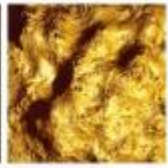


**Gowest**



# **Gowest Gold Ltd. Selective Arsenopyrite-Pyrite Flotation**

**CMP Ottawa  
January 2012**

**G. Wilcox / D. Koningen / R. Jackman (SGS Canada Ltd.)**

**TSX-V:GWA**

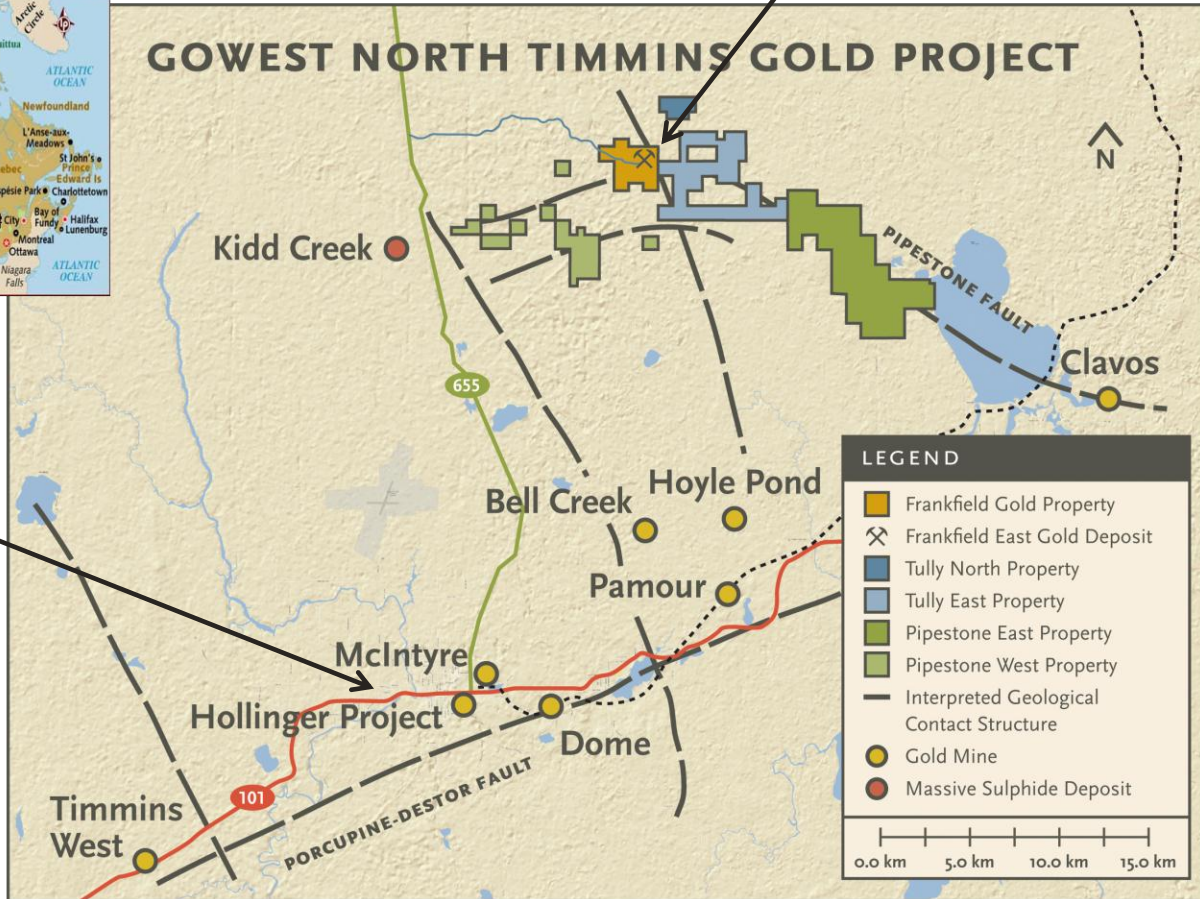
**[www.gowestgold.com](http://www.gowestgold.com)**

