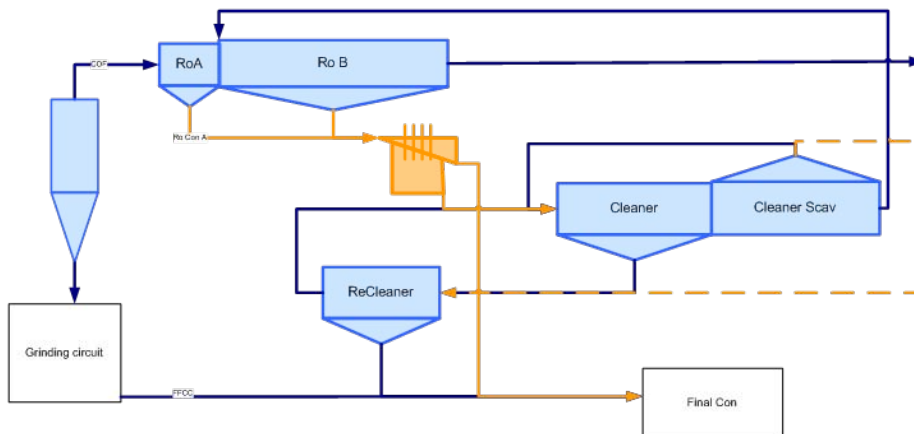
- Simplified AMIRA P9 model:

$$R_{ij} = \frac{k_{ij} \tau (1 - R_w) + ENT R_w}{(1 + k_{ij} \tau)(1 - R_w) + ENT R_w}$$

- Various reconfigurations simulated using Monte-Carlo
- Minor improvements could be made using existing equipment:
 - open-circuiting the Cl Scav Con (to Recleaners)
 - diluting the Cl/Cl Scav bank to reduce R_w
- Additional capacity required to make a significant improvement
- Jameson cell chosen as new capacity
 - published performance data (>50% stage recovery at high grades)
 - ability to reject entrainment by froth washing
 - Incorporated in model using the dilute batch float selectivity

Modified Cleaner Flowsheet

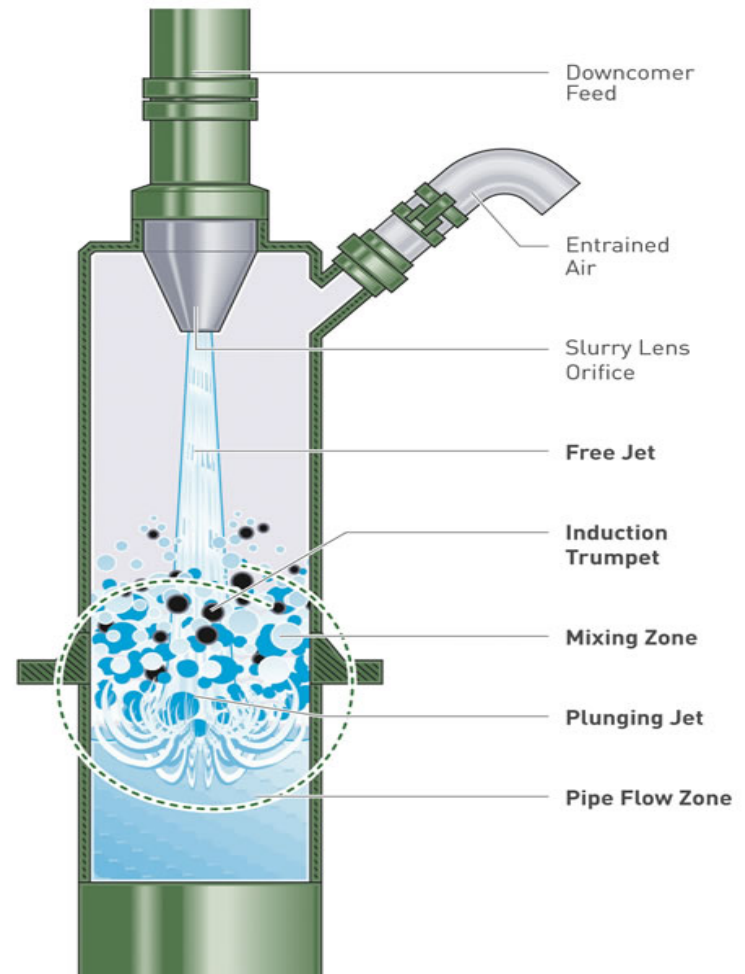
- Installation of one Jameson cell per Train fed by Cu Ro Con
 - Similar approach to recent installations at Phu Kam and Prominent Hill
- Open circuit Cl Scav Con to allow additional dilution of Cleaners
- Modelled improvement consistent with mineralogical characterisation



Jameson Cell Technology

The Downcomer

- Slurry is pumped through a slurry lens orifice at high pressure (150kPa)
- Air is entrained into the downcomer
- Mixing zone is formed in the downcomer where particles and bubbles contact
- Internal recycle of cell content allowing the use of a fixed speed pump, designed for approximately 2:1 (downcomer flowrate: fresh feed)
- Cells are fitted with wash-water trays to allow effective froth washing to reduce entrainment



