



Investigating the Potential of HydroFloat™ Coarse Particle Flotation Techniques on Copper Sulphide Ores

Canadian Mineral Processors Conference 2017
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Presentation Outline



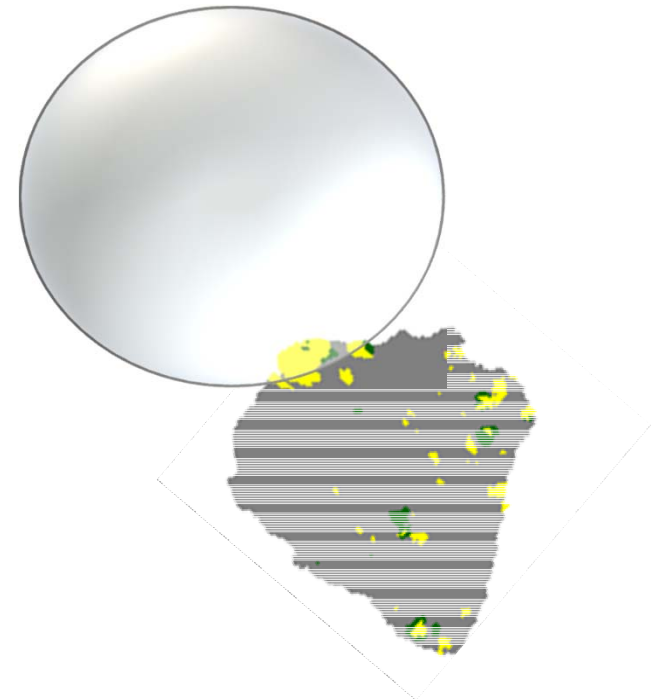
- Coarse particle losses in conventional flotation
- Eriez HydroFloat™ Separator – description
- Comparisons of metallurgical performance - copper ores
 - Denver lab cell Vs. HydroFloat™ – recovery by size
- Mineralogical assessments of coarse fractions
- Potential circuit configuration

Coarse Particle Losses – Conventional Flotation



Recovery typically decreases significantly above 200 μ m

- Poor liberation in coarse fractions, not much sulphide mineral surface for bubble attachment
- Mass of coarse grains requires a larger bubble for buoyancy
- Agitated tank not ideal to maintain attachment of coarse particles to bubbles – high mixing energy required for suspension, fine particle attachment
- Coarse particles can drop out of froth phase easily