**1.877.363.1218**

# Frankfield East Gold Deposit



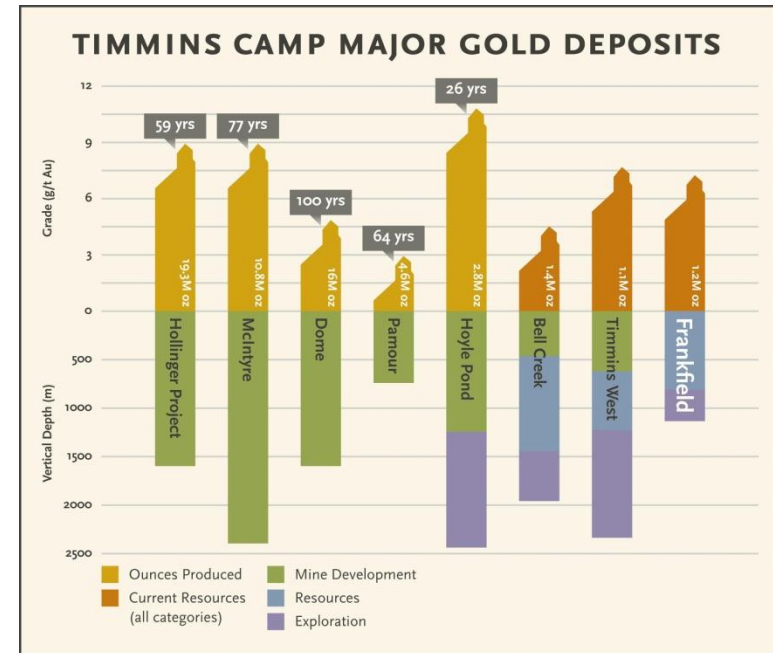
Frankfield East Deposit



Timmins, Ontario

## Highly Prospective Region:

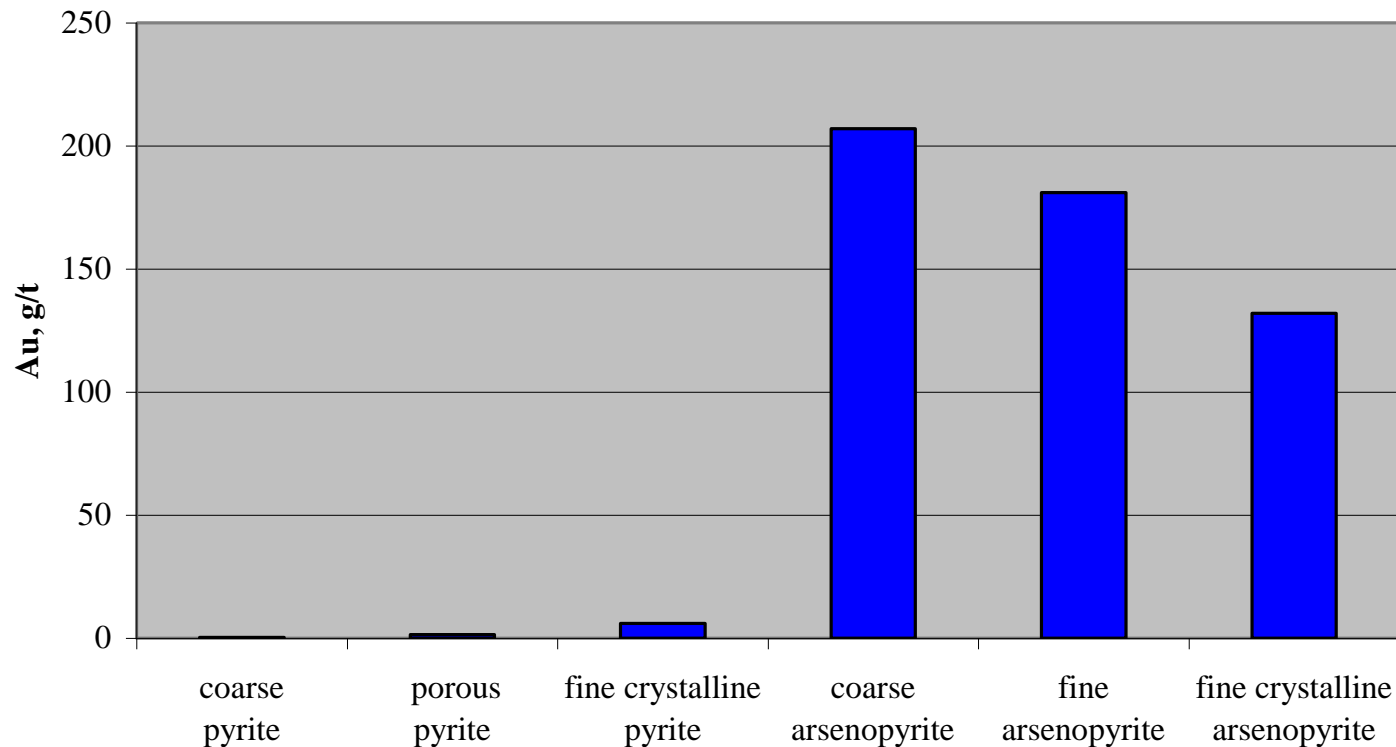
- 60 sq. km land package in Timmins/Abitibi Gold District
- Timmins, Ontario Gold Camp is part of Abitibi Greenstone Belt (est. 48% of all gold in Canada)
- **+70 million ounces historic production**
- **Pipestone Fault** – Relatively unexplored shear structure offset from historic Porcupine – Destor fault system
- Excellent mining infrastructure
- Ready access to equipment, services and mining personnel.

