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CANADA - NWT

MINERAL DEVELOPMENT AGREEMENT

Giant Yellowknife Mines Limited
Yellowknife Division
Recovery Improvement Project

Volume 3

Canada

Northwest Territories Canada

Canada-NWT

Mineral Development Agreement

Northern Technology Assistance Program

Giant Yellowknife Mines Limited
Yellowknife Division
Recovery Improvement Project

Volume 3

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GIANT YELLOWKNIFE MINES LIMITED
Yellowknife Division

Recovery Improvement Project
#SC-265237

Phase III

VOLUME 3

March 1990

An Investigation of

THE RECOVERY OF GOLD

from samples of Giant Yellowknife Mines ore

submitted by

GIANT YELLOWKNIFE MINES LTD.

Progress Report No. 1

Project No. L.R. 3785

NOTE:

This report refers to the samples as received.

LAKEFIELD RESEARCH
A DIVISION OF FALCONBRIDGE LIMITED
February 1st,1990

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ABSTRACT

During the period September 1989 to January 1990 a testwork program covering gold association determination, flotation testwork and cyanidation was carried out on a series of Giant Yellowknife products.

The overall objectives of the program were:

a) to review gold association in selected products of Giant Yellowknife operation
b) to study the fundamentals of Giant Yellowknife ore flotation and improve gold recovery from the ore
c) to study the cyanidation response of selected products of Giant Yellowknife and
d) to examine possible routes to improve gold recovery from calcine residue of Giant Yellowknife.

The flotation testwork provided information on the fundamentals of flotation of mill feed. A flowsheet incorporating a scavenger cleaner was developed and gave the following result.

	Grade		Recovery	
	Au (g/t)	S (%)	Au (%)	S (%)
Rougher Concentrate and Scavenger Cleaner Concentrate	107.5	22.2	88.1	91.7

This result compared favourably with the laboratory result for the existing Giant Yellowknife flotation circuit.

INTRODUCTION

This report details the results of testwork conducted on samples of ore and products from Giant Yellowknife Mine, Yellowknife, North-West Territories. The samples were submitted by Giant Yellowknife Mines Limited.

The test program consisted of chemical and sizing analysis of samples received, gold association investigations, flotation testwork on mill feed sample and cyanidation testwork on several of the samples received.

The results and direction of testwork were discussed during the course of the program in telephone conversations with Mr. Brad Starcheski of Giant Yellowknife Mines Limited.

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SUMMARY

This program was to establish some insight into gold losses from the Giant Yellowknife operation and develop, where possible, routes for improvement in total Au recovery.

The objectives of this program were to:

(1) Determine the gold association of selected plant products.

(2) Study the fundamentals of plant flotation and using this information, try to improve flotation circuit performance.

(3) Study the cyanidation recovery of ore and selected products of flotation.

(4) Study possible improvements in Au recovery from calcine residues.

1. SAMPLE DESCRIPTION

Nine samples were received at Lakefield Research on September 6th, 1989 (Lakefield Reference Number LR 8932690). The weights are listed below.

1.	Roaster Feed	11.4 kg
2.	Transfer Dust	10.2 kg
3.	Roaster Calcines	14.2 kg
4.	Calcine Residue	14.6 kg
5.	Classifier Overflow	8.8 kg
6.	Flotation Tails	10.6 kg
7.	Hot Cottrell Dust	8.2 kg
8.	Dust Treatment Residue	10.2 kg
9.	Mill Feed	275 kg

For samples 1 - 8 representative samples were riffled out for head assaying and screen/cyclosizing analyses. The samples were prepared into 500 g lots for future work.

For the larger mill feed sample, all the sample was crushed down to -1/2 inch and then one quarter riffled out and further reduced to -10 mesh. The -10 mesh material was then prepared in 2 kg charges for flotation testwork.

1.1 Head Analysis and Size

The assay heads are given in Table 1. In Table 2 are the size fraction analyses and assay on mesh distributions.

The assay on mesh distributions are presented graphically in Figures 1 and 2.

Most of the gold in the calcine residue occurs in the +24, -74 micron fraction. The majority of the gold in the dust treatment residue is in the -9 micron fraction. 29.8% of the gold lost in the flotation tails in in the -10 micron fraction. This compares with only 8.0% of gold in this fraction in the mill feed sample and shows that gold recovery of this fraction is poor in flotation.

Table No. 1 - Head Assays

Sample	No.	Assays Au (g/t)	As (%)	S (%)	S(py) (calc.)	Sb (%)
Roaster Feed	1	104	9.36	21.3	17.3	-
Transfer Dust	2	129	1.96	11.2	-	-
Roaster Calcine	3	137	1.75	4.66	-	-
Calcine Residue	4	2.40	1.46	4.24	-	-
Hot Cottrell Dust	5	49.6	2.61	1.23	-	0.39
Dust Treatment Residue	6	8.13	3.03	1.33	-	-
Classifier O/F	7	9.90	1.07	2.79	2.33	-
Flotation Tail	8	0.73	0.076	0.06	0.03	-
Mill Feed	9	9.75	0.75	1.93	1.61	0.025

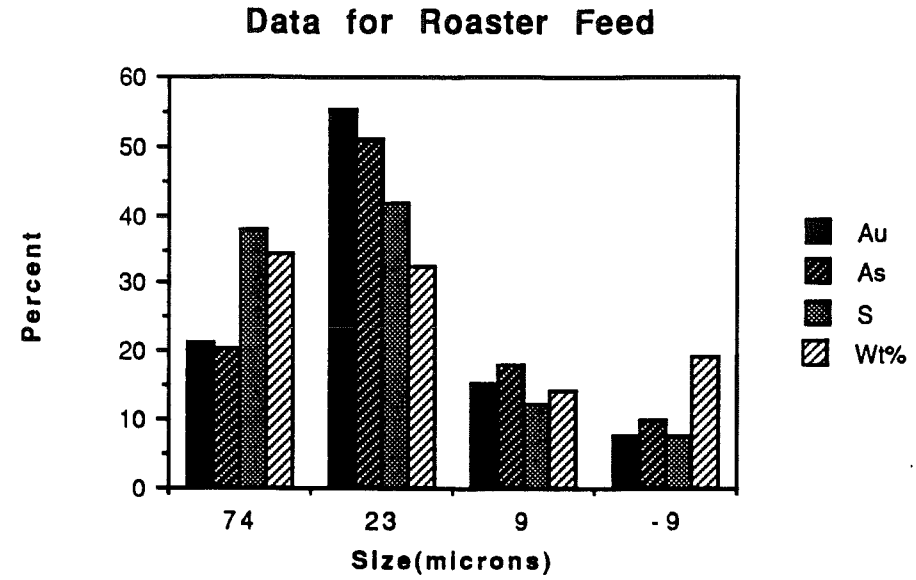
Note:
S(py) is pyrite content. This number has been calculated assuming 46% As in arsenopyrite and 53.4% S in pyrite; all arsenic is associated with arsenopyrite and all sulfur is associated with these two sulphide minerals.

Table No. 2 - Size Fraction Analysis

Sample No.	Fraction	Weight %	Assays g/t, %			% Distribution		
			Au	As	S	Au	As	S
1 Roaster Feed	+200 mesh	34.1	60.4	5.79	22.8	21.2	20.7	37.8
	-200m +22.5µ	32.5	166	15.0	26.5	55.5	51.1	41.9
	-22.5m +8.4	14.2	107	12.2	17.9	15.6	18.1	12.4
	-8.4	19.2	39.0	5.02	8.51	7.7	10.1	7.9
	Head (calc)	100.0	97.2	9.55	20.6	100.0	100.0	100.0
	Head (direct)		104	9.36	21.3			
2 Transfer Dust	+200 mesh	41.6	80.8	1.44	14.1	27.4	31.5	53.1
	-200m +23.6µ	33.3	204	2.57	13.4	55.4	45.0	40.4
	-23.6m +8.7	11.4	132	2.08	4.91	12.3	12.5	5.1
	-8.7	13.7	44.4	1.54	1.13	5.0	11.1	1.4
	Head (calc)	100.0	123	1.90	11.0	100.0	100.0	100.0
	Head (direct)		129	1.96	11.2			
3 Roaster Calcine	+200 mesh	23.3	88.3	0.96	2.07	18.0	13.3	11.3
	-200m +23.4µ	42.4	140	1.91	6.39	51.8	48.2	63.7
	-23.4m +8.7	20.5	91.4	1.82	3.76	16.4	22.2	18.1
	-8.7	13.8	115	1.97	2.12	13.9	16.2	6.9
	Head (calc)	100.0	115	1.68	4.26	100.0	100.0	100.0
	Head (direct)		137	1.75	4.66			
4 Calcine Residue	+200 mesh	8.5	3.18	0.36	0.81	4.6	2.2	1.6
	-200m +24.2µ	39.7	10.0	1.60	6.81	67.6	45.1	61.9
	-24.2m +9.0	28.1	3.66	1.41	3.98	17.5	28.1	25.6
	-9.0	23.7	2.56	1.46	2.00	10.3	24.6	10.9
	Head (calc)	100.0	5.88	1.41	4.36	100.0	100.0	100.0
	Head (direct)		2.40	1.46	4.24			
5 Hot Cottrel Dust	-25.3m +9.4	11.0	118	3.24	2.64	26.8	14.9	49.7
	-9.4	89.0	39.9	2.29	0.33	73.2	85.1	50.3
	Head (calc)	100.0	48.5	2.39	0.58	100.0	100.0	100.0
	Head (direct)		49.6	2.61	1.23			
6 Dust Treatment Residue	-24.6m +9.1	10.9	18.2	2.56	0.62	27.1	7.6	1.9
	-9.1	89.1	6.00	3.79	3.91	72.9	92.4	98.1
	Head (calc)	100.0	7.33	3.66	3.55	100.0	100.0	100.0
	Head (direct)		8.13	3.03	1.33			

Table No. 2 - Size Fraction Analysis (cont'd)

Sample No.	Fraction	Weight %	Assays g/t, %			% Distribution		
			Au	As	S	Au	As	S
7 Classifier O/F	+200 mesh	41.6	9.12	0.90	N.S.S	37.1	36.6	-
	-200m +27.6µ	17.1	25.8	2.43	N.S.S	43.2	40.7	-
	-27.6m +10.2	16.0	7.46	0.86	N.S.S	11.7	13.5	-
	-10.2	25.5	3.20	0.37	N.S.S	8.0	9.2	-
	Head (calc)	100.0	10.2	1.02	-	100.0	100.0	-
	Head (direct)		9.90	1.07	2.79			
8 Flotation Tail	+200 mesh	15.5	1.66	0.10	N.S.S	26.1	21.5	-
	-200m +28.5µ	24.5	1.29	0.086	N.S.S	32.0	29.2	-
	-28.5m +10.6	25.5	0.47	0.034	N.S.S	12.1	12.0	-
	-10.6	34.6	0.85	0.078	N.S.S	29.8	37.4	-
	Head (calc)	100.0	0.99	0.07	-	100.0	100.0	-
	Head (direct)		0.73	0.076	0.06			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23
9
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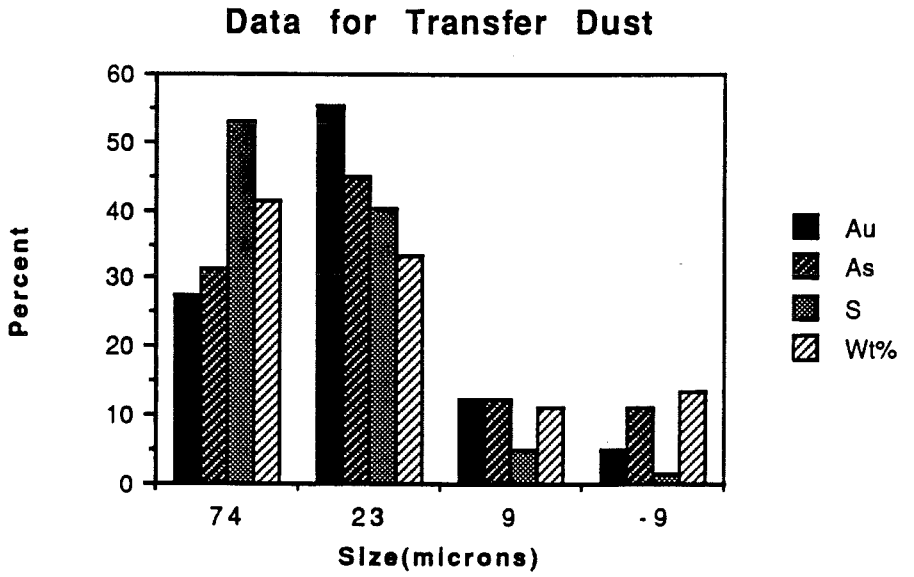
Size(microns)
Au
As
S
Wt%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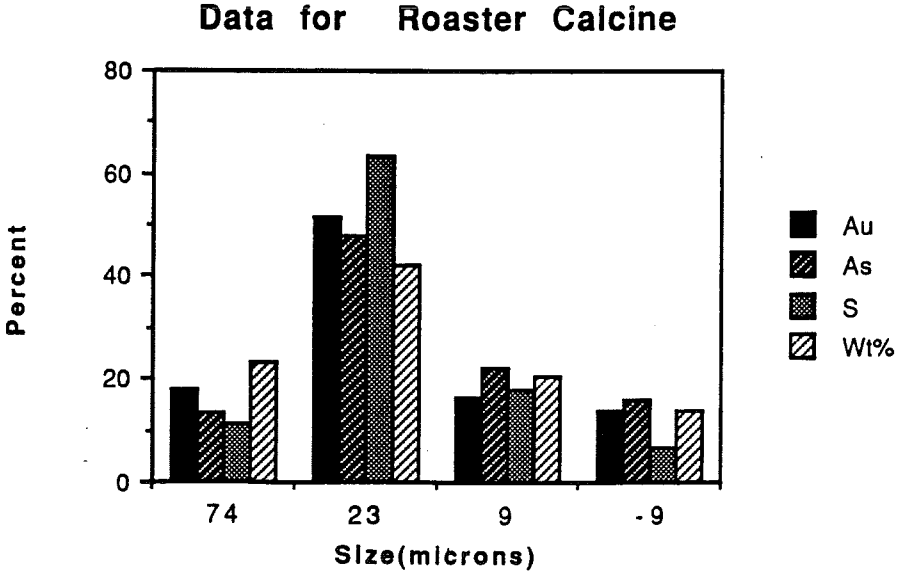
Wt%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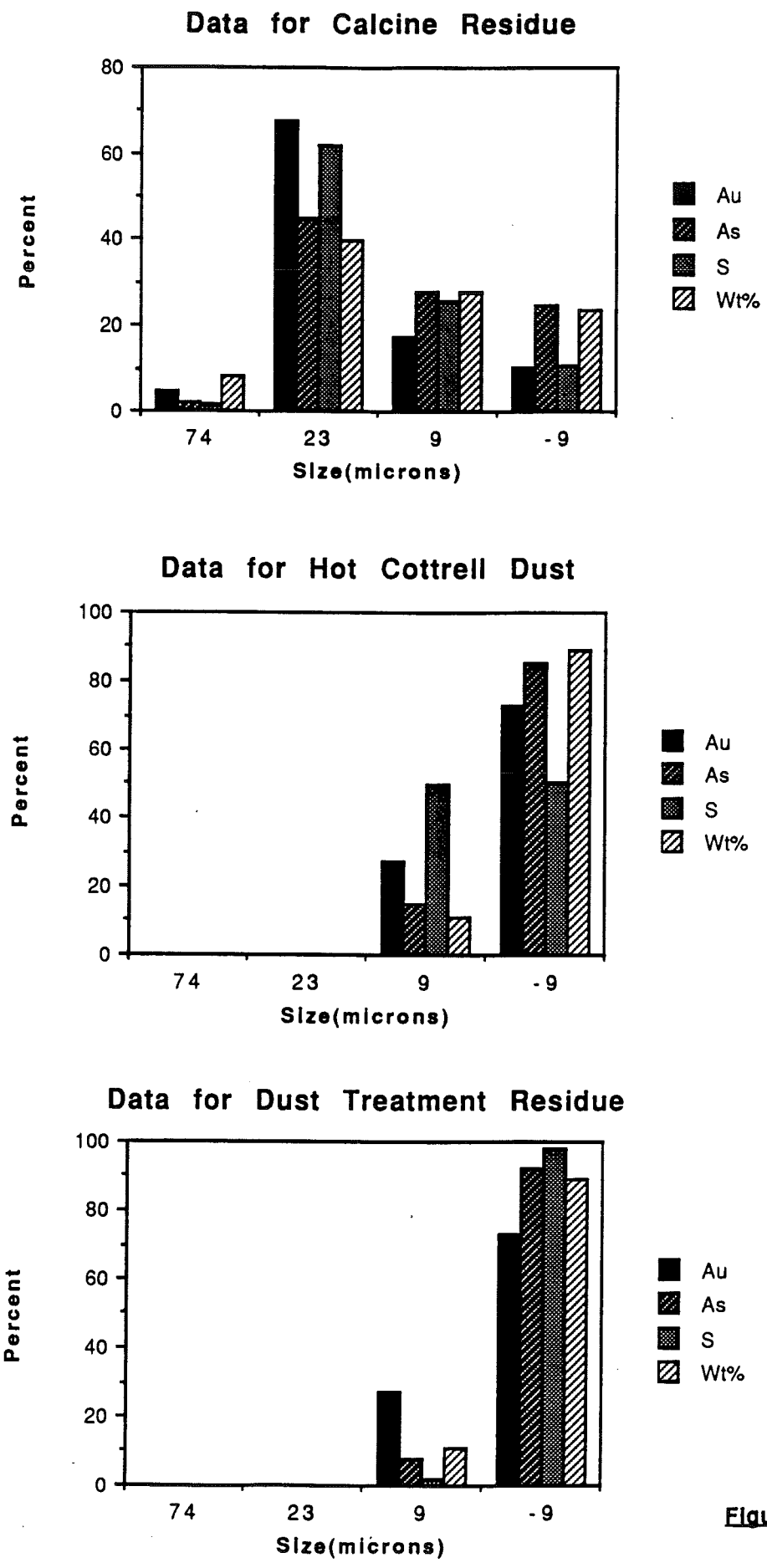
Au
As
S
Wt%

Figure 1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0
74
23
9
-9
Size(microns)
Au
As
S
Wt%
Data for Hot Cottrell Dust
Percent
100
80
60
40
20
0
74
23
9
-9
Size(microns)
Au
As
S
Wt%
Data for Dust Treatment Residue
Percent
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40
20
0
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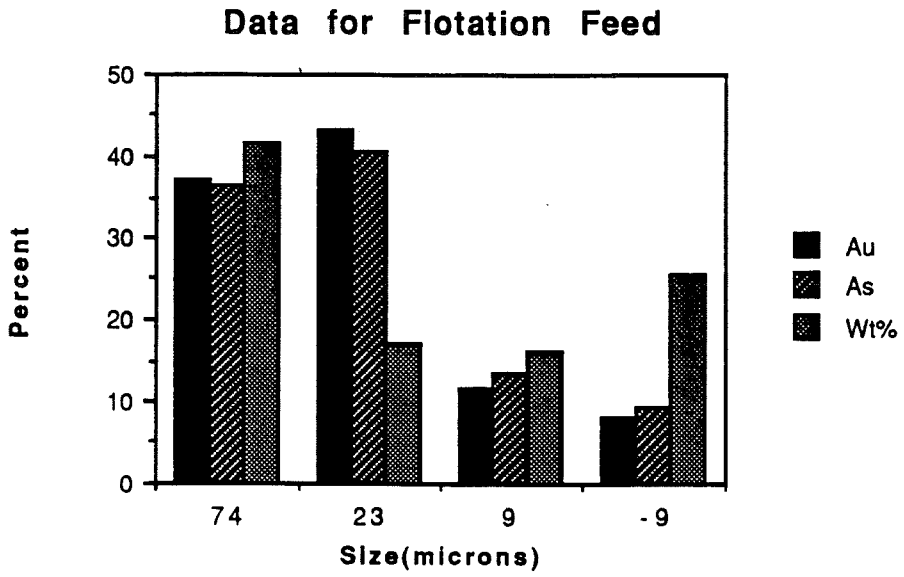
23
9
-9
Size(microns)
Au
As
S
Wt%

Figure 2A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Size(microns)
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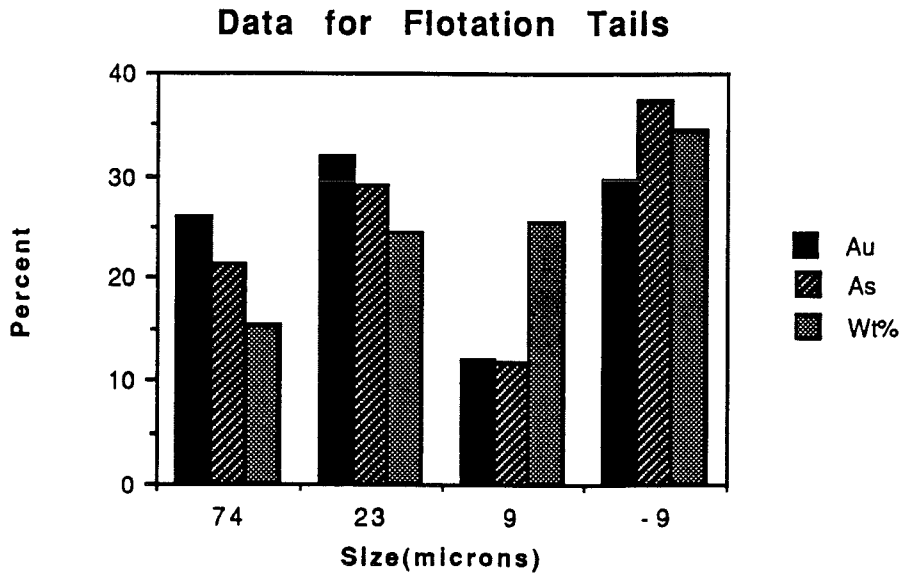
As
Wt%


Data for Flotation Tails
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20
10
0
74
23
9
-9
Size(microns)
Au
As
Wt%

Figure 2B

2.0 GOLD ASSOCIATION TESTWORK

The gold association in each of the 8 products was determined using a sequential leaching program.

The amount of exposed gold was determined by leaching the sample for 24 hours at 2 g/L NaCN solution. The residue was repulped and leached in 150 g/L NaOH solution at 20% solids for 2 hours to decompose the arsenates. The pulp was then filtered and the residue washed, repulped and cyanided at 20 g/L NaCN for 2 hours to recover the liberated gold that was associated with the arsenates. A hot aqua regia leach was then applied to break down the sulphides and gold associated with the sulphides. The gold remaining in the residue was considered to be associated with insoluble gangue.

A flowsheet for this process is given in Figure 3.

The results from the gold association testwork are given in Table 3.

Figure 3

Gold Association Test

Flowsheet

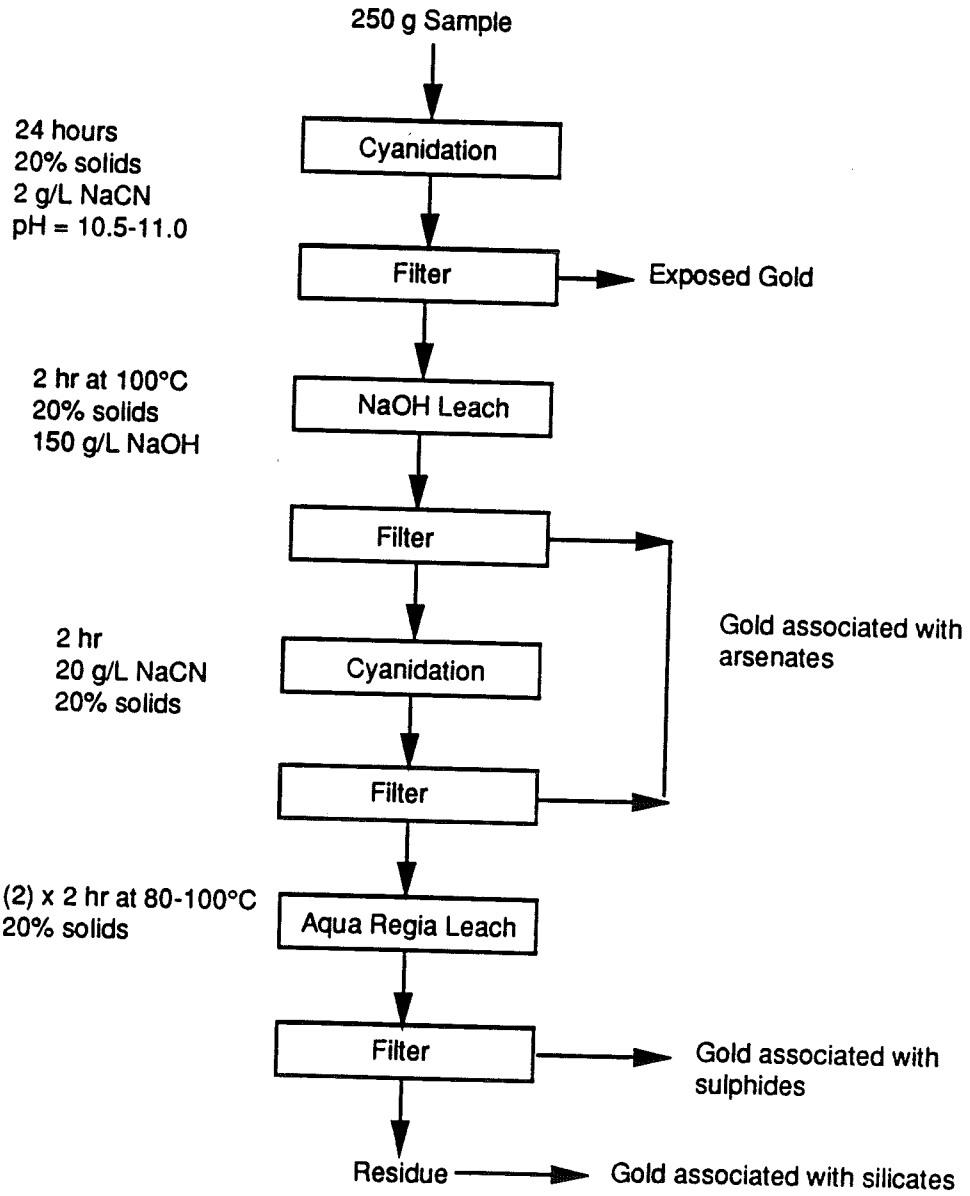


Table No. 3

Product	Roaster Feed	Transfer Dust	Roaster Calcine	Calcine Residue	Hot Cottrell Dust	Dust Treatment Residue	Classifier Overflow	Flotation Tails
Available Gold	43.70	81.80	86.40	33.00	85.60	8.50	30.90	38.80
Arsenate Au	1.50	10.00	7.60	43.50	12.40	83.70		
Sulphide Au	54.50	8.10	5.80	19.30	1.70	5.30		
Other Gold	0.30	0.10	0.30	4.20	0.30	2.50	69.1*	61.2*
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Head(calc.) gpt Au	99.9	144	117	2.65	45.8	7.12	10.5	0.98

Repeat of above

Product	Calcine Residue	Dust Treatment Residue
Available Gold	23.2	
Arsenate Au	15.1	84.1
Sulphide Au	60.4	
Other Au	1.3	15.9
Total	100	100
Head(calc.) gpt Au	4.27	9.01

*This is gold in all other forms except exposed gold

The cyanidable gold content is seen to be increasing through the roasting stages, going from 43.7% in roaster feed to 81.8% in the transfer dust and 86.4% in the roaster calcine.

The available gold content in the calcine residue was surprisingly high at 33.0%. A repeat of this (Test 16) has the level at 23.2%. However there is a large discrepancy in head assay between these two tests. The reason for this head variance is unknown but as can be seen from the repeat test there is also a large disagreement in the gold associated with sulphides.

The Hot Cottrell dust has 85.6% available gold and this is reduced to 8.5% in the dust treatment residue after process cyanidation.

Summary

In the dust treatment residue the gold is predominantly associated with arsenates (83.7%). The arsenate gold association of the calcine residue is also high at 43.5% although the repeat test gave only 15.1%. The gold association for dust treatment residue was also repeated (Test 14) and gave similar results to the first test. On the repeat test, total available gold and gold associated with arsenates was determined to be 84.1%.