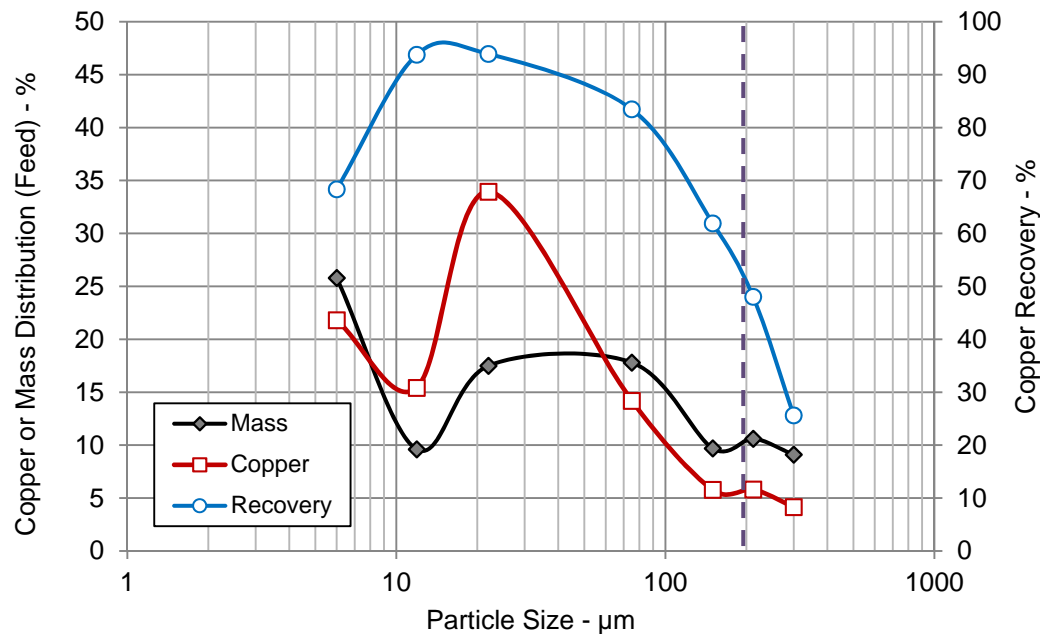


Coarse Particle Losses – Conventional Flotation



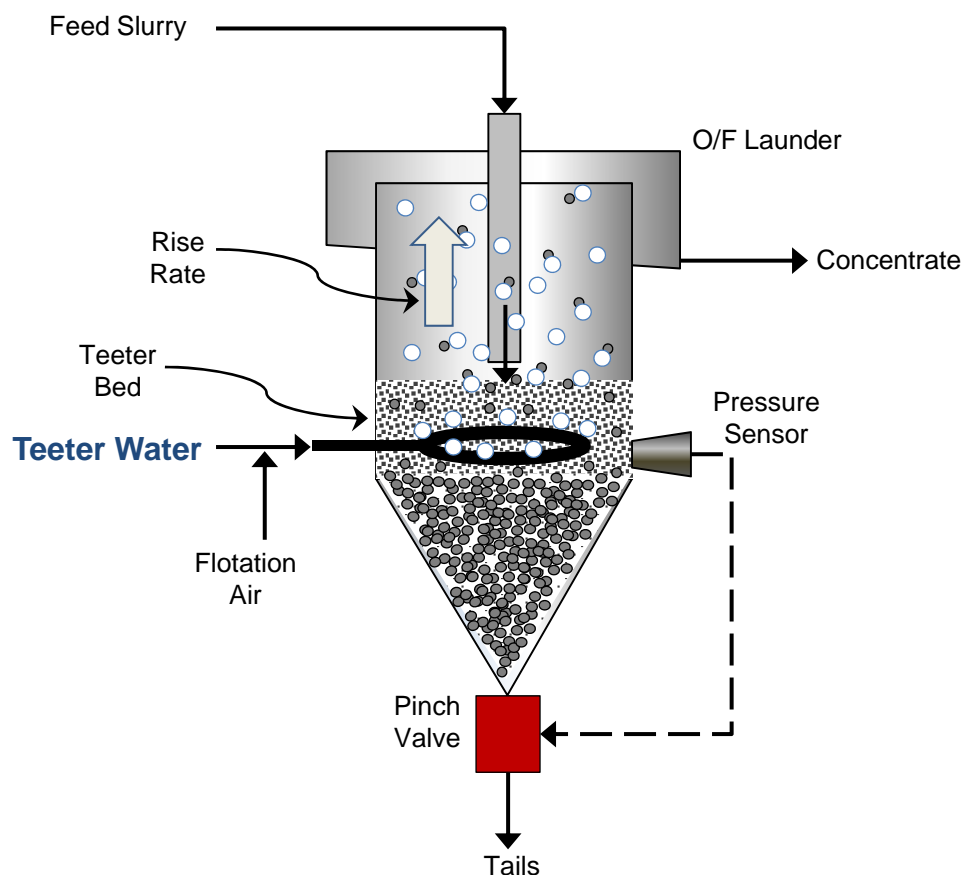
Mill process is designed around these limitations

- Grind to P_{80} values finer than $200\mu\text{m}$



- Long retention times to accommodate low success rate of coarse particle recovery sequence – attach / pulp transport / froth transport

HydroFloat™ Separator - Operation



- Feed slurry is presented to the teeter bed zone.
- Teeter water added to fluidize bed and provide rise rate.
- Air/frother introduced with teeter water.
- Coarse mineralized particles recovered from teeter bed.
- Teeter bed level controlled by a pressure sensor.
- Underflow density approximately 65% solids.
- Concentrate is light density, contains feed grade fines.