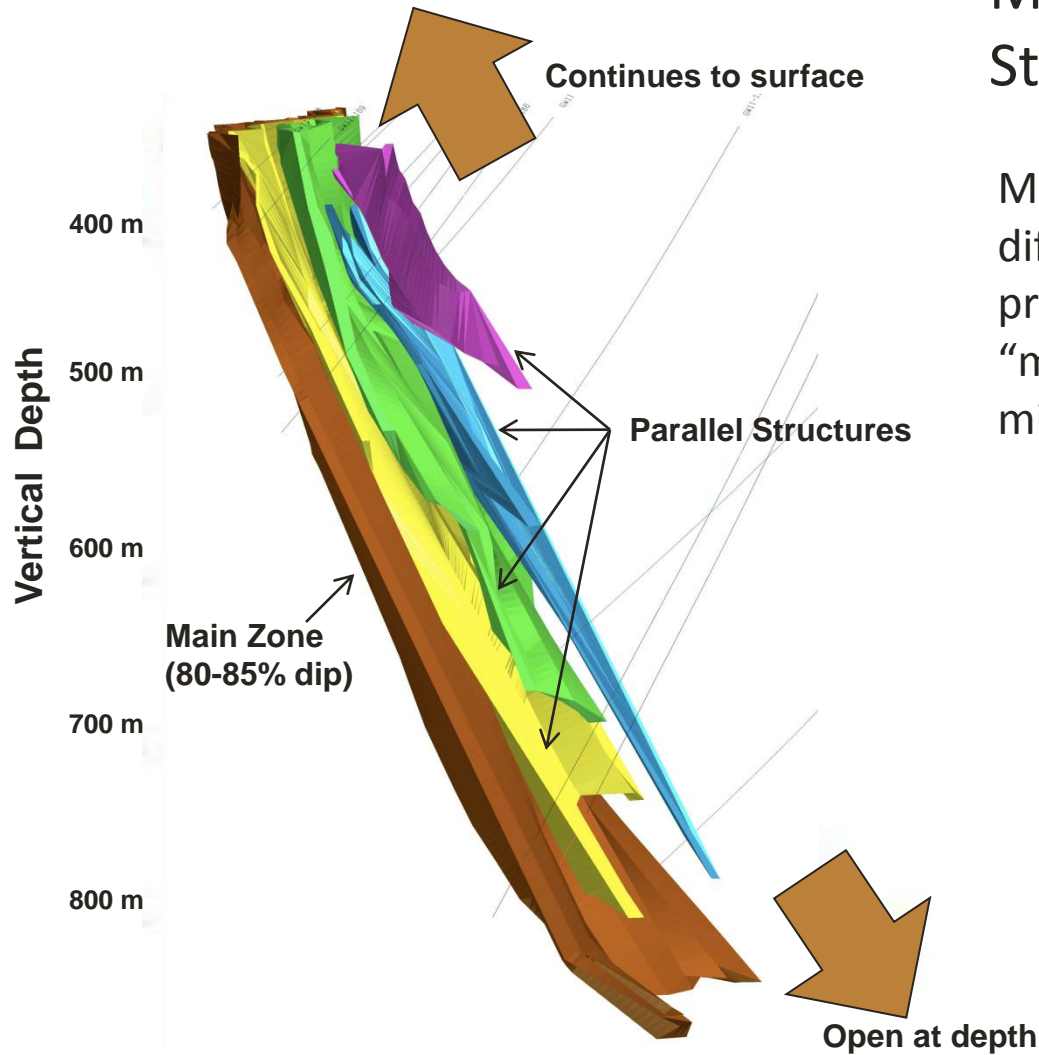


Numerous deposits have been developed or explored in the Timmins/Abitibi Gold District much deeper than the current resource being drilled at Frankfield East. (+800m)

- Drilling program of + 30,000 m in 2010/11 demonstrated the size potential of the Frankfield East deposit
  - Extensions along strike (+800 m) and at depth (+900 m)
  - Updated NI 43-101 compliant resource estimate in June 2011 which outlined 1.2 million ounces of indicated/inferred gold resources (approx. 6 million tonnes @ 6-7 g/t Au at a 3 g/t cut-off grade).
- Detailed mineralogical study on the Frankfield East deposit determined the presence of arsenopyrite and pyrite as the major sulphide minerals with gold associated almost exclusively with arsenopyrite.
- The goal of detailed metallurgical testwork and engineering studies completed to date was to ensure viable project development alternatives would be available.
- Recent preliminary economic assessment (PEA) for the current resource at Frankfield East deposit quantifies the metallurgical work done to date.

- Rock samples from different zones within the deposit were subjected to a program of QEMSCAN™ and XRD analysis to identify the type and nature of the mineral species present. (approaching 90 percent of arsenopyrite grains liberated at less than 40 microns particle size).