3. FLOTATION TESTWORK

3.1 Batch Grinding Tests

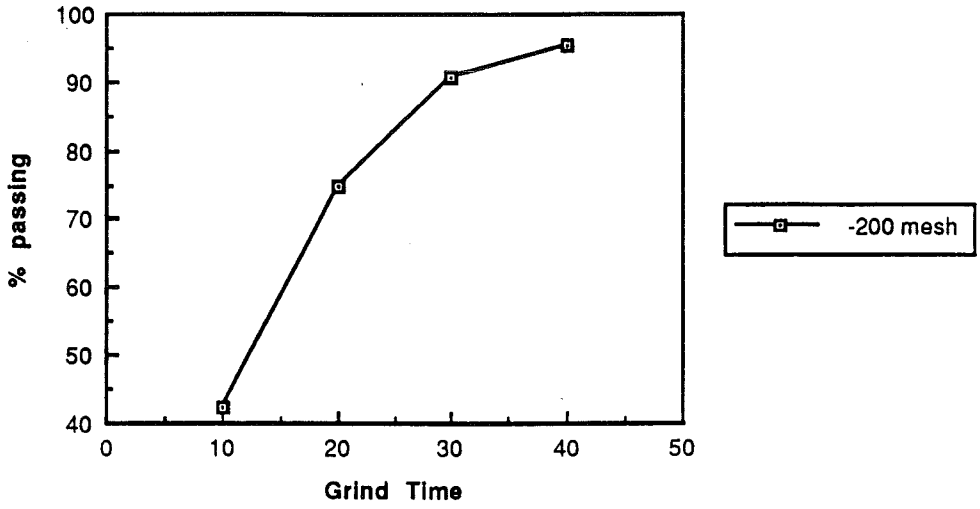
Test charges of 2.0 kg of mill feed were subjected to batch stage grinding in a Denver laboratory ball mill to determine the grind time necessary to produce target feed size.

These results are summarized on Table 4 and presented graphically on Figure 4.

Based on this data a primary grind of 13 minutes was selected to give 55% -200 mesh for flotation testwork.

Table 4

Test No.	Grind Time (min)	-200 mesh (%)	-400 mesh (%)
10D	10	42.5	32.5
10A	20	74.7	54.8
10B	30	90.8	69.5
10C	40	95.3	77.8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10
20
30
40
50
Grind Time
-200 mesh

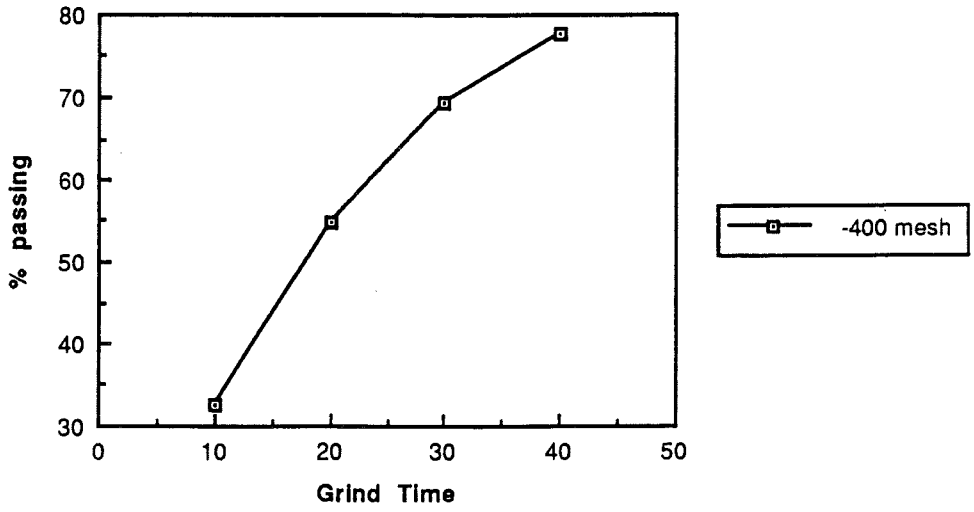

80
70
60
50
40
30
% passing
0
10
20
30
40
50
Grind Time
-400 mesh

Figure 4

3.2 Flotation Testwork Overview

The objective of the flotation testwork was to maximize Au recovery whilst maintaining greater than 20% sulphur grade.

A number of series of tests were conducted examining various aspects of metallurgical performance. A summary of these sub-groups is listed below. Each group of tests is then analyzed in detail in the sections following in this report.

Group 1	Rougher Flotation Rates	Tests 9, 15 and 48
Group 2	Stage Regrinding of Rougher Tailing	Tests 21-26 and Tests 31-33
Group 3	Primary Grind Analysis	Tests 39-42
Group 4	Pulling Rate Analysis	Tests 43 and 44
Group 5	Reagent Modifications	Tests 20, 28A, 28B, 27, 36, 37, 38
Group 6	Flowsheet Development I	Tests 19, 29 and 34
Group 7	Flowsheet Development II	Tests 45, 46, 47, 50 and 51

3.3 Rougher Flotation Rates

Three tests were conducted to examine rougher flotation rates. These are Tests 9, 15 and 48.

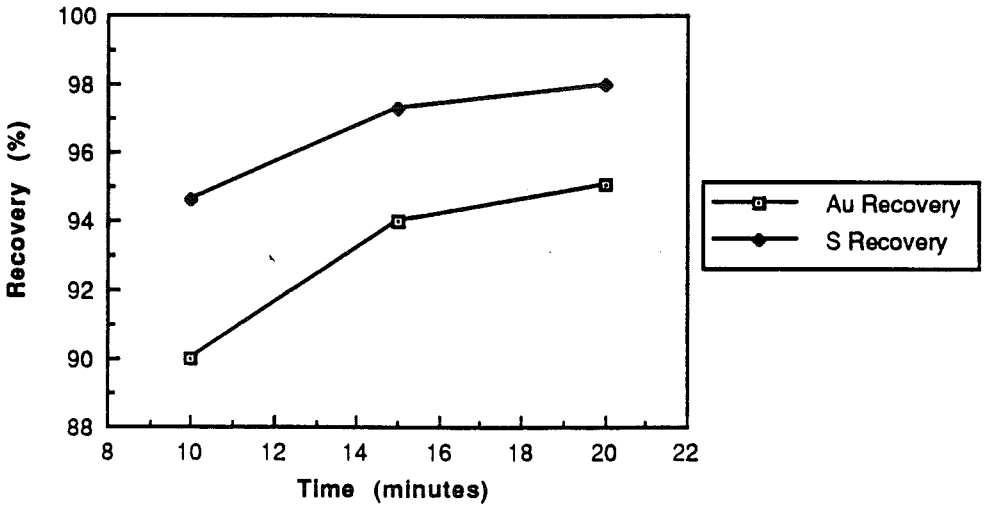
In Test 9 three rougher concentrates were produced after 10, 15 and 20 minutes flotation time. With Test 15, 2 rougher concentrates were produced after 5 and 6 minutes flotation time. The rougher tail was then reground for 8.75 minutes and then 4 scavenger concentrates were produced after float time of 7, 8, 11 and 14 minutes.

Test 48 was conducted to examine very long flotation time. In this test a rougher concentrate was produced from 6 minutes flotation time, a 10 minute rougher tail regrind was then included, followed by 4 scavenger concentrates after 12, 16, 20 and 24 minutes of flotation time.

The results from Test 9 are given graphically in Figure 5, Test 15 results are presented in Figure 6.

The overall gold recovery was 94% for Test 9 and 95% for Test 15. With Test 15 we see gold and sulphur recovery increasing rapidly in the first 7 minutes but then the recovery rate slowing. This trend is not apparent in Test 9 because the first rougher concentrate is after 10 minutes of flotation time.

Test 9 - Rougher Flotation Rates



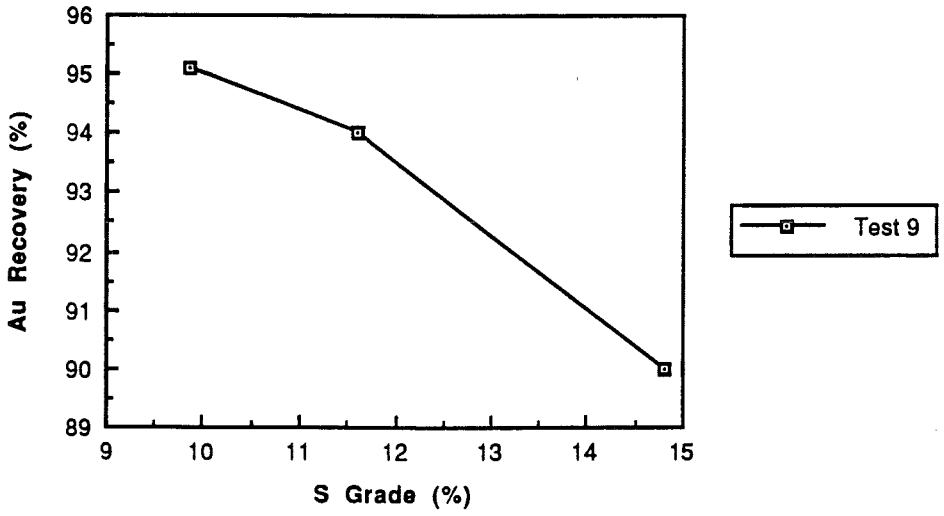
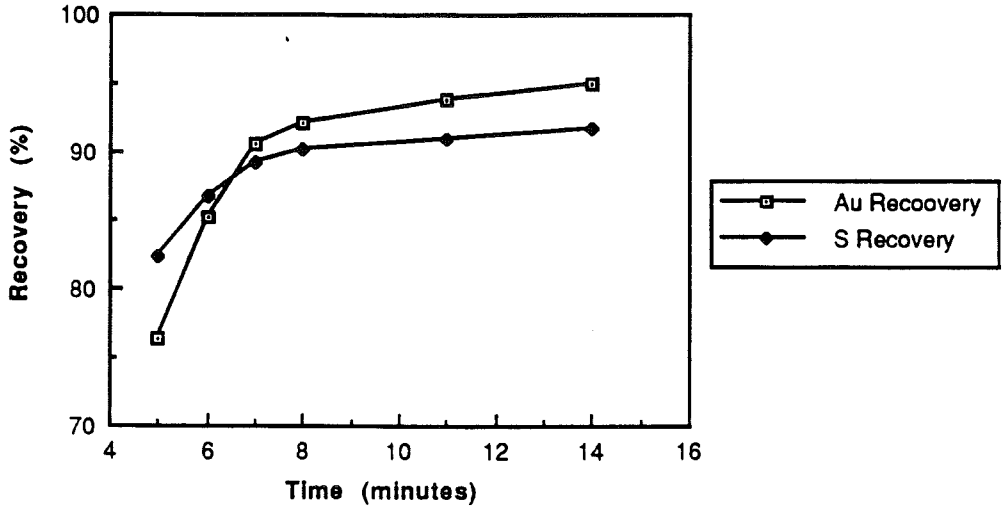


Figure 5

Test 15 - Rougher Flotation Rates



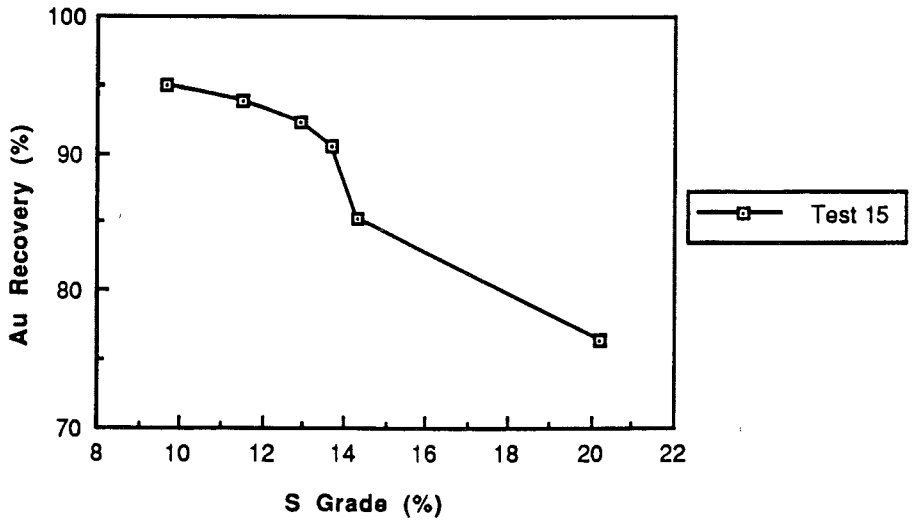


Figure 6

The results from Tests 9 and 15 indicate long flotation time is necessary to achieve very high Au recovery levels.

Results for Test No. 48 are shown in Figures 7, 8 and 9.

The total gold recovery from Test 48 was 95.3% and sulphur recovery was 91.6%. These levels have fallen short of desired levels of recovery despite the very long flotation time. A fairly good concentrate grade was still being produced from the last scavenger stage although weight recovery was very low. This information indicates that at these conditions exceedingly long flotation time would be required to achieve plus 97% gold recovery.

Figures 7 and 9 show a very definite one-to-one relationship between gold recovery and arsenopyrite recovery in Test 48. The pyrite/gold recovery relationship is also linear although this is about 0.4 to 1.

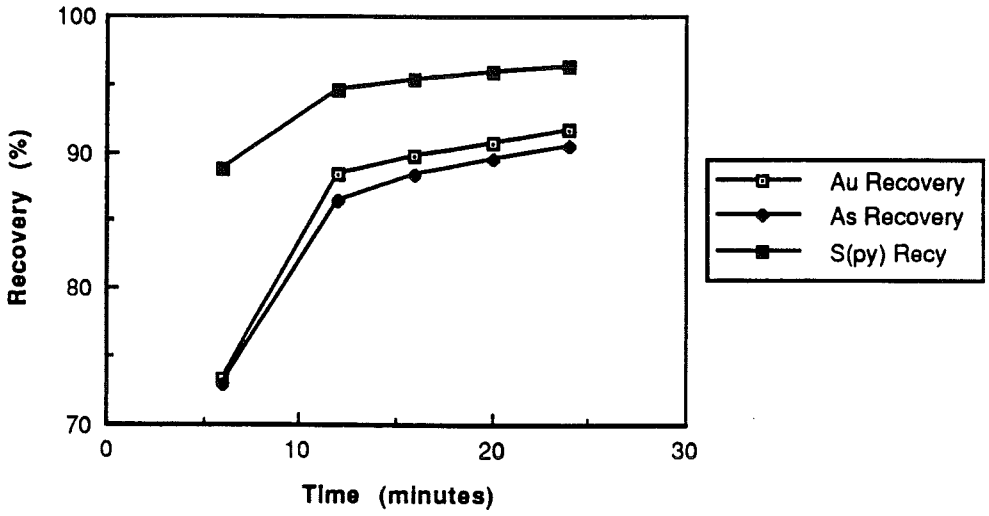
From Figure 9 it can be calculated that to achieve 97.5% gold recovery will require 97.5% arsenopyrite recovery and 98% pyrite recovery.

3.4 Stage Regrinding of the Rougher Tailing

Two series of tests were conducted with stage regrinding of the rougher flotation tailing. These tests are 21-26 and 31-33.

A summary of these tests is given in Table 5.

Test 48 - Rougher Flotation Rates



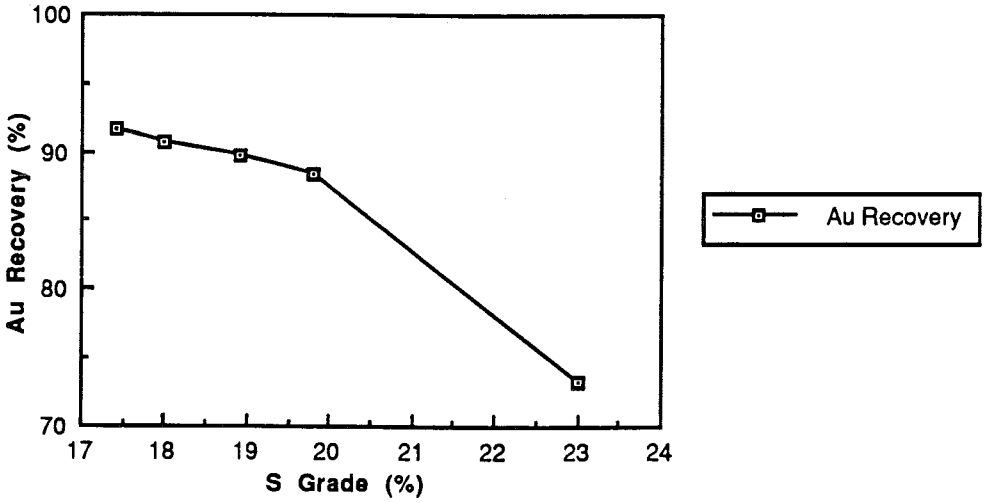
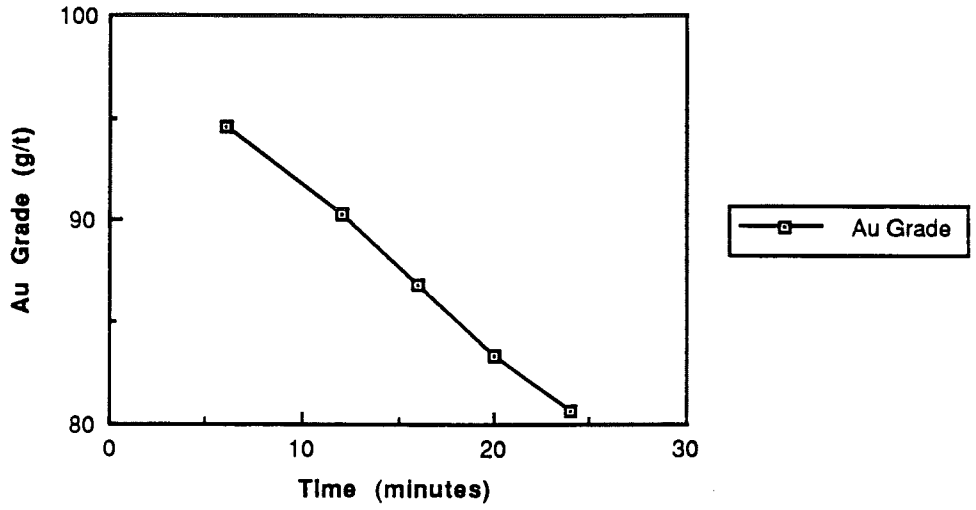


Figure 7

Test 48 - Rougher Flotation Rates



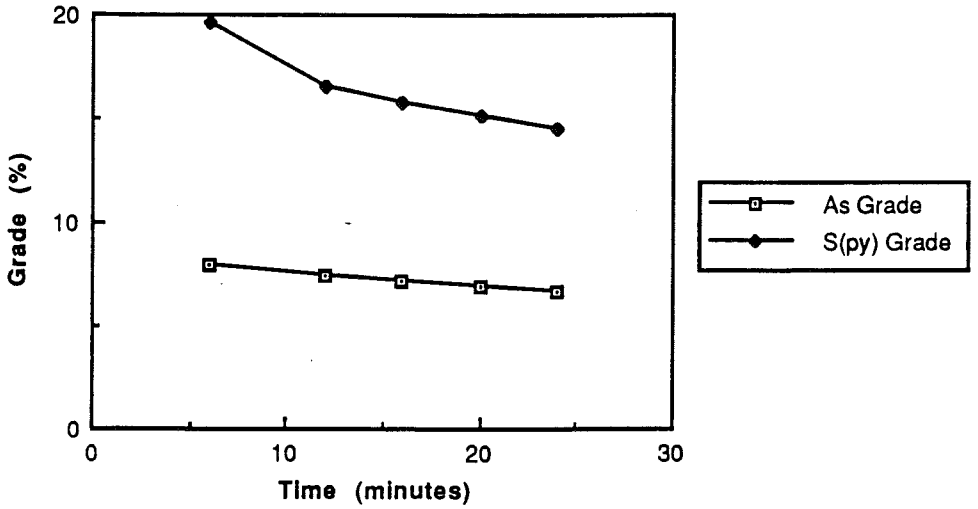


Figure 8

Test 48 - Rougher Flotation Rates

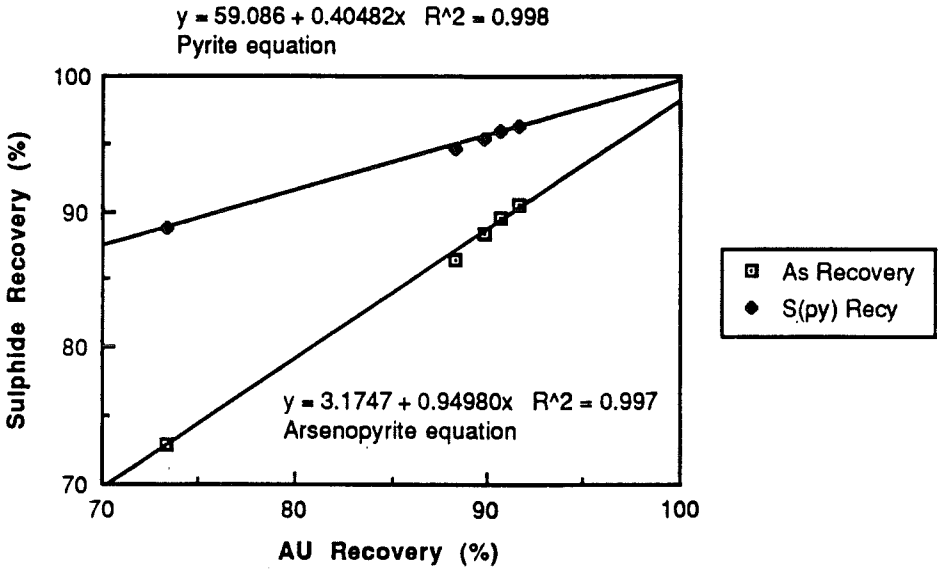


Figure 9

Table 5

Test No.	Number of Grinding	Grind Stage	Grind Time (mins)	Flotation Stage	Flotation Time (mins)
21	4	Primary Grind 1st Stage Regrind 2nd Stage Regrind 3rd Stage Regrind	13 11 5 10	1st Rougher 2nd Rougher 3rd Rougher 4th Rougher	6 3 3 2
22	1	Primary Grind	13	1st Rougher	6
23	2	Primary Grind 1st Stage Regrind	13 12	1st Rougher 2nd Rougher	6 3
24	3	Primary Grind 1st Stage Regrind 2nd Stage Regrind	13 12 6	1st Rougher 2nd Rougher 3rd Rougher	6 3 3
25	4	Primary Grind 1st Stage Regrind 2nd Stage Regrind 3rd Stage Regrind	13 12 6 15	1st Rougher 2nd Rougher 3rd Rougher 4th Rougher	6 3 3 2
26	4	Primary Grind 1st Stage Regrind 2nd Stage Regrind 3rd Stage Regrind	13 12 6 15	1st Rougher 2nd Rougher 3rd Rougher 4th Rougher	6 3 3 4
31	2	Primary Grind 1st Stage Regrind	13 12	1st Rougher 2nd Rougher	6 3
32	3	Primary Grind 1st Stage Regrind 2nd Stage Regrind	13 12 6	1st Rougher 2nd Rougher 3rd Rougher	6 3 3
33	4	Primary Grind 1st Stage Regrind 2nd Stage Regrind 3rd Stage Regrind	13 12 6 15	1st Rougher 2nd Rougher 3rd Rougher 4th Rougher	6 3 3 4

The rougher tailing from Test 21 was sized. The results from this size analysis are given in Figure 10. From these figures the following regrind times were selected for subsequent tests. 1st stage regrind 12 minutes (85% -200 mesh); 2nd stage regrind 6 minutes (90% -200 mesh) and 3rd stage regrind of 15 minutes (95% -200 mesh).

Test 21 is not interpreted any further as weights removed during the test for sizing and assay have biased the metallurgical balance.

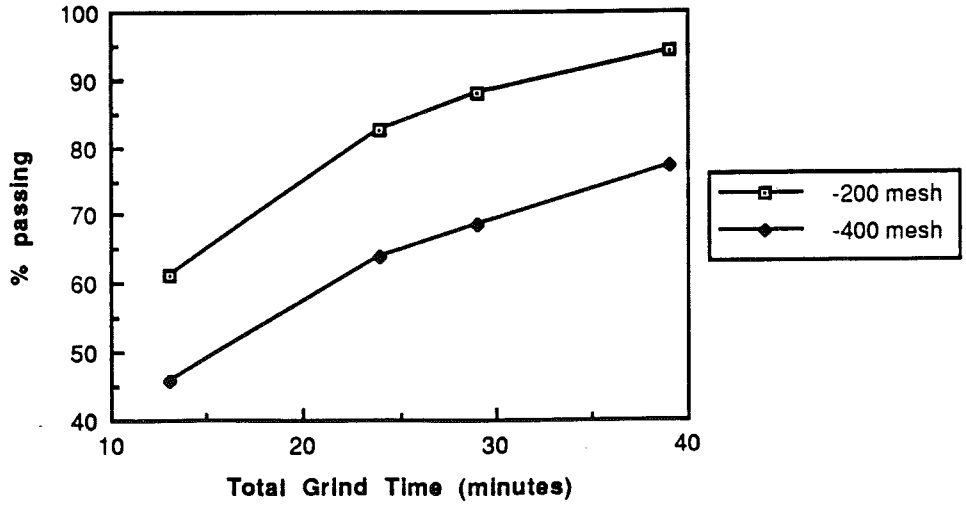
The overall results of Tests 22-26 and 31-33 are given in Table 6.

Table 6

Test No.	Total Grind Time (mins)	Total Float Time (mins)	Au Grade g/t	Au Recovery %	S Grade %	S Recovery %
22	13	6	94.0	83.4	20.6	90.6
23	25	9	85.4	87.0	18.0	91.4
24	31	12	98.8	91.6	14.8	94.7
25	46	14	56.9	91.3	11.5	92.6
26	46	16	65.1	95.1	12.4	99.1
31	25	9	38.1	88.4	8.7	94.5
32	31	12	31.0	94.5	6.4	97.0
33	46	16	23.5	97.2	4.8	98.4

Test 21 - Tailing Size Analysis

Figure 10



Summary

From these results the best overall gold and sulphur recoveries were achieved with Tests 26 and 33. These tests have the finest tailing regrinds and the longest flotation times.

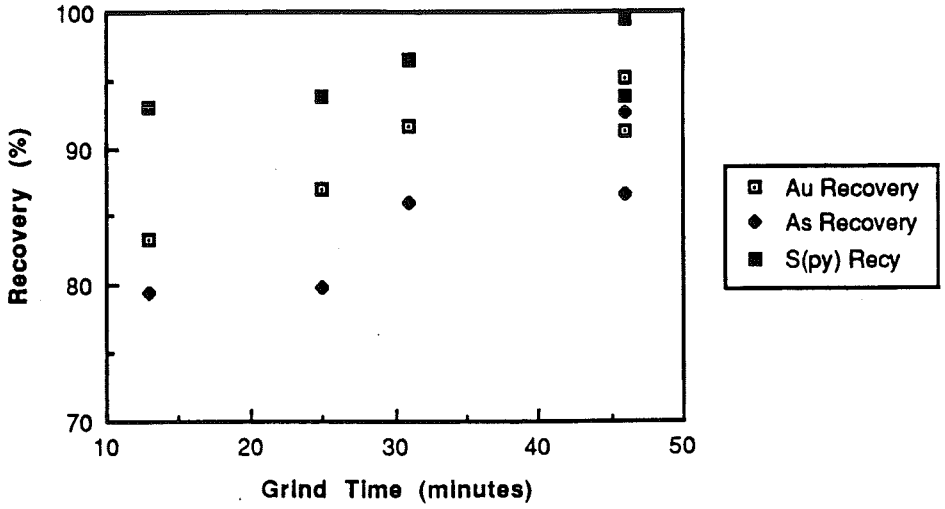
The results from these tests are given in Figure 11 for Tests 22-26 and Figure 12 for Tests 31-33. Recovery versus both grind time and float times is presented in these graphs.

These series of tests show consistent results where, as grind time and float time are increased, the recovery of gold and sulphide minerals improved.