HydroFloat™ Separator - Testing



Feed preparation – remove fines (<150µm)

- Rise rate will recover fine feed grade material by hindered settling, dilutes concentrate
- High contents of fine material in the feed will compromise teeter bed control, extend time required to reach steady state
- Condition coarse feed pulp with collector prior to testing

Dynamic test, requires continuous feed

- Feed rate to lab cell 1 – 2 kg/minute, may require 8 minutes to reach steady state, another 5 minutes for sampling ~ approximately 20 kg required to test one condition

Performance Comparisons – Feed Material

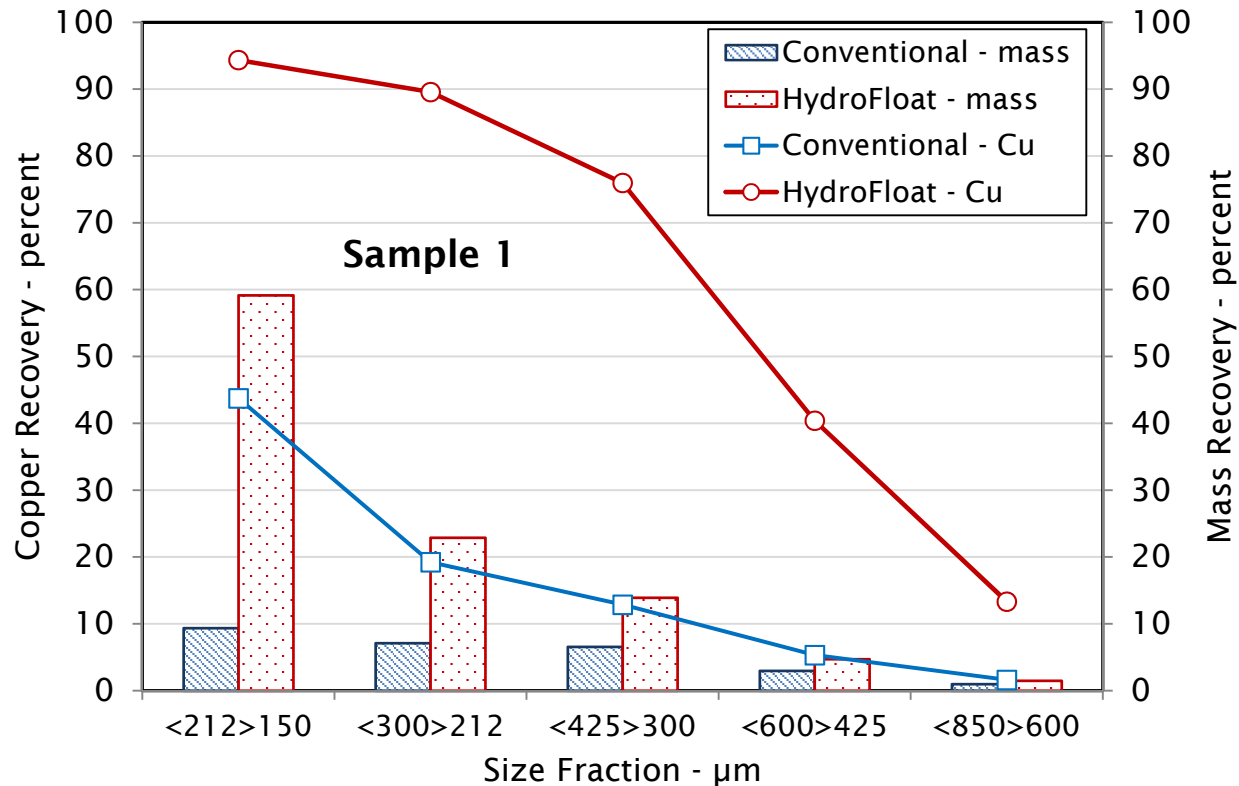


Three different feeds were evaluated:

Sample	Type	Sulphide Minerals	Head Assay	Feed F80 (µm)		HF Teeter Water (m3/hr/m2)
			Cu %	Conventional	HydroFloat	
1	Fresh Feed	Chalcopyrite, Pyrite	0.30	547	675	20
2	Rougher Tails	Chalcopyrite, Bornite, Pyrite	0.04	447	546	20
3	Cyclone U/F	Chalcopyrite, Pyrite	0.23	383	412	16