- Gold department study quantified sub-microscopic gold content in pyrite and arsenopyrite.





## Multiple Parallel Gold Structures at Depth

Mineralogy data confirmed that the differences between the mineralization present in the previously identified “main” and “hanging wall” zones were minimal.

- Metallurgical work was completed at SGS Canada Inc. in Lakefield from 2009 to 2011, and continues.
- Proposed testwork required 500-600 kg of representative feed material acquired by drilling large core diameter (HQ size ~60mm) metallurgical holes.
- Core section samples assaying greater than 2 g/t Au were then combined to form two master composites (MC1 and MC2 totaled ~600 kg).

## Master Composites

Element		Master Comp #1	Master Comp #2
<b>Gold</b>	<b>g/t Au</b>	<b>5.95</b>	<b>6.75</b>
Sulphur	% S	3.43	2.79
Sulphide Sulphur	% S <sup>=</sup>	3.30	NA
Arsenic	% As	2.19	1.81
Iron	% Fe	9.30	NA

- Whole ore leaching attempts confirmed expected difficulties in extracting the gold from the sulphide minerals (<10% recovery).
- Focused on processing methods which would take advantage of the unique mineralogical properties of the Frankfield East ore.
- Flotation was next logical step to produce high grade/ low volume gold-bearing concentrate.
- Initially examined bulk flotation to maximize gold recovery and reduce the tonnes of material requiring processing (ie. sulphide oxidation).