From these results it is not clear whether it is increasing grind time or increasing flotation time or a combination of both that is giving the improvement in overall recovery.

Comparison of Tests 25 and 26 provides some insight into this. These tests have the same total amount of grind time but Test 26 has 2 minutes longer flotation time than Test 25. The gold and sulphur recoveries for Test 26 are better than Test 25. This result indicates that flotation time is having an affect on the overall recovery. Therefore tail regrind time alone is not the reason for improved total recovery in these series of tests.

Tests 22-26 - Recovery Versus Grind Time and Float Time



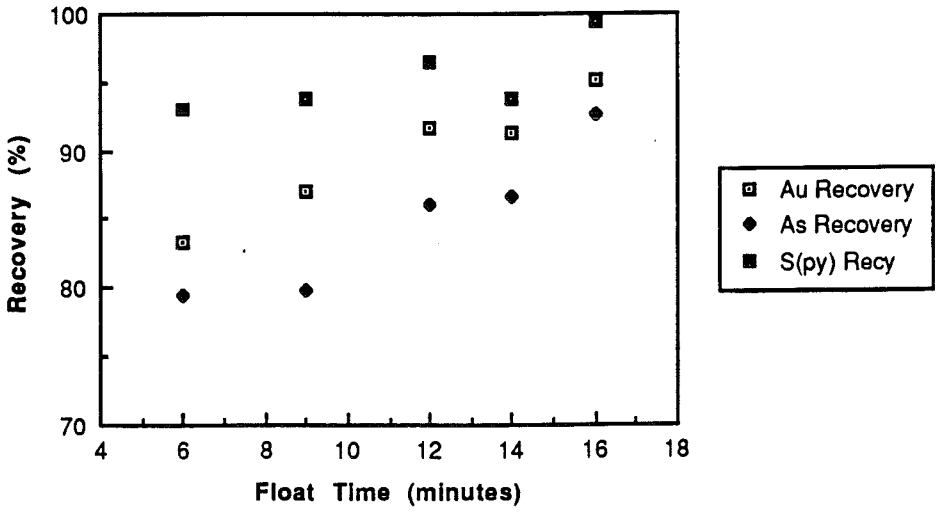
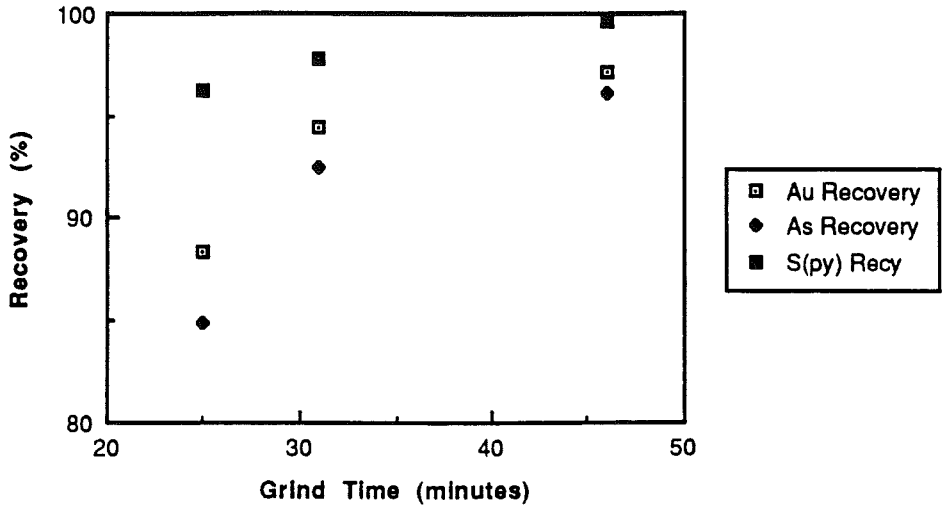


Figure 11

Tests 31-33 - Recovery Versus Grind Time and Float Time



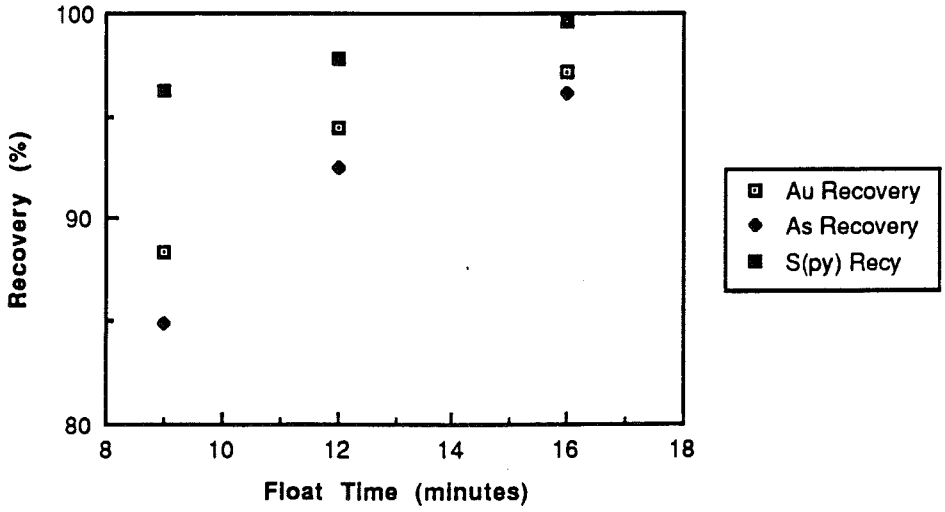


Figure 12

Tests 26 and 33 are compared on Figures 13A and 13B. The total recovery of gold and sulphur are very similar between these two tests but the metallurgical performance of Test 26 is much superior to Test 33. This can be seen on the grade/recovery curve of Figure 13A.

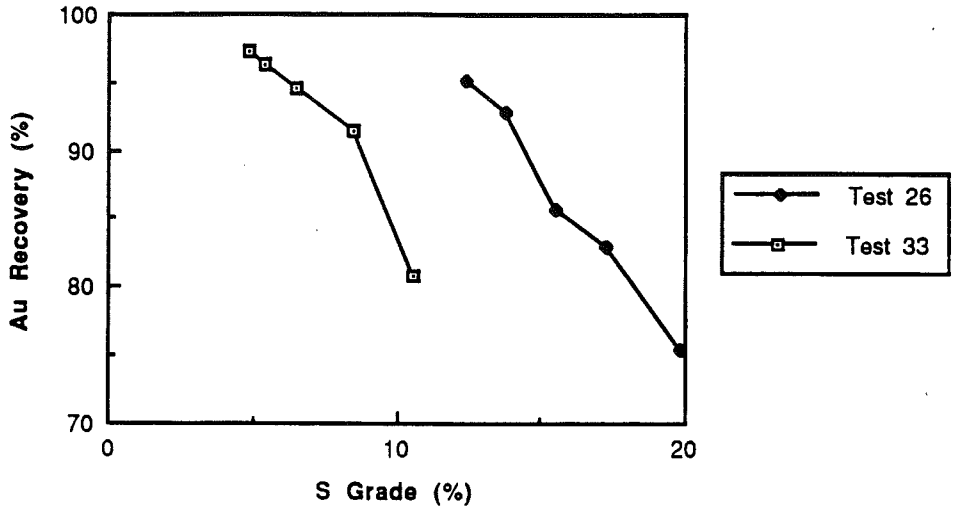
This observation can be made when comparing other equivalent tests in these two series. That is, comparing Test 23 with Test 31 and Test 24 with Test 32.

The significant difference between these two tests was the way they were pulled. Test 26 and all tests in that series, were pulled shallow and slow. Tests 31 to 33 were pulled quite hard and deep. This has resulted in a noticeable difference in the selectivity of valuable mineral against gangue between these two series of tests. For the tests that were pulled hard and deep, the selectivity of valuable mineral against gangue is much poorer than for the series that was pulled shallow and slow.

The sulphur versus gold recovery relationship is given in Figure 13A. Again it can be seen that to achieve 97% plus Au recovery will require around 99% sulphur recovery.

The recovery of arsenopyrite and pyrite versus gold is given in Figure 13B. From these graphs it can be seen that 97% plus Au recovery will require 99% pyrite recovery and about 96% arsenopyrite recovery. These results are consistent with the results from Test 48.

Comparisons - Tests 26 versus 33



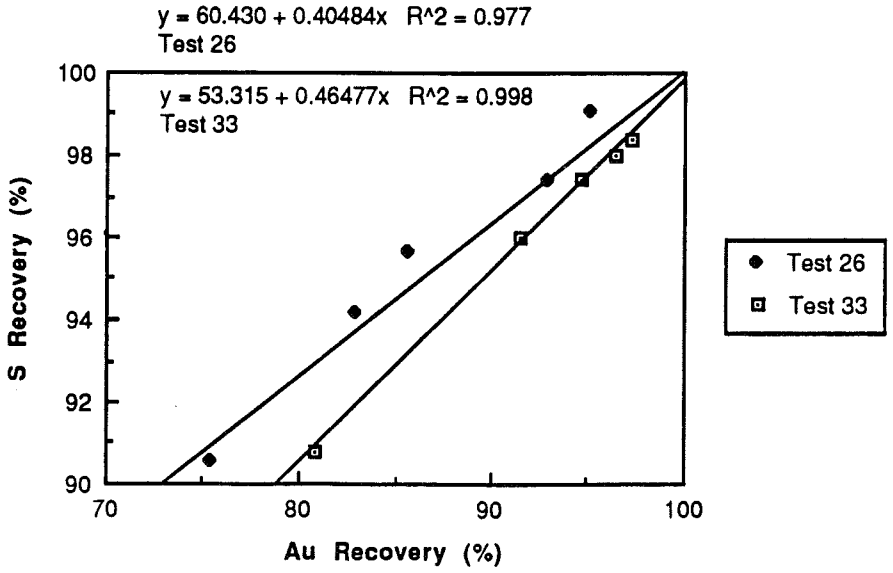
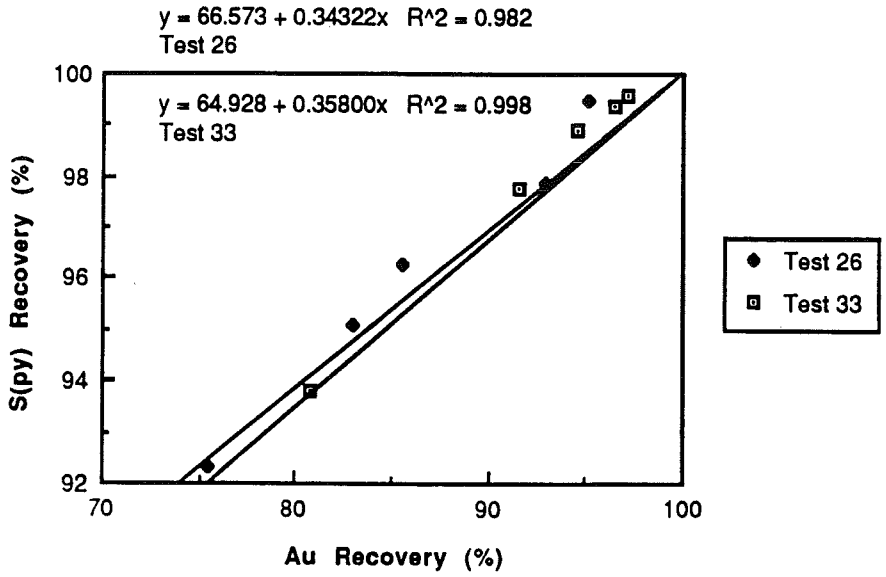


Figure 13A

Comparisons - Tests 26 versus 33



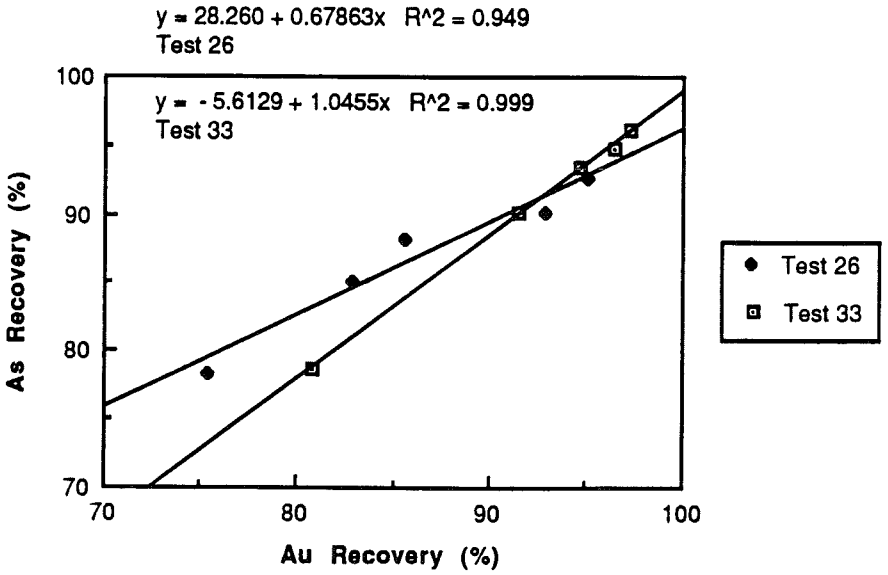


Figure 13B

The pyrite recovery in both Tests 26 and 33 are about 99%. That is, they are to the level that is required for maximum gold recovery. However, the arsenopyrite recovery is about 92% in Test 26 and 95% in Test 33. So in these tests the last significant gold losses are with arsenopyrite.

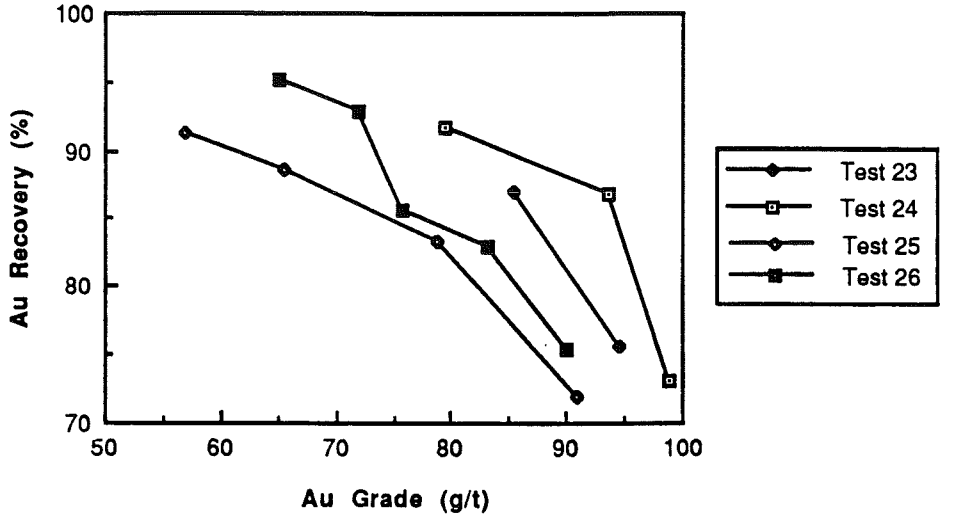
The pyrite/gold recovery relationship for Tests 26 and 33 are almost identical and similar to that for Test 48.

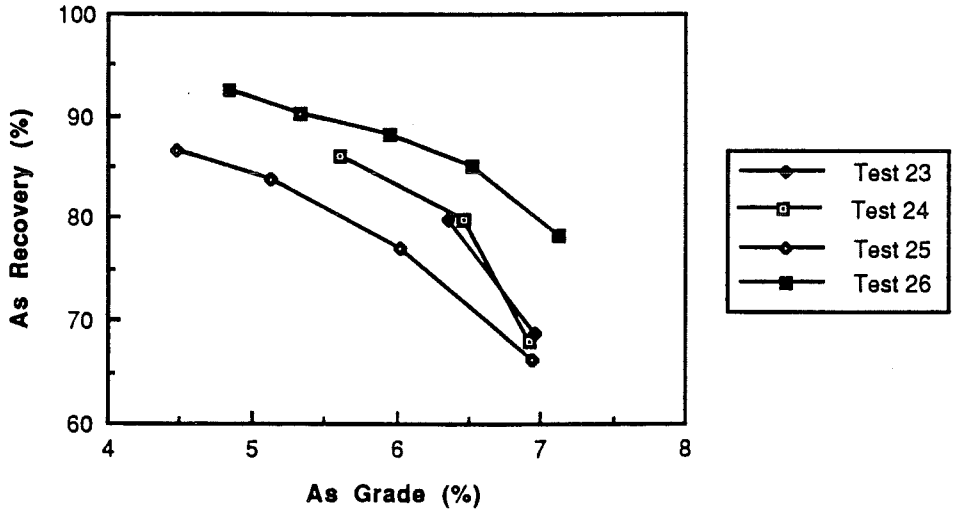
The arsenopyrite/gold recovery relationship for Test 33 is very similar to Test 48 where we have a one-to-one relationship. Test 26 is different with this relationship 0.6 to 1. The reason for this is not known.

The grade/recovery relationships for these two series of tests are given in Figure 14 for Tests 23-26 and Figure 15 for Tests 31-33.

For the series of Tests 22-26, with the notable exception of Test 25, the grade/recovery relationships are equivalent. Again, for the series of Tests 31-33 the grade/recovery relationships are equivalent. It is to be expected that these curves would be equivalent because the test conditions for each comparable stage are identical. Test 25 gave poorer metallurgical results than the other tests in that series. The reason for this is not known.

Tests 23 - 26 - Grade versus Recovery





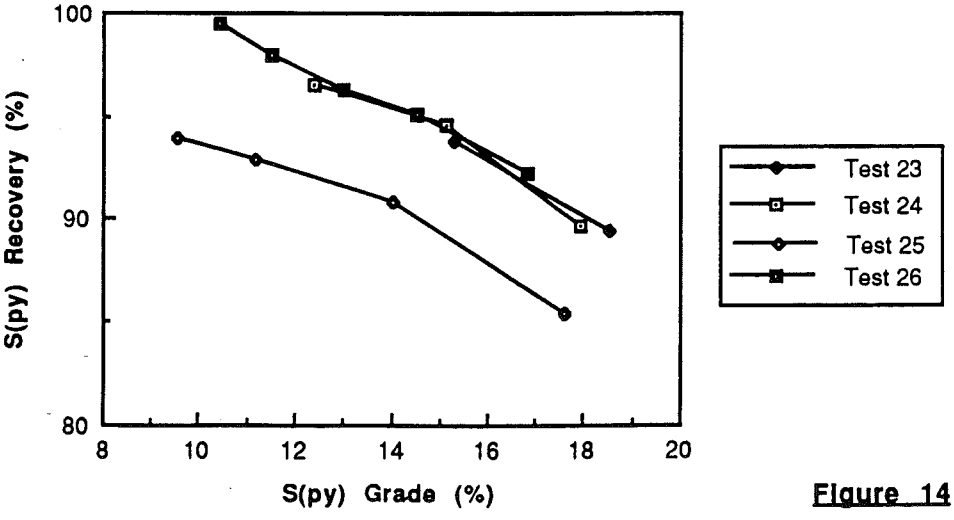


Figure 14

Tests 31 - 33 - Grade versus Recovery

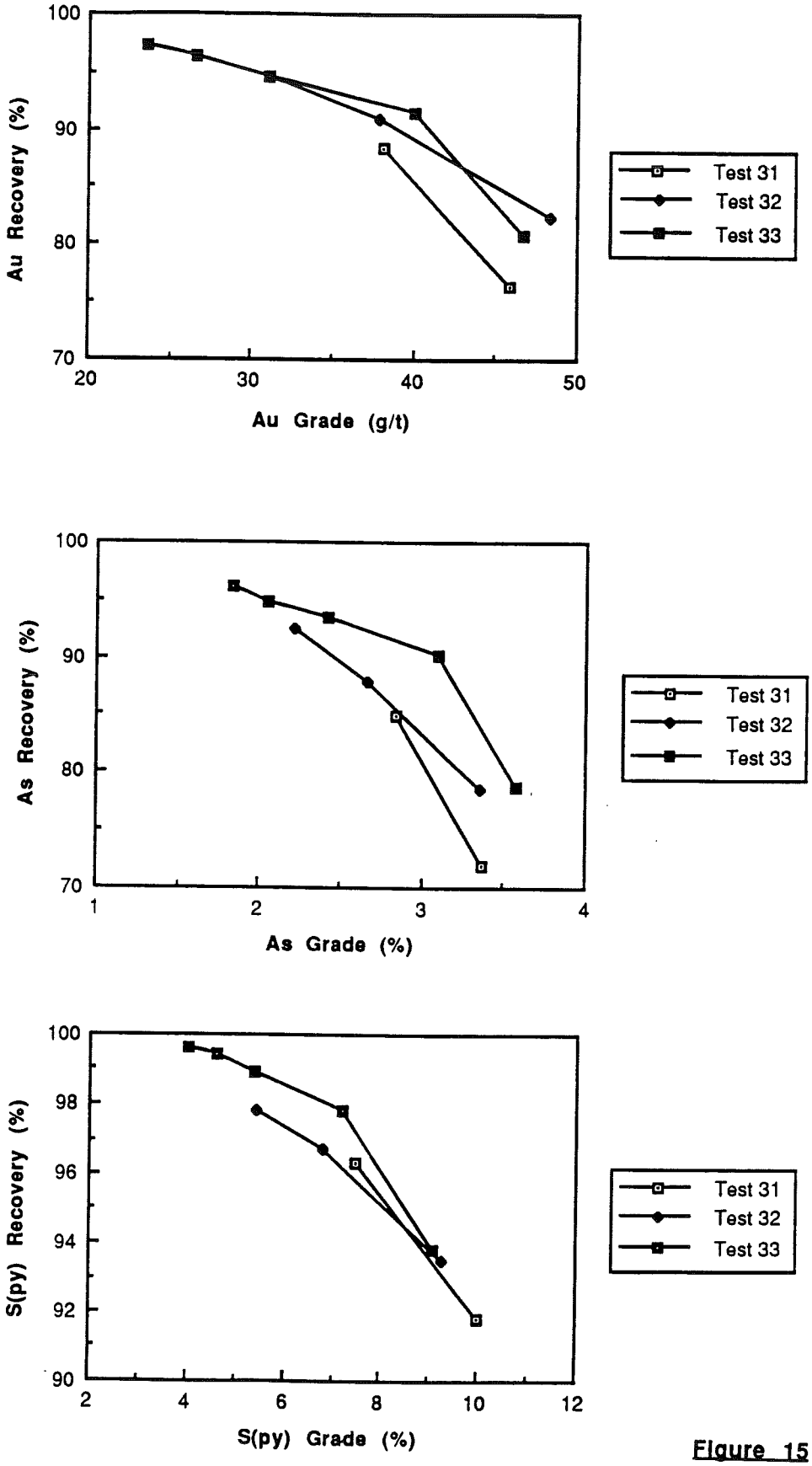


Figure 15

3.5 Primary Grind Analysis

Tests 39 to 42 were conducted with varying primary grind size. Each flotation test then consisted of a timed rougher flotation series with concentrates being removed after 1, 2, 4, 6, 9 and 12 minutes of flotation time. Grind times for the series were 13 minutes for Test 39, 20 minutes for Test 40, 25 minutes for Test 41 and 30 minutes for Test 42.

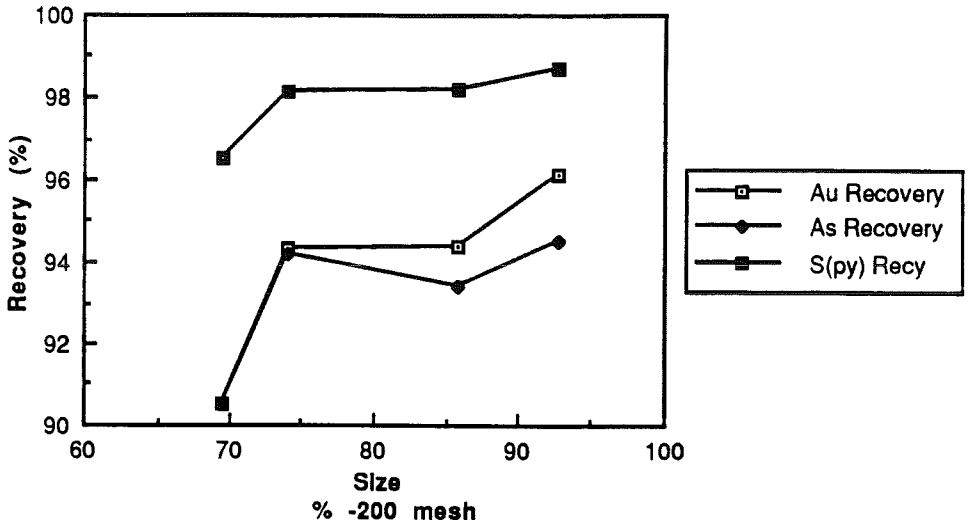
Products from these tests were sized. The 13 minute grind gave 69.5% passing 200 mesh, 20 minutes gave 74% passing 200 mesh, 25 minutes gave 85.8% passing 200 mesh and for 30 minutes a size of 92.7% passing 200 mesh was achieved.

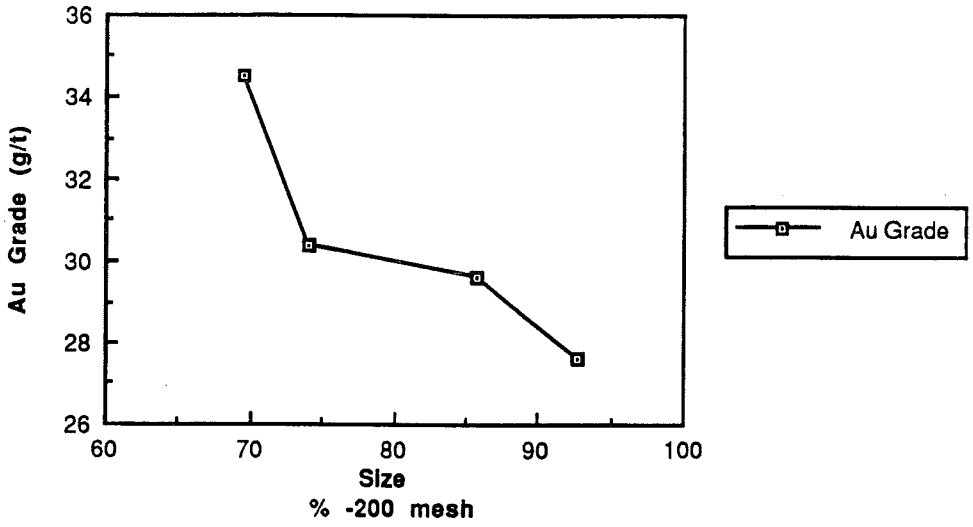
The results from these tests are given graphically. In Figure 16 the recovery versus size and grade versus size relationships are given. The Au recovery/S grade relationship can be seen on Figure 17.

From Figure 16 it can be seen that total gold and sulphide mineral recovery improves with the finer primary grind. However, the concentrate grade is decreasing with the finer grinds.

The grade/recovery relationship given on Figure 17 shows an interesting trend. The top ends of these curves are all equivalent but at the higher grade section of the curves, the finer grind gave a poorer metallurgical response. That is, the selectivity in the first rougher stages of the finer grind tests was poorer for valuable mineral against gangue minerals. This data suggests that the approach of a rougher tail regrind is desirable.