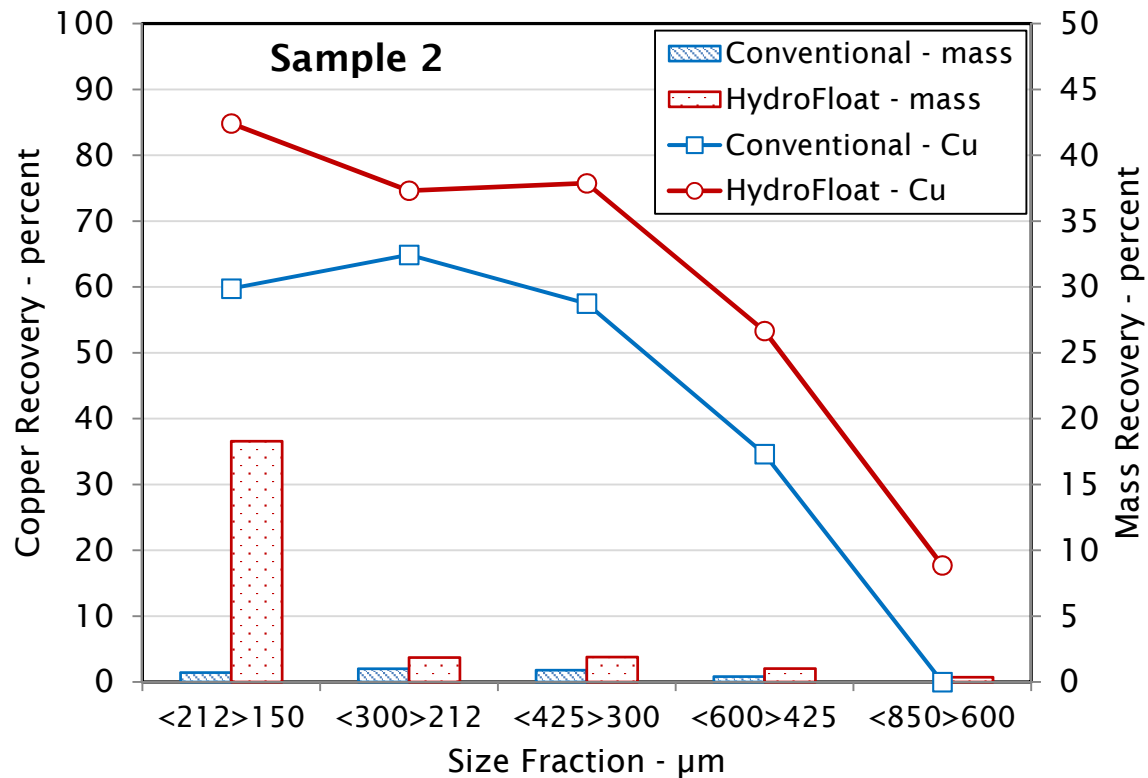
Difference in feed sizing is due to inclusion of <150µm material in Denver test feeds