- Initial tests showed that using sodium hydrosulphide as an activator had a dramatic positive effect on the flotation kinetics and gold recovery.
- Batch tests indicated that the concentrate mass could be reduced to ~16%, while potential gold recovery of ~96% with 2 cleaning stages was achievable, without regrinding.

## Bulk Flotation Batch Test Results

Product	Wt	Assays, g/t, %			% Distribution		
	%	Au	S	As	Au	S	As
2 <sup>nd</sup> Cl Concentrate	<b>15.5</b>	36.1	21.0	12.7	93.2	93.1	92.2
1 <sup>st</sup> Cl + Cl Scav Conc	23.7	24.5	14.3	8.64	96.4	96.6	95.8
Rougher Concentrate	33.7	17.4	10.1	6.15	97.7	97.5	97.2
Rougher Tailing	66.3	0.21	0.13	0.091	2.3	2.5	2.8
Head (calc)	100	6.00	3.49	2.13	100	100	100

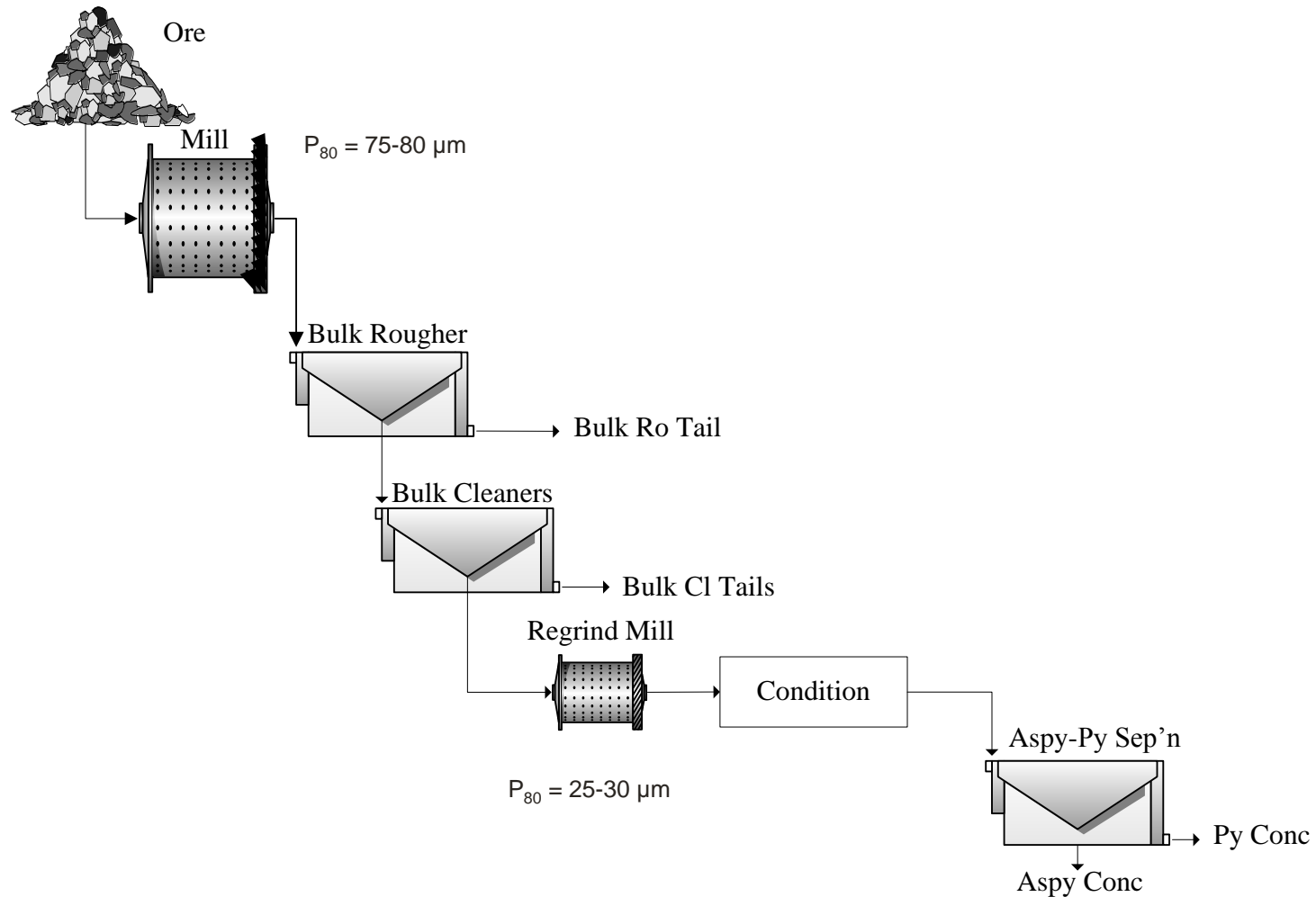
## Objectives:

- Gold is almost entirely associated with the arsenopyrite, therefore wanted to determine if arsenopyrite/pyrite are separable.
- Reduce the tonnes of concentrate material to be processed or shipped.
- Achieve high gold recoveries from the arsenopyrite concentrate.
- Produce a clean pyrite concentrate with minimal gold and arsenic as a potential sale product.

## Flowsheet options were investigated for selective flotation:

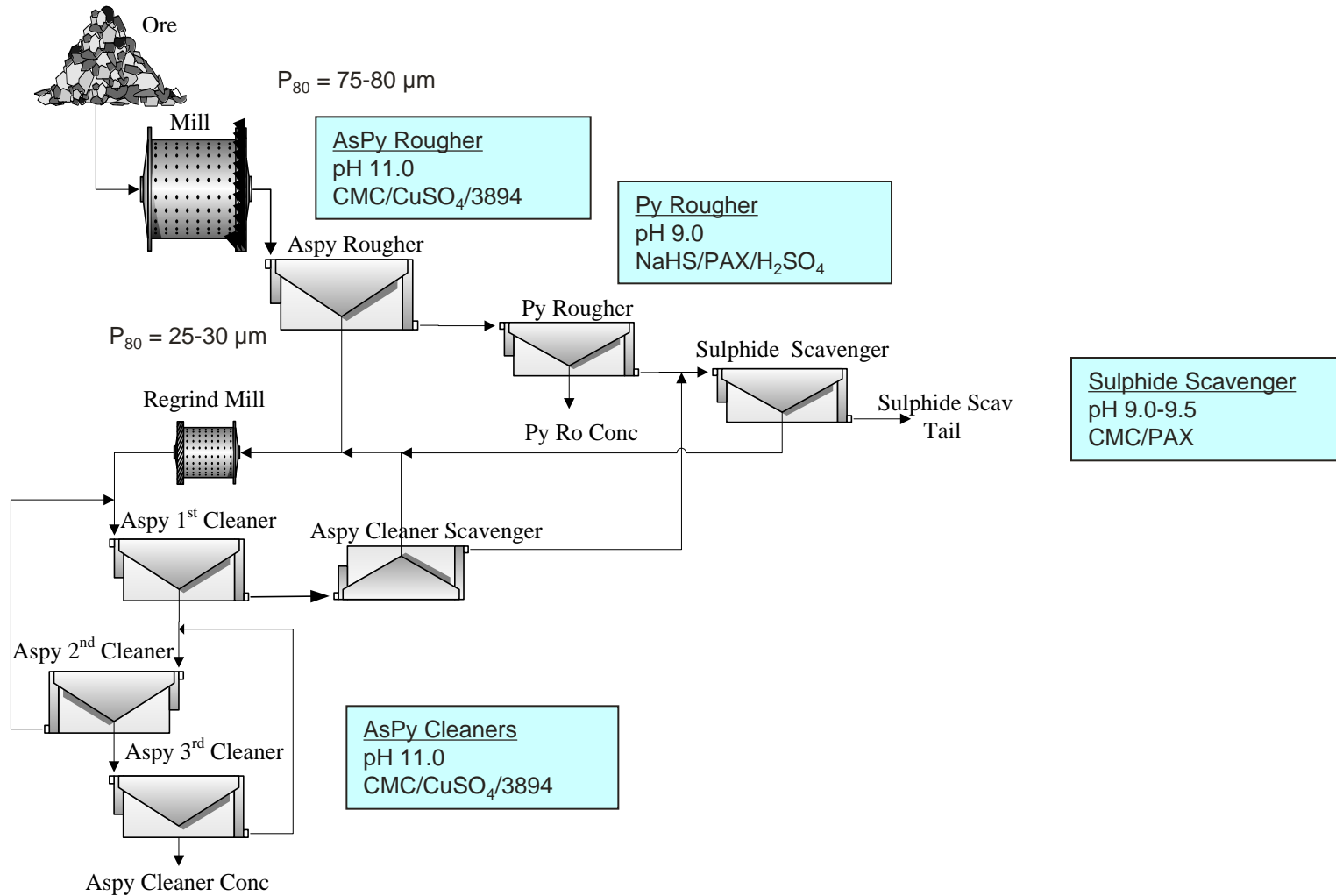
- *Bulk flotation followed by Aspy-Py separation*
- *Sequential Aspy-Py flotation*
- *Sequential Py-Aspy flotation (not successful)*