Tests 39 - 42 - Primary Grind Analysis





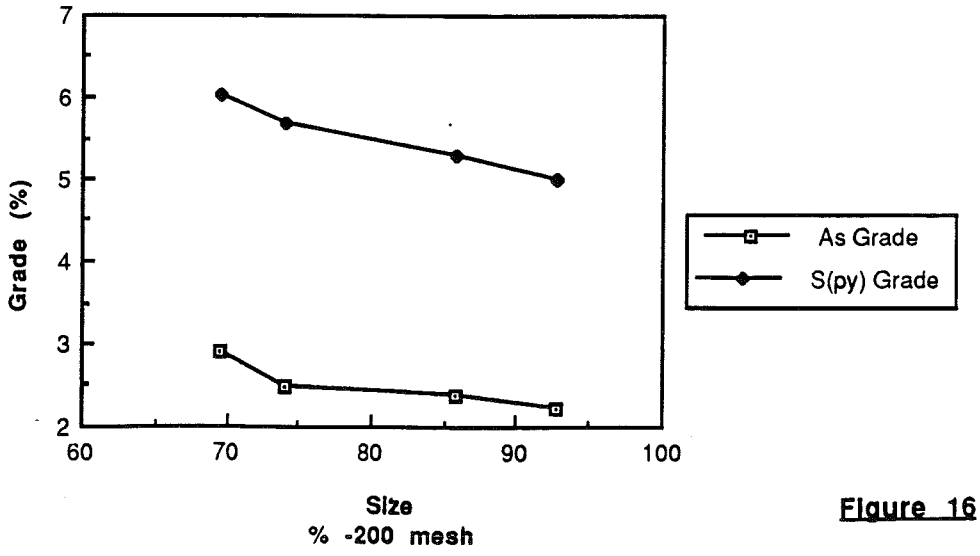
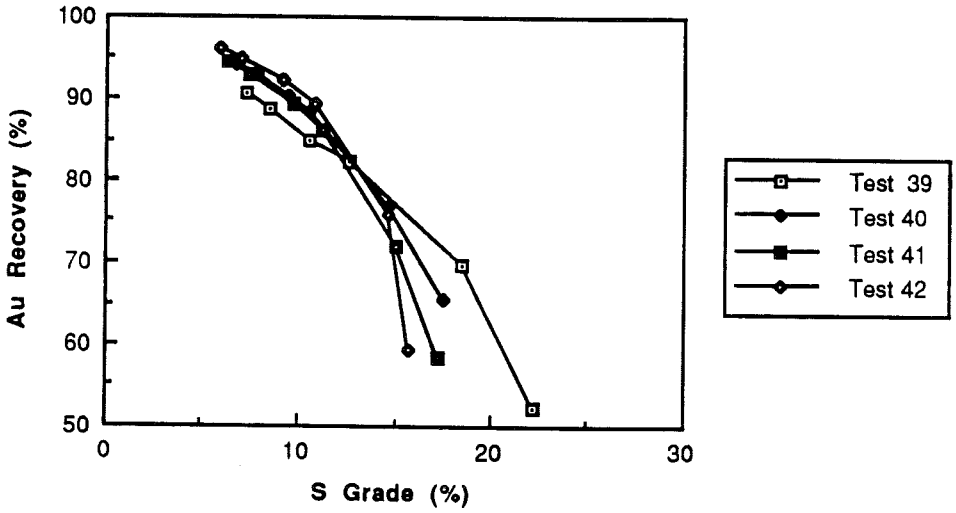


Figure 16

Tests 39-42 - Primary Grind Analysis

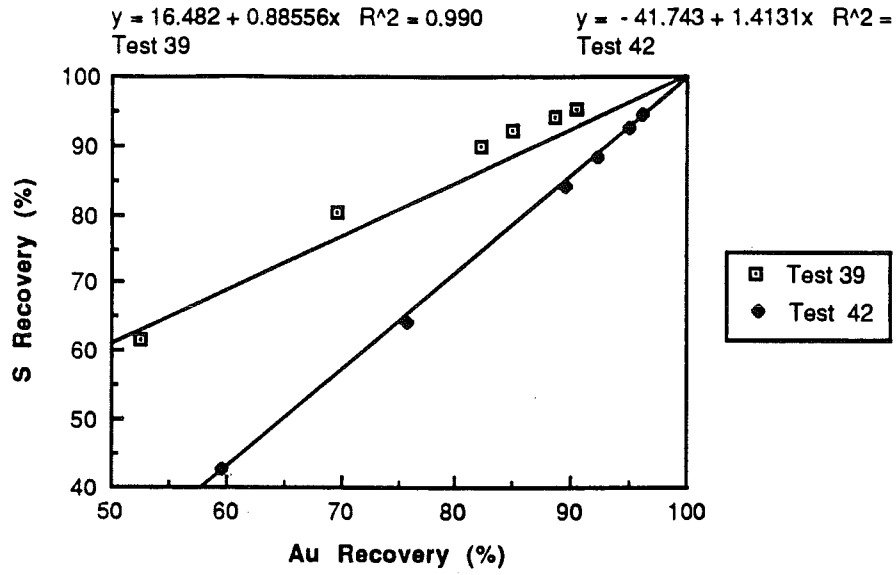
Figure 17

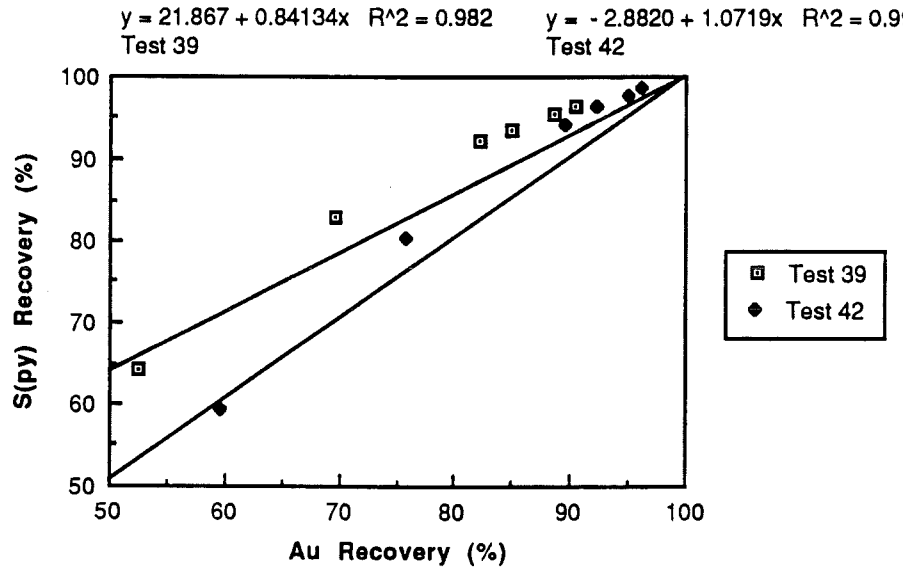


The findings in this series of tests adds weight to the observation from the stage tailing regrind series that fineness of grind is important in achieving maximum gold and sulphur recovery.

The sulphur and sulphide recovery versus gold recovery is given in Figure 18. Only the results from the two size extremes, being tests 34 and 42, are plotted.

All these graphs show that, for equivalent Au recovery, higher sulphur and sulphide mineral recoveries are required at coarser grinds. This result is expected because of the probable higher degree of sulphide mineral liberation at the finer grind.


y = 16.482 + 0.88556x R^2 = 0.990
Test 39
y = - 41.743 + 1.4131x R^2 = 0.999
Test 42
S Recovery (%)
Au Recovery (%)
Test 39
Test 42


y = 21.867 + 0.84134x R^2 = 0.982
Test 39
y = - 2.8820 + 1.0719x R^2 = 0.991
Test 42
S(py) Recovery (%)
Au Recovery (%)
Test 39
Test 42

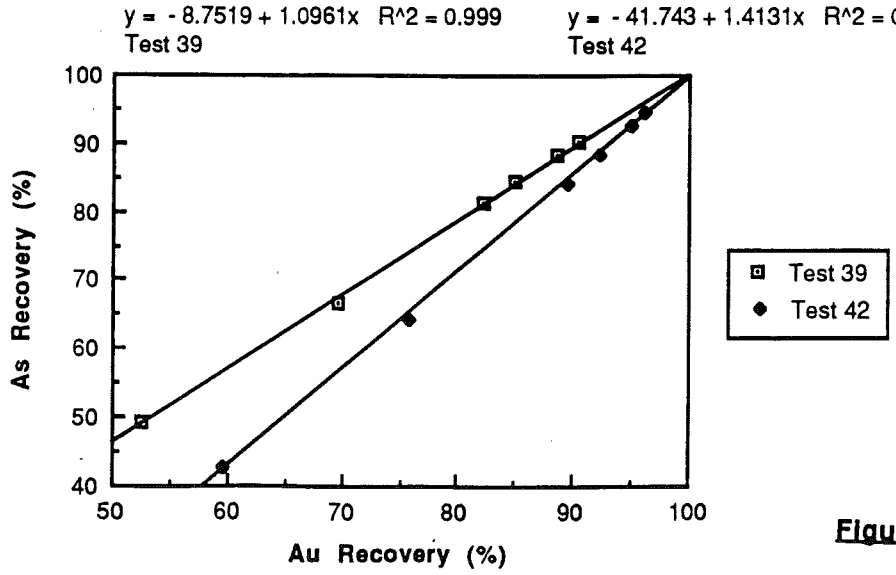

y = - 8.7519 + 1.0961x R^2 = 0.999
Test 39
y = - 41.743 + 1.4131x R^2 = 0.999
Test 42
As Recovery (%)
Au Recovery (%)
Test 39
Test 42

Figure 18

3.6 Pulling Rate Analysis

Because of the observation from Tests 22-26 versus Tests 31-33 that pulling rates had a pronounced effect on metallurgical performance it was decided to include two tests to specifically look at this aspect. These are Tests 43 and 44.

Tests 43 and 44 are equivalent in all parameters except pulling rate. Test 43 is pulled hard and deep while Test 44 is pulled shallow and slow. Float times were limited to 3, 3 minute roughers, so it was not to be expected that total gold and sulphur recovery would be high with the short flotation time.

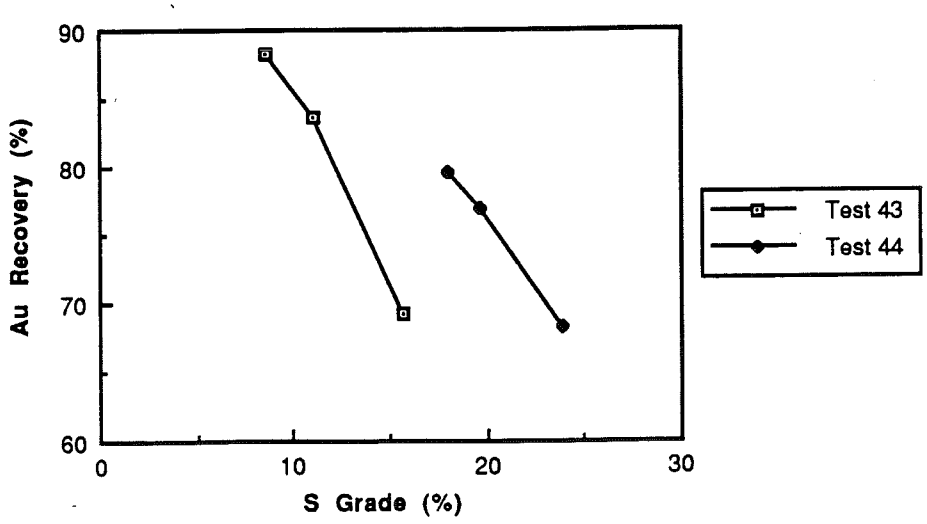
The sulphur grade/gold recovery curve for these tests is given in Figure 19.

The total sulphur and gold recovery is higher in Test 43 than Test 44, however, the metallurgical performance shows a superior curve for Test 44 versus Test 43.

These tests support the observation from the tailing stage regrinding series that improvements in metallurgical performance can be achieved by flotation cell operating technique. The slow/shallow pulling rate gives superior metallurgical performance than hard/deep pulling rate.

Tests 43 - 44 - Pulling Rate Analysis

Figure 19



3.7 Reagent Modifications

A few tests were run on varying reagent regrime and reagent addition points. A summary of these tests is given in Table 7.

Table 7

Test No.	Comment	Compare With
20	Use of Na_2CO_3 (at 35.9 kg/t)	Test 19
27	Addition point of $CuSO_4$ varied from grind to conditioner	Test 22
28A	No $CuSO_4$ and use of Na_2SiO_3	Test 22, Test 27, Test 28B
28B	Na_2SiO_3 and $CuSO_4$	Tests 22, Test 27, Test 28A
36	Xanthate collector (Aero 343/Aero 350 at 3:1 mix)	Test 37, Test 38
37	Xanthate collector (343/350 mix as above) with Aerofloat 208 80:20	Test 36, Test 38
38	Xanthate collector (343/350 mix as above) with Aerofloat 208 60:40	Test 35, Test 37

Use of Soda Ash

Results from test with soda ash is given in Table 8.

Table 8

Test No.	Product	Soda Ash (kg/t)	Grade		Recovery	
			Au (g/t)	S (%)	Au (%)	S (%)
19	Cleaner Conc.	0	121	23.9	86.4	91.6
	Rougher + Scav.Conc.		86.9	17.1	90.6	95.4
20	Cleaner Conc.	35.9	113	20.3	91.1	94.0
	Rougher + Scav.Conc.		74.5	13.7	94.7	97.4

This result does not suggest a positive metallurgical advantage in using soda ash and it is considered that the level of soda ash trialled here is practically excessive.

$CuSO_4$ Addition Point

Results comparing CuSO4 addition point are given in Table 9.

Table 9

Test No.	Product	Addition Point	Grade		Recovery	
			Au (g/t)	S (%)	Au (%)	S (%)
22	Rougher Conc. Grind	Primary	94	20.6	83.4	90.6
27	Rougher Conc. Conditioner	Flotation Feed	65.7	13.9	87.9	93.9

These results do not indicate any preferential addition point for $CuSO_4$ addition. From Test 27 onwards $CuSO_4$ was added to the flotation feed conditioner.

Use of Sodium Silicate

Results from Tests 22, 27, 28A and 28B are given in Table 10.

Table 10

Test No.	Product	$CuSO_4$ Addition (g/t)	Na_2SiO_3 Addition (g/t)	Grade		Recovery	
				Au (g/t)	S (%)	Au (%)	S (%)
22	Rougher Conc.	80	-	94.0	20.6	83.4	90.6
27	Rougher Conc.	80	-	65.7	13.9	87.9	93.9
28A	Rougher Conc.	-	250	59.6	14.0	79.0	89.9
28B	Rougher Conc.	80	250	50.9	81.2	84.4	93.2

Test 28A gave the poorest result overall. Test 28B is also poor relative to Tests 22 and 27.

From these results it is concluded that the use of Na_2SiO_3 shows no metallurgical advantage.

Use of Aerofloat 208 with Xanthate Collector

Tests 36 to 38 were run to examine the use of Aerofloat 208 collector in combination with xanthate collector.

In Test 36, only xanthate collector is used. The xanthate collector used was a blend of Aero Xanthate 343/Aero Xanthate 350 at a ratio of 3:1. This blend of xanthate collectors was used in all the flotation testwork carried out in this program.

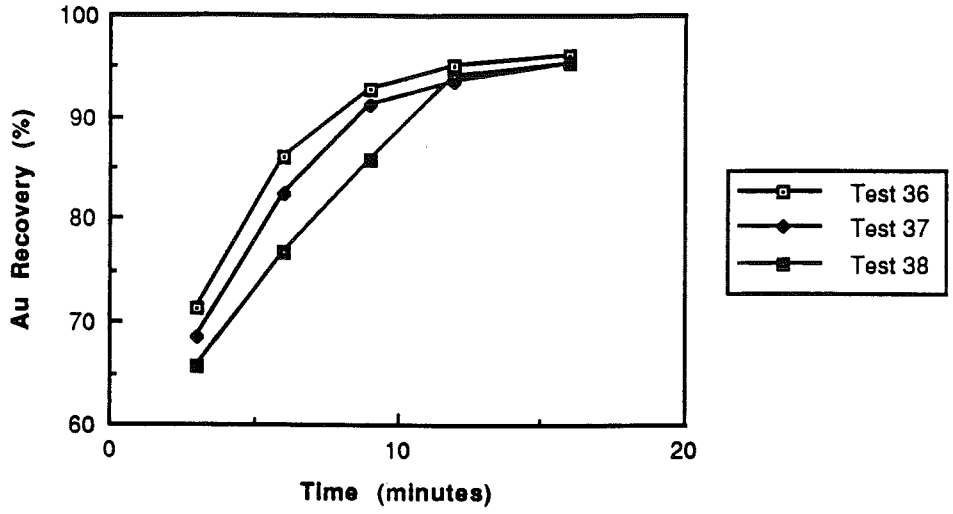
Test 37 uses Aerofloat 208 and xanthate collectors at a ratio of 20:80. In Test 38 this ratio of Aerofloat 208 to xanthate was changed to 40:60.

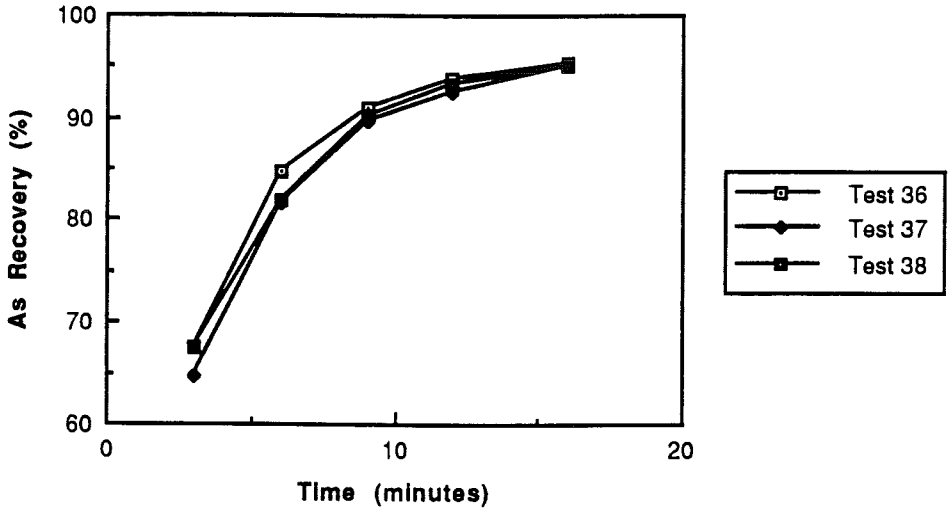
The recovery of gold and sulphide minerals versus time is given in Figure 20.

These graphs show that the rate of recovery of pyrite and arsenopyrite is unchanged between Tests 36 to 38 but the gold recovery rate is a little slower for Tests 37 and 38 versus Test 36.

The total recovery of gold and sulphide minerals is equivalent for each of these tests.

Tests 36 - 38 - Collector Series





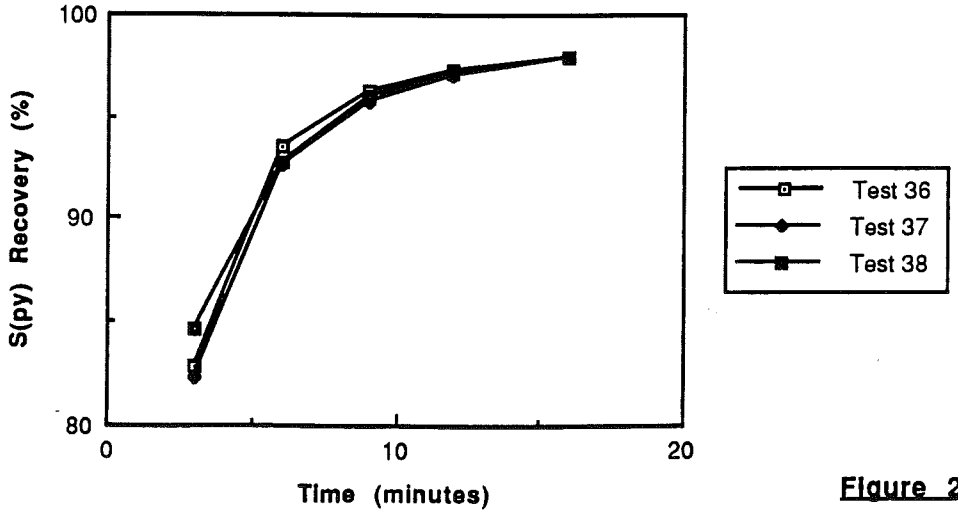
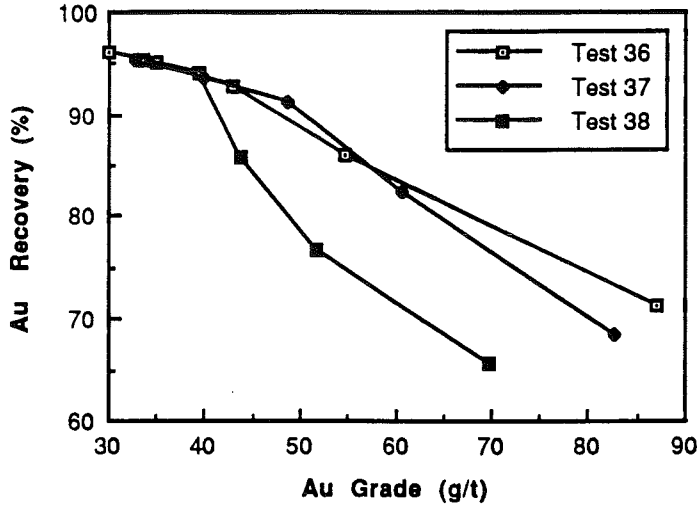
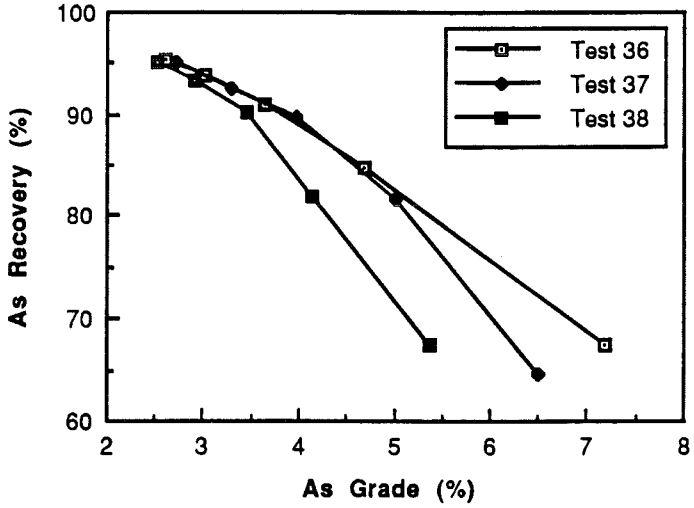


Figure 20

Tests 36 - 38 - Collector Series





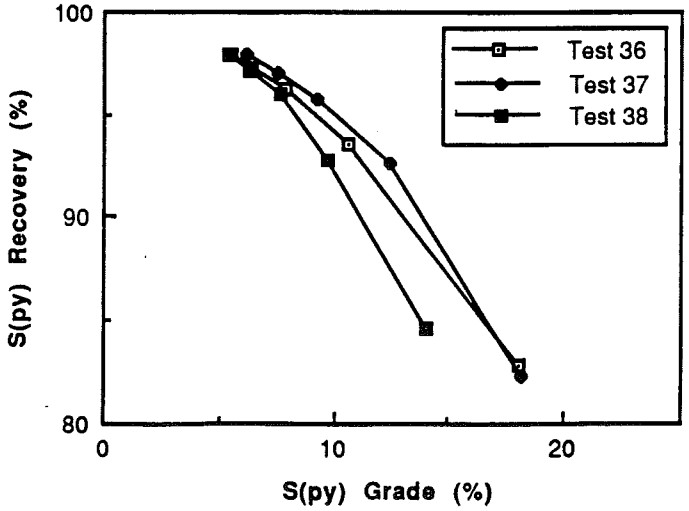


Figure 21

The grade/recovery relationships from Tests 36 to 38 is given in Figure 21. These graphs show that metallurgical performance of Test 38 is poorer than the other tests. The best results from these tests was achieved with the xanthate collector alone.

3.8 Flowsheet Development I

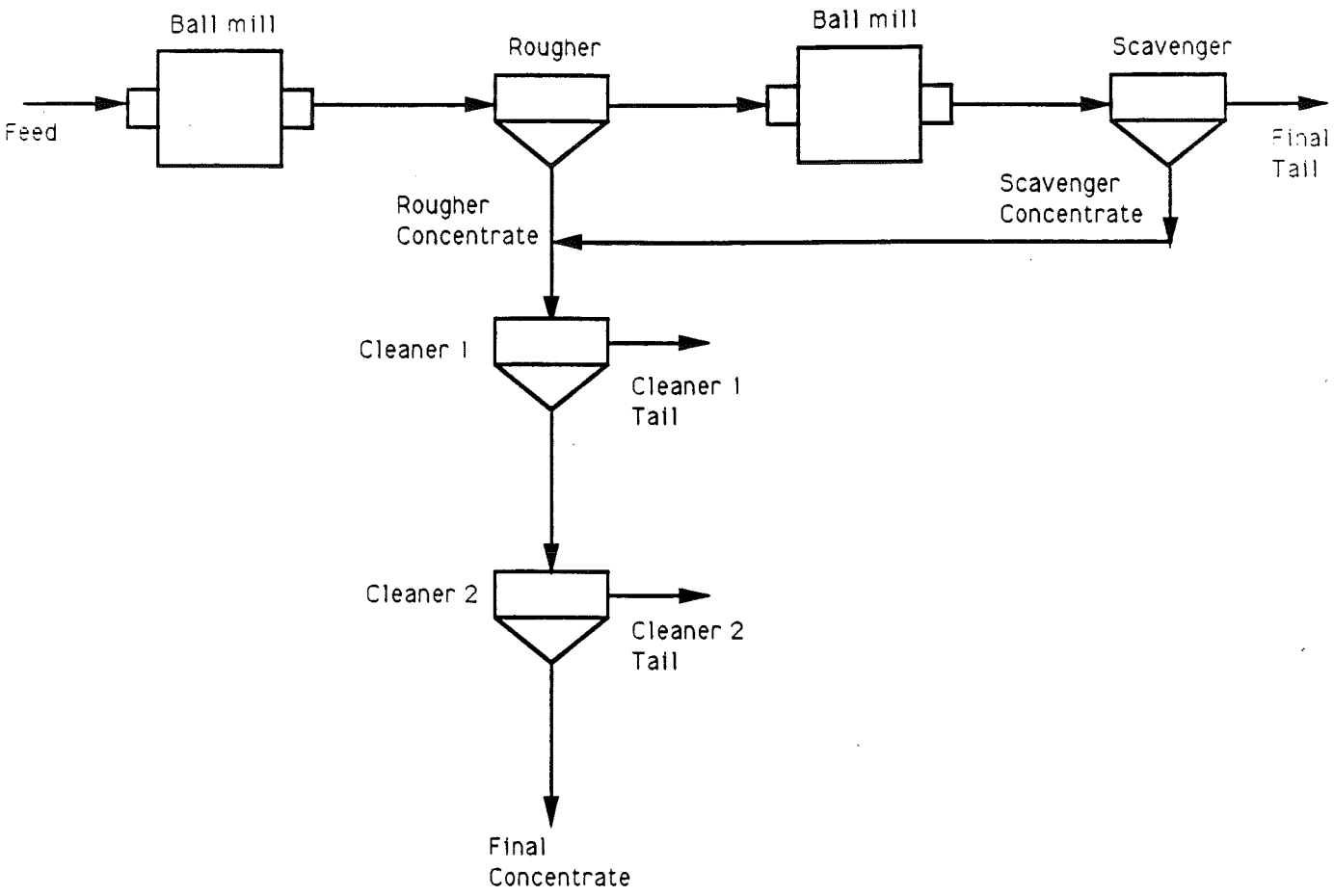
Tests 19, 29 and 34 are considered here. Test 19 cleans the combined rougher and scavenger concentrate once. In Test 29 two cleaning stages are included and in Test 34 three cleaning stages are included. These flowsheets are shown in Figure 22.

The results from the tests are given in Table 11.

Table 10

Test No.	Au		S		Internal Au recovery (%)	Internal S recovery	Enrichment Ratio	
	Grade (g/t)	Rec. (%)	Grade (%)	Rec. (%) (%)			Au	S
19								
Rougher	86.9	90.6	17.1	95.4	90.6	95.6	9.3	9.8
Cleaner 1	121	86.4	23.9	91.6	95.4	96.0	1.4	1.4
29								
Rougher	59.4	91.2	13.4	98.6	91.2	98.6	6.75	7.3
Cleaner 1	106.2	81.0	24.9	90.9	88.8	92.2	1.8	1.9
Cleaner 2	125	76.8	29.8	87.5	94.8	96.2	1.2	1.2
34								
Rougher	24.3	96	5.3	98.2	96	98.2	2.85	2.9
Cleaner 1	72.3	77.0	16.9	84.7	80.2	86.3	3.0	3.2
Cleaner 2	141.4	73.7	33.1	81.4	95.7	96.1	2.0	2.0
Cleaner 3	148	70.8	34.9	78.6	96.1	96.6	1.05	1.05

Figure 22 - Flowsheet Test 29



First cleaner performance from these three tests is given graphically in Figure 23.