Performance Comparisons – Sample 1



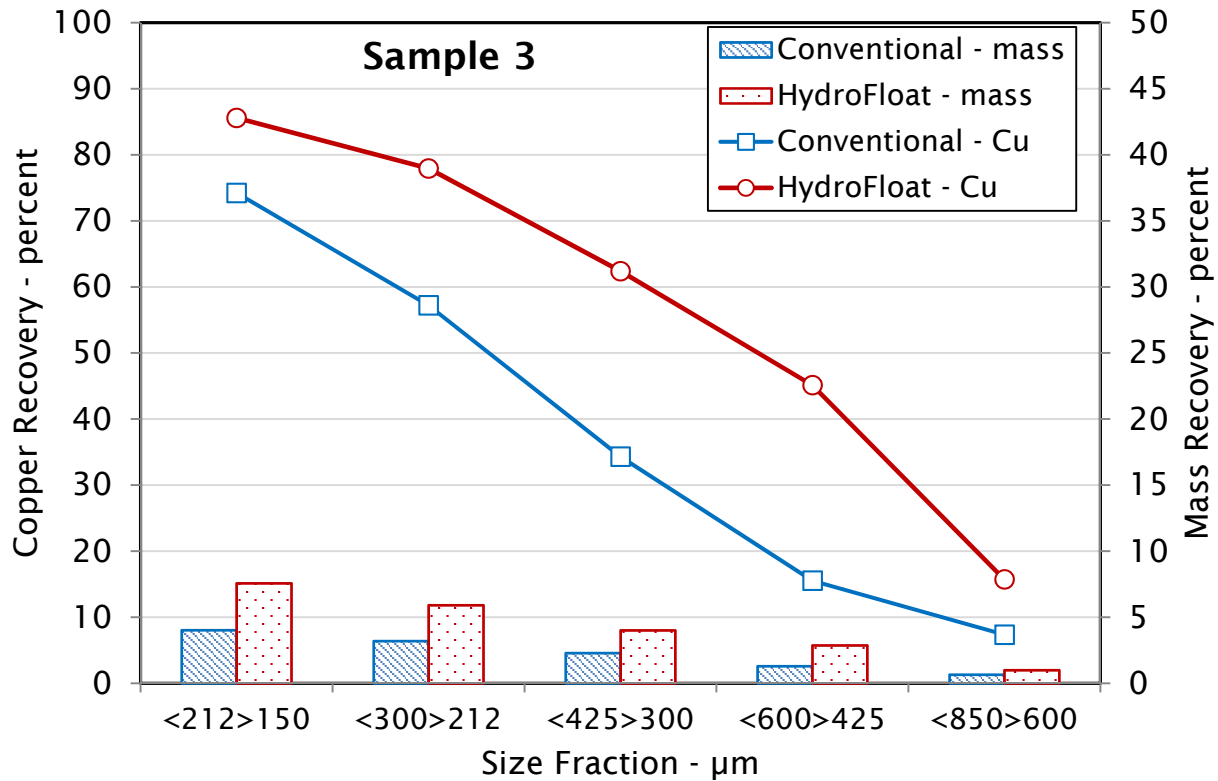
An additional **41** percent of the copper contained in the **>212 μm** fractions was recovered in the HydroFloat™ test compared to the conventional test.

Performance Comparisons – Sample 2



An additional **18** percent of the copper contained in the **>212μm** fractions was recovered in the HydroFloat™ test compared to the conventional test.

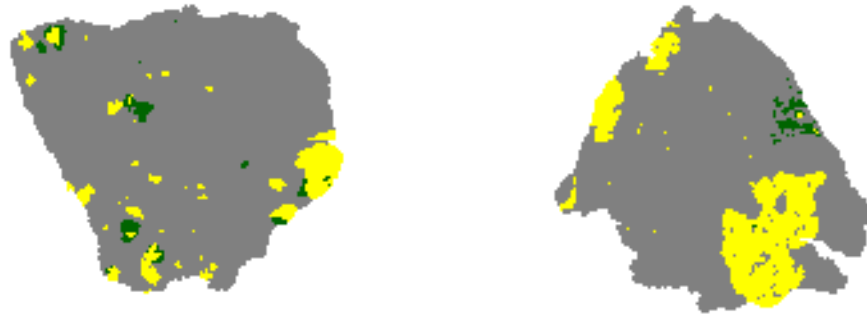
Performance Comparisons – Sample 3



An additional **24** percent of the copper contained in the **>212μm** fractions was recovered in the HydroFloat™ test compared to the conventional test.