# Bulk Flotation Followed by Aspy-Py Sep.



This flotation flowsheet resulted in high Arsenic in pyrite (5.5%) and low Au recovery (<60%) in the Arsenopyrite concentrate

# Sequential Aspy-Py Separation



Best overall separation efficiencies were achieved following a sequential arsenopyrite-pyrite flowsheet (Aspy and Py conc. produced)

- High pH more effective with lime added to grinding circuit
- Small additions of CMC for depression of floatable gangue
- Copper sulphate to activate Aspy
- Thionocarbamate (Cytec's 3894) for Aspy flotation (collector)
- Py circuit conditions based on bulk flotation tests.

## **Aspy circuit:**

- pH 11 (lime), CMC
- Copper sulphate
- Thionocarbamate collector (3894)
- MIBC

## **Py circuit:**

- pH 9 (sulphuric acid)
- NaHS
- PAX, MIBC

## **S<sup>=</sup>circuit:**

- pH 9-9.5
- CMC
- PAX

- Necessary to maintain high recovery of Aspy in the Aspy rougher.
- With the addition of NaHS and PAX at pH 9, the pyrite flotation kinetics were very fast (2 minutes in the lab).
- Important to avoid all recycle to the pyrite circuit to maintain low As in the pyrite conc.
- Addition of the sulphide scavenger circuit improves gold recovery in the Aspy concentrate while maintaining the low As content in the Pyrite concentrate.
- The combined arsenopyrite + pyrite concentrate has the same overall gold recovery that was achieved in the prior bulk flotation testwork with only half of the concentrate weight.
- Overall the effectiveness of the selective flotation process at separating and concentrating the sulphide minerals is apparent when examining the final concentrates.