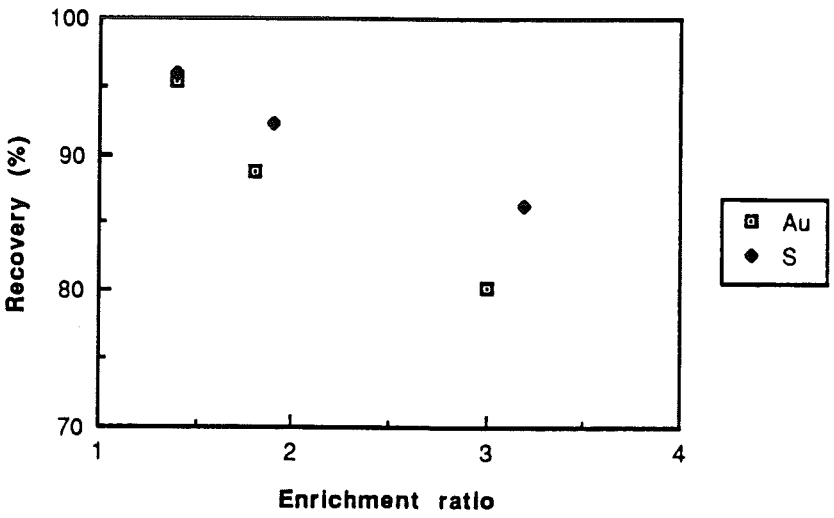
Target concentrate grade has been achieved with one stage cleaning in Tests 19 and 29.

Figure 23 shows that recovery losses to the first cleaner tail increases significantly as the enrichment ratio increases. Thus the lower the first cleaner feed the higher the cleaner recovery losses will be to maintain target concentrate grade.

Cleaner 2 and 3 concentrate grades in Test 29 and 34 are very high against target concentrate grade. There is little reason to go to this many stages of cleaning.

Tests 19, 29 and 34 - First Cleaner Performance

Figure 23



3.9 Flowsheet Development II

Five tests were conducted to examine several flowsheet parameters including scavenger concentrate regrind, scavenger concentrate cleaning, very long flotation time and very fine rougher tail regrinding.

These tests are:

Test 45 - Scavenger concentrate cleaning.

Test 46 - Regrind scavenger concentrate and then clean.

Test 47 - Combine rougher and scavenger concentrates and then clean.

Test 50 - Long scavenger flotation time; circuit pulled hard. Scavenger concentrate reground and cleaned. Rougher concentrate cleaned.

Test 51 - Very fine rougher tail regrind; long scavenger flotation time; circuit pulled slow. Scavenger concentrate cleaned. Rougher concentrate cleaned.

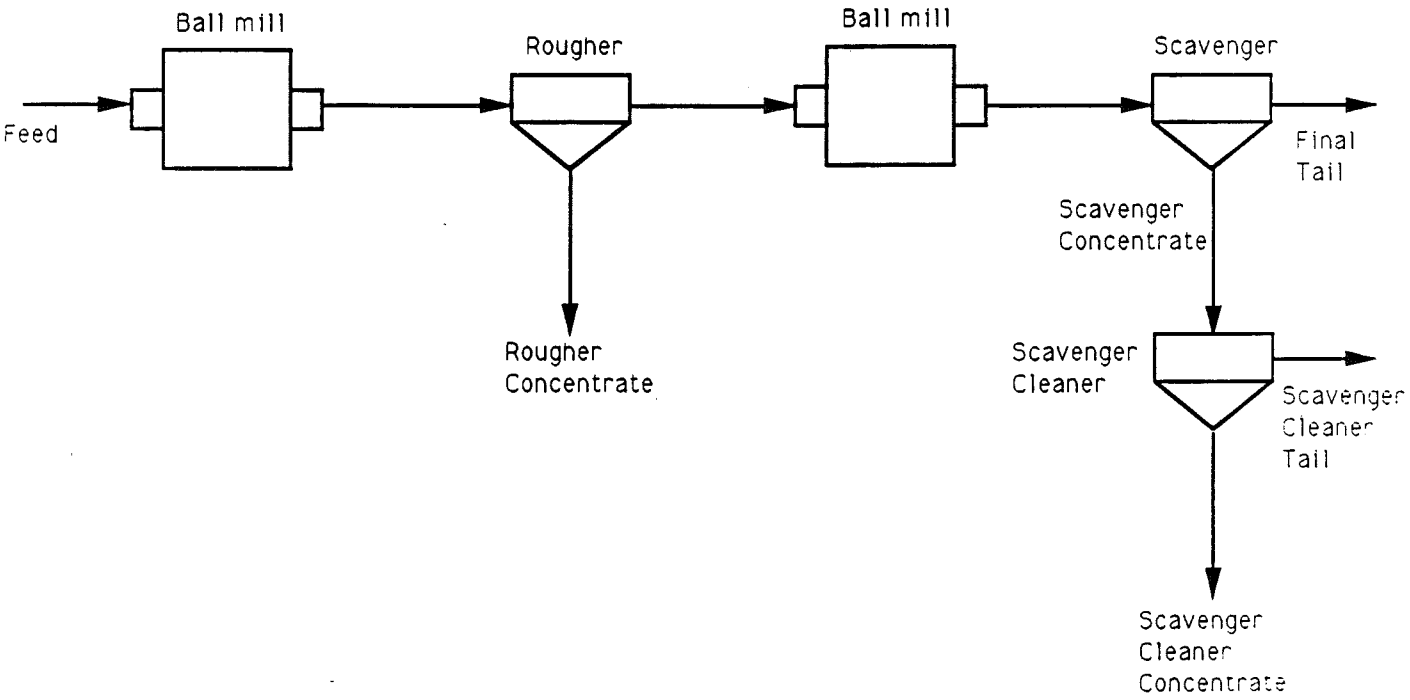
The flowsheets from these circuits is given in Figure 24 and 22 (For Test 47).

Results for Test 45-47 are given in Table 12 and the results for Test 50 and 51 are given in Table 13.

Table 12

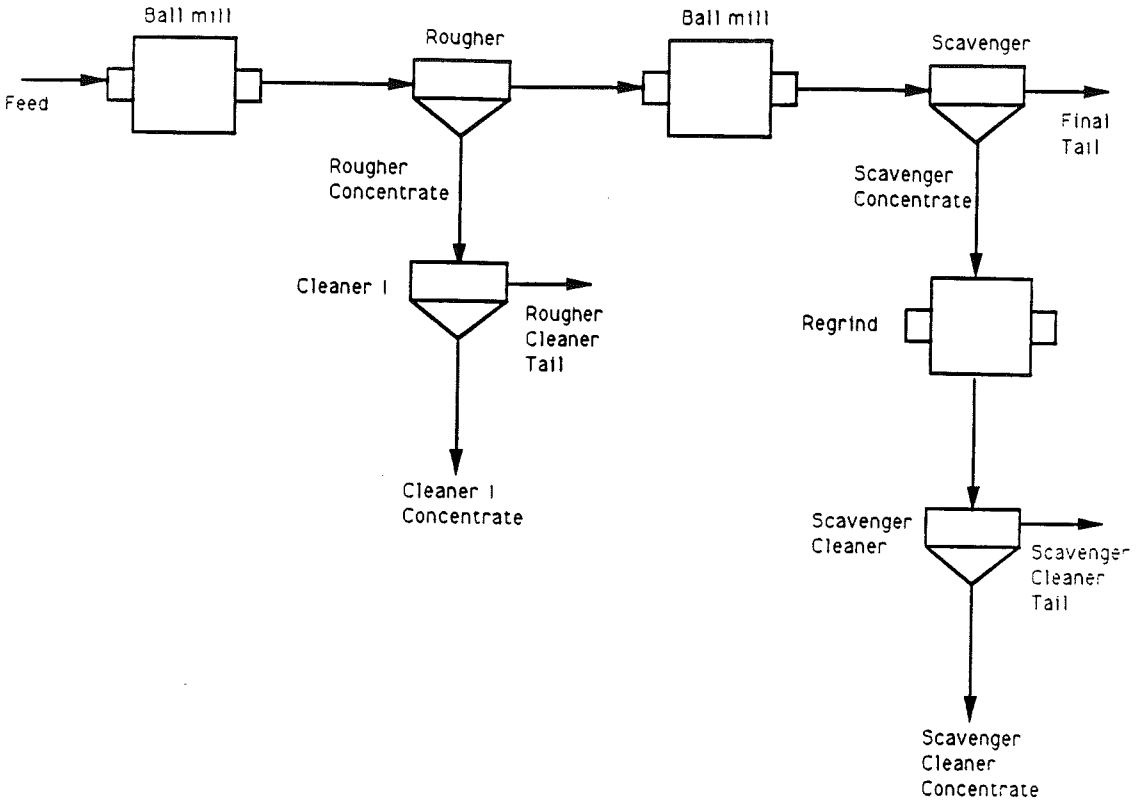
Test No.	Product	Grade Au (g/t)	Grade S (%)	Recovery Au (%)	Recovery S (%)	Internal Recovery Au (%)	Internal Recovery S (%)	Enrichment Ratio Au	Enrichment Ratio S
45	Rougher Concentrate	105	22.9	80.6	88.6	80.6	88.6	11.3	12.4
	Scavenger Concentrate	38.9	4.1	10.4	5.5	53.6	48.2	18.6	17.8
	Rougher + Scav. Conc.	88.0	18.1	91.0	94.1	91.0	94.1	9.5	9.8
	Scav. Cleaner Conc.	143.0	11.5	7.5	3.1	72.1	56.4	3.7	2.8
	Ro. + Scav. Cleaner Conc.	107.5	22.2	88.1	91.7	-	-	-	-
46	Rougher Conc.	106	23.6	73.1	83.7	73.1	83.7	11.6	13.3
	Scavenger Concentrate	54.8	6.1	16.9	9.6	62.8	58.9	20.8	19.6
	Rougher + Scav. Conc.	90.2	18.2	90.1	93.4	90.1	93.4	9.9	10.2
	Scav. Cleaner Conc.	212	17.6	9.8	4.2	58.0	43.8	3.9	2.9
	Ro. + Scav. Cl. Conc.	112.3	23.2	82.9	87.9	-	-	-	-
47	Rougher + Scav. Conc.	78.5	16.8	89.7	93.3	89.7	93.3	9.2	9.7
	1st Cleaner Concentrate	115	25.0	83.7	88.7	93.3	95.1	1.5	1.5
	2nd Cleaner Concentrate	122	26.8	80.1	85.8	95.7	96.7	1.1	1.1

Figure 24 Flowsheet - Test 45 and 51



Summary

Figure 24 Flowsheet - Test 46 and 50



Of the three tests above the best overall result at target concentrate grade is Test 45 with grade of 107.5 g/t Au and 22.2% S and recoveries of 88.1% Au and 91.7% S. This result is achieved with the combination of scavenger cleaner concentrate with rougher concentrate.

Table 13

Test No.	Product	Grade		Recovery		Internal Recovery		Enrichment Ratio	
		Au (g/t)	S (%)	Au (%)	S (%)	Au (%)	S (%)	Au	S
50	Rougher Concentrate	108	25.7	78.5	86.7	78.5	86.7	11.7	12.9
	Rougher Cleaner Conc.	129	31.2	75.0	83.9	95.5	96.8	1.2	1.2
	Scavenger Concentrate	7.04	0.9	16.9	10.1	78.6	75.9	3.3	3.1
	Scavenger Cleaner Conc.	36.7	4.2	12.6	6.6	74.6	65.3	5.2	4.7
	Combined Cleaner Conc.	94.7	21.2	87.6	90.5	-	-	-	-
	Ro. Conc.+ Scav. Cl.Conc.	85.0	18.8	91.1	93.3	-	-	-	-
	Rougher + Scav. Conc.	30.5	6.7	95.4	96.8	95.4	96.8	3.3	3.4
51	Rougher Concentrate	98.7	23.9	71.3	82.9	71.3	82.9	10.6	12.3
	Rougher Cleaner Conc.	130	31.9	68.1	80.2	95.5	96.7	1.3	1.3
	Scavenger Concentrate	32.4	3.42	19.5	9.9	67.9	57.9	11.2	9.5
	Scavenger Cleaner Conc.	129	12.5	17.3	8.1	88.7	81.8	4.0	3.7
	Combined Cleaner Conc.	129.8	27.8	85.4	88.3	-	-	-	-
	Ro.Conc.+ Scav. Cl.Conc.	103.6	22.0	88.6	91.0	-	-	-	-
	Rougher + Scav. Conc.	68.5	14.6	90.9	92.8	90.9	92.8	7.3	7.5

Test 51 ended up with a slightly better overall result than Test 50. Test 51 rougher and scavenger cleaner concentrate combined product has a grade of 103.6 g/t Au and 22.0% S with recoveries of 88.6% Au and 91.0% S. The most grade equivalent product in Test 50 is the combined cleaner concentrate. This had a grade of 94.7 g/t Au, 21.2% S at a recovery of 87.6% Au and 90.5% S.

The overall result for Test 51 is slightly better than Test 50 despite the total rougher and scavenger concentrate recovery being lower. Test 51 has 90.9% Au and 92.8% S recovery while in Test 50 this is 95.4% Au and 96.8% S. The losses of gold and sulphur to the scavenger cleaner tail are greater for Test 50 than Test 51.

Test 51 overall result is very similar to Test 45. Test 51 has a very fine rougher tail regrind and long flotation time. Test 45 uses a much shorter rougher tail regrind and shorter flotation time. Both circuits use scavenger concentrate cleaning.

The failure of Test 51 to achieve very high total recoveries of gold and sulphur is inconsistent with the findings of Tests 26 and 33 (fine rougher tail regrinds) and Test 42 (fine primary grind). The reason for this is not known. Possible reasons are either that reagent conditions are not optimised for this very fine grind or that there has been some sample oxidation over time in the test program.

However the result of Test 51, total gold and sulphur recovery, does say that conclusive support for fine rougher tail regrind does not exist.

The best circuits operated here (Tests 45 and 51) both use slow pulling rates and scavenger cleaner concentrate combined with rougher concentrate to give final concentrate.

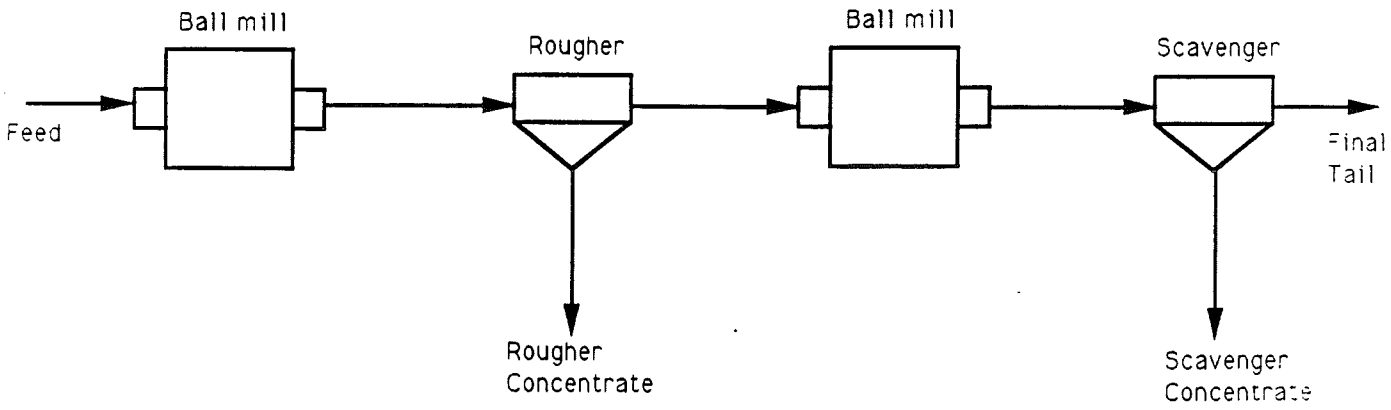
In Test 46 losses of gold and sulphur recovery to the scavenger cleaner tail are quite high after the scavenger concentrate regrind. Scavenger cleaner concentrate recovery is 58% Au and 43.8% S. This is similar to what occurred with scavenger concentrate regrinding in Test 50.

In Test 47 all rougher and scavenger concentrates are cleaned. As with results from Tests19 and 29, target concentrate grade is achieved with one stage of cleaning. However the 1st cleaner concentrate of 115 g/t Au, 25.0% S grade and 83.7% Au and 88.7% S recovery is poorer than the best overall results from Tests 45 and 51 (in both cases, where target product is combined rougher concentrate and scavenger cleaner concentrate).

From this testwork the best circuit has these features: slow pulling rates, scavenger concentrate cleaning with scavenger cleaner concentrate combined with rougher concentrate to give final concentrate. The necessity for a very fine rougher tail regrind is not proven. Total flotation time is long (Test 45 has 6 minutes rougher flotation and 10 minutes scavenger flotation), but even longer flotation times have not been proven to improve the metallurgy.

The results from Tests 45 and 51 are compared below to the results from Test 48, comparing near equivalent sulphur grade products. (Test 48 produces only rougher and scavenger concentrate. Flowsheet for Test 48 is given in Figure 25.)

Figure 25 Flowsheet - Test 48



		Grade		Recovery	
		Au (gpt)	S (%)	Au (%)	S (%)
Test 45	Rougher + Scav. Cleaner Conc.	107.5	22.2	88.1	91.7
Test 51	Rougher + Scav. Cleaner Conc.	103.6	22.0	88.6	91.0
Test 48	Rougher Concentrate	94.6	23.0	73.3	86.0
Test 48	Rougher + Scav. 1 & 2 Conc.	90.3	19.8	88.3	93.2
Test 48	Inferred product	92.2	22.0	78.0	88.2

The equivalent sulphur grade product for Test 48 has been calculated at 22.0% S and is listed above as the inferred product.

On gold grade and recovery the results for Tests 45 and 51 are better than Test 48. Overall sulphur recovery between these three tests is similar although the inferred product is slightly lower than that achieved in Tests 45 and 51.

It is to be expected that in a closed circuit system the results for Tests 45 and 51 will further improve with gold and sulphur recovery with the recycling of the scavenger cleaner tail.

4. CYANIDATION TESTWORK

The cyanidation testwork program is in four groups. These are:

a) cyanidation of mill feed
b) cyanidation of reground flotation tailing
c) cyanidation of all flotation products
d) calcine residue testwork.

4.1 Cyanidation of Mill Feed

Mill feed was ground for 30 minutes, giving a size of 90% passing 200 mesh and then cyanided for 48 hours at 0.5 gpl NaCN. This was done in Tests 11, 12 and 35. Tests 11 and 35 are identical in all conditions. In Test 12 the pH for cyanidation is 10.0 whereas it is 11.0 in the other two tests. The results for these tests are given in Table 14.

Table 14

Test No.	NaCN Solution g/L	pH	NaCN Consumption kg/t	Lime Consumption kg/t	Calc. Head Au (g/t)	Au Recovery (%)
11	0.5	11.0	1.05	0.74	9.53	51.4
12	0.5	10.0	1.23	0.0	9.83	51.4
35	0.5	11.0	1.23	0.68	9.17	53.3

These results are all very consistent with around 52% gold recovery by cyanidation from ground mill feed. The pH variance from Test 11 to Test 12 made no difference to the overall result or the NaCN consumption. Lime consumption at pH 10.0 was nil.

4.2 Cyanidation of Reground Flotation Tailing

For the two series of rougher tailing regrind flotation testwork (Tests 22-26 and Tests 31-33) the final scavenger tailing was taken and cyanided at 1.0 g/L NaCN. This was also done on Test 27 and Test 51. Test 51 was a very fine tailing regrind. The objective of this program was to see if there is any improvement in gold cyanide recovery with increasing fineness of grind. These results are given in Table 15.

The sizing given for each grind time is inferred from the series of batch grinding versus size (Test 10). In Test 51 the tailing size was 100% -200 mesh and 97.6% -400 mesh.

Table 15

Test No.	% -200 mesh	Flotation Tail Au (g/t)	pH	NaCN Cons. kg/t	Lime Cons. kg/t	Residue Assay Au (g/t)	Au Cyanide Recovery (%)	Total Au Recovery (%)
22	55	1.67	10.0	0.8	0.16	1.07	35.5	89.3
23	80	1.36	10.0	0.8	0.22	0.97	32.6	91.2
24	90	0.96	10.0	0.78	0.22	0.59	36.9	94.7
25	95	0.94	10.0	0.82	0.22	0.65	32.9	94.2
26	95	0.61	11.0	0.36	0.42	0.28	47.2	97.4
27	55	1.29	11.0	0.44	0.32	0.71	40.8	92.8
31	80	1.38	11.0	0.7	0.53	0.78	40.0	93.0
32	90	0.83	11.0	0.35	0.54	0.45	44.9	97.0
33	95	0.43	11.0	0.36	0.54	0.24	43.8	98.4
51	100	0.97	11.0	0.73	0.73	0.82	24.6	93.1

* Total Au recovery is the sum of flotation and subsequent cyanidation recovery.

These results are given graphically in Figures 26-29.

There is a very good correlation between gold residue analysis and both arsenopyrite content and gold content in the flotation tailing (Figure 27).

There is a fair correlation between arsenopyrite content in the flotation tailing and gold cyanide recovery (Figure 26).

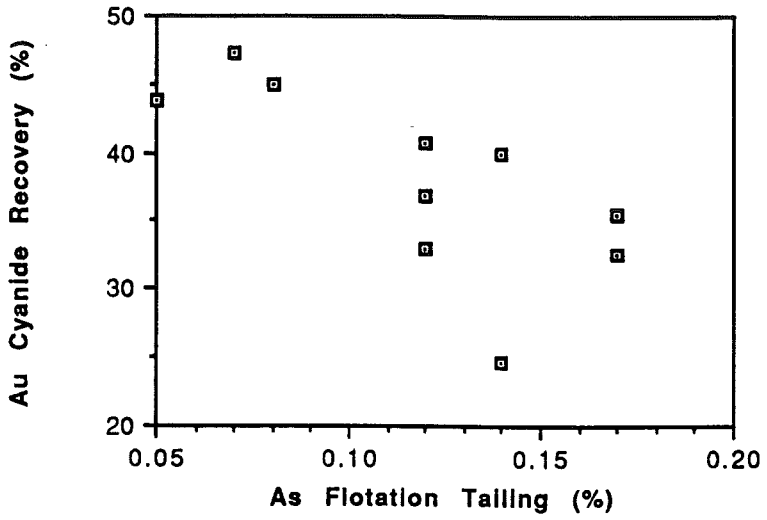
There is a very good correlation between arsenopyrite in the flotation tailing and total gold recovery from both flotation and cyanidation (Figure 29).

All this data shows well that the cyanide recovery of gold from flotation tailings is dependant on the amount of arsenopyrite present, which is dependant on the flotation circuit recovery. The lowest levels of arsenopyrite in the flotation tailings gave the highest level of gold cyanide recovery from those tailings and therefore the highest total gold recovery.

Figure 28 shows no relationship between size (over the range tested) and gold recovery or gold residue assay.

Summary

Cyanidation Testwork - Au Cyanide Recovery vs Feed Assays



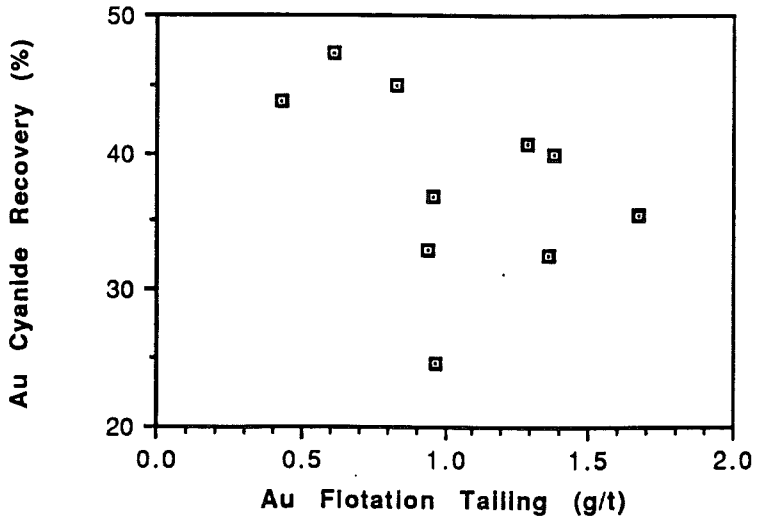
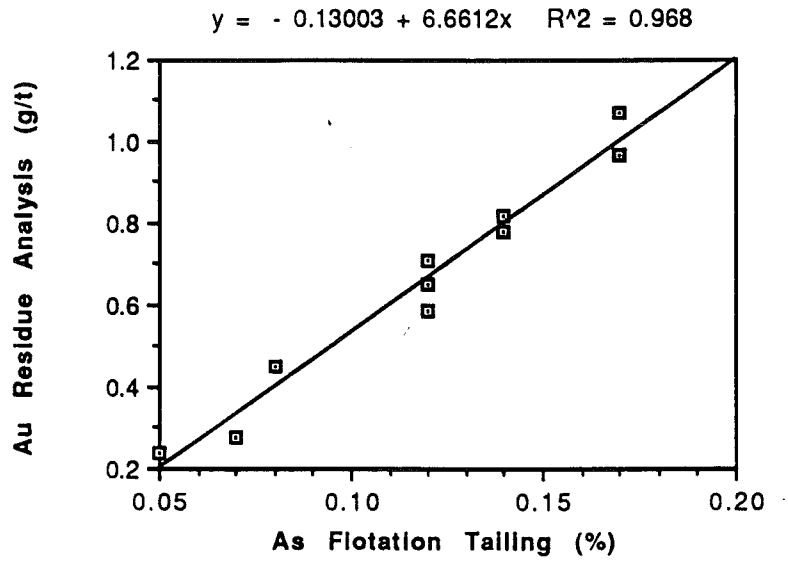


Figure 26

Cyanidation Testwork - Au Residue Assay vs Feed Assays



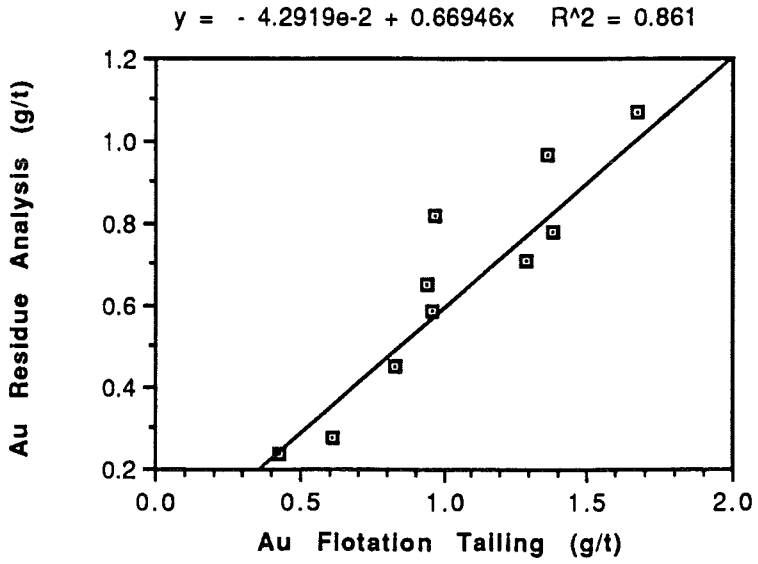
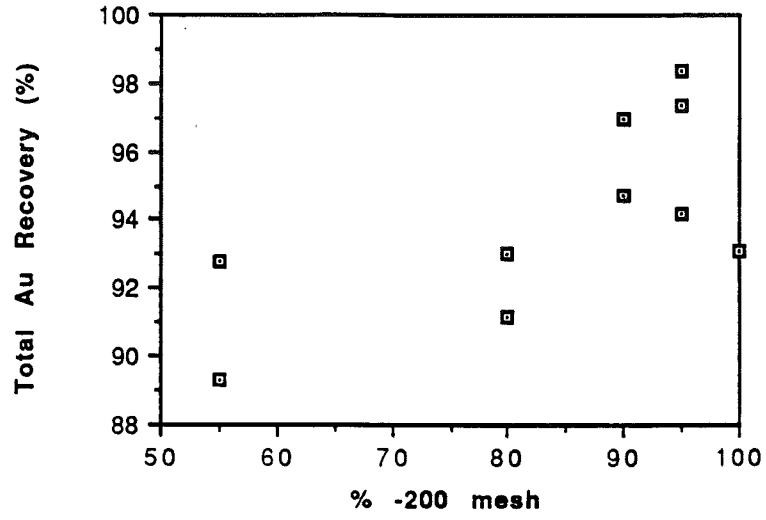


Figure 27

Cyanidation Testwork - Size vs Gold Recovery



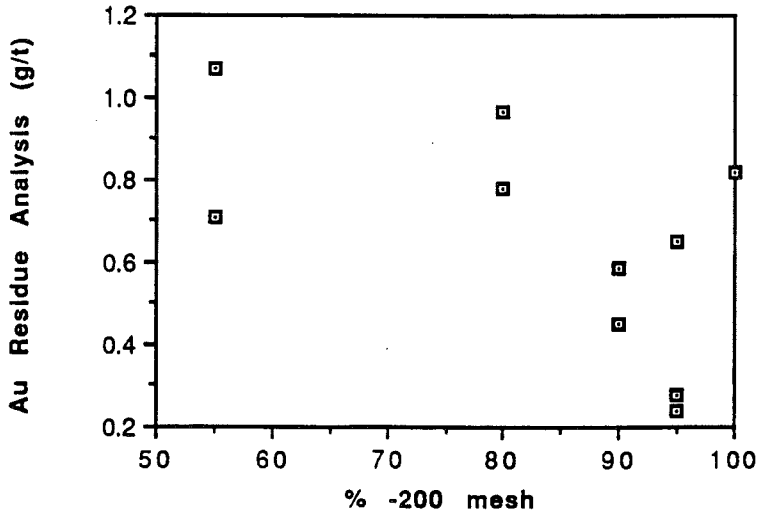
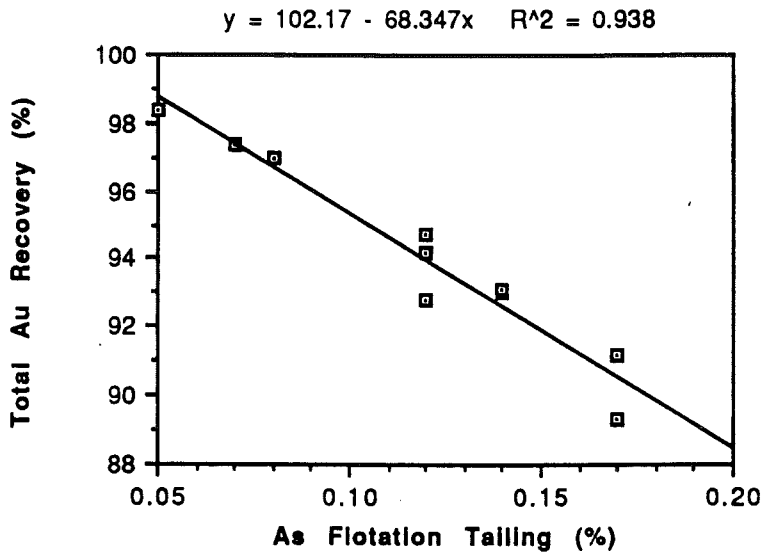


Figure 28

Cyanidation Testwork

Figure 29



4.3 Cyanidation of Flotation Products

Flotation Test 30 was conducted to produce products for cyanidation. Test 30 consisted of 13 minutes primary grind, 6 minutes rougher flotation, 8.75 minutes rougher tailing regrind and 8 minutes scavenger flotation. Rougher and scavenger concentrates and scavenger tailings were all cyanided. The results from this test are given in Table 16.