Mineralogical assessments using QEMSCAN

- Assessed concentrate and tails from HydroFloat™ tests, coarse fractions
- Exposed copper sulphide mineral as percent of grain perimeter - two dimensional assessment

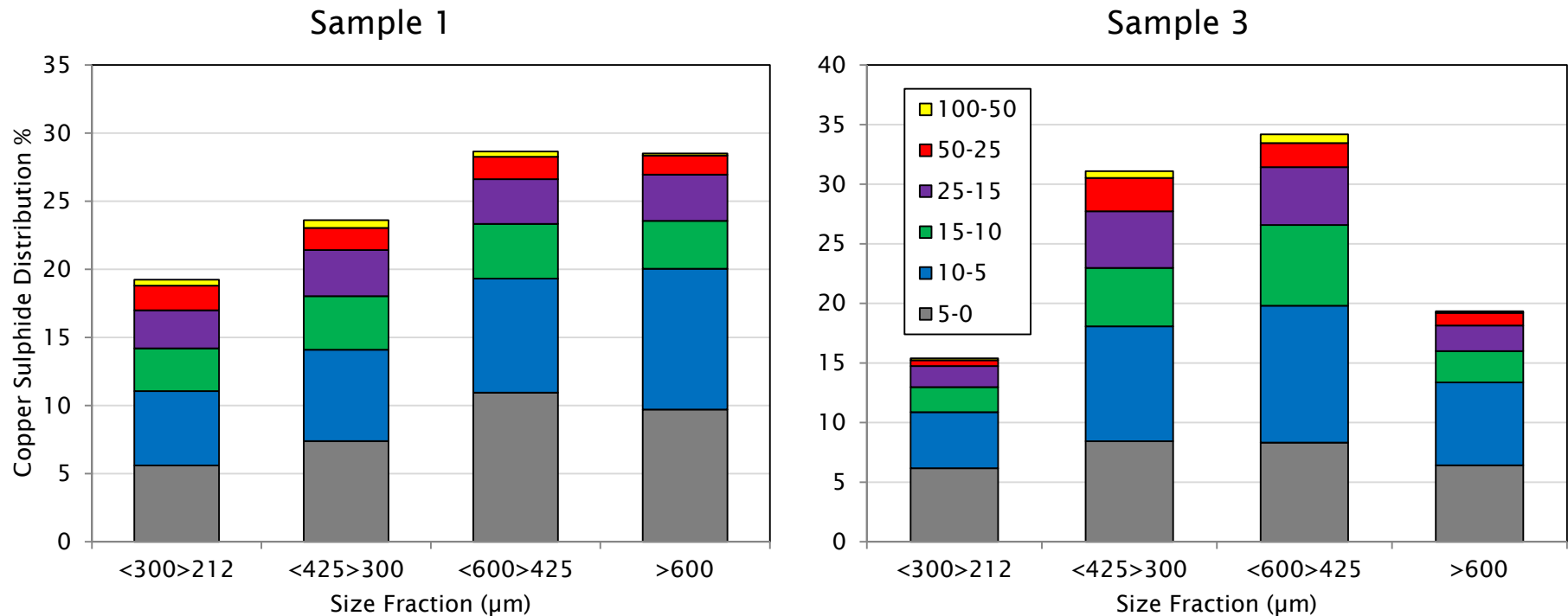


- Grouped copper sulphide observations into exposure categories, more resolution at low exposure levels (100-50, 50-25, 25-15, 15-10, 10-5, 5-0 %)