# Sequential Aspy-Py Locked Cycle Tests



Test No.	Product	Wt %	Assays, g/t, %					Distribution, %				
			Au	S	As	Py*	Aspy*	Au	S	As	Py*	Aspy*
LCT2	Aspy 2 <sup>nd</sup> Cl Conc	<b>7.7</b>	<b>77.0</b>	14.1	20.9	9.7	45.4	<b>92.3</b>	40.3	89.2	20.7	89.2
	Py Ro Conc	6.0	5.12	23.9	<b>1.74</b>	43.3	3.8	4.8	53.1	5.8	72.1	5.8
	Rougher Tailing	86.4	0.22	0.20	0.10	0.3	0.2	3.0	6.6	5.0	7.2	5.0
	Head (calc)	100	6.40	2.69	1.80	3.6	3.9	100	100	100	100	100
LCT3	Aspy 3 <sup>rd</sup> Cl Conc	<b>6.4</b>	<b>93.7</b>	16.2	24.3	10.8	52.9	<b>92.7</b>	40.3	90.2	20.2	90.2
	Py Ro Conc	4.8	4.64	28.6	<b>1.54</b>	52.3	3.4	3.5	54.1	4.3	74.3	4.3
	Rougher Tailing	88.8	0.27	0.16	0.11	0.2	0.2	3.8	5.5	5.5	5.5	5.5
	Head (calc)	100	6.44	2.56	1.72	3.4	3.7	100	100	100	100	100

\*calculation based on the assumption that all arsenic was present as arsenopyrite and the remaining sulphur was present as pyrite.

- **LCT results 92-93% high gold recovery in ~7% of the mass.**
- **Pyrite concentrate analysed ~1.5% As.**

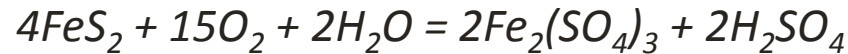
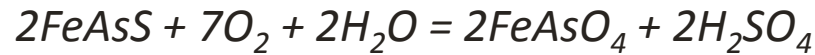
- Recovered majority of the gold contained in the composite material into one gold-bearing sulphide concentrate.
- Reduced the tonnes of Au-containing concentrate for processing/shipping.
- Produced potential pyrite concentrate for sale with high S grade and low As content.
- May lead to environmental benefits should pyrite go to tailings disposal.

## Bulk vs. Selective Flotation ( 1500 tpd Plant)

	Bulk Concentrate*	Selective Aspy Concentrate (LCT3)
Concentrate Feed Rate (tpd)	260	95
Concentrate Assays:		
Gold (g/t)	30	94
Arsenic (%)	10	24
Sulphur (%)	18	16
Gold Recovery to Concentrate (%)	96%	93%

- Flotation work on ore samples provides critical data to assess the trade-offs between the different flotation alternatives.
- Operating cost assumptions demonstrates the value of the selective flotation over bulk methods in terms of reduced reagent consumptions.

*Simplified dissolution reactions for Aspy and Py:*



## Operating Cost Assumptions (Not Affected by Gold Price)

	Bulk Concentrate	Selective Aspy Concentrate	Cost Differential
Oxygen	4.5 t/h	2.5 t/h	-200 \$/h
Limestone	5.7 t/h	3.3 t/h	-72 \$/h
Lime	1.0 t/h	0.6 t/h	-58 \$/h
Total			-330 \$/h

- A detailed mineralogical analysis was critical to evaluating the process alternatives for the Frankfield East deposit
  - Results indicated almost all of the gold was contained in the arsenopyrite.
- Improved understanding of the deposit's mineralogy and the ability to effectively separate the arsenopyrite and pyrite components in the ore provides Gowest with added economic opportunities.
- Decision on a final processing option depends on the evaluation of projected operating cost savings versus losses in gold recovery. At \$1200 /oz gold economics of two options for Frankfield East deposit are similar based exclusively on major reagent costs.
- A more complete assessment is required to fully evaluate the additional operating and capital cost savings resulting from the selective flotation option.
  - Concentrate shipping costs (mill and autoclave at different locations)
  - Capital cost savings from reduced material flows
  - Impact of selective flotation cost savings increases as gold price drops