Table 16

Product	Wt. %	Grade Au (g/t)	Grade S (%)	Recovery Au (%)	Recovery S (%)	NaCN Soln. g/L	pH	NaCN Cons. kg/t	Lime Cons. kg/t	Au Cyanide Recovery (%)
Rougher Conc.	7.5	99.4	21.5	79.8	88.4	5.0	9.5	4.9	0	54.2
Scav. Conc.	6.2	19.9	2.46	13.1	8.3	5.0	9.5	7.4	0	40.2
Scav. Tail	86.3	0.77	0.07	7.1	3.3	1.0	11.0	0.2	0.57	37.6
Recalculated Feed	100.0	9.35	1.83	100.0	100.0	-	-	-	-	51.2

The cyanide gold recovery in the rougher concentrate is the highest of the three products and this indicates that exposed gold in the feed is preferentially concentrated to the rougher concentrate. The cyanide gold recovery in the scavenger concentrate is close to the level in the scavenger tailing. This suggests that the gold in the scavenger concentrate and scavenger tailing is predominantly associated in forms other than exposed gold.

4.4 Calcine Residue Testwork

Three tests were conducted on calcine residue to examine possible routes to recovering gold lost in this product. In Test 17 and 49 fine regrind of calcine residue is examined. In Test 18 the use of gravity concentration is examined. The results for Tests 17 and 49 are given in Table 17 and the results from Test 18 are given in Table 18.

Table 17

Test No.	Grind Time (minutes)	-14 micron (%)	NaCN Solution gpL	pH	NaCN Cons. kg/t	Lime Cons. kg/t	Au Cyanide Recovery (%)	Residue Assay Au (g/t)	Comment
17	30	57.2	2.0	11.0	1.25	0.79	17.4	2.76	
49	45	81.7	2.0	11.0	2.43	1.07	11.8	2.47	
	-	-	-	-	-	-	20.8	-	Pre-wash Cyanide Solution

Table 18

Product	Concentrate Au grade (g/t)	Concentrate Au Recovery (%)
Mozley Concentrate	2600	4.5
Wilfley Concentrate	9.71	27.7

The total gold recovered from cyanidation has improved from 17.4% in Test 17 to 32.6% in Test 49. This suggests that the very fine regrind of the calcine residue has improved the gold cyanide recovery. However the total recovery is still low.

The gold recoveries in the gravity concentration testwork are poor.

CONCLUSIONS

Nine samples were received from Giant Yellowknife for a range of testwork. These samples were:

Sample	Assay		
	Au (g/t)	As (%)	S (%)
Roaster Feed	104	9.36	21.3
Transfer Dust	129	1.96	11.2
Roaster Calcine	137	1.75	4.66
Calcine Residue	2.4	1.46	4.24
Hot Cottrell Dust	49.6	2.61	1.23
Dust Treatment Residue	8.13	3.03	1.33
Classifier overflow	9.9	1.07	2.79
Flotation Tail	0.73	0.076	0.06
Mill Feed	9.75	0.75	1.93

The testwork program was in three areas:

a) gold association determination for all but mill feed sample

b) flotation testwork on the mill feed sample

c) cyanidation testwork on mill feed sample, flotation products and calcine residue sample.

The available gold content in the roaster feed was 43.7%, going to 81.8% in the transfer dust and 86.4% in the roaster calcine. The calcine residue had a surprisingly high content of available gold at 23.2% -33.0% (two tests carried out). The Hot Cottrell dust had 85.6% available gold, with most of this being recovered in the process cyanidation as the dust treatment residue had only 8.5% available gold. Most of the gold being lost in the dust treatment residue is associated with arsenates at 83.7% of the gold. Most of the gold being lost in the calcine residue is associated with arsenates and unreacted sulphides with the total of these two being 62.8 - 75.5% (two tests).

The flotation program demonstrated some important fundamentals in the flotation of the Giant Yellowknife mill sample.

The necessity for long flotation time in the scavengers was demonstrated. However very long flotation time only gave very small recovery gains.

The recovery of pyrite to the rougher/scavenger concentrate can be very high with some tests achieving plus 99% pyrite recovery. However difficulty in achieving very high arsenopyrite recovery was a consistent problem in this program. Maximum arsenopyrite recovery achieved was 95%. This suggests that the significant component of gold being lost to scavenger tailing is associated with arsenopyrite.

The test program showed a strong relationship between gold recovery and sulphide recovery with high gold recovery requiring high sulphide recovery.

No conclusive relationship between fineness of grind and gold recovery could be demonstrated over a range of 55% -200 mesh to 97% passing 200 mesh.

Flotation cell operating technique was demonstrated to have a significant effect on metallurgical performance. Operating cells with slow pulling rates gave superior metallurgical performance to hard pulling rates.

A new flowsheet was developed with superior performance to the existing flotation plant flowsheet. This circuit consists of primary grind to 55% passing 200 mesh, 6 minutes rougher flotation, rougher tailing regrind to 80% passing 200 mesh, 10 minutes scavenger flotation and then one stage scavenger cleaning with 3 minutes flotation time. The rougher concentrate and scavenger cleaner concentrates are combined as final product. This flowsheet is given in Figure 30. An open circuit batch test on this circuit gave the following result:

Grade:	Au (g/t)	S (%)	Recovery:	Au (%)	S (%)
Ro. and Scav. Cl. Conc.	107.5	22.2		88.1	91.7
Scavenger Cl. Tail	13.2	2.25		8.8	2.4
Scavenger Tail	0.93	0.12		9.1	5.9

It is to be expected that this result would improve in overall gold and sulphur recovery with the recycling of the scavenger cleaner tail.

Extensive cyanidation work on scavenger tailing showed no relationship between gold cyanidation recovery and scavenger tailing size. The gold cyanidation recovery was between 25-45% for these tests. A strong relationship between arsenopyrite content of the scavenger tailings and cyanide gold recovery from thee tailings was demonstrated, with best gold cyanide recovery being achieved with lowest arsenopyrite level in the tailings.

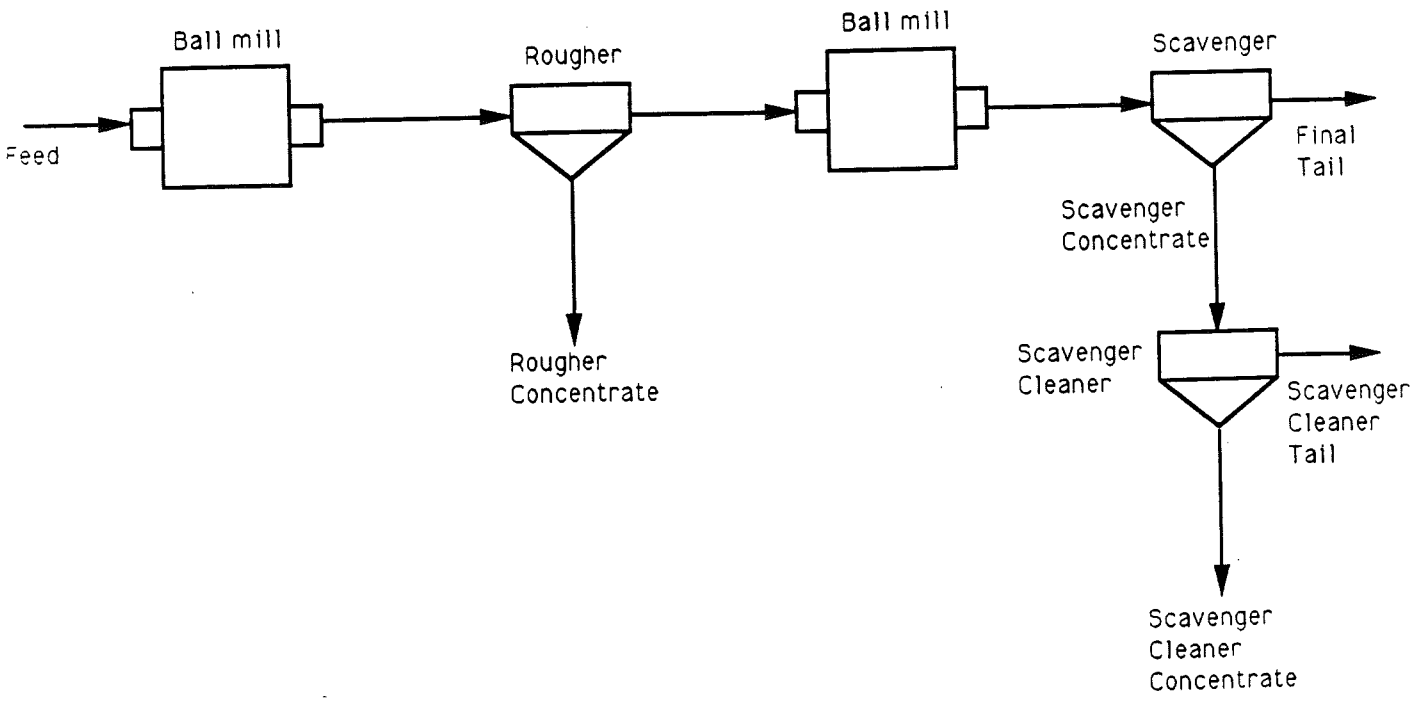
Cyanidation of mill feed ground to 90% passing 200 mesh gave about 52% gold recovery.

Cyanidation of flotation products showed higher gold cyanide recovery in the rougher concentrate than scavenger concentrate and scavenger tailing. This information suggests preferential concentration of the exposed gold to the rougher concentrate.

Calcine residue sample was given a very fine regrind and then cyanided. The gold cyanide recovery was only 32.6% after an 80% passing 14 micron regrind.

Gravity concentration testwork on calcine residue was unsuccessful with poor gold recoveries to the concentrate.

Figure 30 - Recommended Flowsheet



RECOMMENDATIONS

This test program has consisted of scoping tests to establish basic information about samples of Giant Yellowknife ore and process products. The flotation testwork has indicated some potential improvement in process performance with flowsheet modification. Further work in this area is required to determine whether overall improvement in gold/sulphur recovery will be seen with the suggested modified circuit. It is recommended that this testwork should include a laboratory locked scale test comparing the new circuit with the existing circuit.

The importance of cell operating technique on metallurgical performance suggests that column flotation cells may be applicable to Giant Yellowknife ore. It is recommended that testwork be carried out with columns for either scavenging or scavenger cleaning roles.

An Investigation of

THE RECOVERY OF GOLD

from samples of Giant Yellowknife Mines ore

submitted by

GIANT YELLOWKNIFE MINES LTD.

Progress Report No. 2

Project No. L.R. 3785

NOTE:

This report refers to the samples as received.

LAKEFIELD RESEARCH
A DIVISION OF FALCONBRIDGE LIMITED
March 13 1990

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ABSTRACT

Testwork was carried out examining fine grinding of both calcine residue and mill feed samples of Giant Yellowknife Mines Limited. The objective was to improve gold recovery with very fine grinding of these samples.

Gold cyanide recovery of calcine residue improved with very fine grind. Neither gold or sulphide recovery changed over a large range of grinds examined with the mill feed sample.

INTRODUCTION

This report details additional testwork conducted on samples of ore and calcine residue from Giant Yellowknife Mine, Yellowknife, NWT. The samples were submitted by Giant Yellowknife Mines Ltd. These tests are continuations of test programs described in Progress Report No. 1 (Project No. 3785), February 1, 1990.

The test program consisted of flotation and cyanidation of these samples.

The results and direction of testwork was discussed with Mr. Gary Halverson of Giant Yellowknife Mines Ltd.

LAKEFIELD RESEARCH

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Manager - Mineral Processing

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Senior Metallurgist

Experimental work by: L. Paquette

SUMMARY

1.0 Sample Description

Samples used in this testwork were mill feed and calcine residue. A complete description of these samples is included in Progress Report No. I (Project No. 3785).

2.0 Testwork

2.1 Calcine Residue Regrinding

Three tests were conducted on calcine residue, with fine grinding. The results from these tests are summarised in Table 1.

Table 1

Test No.	Grind Time (mins)	-10 Micron (%)	NaCN Consump. (kg/t)	Lime Consump. (kg/t)	Au Cyanide Recovery	Au Residue (g/t)	Comments
17	30	49.1	1.25	0.79	17.4	2.76	
49	45	73.1	2.43	1.07	11.8 (1) 20.8 (2)	2.47	Pre-wash (1) Cyanidation (2)
52	210	96.0	20.78	0.0	12.5 (1) 33.6 (2)	1.91	Pre-wash (1) Cyanidation (2)

The gold recovery from cyanidation improves with very fine regrinding. However, the cyanide consumption at the finest grind is extremely high.

2.2 Primary Grind Analysis

Tests 53, 54 and 55 were run to examine very fine primary grinds. These tests are an extension of Tests 39-42 reported in Progress Report No. 1 (Project No. 3785).

The results from these tests are given in Table 2 together with the results from Test 39-42 for comparison.

Table 2

Test No.	Grind Time (minutes)	-400 mesh (%)	Head (calc.) Au (g/t)	Rougher Conc. Grade			Recovery (%)		
				Au (g/t)	As (%)	S (%)	Au	Arseno.	Pyrite
53	40	82.1	9.53	56.8	4.32	11.15	93.2	87.9	95.9
54	60	89.6	9.69	64.6	4.86	12.8	93.3	88.8	95.2
55	75	97.5	9.42	44.5	3.48	8.61	94.5	89.7	95.8
39	13	53.3	9.18	34.5	2.90	7.26	90.5	90.5	96.5
40	20	55.8	9.25	30.4	2.48	6.73	94.3	94.2	98.1
41	25	64.3	9.15	29.6	2.39	6.32	94.4	93.4	98.2
42	30	71.8	9.38	27.6	2.23	5.95	96.1	94.5	98.7

The results from Tests 53-55 are given graphically in Figures 1 and 2.

These results show no relationship between grind size and either gold or sulphide recovery.

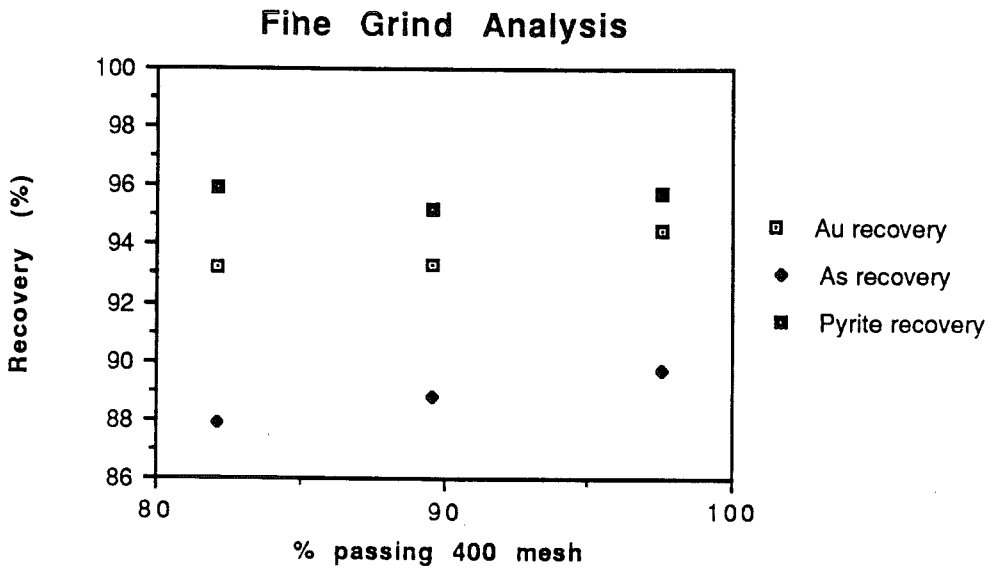
The final tailings from Tests 54 and 55 were cyanided. The results from these tests are given in Table 3.

Table 3

Test No.	Size -400 mesh	NaCN Consump. (kg/t)	Lime Consump. (kg/t)	Flotation Tails Au (g/t)	Flotation Tails As (%)	Au Cyanide Recovery (%)	Au Residue Assay (g/t)
54	89.6	0.53	0.93	0.57	0.10	39.0	0.35
55	97.5	0.76	0.88	0.59	0.10	30.9	0.41

There is no improvement in gold cyanide recovery with the finest primary grind.

Figure 1


Fine Grind Analysis
Recovery (%)
100
98
96
94
92
90
88
86
80
90
100
% passing 400 mesh
Au recovery
As recovery
Pyrite recovery

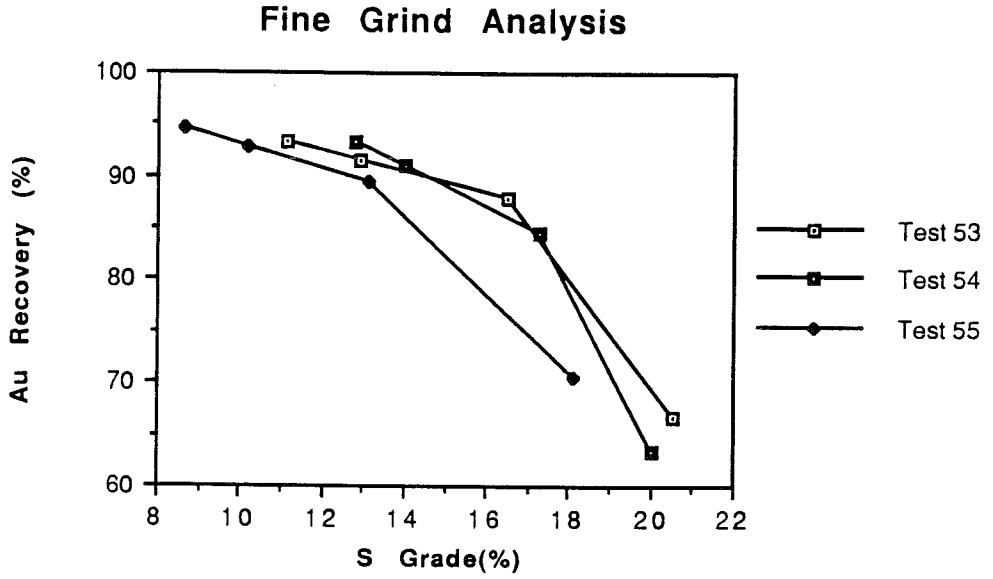
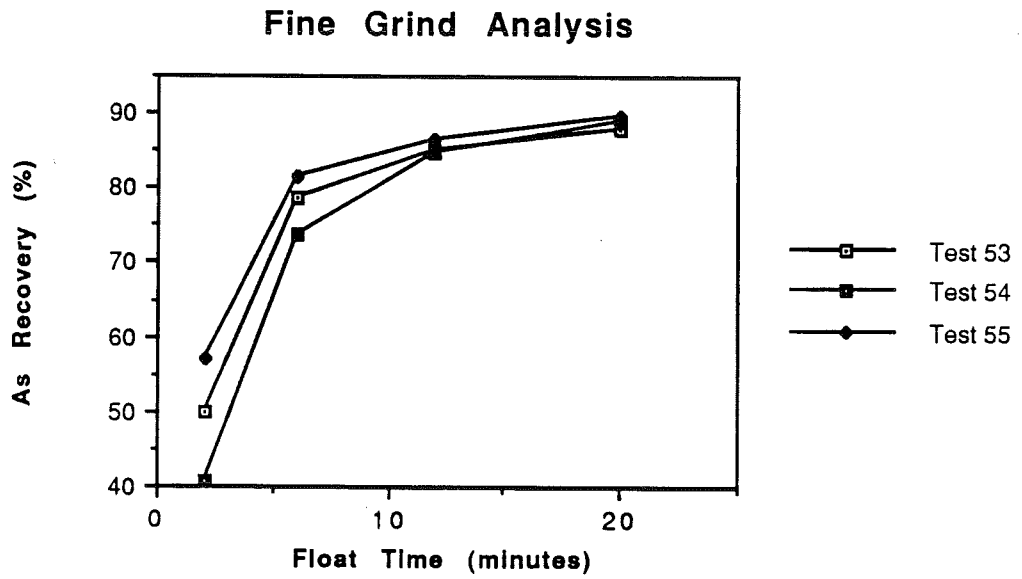
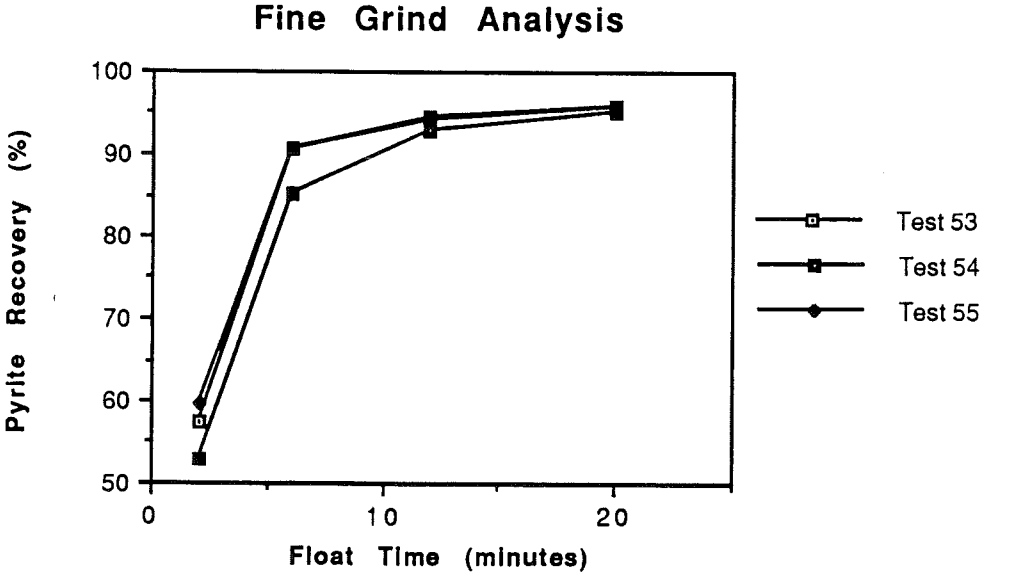

Fine Grind Analysis
Au Recovery (%)
100
90
80
70
60
8
10
12
14
16
18
20
22
S Grade(%)
Test 53
Test 54
Test 55

Figure 2


Fine Grind Analysis
As Recovery (%)
90
80
70
60
50
40
0
10
20
Float Time (minutes)
Test 53
Test 54
Test 55


Fine Grind Analysis
Pyrite Recovery (%)
100
90
80
70
60
50
0
10
20
Float Time (minutes)
Test 53
Test 54
Test 55

CONCLUSION

Testwork with calcine residue shows that very fine regrinding improves gold cyanide recovery.

Testwork with mill feed sample shows no relationship between grind size and gold or sulphide recovery from flotation.

TESTWORK DETAILS

Test No. 52 Project No. 3785 Operator: LP Date: 29/01/90

Purpose: To investigate the effect of a fine grind on the cyanidation response of the calcine residue with a water prewash prior to grinding.

Water Wash

Procedure: The sample was pulped to 33% solids, filtered and washed. The residue was repulped to 33% solids, filtered and washed again. The filtrate was assayed for Au.

Feed: 500 g calcine residue (Sample No. 4)

Test No. 52 Project No. 3785 Operator LP Date: 29/01/90

Cyanidation A

Procedure: The sample was pulped with water in a 2 liter bottle. NaCN and lime were added and the cyanidation was carried out on rolls in a 48 hour stage. The pulp was filtered and the residue washed three times with water.