HydroFloat Test Products – Surface Exposure



Re-calculated feed – Copper sulphide surface exposure

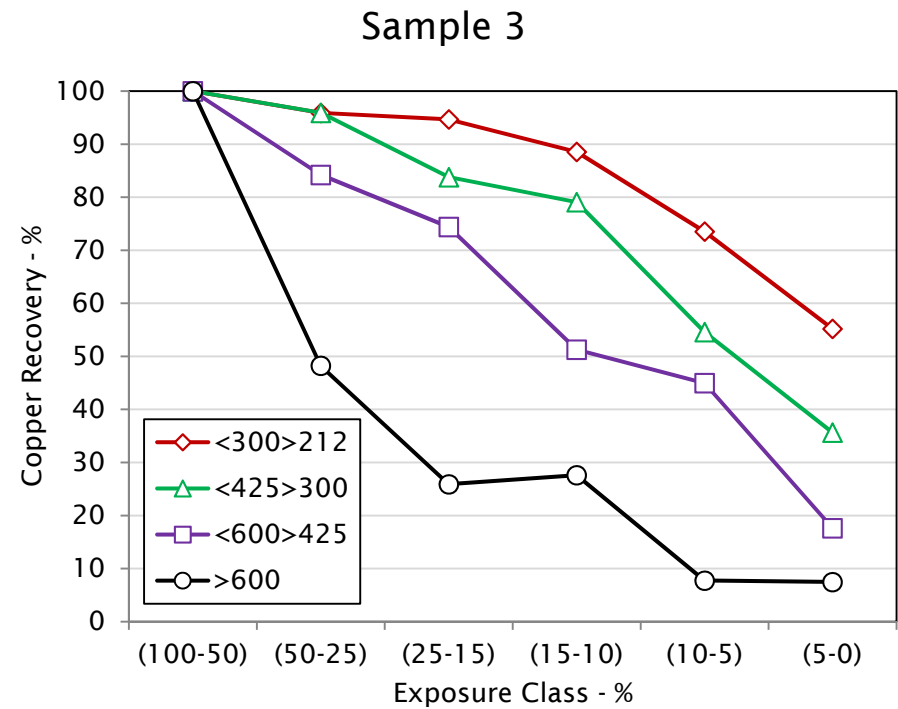
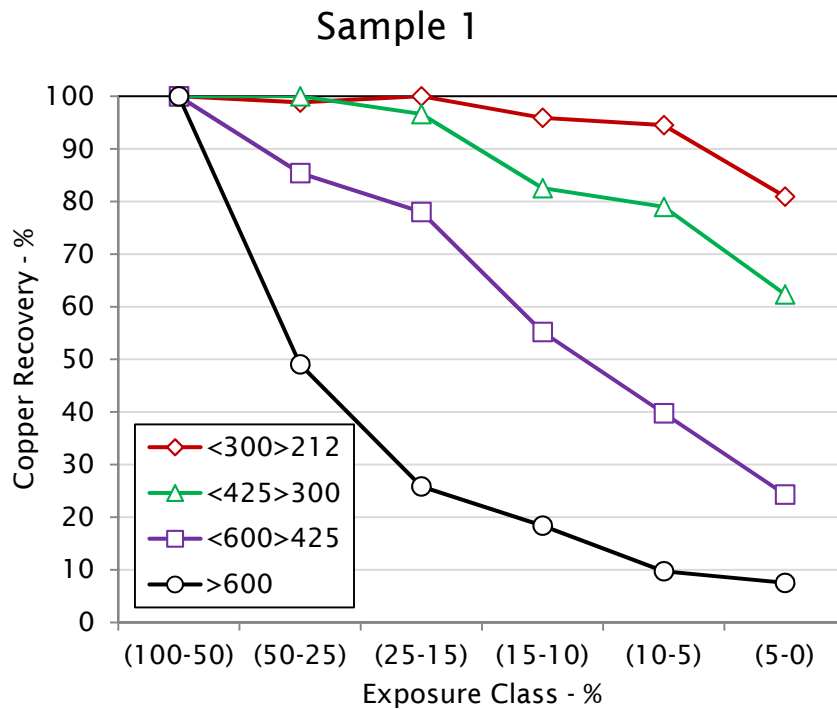


Limited portion of the grains have copper sulphide exposures >15%
~approximately 21% for Sample 1, 24% for Sample 3