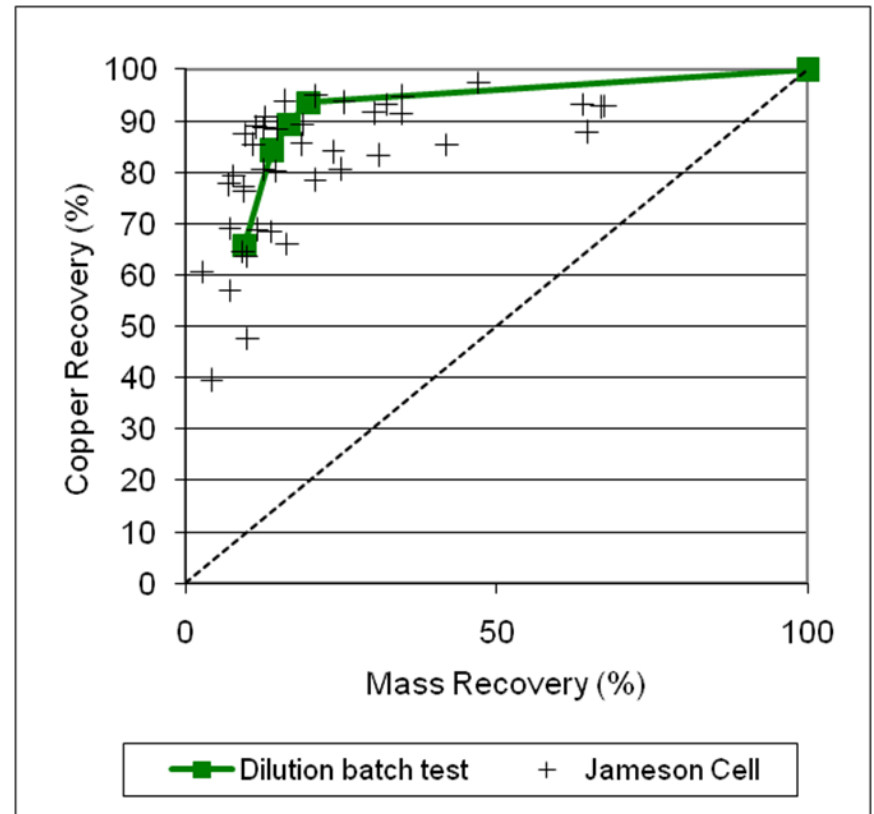
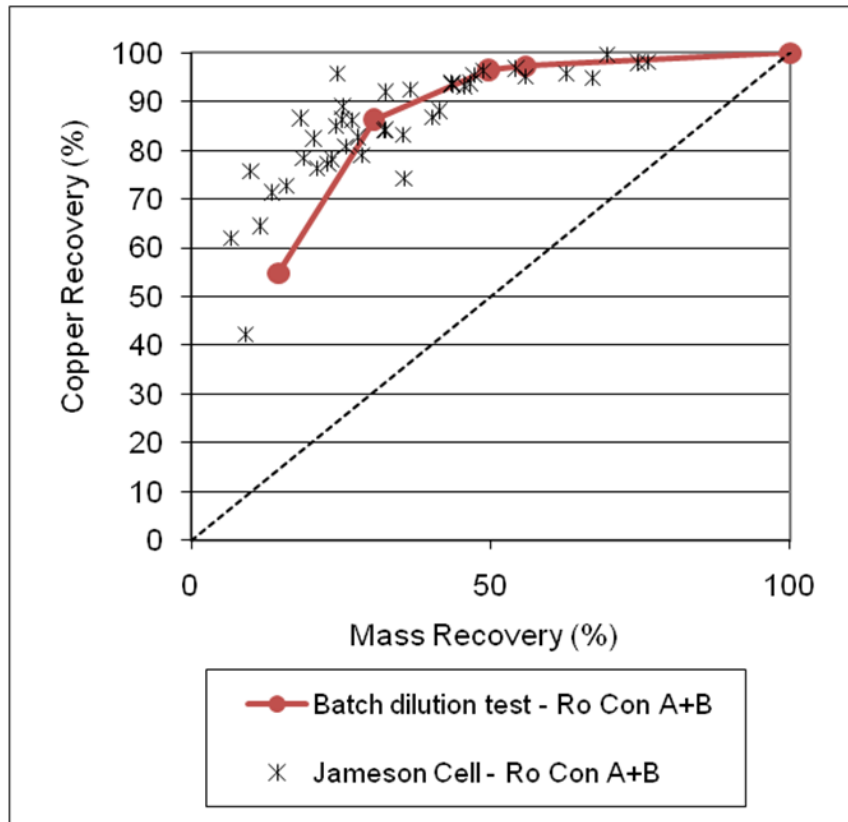
Telfer Jameson Cell Installation



Installation Details

- 2 x E3432/8 Jameson Cells
- Designed to treat up to 60tph fresh feed each (350m³/h slurry)
- Concentrate and tailings flow by gravity
- Each cell driven by a 75kW Warman 10/8 pump (700m³/h)
- Wash water utilisation ~ 30-100m³/h
- Major equipment direct purchased by Newcrest, installation carried out under a lump sum EPC - reduced project delivery time
- Timing
 - Oct 2010 – Project initiated to address NSG in concentrate
 - May 2011 – Order placed for major equipment
 - November 2011 – New cleaning circuit commissioned

Jameson Cell Actual vs Predicted



Similar selectivity observed to date, high stage recoveries achieved (>80%) for Cu and Au

Further Circuit Modifications in 2012

- Copper regrind mill for improved liberation (Cu/Pyrite) of a complex ore body to be processed
 - ISAMill M3000 – 1.2MW
- Pyrite regrind to liberate gold and copper from Pyrite and recover by flotation prior to leaching
 - ISAMill M5000 – 1.5 MW
 - 5xOutotec TC 30s