Feed: 500 g Calcine Residue (Sample No. 4)

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 2.0 g/L NaCN

pH Range: 10.5-11.0 with Ca(OH)2

Grind: 210 minutes/500 g at 50 % solids in a lab rod mill

Reagent Consumption (kg/t of cyanide feed) NaCN: 20.78 CaO: 0.00

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 1.5	2.10	0.00	2.00	0.00	0.05	0.00	1.95	0.00	11.4-11.2
1.5 - 3.0	1.95	0.00	1.95	0.00	1.05	0.00	0.95	0.00	11.6-11.6
3.0 - 11.5	1.00	0.00	0.95	0.00	0.05	0.00	1.95	0.00	11.6-10.6
11.5 - 14	2.00	0.00	1.95	0.00	0.18	0.00	1.82	0.00	10.8-10.9
14 - 16.5	1.92	0.00	1.82	0.00	0.33	0.00	1.67	0.00	11.1-11.3
16.5 - 19	1.76	0.00	1.67	0.00	1.01	0.00	0.99	0.00	11.3-11.3
19 - 36	1.04	0.00	0.99	0.00	0.85	0.00	1.15	0.00	11.5-11.2
36 - 43	1.21	0.00	1.15	0.00	1.67	0.00	0.33	0.00	11.4-11.4
43 - 48	0.35	0.00	0.33	0.00	2.00	0.00	0.00	0.00	11.4-11.2
Total	13.33	0.00	12.81	0.00	2.00	0.00	10.81	0.00	

Test No. 52

Metallurgical Balance

Product	Amount	Assays (mg/L, g/t, %)			%Distribution		
	ml, g	Au	As	Fe	Au	As	Fe
Prewash Filtrate	2100	0.11	-	-	12.5	-	-
Cyanidation Filtrate	1820	0.34	-	-	33.6	-	-
Residue	520.1	1.91	1.31	32.1	53.9	-	-
Head (calc.)	500.0	3.69	-	-	100.0	-	-

Test No. 53 Project No. 3785 Date: Feb. 6/90 Operator: LP

Purpose: To repeat test 42 with a finer grind and extended flotation time.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 40 min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			pH
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	
Grind			-	-	-			40			
Condition 1			85	-	-				3		8.4
Rougher 1			-	25	20				1	2	8.4
Rougher 2			-	25	15				1	4	8.4
Rougher 3			-	15	15				1	3	8.4
			-	15	15				1	3	
Rougher 4			-	15	15				1	8	8.5

Stage	Roughers 1 - 4				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 53

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc 1	102.0	5.0	126	7.59	20.5	17.3	66.8	49.9	56.2	57.5
2. Rougher Conc 2	98.5	4.9	41.2	4.55	12.3	10.4	21.1	28.9	32.5	33.3
3. Rougher Conc 3	68.1	3.4	10.5	1.41	2.29	1.69	3.7	6.2	4.2	3.8
4. Rougher Conc 4	47.1	2.3	6.63	0.96	1.29	0.88	1.6	2.9	1.6	1.4
5. Rougher Tail	1704.8	84.4	0.77	0.11	0.12	0.07	6.8	12.1	5.5	4.1
Head (calc.)	2020.5	100.0	9.53	0.77	1.84	1.51	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc 1+2 (Prod 1-2)	9.9	84.3	6.10	16.5	13.9	87.8	78.8	88.7	90.8
Rougher Conc 1-3 (Prod 1-3)	13.3	65.6	4.91	12.9	10.78	91.6	85.0	92.9	94.6
Rougher Conc 1-4 (Prod 1-4)	15.6	56.8	4.32	11.15	9.30	93.2	87.9	94.5	95.9

Test No. 54 Project No. 3785 Date: Feb. 6/90 Operator: LP

Purpose: To repeat test 42 with a finer grind and extended flotation time.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 60 min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	pH
Grind			-	-	-			60			
Condition 1			85	-	-				3		8.4
Rougher 1			-	25	20				1	2	8.4
Rougher 2			-	25	15				1	4	8.4
Rougher 3			-	15	15				1	3	8.5
			-	15	15				1	3	
Rougher 4			-	15	15				1	8	8.5

Stage	Roughers 1 - 4				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 54

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc 1	93.5	4.8	127	6.46	20.0	17.2	63.3	40.7	50.9	53.0
2. Rougher Conc 2	82.8	4.3	48.0	5.94	14.3	11.8	21.2	33.1	32.2	32.0
3. Rougher Conc 3	64.4	3.3	18.9	2.53	4.84	3.76	6.5	11.0	8.5	8.0
4. Rougher Conc 4	30.5	1.6	14.8	1.98	3.03	2.18	2.4	4.1	2.5	2.2
5. Rougher Tail	1665.7	86.0	0.75	0.10	0.13	0.09	6.7	11.2	5.9	4.8
Head (calc.)	1936.9	100.0	9.69	0.77	1.90	1.57	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc 1+2 (Prod 1-2)	9.1	89.9	6.22	17.3	14.7	84.4	73.8	83.1	85.1
Rougher Conc 1-3 (Prod 1-3)	12.4	70.9	5.23	14.0	11.7	90.9	84.7	91.6	93.0
Rougher Conc 1-4 (Prod 1-4)	14.0	64.6	4.86	12.8	10.7	93.3	88.8	94.1	95.2

Test No. 55 Project No. 3785 Date: Feb. 7/90 Operator: LP

Purpose: To repeat test 42 with a finer grind and extended flotation time.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 75 min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	pH
Grind			-	-	-			75			
Condition 1			85	-	-				3		8.4
Rougher 1			-	25	20				1	2	8.4
Rougher 2			-	25	15				1	4	8.4
Rougher 3			-	15	15				1	3	8.4
			-	15	15				1	3	
Rougher 4			-	15	15				1	8	8.5

Stage	Roughers 1 - 4				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 55

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc 1	118.0	6.0	112	7.46	18.1	14.9	70.7	57.2	59.3	59.8
2. Rougher Conc 2	125.6	6.3	27.8	2.98	8.49	7.21	18.7	24.3	29.6	30.8
3. Rougher Conc 3	83.7	4.2	7.27	0.92	1.66	1.27	3.3	5.0	3.9	3.6
4. Rougher Conc 4	69.2	3.5	4.87	0.69	1.01	0.71	1.8	3.1	1.9	1.7
5. Rougher Tail	1586.4	80.0	0.65	0.10	0.12	0.08	5.5	10.3	5.3	4.2
Head (calc.)	1982.9	100.0	9.42	0.78	1.82	1.48	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc 1+2 (Prod 1-2)	12.3	68.6	5.15	13.1	10.9	89.4	81.6	88.9	90.6
Rougher Conc 1-3 (Prod 1-3)	16.5	52.9	4.07	10.2	8.47	92.7	86.6	92.8	94.2
Rougher Conc 1-4 (Prod 1-4)	20.0	44.5	3.48	8.61	7.12	94.5	89.7	94.7	95.8

Project No: 3785 MB

Product: Combined Product Test No: 53

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	0.0	0.0	0.0	100.0
147	100	0.0	0.0	0.0	100.0
104	150	0.3	0.3	0.3	99.7
74	200	1.9	1.9	2.2	97.8
53	270	6.0	6.0	8.2	91.8
38	400	9.7	9.7	17.9	82.1
-38	-400	82.1	82.1	100.0	-
	Total	100.0	100.0	-	-

Product: Combined Product Test No: 54

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	0.0	0.0	0.0	100.0
147	100	0.1	0.1	0.1	99.9
104	150	0.1	0.1	0.2	99.8
74	200	0.6	0.6	0.8	99.2
53	270	2.8	2.8	3.6	96.4
38	400	6.8	6.8	10.4	89.6
-38	-400	89.6	89.6	100.0	-
	Total	100.0	100.0	-	-

Project No: 3785 MB

Product: 48 hr. Cyanide Residue Test No: 52 S.G.= 3.52

Microns	Weight Grams	% Weight		
		Ind.	Cum.	Passing
37.5µ	1.60	3.2	3.2	96.8
29.1	0.10	0.2	3.4	96.6
20.3	0.10	0.2	3.6	96.4
14.0	0.08	0.2	3.8	96.2
10.8	0.11	0.2	4.0	96.0
-10.8	48.01	96.0	100.0	-
Total	50.00	100.0	-	-

Product: Combined Product Test No: 55 S.G.= 2.98

Microns	Weight Grams	% Weight		
		Ind.	Cum.	Passing
42.2µ	0.54	1.1	1.1	98.9
32.7	1.03	2.1	3.1	96.9
22.8	4.35	8.7	11.8	88.2
15.7	6.33	12.7	24.5	75.5
12.1	2.71	5.4	29.9	70.1
-12.1	35.04	70.1	100.0	-
Total	50.00	100.0	-	-

Test No. 54A Project No. 3785 Operator: LP Date: Feb. 6/90

Purpose: To investigate the cyanidation response of the rougher tailing.

Procedure: The sample was pulped with water in a 2 liter bottle. NaCN and lime were added and the cyanidation was carried out on rolls in one 48 hour stage. The pulp was filtered and the residue washed three times with water.

Feed: 500 g rougher tailing from test 54

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 1.0 g/L NaCN

pH Range: 10.5-11 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.53 CaO: 0.93

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 2	1.05	0.15	1.00	0.11	0.78	0.00	0.22	0.11	10.9-10.0
2 - 7	0.23	0.30	0.22	0.23	0.99	0.03	0.01	0.20	11.1-10.8
7 - 23.5	0.00	0.10	0.00	0.08	0.99	0.01	0.00	0.10	11.2-11.0
23.5 - 31	0.00	0.00	0.00	0.00	0.98	0.01	0.01	0.00	11.0-10.9
31 - 48	0.00	0.00	0.00	0.00	0.98	0.00	0.00	0.01	10.9-10.7
Total	1.28	0.55	1.22	0.42	0.98	0.00	0.24	0.42	

Test No. 54A

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. 48 h Preg + Wash	2020 mL	0.050	39.0
2. 48 h Residue	451.8 g	0.35	61.0
Head (calc)	451.8 g	0.57	100.0

Test No. 55A Project No. 3785 Operator: LP Date: Feb. 6/90

Purpose: To investigate the cyanidation response of the rougher tailing.

Procedure: The sample was pulped with water in a 2 liter bottle. NaCN and lime were added and the cyanidation was carried out on rolls in one 48 hour stage. The pulp was filtered and the residue washed three times with water.

Feed: 500 g rougher tailing from test 55

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 1.0 g/L NaCN

pH Range: 10.5-11 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.76 CaO: 0.88

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 2	1.05	0.35	1.00	0.27	0.81	0.00	0.19	0.27	11.1-10.5
2 - 16.5	0.20	0.16	0.19	0.12	1.00	0.01	0.00	0.11	11.2-10.9
16.5 - 24	0.00	0.00	0.00	0.00	0.93	0.01	0.07	0.00	10.9-10.8
24 - 48	0.07	0.00	0.07	0.00	0.92	0.00	0.08	0.01	10.8-10.6
Total	1.32	0.51	1.26	0.39	0.92	0.00	0.34	0.39	

Test No. 55A

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. 48 h Preg + Wash	2040 mL	0.040	30.9
2. 48 h Residue	444.8 g	0.41	69.1
Head (calc)	444.8 g	0.59	100.0

LAKEFIELD RESEARCH
A Division of Falconbridge Limited
Lakefield, Ontario
March 13, 1990/mo

DETAILS OF TESTWORK

Test No. 9 Project No. 3785 Operator: LM Date: 10/10/89

Purpose: To investigate the flotation of sulphides from classifier O/F.

Procedure: As indicated below.

Feed: 2 kg classifier O/F

Grind: 10 min/2kg at 65 % solids in a lab ball mill

Conditions:

Stage	Reagents added, grams per tonne						Time, minutes			pH
		CuSO4		*Ax 343/350		MIBC	Grind	Cond.	Froth	
Conditioner (1)		85						5		5.1
1st Ro. (1)				73		5		1	5	4.9
1st Ro. (2)				73		2.5		1	5	
Conditioner (2)		48						3		7.9
2nd Ro.				25		2.5		1	5	
Scavenger				25		2.5		1	5	6.4

Stage	Ro. 1 & 2			
Flotation Cell	1000 g D-1			
Speed: r.p.m.	1800			
% Solids	33			
%- mesh				

*3:1 Ax343:Ax350

Test No. 9

Metallurgical Balance

Product	Weight		Assays		% Distribution	
	(g)	(%)	Au (g/t)	S (%)	Au	S
1. 1st Rougher Conc.	332.3	16.7	55.8	14.8	90.0	94.6
2. 2nd Rougher Conc.	104.8	5.3	7.80	1.34	4.0	2.7
3. 3rd Rougher Conc.	79.5	4.0	3.08	0.47	1.2	0.7
4. Rougher Tails	1473.2	74.0	0.68	0.07	4.9	2.0
Head (calc.)	1989.8	100.0	10.36	2.61	100.0	100.0

Calculated Grades and Recoveries

1st Ro Conc+2nd Ro Conc (Prod 1+2)	22.0	44.3	11.6	94.0	97.3
1st Ro Conc-3rd Ro Conc (Prod 1-3)	26.0	37.9	9.86	95.1	98.0

Project No: 3785 M.B.

Product: Rougher Tail Test No: 9

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	0.6	0.4	0.4	99.6
147	100	3.6	2.6	3.1	96.9
104	150	7.8	5.7	8.7	91.3
74	200	12.8	9.3	18.0	82.0
53	270	15.7	11.4	29.5	70.5
38	400	14.4	10.5	39.9	60.1
-38	-400	82.6	60.1	100.0	-
	Total	137.5	100.0	-	-

Test No. 15 Project No. 3785 Operator: LM Date: 25/10/89

Purpose: To investigate the flotation of sulphides from rod mill feed.

Procedure: As indicated below.

Feed: 2 kg rod mill feed

Grind: 13 min/2kg at 65 % solids in a lab ball mill

Conditions:

Stage	Reagents added, grams per tonne					Time, minutes			pH
		CuSO4		*Ax 343/350	MIBC	DF 250	Grind	Cond.	Froth	
Conditioner (1)		85						3		
1st Rougher				25	12.5			1	5	
2nd Rougher				25		2.5		1	1	
Regrind Ro. tails							8.75			
Conditioner (2)		50						3		
1st Scavenger				25				1	1	
2nd Scavenger				10				1	1	
3rd Scavenger				15		2.5		1	3	
4th Scavenger				10		2.5		1	3	

Stage	Ro. + Scav.			
Flotation Cell	1000 g D-1			
Speed: r.p.m.	1800			
% Solids	33			
%- mesh				

*3:1 Ax343:Ax350

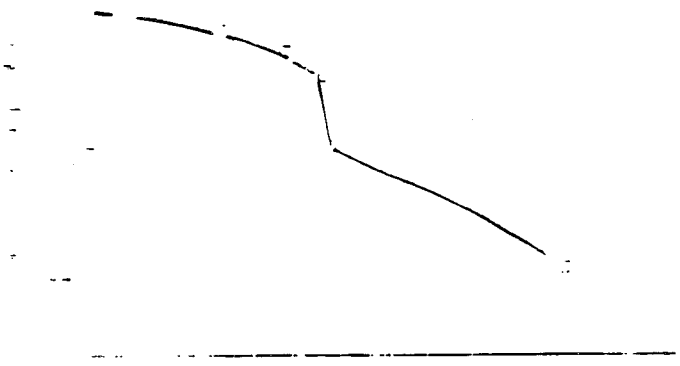
Test No. 15

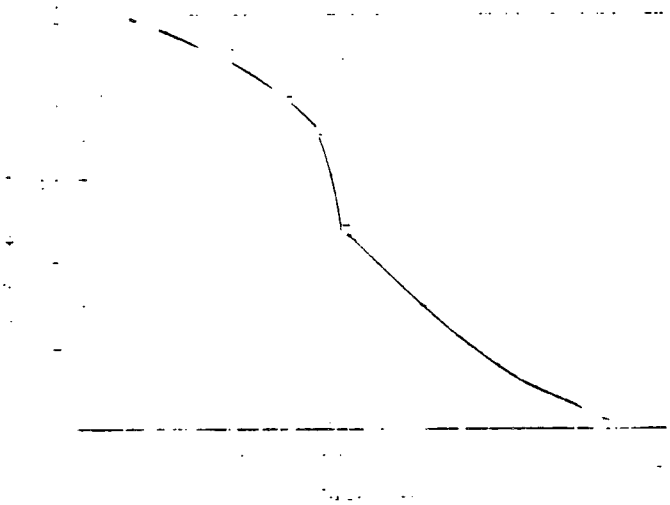
Metallurgical Balance

Product	Weight		Assays		% Distribution	
	(g)	(%)	Au (g/t)	S (%)	Au	S
1. 1st Rougher Conc.	165.4	8.3	80.5	20.2	76.3	82.3
2. 2nd Rougher Conc	80.8	4.0	19.2	2.26	8.9	4.5
3. 1st Scavenger Conc.	18.7	0.9	50.8	5.26	5.4	2.4
4. 2nd Scavenger Conc.	18.6	0.9	14.7	1.94	1.6	0.9
5. 3rd Scavenger Conc.	36.5	1.8	7.47	0.99	1.6	0.9
6. 4th Scavenger Conc.	66.2	3.3	3.25	0.42	1.2	0.7
7. Scavenger Tails.	1614.8	80.7	0.54	0.21	5.0	8.3
Head (calc.)	2001.0	100.0	8.72	2.03	100.0	100.0

Calculated Grades and Recoveries

1st Ro Conc+2nd Ro Conc (Prod 1+2)	12.3	60.4	14.3	85.2	86.8
Ro Conc+1st Scav Conc (Prod1-3)	13.2	59.7	13.7	90.6	89.2
Ro Conc+1st & 2nd Scav Conc (Prod1-4)	14.2	56.7	12.9	92.2	90.1
Ro Conc+1st,2nd & 3rd Scav Conc (Prod 1-5)	16.0	51.1	11.5	93.8	91
Ro Conc+Scav Conc Prod 1-6)	19.3	42.9	9.64	95.0	91.7
Rougher Tail (Prod3-7)	87.7	1.44	0.30	14.8	13.2





Test No. 19 Project No. 3785 Date: 02/11/89

Purpose: To investigate the flotation of sulphides from rod mill feed.

Procedure: As indicated below.

Feed: 2 kg rod mill feed

Grind: 13min/2kg at 65 % solids in a lab ball mill

Conditions:

Stage	Reagents added, grams per tonne						Time, minutes			pH
		CuSO4		*Ax 343/350		DF 250	Grind	Cond.	Froth	
										5.9
Conditioner (1)		85						3		7.0
Rougher (1)				25		5		1	3	7.2
Rougher (2)				25		-		1	3	7.5
Regrind Ro. tails							10			
Conditioner (2)		50						3		5.8
1st Scavenger				15		2.5		1	3	6.6
2nd Scavenger				15		2.5		1	3	
3rd Scavenger				17		-		1	2	
		Combine rougher and scavenger concentrates.								
1st Cleaner				-		-		1	2	
				5		-		1	2	

Stage	Ro. + Scav.	Cleaner		
Flotation Cell	1000 g D-1	250 g D-1		
Speed: r.p.m.	1800	1100		
% Solids	33	33		
%- mesh				

*3:1 Ax343:Ax350

Test No. 19

Metallurgical Balance

Product	Weight		Assays			% Distribution		
	(g)	(%)	Au (g/t)	S (%)	As (%)	Au	S	As
Cleaner Conc.	131.6	6.7	121	23.9	9.78	86.4	91.6	83.4
Cleaner Tails.	59.8	3.0	12.9	2.13	1.38	4.2	3.7	5.1
Scavenger Tails.	1770.8	90.2	0.97	0.09	0.10	9.4	4.6	11.
Head (calc.)	1962.2	100.0	9.35	1.75	0.79	100.0	100.0	100.(

Calculated Grades and Recoveries

Rougher+Scavenger Conc (Prod 1+2)	9.8	86.9	17.1	7.16	90.6	95.4	88.8

Project No: 3785

Product: Scavenger Tail Test No: 19

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	2.4	1.3	1.3	98.7
147	100	8.2	4.3	5.6	94.4
104	150	14.8	7.8	13.4	86.6
74	200	19.8	10.4	23.9	76.1
53	270	20.6	10.9	34.7	65.3
38	400	17.4	9.2	43.9	56.1
-38	-400	106.3	56.1	100.0	-
	Total	189.5	100.0	-	-

Test No. 20 Project No. 3785 Date: 02/11/89

Purpose: To repeat Test No. 19 but with sodium carbonate added.

Procedure: As indicated below.

Feed: 2 kg rod mill feed

Grind: 13 min/2kg at 65 % solids in a lab ball mill

Conditions:

Stage	Reagents added, grams per tonne						Time, minutes			pH
	NaCO3	CuSO4		*Ax 343/350		DF 250	Grind	Cond.	Froth	
										5.9
Conditioner (1)	35880									8.9
Conditioner (2)		85						3		9.2
Rougher (1)				25		5		1	3	9.0
Rougher (2)				25		-		1	3	8.9
Regrind Ro. tails							10			
Conditioner (3)		50						3		9.2
1st Scavenger				15		2.5		1	3	
2nd Scavenger				15		2.5		1	2.5	
3rd Scavenger				17		-		1	2	
1st Cleaner				-		-		1	2	
				5		-		1	2	

Stage	Ro. + Scav.	Cleaner		
Flotation Cell	1000 g D-1	250 g D-1		
Speed: r.p.m.	1800	1100		
% Solids	33	33		
%- mesh				

*3:1 Ax343:Ax350

Test No. 20

Metallurgical Balance

Product	Weight		Assays			% Distribution		
	(g)	(%)	Au (g/t)	S (%)	As (%)	Au	S	As
Cleaner Conc.	149.2	7.6	113	20.8	9.02	91.1	94.0	90.4
Cleaner Tails.	85.2	4.3	7.9	1.32	0.72	3.7	3.4	4.1
Scavenger Tails.	1737.0	88.1	0.56	0.05	0.047	5.3	2.6	5.5
Head (calc.)	1971.4	100.0	9.35	1.68	0.76	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher + Scavenger Conc (Prod 1+2)	11.9	74.5	13.7	6.00	94.7	97.4	94.5

Test No. 21 Project No. 3785 Date: Nov-9-89 Operator: SA

Purpose: To examine the flotation of sulphides with finer grinds.

Procedure: As indicated below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			pH
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	
Grind			85	-	-			13			
Rougher -1			-	25	20				1	3	8.8
			-	25	15				1	3	8.9
Regrind			-	-	-			11			
Rougher -2			-	15	15				1	3	8.8
Regrind			-	-	-			5			
Rougher -3			-	15	15				1	3	9.0
Regrind			-	-	-			10			
Rougher -4.			-	20	15				1	2	8.8

Stage	Roughers 1-4				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 21

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. 1st Rougher Conc	131.1	7.9	113.8	8.17	23.5	20.0	78.2	72.7	88.2	91.6
2. 2nd Rougher Conc	32.2	1.9	62.4	5.40	6.29	3.98	10.5	11.8	5.8	4.5
3. 3rd Rougher Conc	26.4	1.6	24.2	2.56	2.68	1.58	3.3	4.6	2.0	1.5
4. 4th Rougher Conc	10.2	0.6	32.8	2.06	2.13	1.25	1.8	1.4	0.6	0.4
5. 4th Rougher Tail	1461.9	88.0	0.80	0.096	0.08	0.04	6.1	9.5	3.3	2.0
Head (calc.)	1661.8	100.0	11.5	0.89	2.10	1.72	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Comb Rougher Conc (Prod1-2)	9.8	103.7	7.62	20.1	16.8	88.8	84.5	94.0	96.1
Comb Rougher Conc (Prod1-3)	11.4	92.6	6.92	17.7	14.7	92.1	89.1	96.0	97.6
Comb Rougher Conc (Prod1-4)	12.0	89.6	6.67	16.9	14.0	93.9	90.5	96.7	98.0
1st Ro Tail (Prod2-5)	92.1	2.71	0.26	0.27	0.16	21.8	27.3	11.8	8.4
2nd Ro Tail (Prod3-5)	90.2	1.43	0.15	0.14	0.07	11.2	15.5	6.0	3.9
3rd Ro Tail (Prod4-5)	88.6	1.02	0.11	0.09	0.05	7.9	10.9	4.0	2.4

Additional Assays (Direct Assays)

Product	% - 200 Mesh	Assays %,g/t		
		Au	As	S
1st Rougher Tail	61.4	2.38	0.24	0.20
2nd Rougher Tail	82.7	1.41	0.16	0.12
3rd Rougher Tail	88.1	0.93	0.11	0.09
4th Rougher Tail	94.3	-	-	-

NB: Weights removed for 1st, 2nd and 3rd Rougher Tailings. These samples were not accounted for in the metallurgical balance.

Project No: 3785 KP

Product: 1st Rougher Tail Test No: 21

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	4.6	7.7	7.7	92.3
147	100	6.0	10.1	17.8	82.2
104	150	6.3	10.6	28.5	71.5
74	200	6.0	10.1	38.6	61.4
53	270	5.3	8.9	47.5	52.5
38	400	4.0	6.7	54.2	45.8
-38	-400	27.2	45.8	100.0	-
	Total	59.4	100.0	-	-

Product: 2nd Rougher Tail Test No: 21

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	0.2	0.3	0.3	99.7
147	100	1.7	2.7	3.0	97.0
104	150	3.9	6.2	9.2	90.8
74	200	5.1	8.1	17.3	82.7
53	270	6.3	10.0	27.3	72.7
38	400	5.6	8.9	36.1	63.9
-38	-400	40.3	63.9	100.0	-
	Total	63.1	100.0	-	-

Project No: 3785 KP

Product: 3rd Rougher Tail Test No: 21

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	0.0	0.0	0.0	100.0
147	100	0.8	1.2	1.2	98.8
104	150	2.4	3.7	4.9	95.1
74	200	4.5	6.9	11.9	88.1
53	270	6.4	9.9	21.7	78.3
38	400	6.3	9.7	31.4	68.6
-38	-400	44.5	68.6	100.0	-
	Total	64.9	100.0	-	-

Product: 4th Rougher Tail Test No: 21

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	0.0	0.0	0.0	100.0
147	100	0.6	0.3	0.3	99.7
104	150	2.8	1.4	1.7	98.3
74	200	7.8	4.0	5.7	94.3
53	270	15.0	7.7	13.4	86.6
38	400	18.5	9.4	22.8	77.2
-38	-400	151.3	77.2	100.0	-
	Total	196.0	100.0	-	-

Test No. 22 Project No. 3785 Date: Nov-15-89 Operator: SA

Purpose: To examine the flotation of sulphides and cyanide the final tails.

Procedure: As indicated below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	pH
Grind			85	-	-			13			8.2
Rougher -1			-	25	20				1	3	8.2
			-	25	15				1	3	8.2
			(500g Ro Tail to cyanidation)								

Stage	Roughers 1				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 22

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Ro Conc	163.7	8.2	94.00	7.35	20.6	17.5	83.4	79.4	90.6	93.0
2. Ro Tail	1836.3	91.8	1.67	0.17	0.19	0.12	16.6	20.6	9.4	7.0
Head (calc.)	2000.0	100.0	9.23	0.76	1.86	1.54	100.0	100.0	100.0	100.0

Test No. 23 Project No. 3785 Date: Nov-15-89 Operator

Purpose: To examine the flotation of sulphides with a finer grind and cyanide the final tails.

Procedure: As indicated below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes		
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth
Grind			85	-	-			13		
Rougher -1			-	25	20				1	3
			-	25	15				1	3
Regrind			50	-	-			12		
Rougher -2			-	15	15				1	3
			(500g 2nd Ro Tail to cyanidation)							

Stage	Roughers 1-2				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 23

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. 1st Rougher Conc	151.0	7.6	94.50	6.96	21.5	18.5	75.7	68.8	85.9	89.4
2. 2nd Rougher Conc	41.1	2.1	51.83	4.12	5.09	3.33	11.3	11.1	5.5	4.4
3. 2nd Rougher Tail	1807.9	90.4	1.36	0.17	0.18	0.11	13.0	20.1	8.6	6.2
Head (calc.)	2000.0	100.0	9.43	0.76	1.89	1.56	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Comb Rougher Conc (Prod1-2)	9.6	85.4	6.35	18.0	15.3	87.0	79.9	91.4	93.8
1st Ro Tail (Prod2-3)	92.5	2.48	0.26	0.29	0.18	24.3	31.2	14.1	10.6

Test No. 24 Project No. 3785 Date: Nov-15-89 Operator:

Purpose: To examine the flotation of sulphides with a finer grind and cyanide the final tail.