Hydrofloat Test Products – Surface Exposure



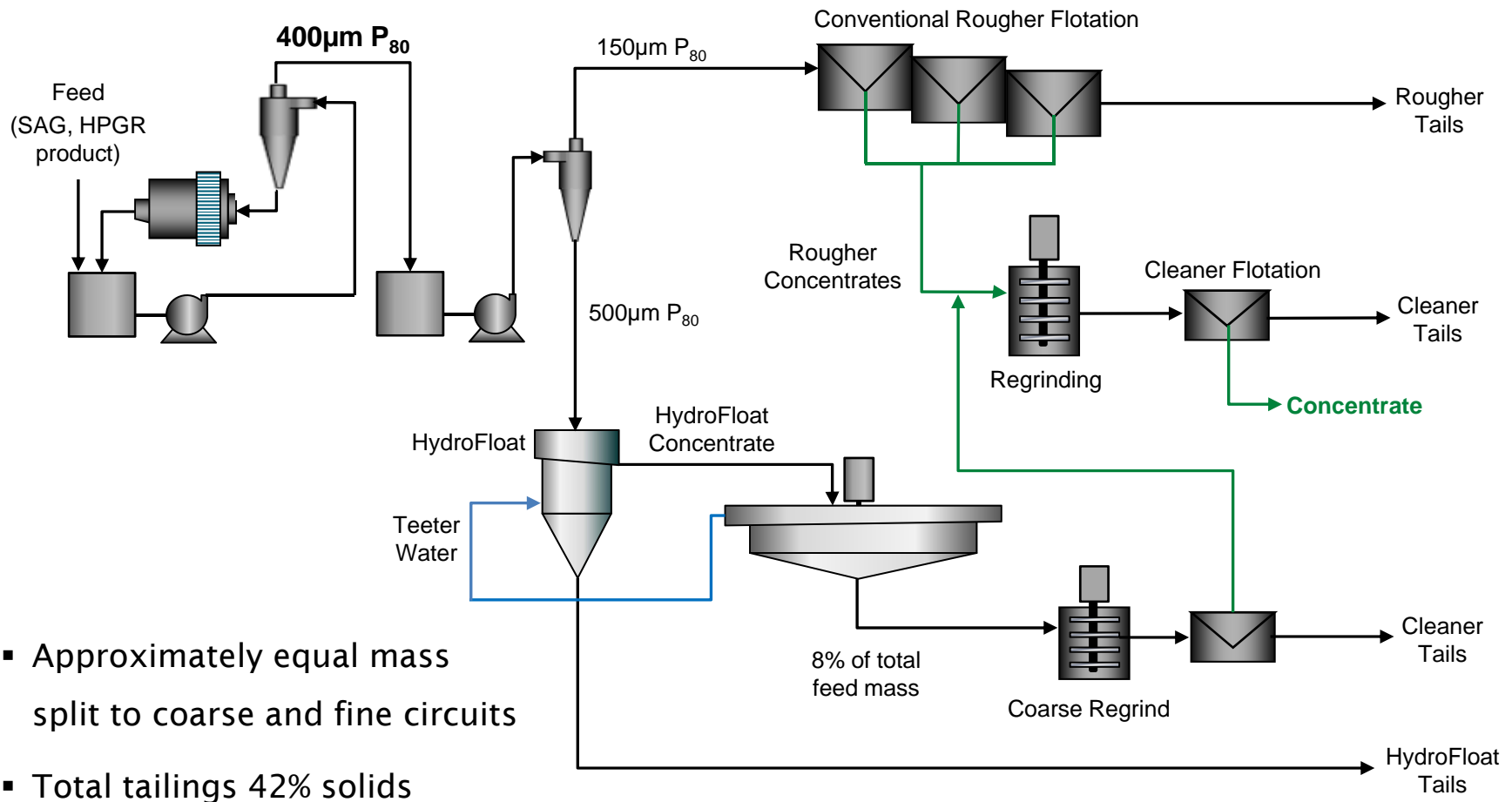
Recovery relative to copper sulphide surface exposure



Consistent trends in recoveries relative to copper sulphide exposure in each size class.

Potential Circuit Arrangement

Split Circuit – coarse primary grind, separate rougher recovery of coarse and fine portions



Conclusions



- Considerable improvements in copper recovery can be achieved in coarse fractions using a HydroFloat™ separator compared to conventional flotation.
- Particles as coarse as 600µm can be well recovered with copper sulphide exposure levels as low as 15%, as measured in two dimensions.
- Recovery relationships to copper sulphide exposure are somewhat consistent in each size class.
- Inclusion of a HydroFloat™ separator in a split circuit flow sheet can offer considerable secondary grinding energy savings.



Acknowledgments

ALS Metallurgy - Kamloops

Eriez Flotation Division





Questions ?