Procedure: As indicated below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes		
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth
Grind			85	-	-			13		
Rougher -1			-	25	20				1	3
			-	25	15				1	3
Regrind			50	-	-			12		
Rougher -2			-	15	15				1	3
Regrind			-	-	-			6		
Rougher -3			-	15	15				1	3
			(500g 3rd Ro Tail to cyanidation)							

Stage	Roughers 1-3				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 24

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. 1st Rougher Conc	149.6	7.5	98.83	6.92	20.90	17.94	73.1	68.1	85.9	89.7
2. 2nd Rougher Conc	38.2	1.9	73.00	4.68	5.80	3.80	13.8	11.8	6.1	4.8
3. 3rd Rougher Conc	45.6	2.3	21.27	2.06	2.17	1.29	4.8	6.2	2.7	2.0
4. 3rd Rougher Tail	1766.6	88.3	0.96	0.12	0.11	0.06	8.4	13.9	5.3	3.5
Head (calc.)	2000.0	100.0	10.12	0.76	1.82	1.50	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Comb Rougher Conc (Prod1-2)	9.4	93.6	6.46	17.8	15.1	86.8	79.9	91.9	94.6
Comb Rougher Conc (Prod1-3)	11.7	79.4	5.60	14.8	12.4	91.6	86.1	94.7	96.5
1st Ro Tail (Prod2-4)	92.5	2.95	0.26	0.28	0.17	26.9	31.9	14.1	10.3
2nd Ro Tail (Prod3-4)	90.6	1.47	0.17	0.16	0.09	13.2	20.1	8.1	5.4

Test No. 25 Project No. 3785 Date: Nov-15-89 Operator:

Purpose: To examine the flotation of sulphides with a finer grind and cyanide the final tail.

Procedure: As indicated below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes		
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth
Grind			85	-	-			13		
Rougher -1			-	25	20				1	3
			-	25	15				1	3
Regrind			50	-	-			12		
Rougher -2			-	15	15				1	3
Regrind			-	-	-			6		
Rougher -3			-	15	15				1	3
Regrind			-	-	-			15		
Rougher -4.			-	20	15				1	2
			(500g 4th Ro Tail to cyanidation)							
.										

Stage	Roughers 1-4				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 25

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. 1st Rougher Conc	145.9	7.3	90.93	6.94	20.6	17.6	72.0	66.3	82.0	85.3
2. 2nd Rougher Conc	49.3	2.5	42.53	3.35	4.73	3.30	11.4	10.8	6.4	5.4
3. 3rd Rougher Conc	53.6	2.7	17.87	1.87	1.99	1.19	5.2	6.6	2.9	2.1
4. 4th Rougher Conc	47.2	2.4	10.87	0.95	1.00	0.59	2.8	2.9	1.3	0.9
5. 4th Rougher Tail	1704.0	85.2	0.94	0.12	0.16	0.11	8.7	13.4	7.4	6.2
Head (calc.)	2000.0	100.0	9.22	0.76	1.83	1.50	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Comb Rougher Conc (Prod1-2)	9.8	78.7	6.03	16.6	14.0	83.3	77.1	88.4	90.7
Comb Rougher Conc (Prod1-3)	12.4	65.6	5.14	13.4	11.2	88.5	83.7	91.3	92.8
Comb Rougher Conc (Prod1-4)	14.8	56.9	4.47	11.5	9.53	91.3	86.6	92.6	93.8
1st Ro Tail (Prod2-5)	92.7	2.79	0.28	0.36	0.24	28.0	33.7	18.0	14.7
2nd Ro Tail (Prod3-5)	90.2	1.70	0.19	0.24	0.15	16.7	22.9	11.6	9.3
3rd Ro Tail (Prod4-5)	87.6	1.21	0.14	0.18	0.12	11.5	16.3	8.7	7.2

Test No. 26 Project No. 3785 Date: Nov-27-89 Operator:

Purpose: To repeat test 25 but add CuSO4 in a conditioning stage and extend the flotation time on the Rougher concentate to 16 minutes.

Procedure: As indicated below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes		
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth
Grind			-	-	-			13		
Condition -1			85	-	-				5	
Rougher -1			-	25	20				1	3
			-	25	15				1	3
Regrind			-	-	-			12		
Condition -2			50	-	-				5	
Rougher -2			-	15	15				1	3
Regrind			-	-	-			6		
Rougher -3			-	15	15				1	3
Regrind			-	-	-			15		
Rougher -4.			-	20	15				1	2
Rougher -5			-	20	15				1	2

Stage	Roughers 1-5				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 26

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. 1st Rougher Conc	173.2	8.8	89.9	7.12	19.8	16.8	75.4	78.3	90.6	92.3
2. 2nd Rougher Conc	32.4	1.6	47.7	3.32	4.18	2.76	7.5	6.8	3.6	2.8
3. 3rd Rougher Conc	27.6	1.4	20.3	1.80	2.08	1.31	2.7	3.2	1.5	1.1
4. 4th Rougher Conc	33.6	1.7	44.6	0.93	1.93	1.53	7.3	2.0	1.7	1.6
5. 5th Rougher Conc	34.7	1.8	13.0	1.07	1.85	1.39	2.2	2.4	1.7	1.5
6. 5th Rougher Tail	1671.8	84.7	0.61	0.07	0.02	0.01	4.9	7.4	0.9	0.5
Head (calc.)	1973.3	100.0	10.5	0.80	1.92	1.59	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Comb Rougher Conc (Prod1-2)	10.4	83.2	6.52	17.3	14.5	82.9	85.1	94.2	95.1
Comb Rougher Conc (Prod1-3)	11.8	75.8	5.96	15.5	13.0	85.6	88.2	95.7	96.3
Comb Rougher Conc (Prod1-4)	13.5	71.9	5.33	13.8	11.5	92.9	90.2	97.4	97.9
Comb Rougher Conc (Prod1-5)	15.3	65.1	4.84	12.4	10.4	95.1	92.6	99.1	99.5
1st Ro Tail (Prod2-6)	91.2	2.82	0.19	0.20	0.13	24.6	21.7	9.4	7.7
2nd Ro Tail (Prod3-6)	89.6	2.00	0.13	0.12	0.09	17.1	14.9	5.8	4.9
3rd Ro Tail (Prod4-6)	88.2	1.71	0.11	0.09	0.07	14.4	11.8	4.3	3.7
4th Ro Tail (Prod5-6)	86.5	0.86	0.09	0.06	0.04	7.1	9.8	2.6	2.1

Test No. 27 Project No. 3785 Date: Nov-26-89 Operator: LP

Purpose: To repeat test 22 but add CuSO4 in a conditioning stage.

Procedure: As indicated below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	pH
								13			
Condition			85	-	-				5		8.2
Rougher			-	25	20				1	3	8.2
			-	25	15				1	3	8.2

Stage	Roughers 1				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 27

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Ro Conc	247.4	12.5	65.7	5.27	13.9	11.6	87.9	86.3	93.9	95.4
2. Ro Tail	1731.4	87.5	1.29	0.12	0.13	0.08	12.1	13.7	6.1	4.6
Head (calc.)	1978.8	100.0	9.34	0.76	1.85	1.53	100.0	100.0	100.0	100.0

Test No. 28A Project No. 3785 Date: Nov-26-89 Operator: LP

Purpose: To repeat test 27 but omit CuSO4 and add Na2SiO3 in a conditioning stage.

Procedure: As indicated below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			pH
			Na2SiO3	AX343 Ax350	DF250			Grind	Cond.	Froth	
								13			
Condition			250	-	-				5		8.4
Rougher			-	25	20				1	3	8.6
			-	25	15				1	3	8.7

Stage	Roughers 1				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 28A

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Ro Conc	233.0	11.8	59.6	4.77	14.0	12.0	79.0	74.4	89.9	93.3
2. Ro Tail	1737.9	88.2	2.13	0.22	0.21	0.1	21.0	25.6	10.1	6.7
Head (calc.)	1970.9	100.0	8.92	0.76	1.84	1.52	100.0	100.0	100.0	100.0

Test No. 28B Project No. 3785 Date: Nov-26-89 Operator: LP

Purpose: To repeat test 27 but add Na2SiO3 in a conditioning stage.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne						Time, minutes			
	Na2SiO3	CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	pH
							13			
Condition	250	-	-	-				3		8.3
	-	85	-	-				5		
Rougher		-	25	20				1	3	8.5
		-	25	15				1	3	8.7

Stage	Roughers 1					
Flotation Cell	1000g D-1					
Speed: r.p.m.	1850					
% Solids	33					
%- mesh						

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 28B

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Ro Conc	316.3	15.5	50.9	3.97	11.2	9.5	84.4	83.8	93.2	95.1
2. Ro Tail	1727.8	84.5	1.72	0.14	0.15	0.1	15.6	16.2	6.8	4.9
Head (calc.)	2044.1	100.0	9.33	0.73	1.86	1.55	100.0	100.0	100.0	100.0

Test No. 29 Project No. 3785 Date: Nov-27-89 Operator:

Purpose: To repeat test 19.

Procedure: As indicated below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes		
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth
Grind			-	-	-			13		
Condition -1			85	-	-				3	
Rougher -1			-	25	20				1	3
Rougher -2			-	25	15				1	3
Regrind			-	-	-			10		
Condition -2			50	-	-				3	
Scavenger -1			-	15	15				1	3
Scavenger -2			-	15	10				1	3
Scavenger -3			-	17	10				1	2
1st Cleaner			-	-	-				1	2
2nd Cleaner			-	5	-				1	2

Stage	Roughers 1-2	Scavenger 1-3	Cleaner 1-2		
Flotation Cell	1000g D-1	1000g D-1	250g D-1		
Speed: r.p.m.	1850	1850	1100		
% Solids	33	33	33		
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 29

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. 2nd Cleaner Conc	106.9	5.4	125	11.3	29.8	25.0	76.8	74.9	87.5	89.5
2. 2nd Cleaner Tail	25.8	1.3	28.3	3.15	4.79	3.4	4.2	5.0	3.4	3.0
3. 1st Cleaner Tail	134.4	6.8	13.1	1.27	2.09	1.5	10.1	10.6	7.7	7.0
4. Rougher Tail	1709.6	86.5	0.90	0.09	0.03	0.01	8.8	9.5	1.4	0.6
Head (calc.)	1976.7	100.0	8.80	0.82	1.84	1.51	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

1st Cleaner Conc (Prod1-2)	6.7	106.2	9.72	24.9	20.8	81.0	79.9	90.9	92.5
Rougher Conc (Prod1-3)	13.5	59.4	5.47	13.4	11.1	91.2	90.5	98.6	99.4

Test No. 30 Project No. 3785 Date: Nov-28-89 Operator:

Purpose: To repeat test 15 and cyanide the flotation products.

Procedure: As indicated below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes		
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth
Grind			-	-	-			13		
Condition -1			85	-	-				3	
Rougher -1			-	25	20				1	5
Rougher -2			-	25	15				1	1
Regrind			-	-	-			8.75		
Condition -2			50	-	-				3	
Scavenger -1			-	15	15				1	1
Scavenger -2			-	10	15				1	1
Scavenger -3			-	15	10				1	3
Scavenger -4			-	10	10				1	3
	Flotation products to cyanidation.									

Stage	Roughers 1-2	Scavenger 1-4			
Flotation Cell	1000g D-1	1000g D-1			
Speed: r.p.m.	1850	1850			
% Solids	33	33			
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 30

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc	149.3	7.5	99.4	7.75	21.5	18.2	79.8	76.4	88.4	91.0
2. Scavenger Conc	122.4	6.2	19.9	1.87	2.46	1.66	13.1	15.1	8.3	6.8
3. Scavenger Tail	1706.9	86.3	0.77	0.075	0.07	0.04	7.1	8.5	3.3	2.2
Head (calc.)	1978.6	100.0	9.40	0.77	1.83	1.51	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Ro + Scav Conc (Prod1-2)	13.7	63.6	5.10	12.9	10.7	92.9	91.5	96.7	97.8

Test No. 31 Project No. 3785 Date: Dec-7-89 Operator: LP

Purpose: To repeat test 23.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Conditions:

Stage	Reagents added, grams per tonne							Time, minutes			pH
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	
Grind			85	-	-			13			8.2
Rougher -1			-	25	20				1	3	8.2
			-	25	15				1	3	8.3
Regrind			50	-	-			12			
Rougher -2			-	15	15				1	3	8.3
			(500g 2nd Ro Tail to cyanidation)								

Stage	Roughers 1-2				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 31

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. 1st Rougher Conc	304.3	15.5	45.9	3.37	11.4	10.0	76.3	72.0	88.7	91.8
2. 2nd Rougher Conc	120.7	6.1	18.3	1.51	1.88	1.23	12.1	12.8	5.8	4.5
3. 2nd Rougher Tail	1540.0	78.4	1.38	0.14	0.14	0.08	11.6	15.1	5.5	3.7
Head (calc.)	1965.0	100.0	9.32	0.72	1.99	1.68	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Comb Rougher Conc (Prod1-2)	21.6	38.1	2.84	8.70	7.48	88.4	84.9	94.5	96.3
1st Ro Tail (Prod2-3)	84.5	2.61	0.24	0.27	0.16	23.7	28.0	11.3	8.2

Test No. 32 Project No. 3785 Date: Dec-7-89 Operator: LP

Purpose: To repeat test 24.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Conditions:

Stage	Reagents added, grams per tonne							Time, minutes			
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	pH
Grind			85	-	-			13			8.3
Rougher -1			-	25	20				1	3	8.3
			-	25	15				1	3	8.3
Regrind			50	-	-			12			
Rougher -2			-	15	15				1	3	8.3
Regrind			-	-	-			6			
Rougher -3			-	15	15				1	3	8.3
			(500g 3rd Ro Tail to cyanidation)								

Stage	Roughers 1-3				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 32

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. 1st Rougher Conc	344.6	17.6	48.3	3.36	10.7	9.26	82.4	78.5	91.1	93.5
2. 2nd Rougher Conc	142.2	7.3	12.2	0.97	1.19	0.77	8.6	9.4	4.2	3.2
3. 3rd Rougher Conc	128.1	6.5	5.45	0.54	0.54	0.31	3.5	4.7	1.7	1.2
4. 3rd Rougher Tail	1343.3	68.6	0.83	0.08	0.09	0.05	5.5	7.5	3.0	2.2
Head (calc.)	1958.2	100.0	10.3	0.75	2.07	1.74	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Comb Rougher Conc (Prod1-2)	24.9	37.8	2.66	7.92	6.78	91.0	87.8	95.3	96.7
Comb Rougher Conc (Prod1-3)	31.4	31.0	2.22	6.38	5.43	94.5	92.5	97.0	97.8
1st Ro Tail (Prod2-4)	82.4	2.20	0.20	0.22	0.14	17.6	21.5	8.9	6.5
2nd Ro Tail (Prod3-4)	75.1	1.23	0.12	0.13	0.08	9.0	12.2	4.7	3.3

Test No. 33 Project No. 3785 Date: Dec-7-89 Operator: LP

Purpose: To repeat test 26.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Conditions:

Stage	Reagents added, grams per tonne							Time, minutes			pH
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	
Grind			-	-	-			13			
Condition -1			85	-	-				5		8.1
Rougher -1			-	25	20				1	3	8.1
			-	25	15				1	3	8.2
Regrind			-	-	-			12			
Condition -2			50	-	-				5		8.1
Rougher -2			-	15	15				1	3	8.1
Regrind			-	-	-			6			
Rougher -3			-	15	15				1	3	8.1
Regrind			-	-	-			15			
Rougher -4.			-	20	15				1	2	8.1
Rougher -5			-	20	15				1	2	8.1
			(500g 5th Ro Tail to cyanidation)								

Stage	Roughers 1-5				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 33

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. 1st Rougher Conc	322.0	16.4	46.7	3.58	10.6	9.07	80.8	78.8	90.8	93.8
2. 2nd Rougher Conc	103.3	5.3	19.2	1.61	1.89	1.20	10.7	11.4	5.2	4.0
3. 3rd Rougher Conc	140.0	7.1	4.17	0.34	0.39	0.24	3.1	3.3	1.5	1.1
4. 4th Rougher Conc	111.9	5.7	2.95	0.18	0.20	0.12	1.8	1.4	0.6	0.4
5. 5th Rougher Conc	91.3	4.7	1.68	0.20	0.17	0.08	0.8	1.2	0.4	0.2
6. 5th Rougher Tail	1194.0	60.8	0.43	0.048	0.05	0.01	2.8	3.9	1.6	0.4
Head (calc.)	1962.5	100.0	9.48	0.75	1.92	1.59	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Comb Rougher Conc (Prod1-2)	21.7	40.0	3.10	8.5	7.2	91.5	90.2	96.0	97.8
Comb Rougher Conc (Prod1-3)	28.8	31.1	2.42	6.5	5.4	94.6	93.5	97.4	98.9
Comb Rougher Conc (Prod1-4)	34.5	26.5	2.05	5.4	4.6	96.4	94.8	98.0	99.4
Comb Rougher Conc (Prod1-5)	39.2	23.5	1.83	4.8	4.0	97.2	96.1	98.4	99.6
1st Ro Tail (Prod2-6)	83.6	2.17	0.19	0.21	0.12	19.2	21.2	9.2	6.2
2nd Ro Tail (Prod3-6)	78.3	1.03	0.09	0.10	0.04	8.5	9.8	4.0	2.2
3rd Ro Tail (Prod4-6)	71.2	0.71	0.07	0.07	0.02	5.4	6.5	2.6	1.1
4th Ro Tail (Prod5-6)	65.5	0.52	0.06	0.06	0.02	3.6	5.2	2.0	0.6

Test No. 34 Project No. 3785 Date: Dec-8-89 Operator: LP

Purpose: To repeat test 29 but increase scavenger flotation time and add a 3rd cleaner stage.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	pH
Grind			-	-	-			13			8.2
Condition 1			85	-	-				3		8.2
Rougher 1			-	25	20				1	3	8.2
Rougher 2			-	25	15				1	3	8.2
Regrind			-	-	-			10			
Condition 2			50	-	-				3		8.3
Scavenger 1			-	15	15				1	3	8.3
Scavenger 2			-	15	10				1	3	8.3
Scavenger 3			-	17	10				1	4	8.3
	Combine rougher and scavenger concentrates.										
1st Cleaner			-	-	-				1	7	8.2
2nd Cleaner			-	5	-				1	5	8.2
3rd Cleaner			-	-	-				1	3	8.2

Stage	Roughers 1 & 2	Scavenger 1-3	Cleaner 1 & 2		
Flotation Cell	1000g D-1	1000 g D-1	250 g D-1		
Speed: r.p.m.	1850	1850	1100		
% Solids	33	33	33		
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 34

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. 3rd Cleaner Conc	78.9	4.1	148	12.0	34.9	29.8	70.8	63.9	78.6	81.9
2. 3rd Cleaner Tail	7.1	0.4	67.9	7.36	13.6	10.45	2.9	3.5	2.8	2.6
3. 2nd Cleaner Tail	89.5	4.6	6.00	0.86	1.32	0.95	3.3	5.2	3.4	3.0
4. 1st Cleaner Tail	476.3	24.6	6.60	0.72	0.99	0.68	19.1	23.1	13.5	11.3
5. Scavenger Tail	1283.6	66.3	0.51	0.05	0.049	0.03	4.0	4.2	1.8	1.3
Head (calc.)	1935.4	100.0	8.52	0.77	1.81	1.48	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

2nd Cleaner Conc (Prod 1-2)	4.4	141.4	11.62	33.1	28.2	73.7	67.4	81.4	84.5
1st Cleaner Conc (Prod 1-3)	9.1	72.3	6.13	16.9	14.3	77.0	72.6	84.7	87.4
Rougher Conc (Prod 1-4)	33.7	24.3	2.18	5.3	4.3	96.0	95.8	98.2	98.7

Project No: 3785 MB

Product: 1st Cleaner Tails Test No: 34

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	0.8	0.5	0.5	99.5
147	100	3.4	2.0	2.5	97.5
104	150	4.0	2.4	4.9	95.1
74	200	4.0	2.4	7.2	92.8
53	270	5.0	3.0	10.2	89.8
38	400	7.5	4.5	14.7	85.3
-38	-400	143.6	85.3	100.0	-
	Total	168.3	100.0	-	-

Test No. 36 Project No. 3785 Date: Dec-12-89 Operator: LP

Purpose: To repeat test 34 but no cleaning stage.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			
			CuSO4	AX343 Ax350	DF250	R208		Grind	Cond.	Froth	pH
Grind			-	-	-			13			
Condition 1			85	-	-				3		8.0
Rougher 1			-	25	20	-			1	3	7.9
Rougher 2			-	25	15	-			1	3	7.9
Regrind			-	-	-			10			
Condition 2			50	-	-				3		7.9
Scavenger 1			-	15	15	-			1	3	8.0
Scavenger 2			-	15	10	-			1	3	8.0
Scavenger 3			-	17	10	-			1	4	8.0

Stage	Roughers 1 & 2	Scavenger 1-3			
Flotation Cell	1000g D-1	1000 g D-1			
Speed: r.p.m.	1850	1850			
% Solids	33	33			
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 36

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc 1	145.4	7.4	87.1	7.18	21.1	18.0	71.3	67.5	80.1	82.8
2. Rougher Conc 2	134.6	6.9	19.5	1.97	3.38	2.54	14.8	17.2	11.9	10.8
3. Scavenger Conc 1	105.3	5.4	11.5	0.94	1.20	0.80	6.8	6.4	3.3	2.7
4. Scavenger Conc 2	97.8	5.0	4.07	0.45	0.55	0.36	2.2	2.8	1.4	1.1
5. Scavenger Conc 3	85.3	4.3	2.37	0.25	0.32	0.21	1.1	1.4	0.7	0.6
6. Scavenger Tail	1393.1	71.0	0.48	0.052	0.07	0.05	3.8	4.7	2.5	2.1
Head (calc.)	1961.5	100.0	9.06	0.79	1.95	1.61	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc (Prod 1-2)	14.3	54.6	4.68	12.6	10.6	86.0	84.7	92.0	93.6
Rougher Tail (Prod 3-6)	85.7	1.5	0.14	0.2	0.1	14.0	15.3	8.0	6.4
Scav Conc 1+2 (Prod 3-4)	10.4	7.9	0.70	0.9	0.6	9.1	9.2	4.7	3.8
Scav Conc 1-3 (Prod 3-5)	14.7	6.3	0.57	0.7	0.5	10.2	10.6	5.4	4.3

Test No. 37 Project No. 3785 Date: Dec-12-89 Operator: LP

Purpose: To repeat test 34 but use Xanthate/R208 combination 75:25 and no cleaning stage.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			
			CuSO4	AX343 Ax350	DF250	R208		Grind	Cond.	Froth	pH
Grind			-	-	-			13			
Condition 1			85	-	-				3		8.0
Rougher 1			-	20	15	6			1	3	8.0
Rougher 2			-	20	10	6			1	3	8.0
Regrind			-	-	-			10			
Condition 2			50	-	-	-			3		7.9
Scavenger 1			-	12	10	4			1	3	8.0
Scavenger 2			-	8	10	2			1	3	8.0
Scavenger 3			-	8	15	2			1	4	8.0

Stage	Roughers 1 & 2	Scavenger 1-3			
Flotation Cell	1000g D-1	1000 g D-1			
Speed: r.p.m.	1850	1850			
% Solids	33	33			
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 37

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc 1	149.1	7.6	82.5	6.49	20.9	18.1	68.4	64.6	79.4	82.3
2. Rougher Conc 2	95.5	4.9	26.3	2.69	4.69	3.54	14.0	17.2	11.4	10.3
3. Scavenger Conc 1	92.4	4.7	17.3	1.26	1.68	1.14	8.9	7.8	4.0	3.2
4. Scavenger Conc 2	85.5	4.3	4.77	0.54	0.69	0.46	2.3	3.1	1.5	1.2
5. Scavenger Conc 3	99.9	5.1	3.30	0.35	0.45	0.30	1.8	2.3	1.1	0.9
6. Scavenger Tail	1446.0	73.5	0.57	0.052	0.07	0.05	4.6	5.0	2.6	2.1
Head (calc.)	1968.4	100.0	9.13	0.76	1.99	1.67	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc (Prod 1-2)	12.4	60.6	5.01	14.6	12.4	82.4	81.8	90.8	92.6
Rougher Tail (Prod 3-6)	87.6	1.8	0.16	0.2	0.1	17.6	18.2	9.2	7.4
Scav Conc 1+2 (Prod 3-4)	9.0	11.3	0.91	1.2	0.8	11.2	10.9	5.5	4.4
Scav Conc 1-3 (Prod 3-5)	14.1	8.4	0.71	0.9	0.6	13.0	13.2	6.6	5.3

Test No. 38 Project No. 3785 Date: Dec-12-89 Operator: LP

Purpose: To repeat test 34 but use Xanthate/R208 combination 60:40 and no cleaning stage.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			
			CuSO4	AX343 Ax350	DF250	R208		Grind	Cond.	Froth	pH
Grind			-	-	-			13			
Condition 1			85	-	-				3		7.9
Rougher 1			-	15	15	10			1	3	7.9
Rougher 2			-	15	10	10			1	3	8.0
Regrind			-	-	-			10			
Condition 2			50	-	-	-			3		8.0
Scavenger 1			-	9	15	6			1	3	8.0
Scavenger 2			-	6	10	4			1	3	8.0
Scavenger 3			-	6	10	4			1	4	8.0

Stage	Roughers 1 & 2	Scavenger 1-3			
Flotation Cell	1000g D-1	1000 g D-1			
Speed: r.p.m.	1850	1850			
% Solids	33	33			
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 38

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc 1	189.7	9.6	69.8	5.37	16.3	14.0	65.6	67.4	81.7	84.7
2. Rougher Conc 2	110.3	5.6	20.7	2.00	3.16	2.30	11.3	14.6	9.2	8.1
3. Scavenger Conc 1	96.8	4.9	18.8	1.30	1.62	1.06	9.0	8.3	4.1	3.3
4. Scavenger Conc 2	86.7	4.4	18.9	0.52	0.64	0.42	8.1	3.0	1.5	1.2
5. Scavenger Conc 3	88.7	4.5	3.00	0.29	0.38	0.26	1.3	1.7	0.9	0.7
6. Scavenger Tail	1400.5	71.0	0.67	0.054	0.07	0.05	4.6	5.0	2.6	2.1
Head (calc.)	1972.7	100.0	10.2	0.77	1.92	1.59	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc (Prod 1-2)	15.2	51.7	4.13	11.5	9.70	76.9	82.0	90.9	92.7
Rougher Tail (Prod 3-6)	84.8	2.79	0.16	0.21	0.14	23.1	18.0	9.1	7.3
Scav Conc 1+2 (Prod 3-4)	9.3	18.8	0.93	1.16	0.76	17.1	11.3	5.6	4.4
Scav Conc 1-3 (Prod 3-5)	13.8	13.7	0.72	0.90	0.59	18.5	13.0	6.5	5.2

Test No. 39 Project No. 3785 Date: Dec-15-89 Operator: LP

Purpose: To conduct a series of tests to investigate the effect of fineness of grind on recovery.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			pH
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	
Grind			-	-	-			13			
Condition 1			85	-	-				3		8.0
Rougher 1			-	25	20				1	1	8.0
Rougher 2			-	-	-					1	
Rougher 3			-	25	15				1	2	8.0
Rougher 4			-	-	-					2	
Rougher 5			-	15	15				1	3	8.0
Rougher 6			-	15	15				1	3	8.0

Stage	Roughers 1 - 6				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 39

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc 1	99.9	5.1	94.7	7.44	22.2	19.0	52.4	49.1	61.6	64.3
2. Rougher Conc 2	56.0	2.8	55.5	4.76	11.9	9.86	17.2	17.6	18.5	18.7
3. Rougher Conc 3	101.3	5.2	22.4	2.19	3.58	2.64	12.6	14.7	10.1	9.1
4. Rougher Conc 4	55.8	2.8	9.07	0.87	1.25	0.88	2.8	3.2	1.9	1.7
5. Rougher Conc 5	87.2	4.4	7.40	0.68	0.91	0.62	3.6	3.9	2.2	1.8
6. Rougher Conc 6	73.0	3.7	4.73	0.42	0.57	0.39	1.9	2.0	1.2	1.0
7. Rougher Tail	1492.0	75.9	1.15	0.096	0.11	0.07	9.5	9.5	4.6	3.5
Head (calc.)	1965.2	100.0	9.18	0.77	1.83	1.50	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc 1+2 (Prod 1-2)	7.9	80.6	6.48	18.5	15.7	69.6	66.7	80.1	83.0
Rougher Conc 1-3 (Prod 1-3)	13.1	57.7	4.79	12.6	10.6	82.2	81.4	90.1	92.1
Rougher Conc 1-4 (Prod 1-4)	15.9	49.0	4.09	10.6	8.85	85.0	84.6	92.1	93.7
Rougher Conc 1-5 (Prod 1-5)	20.4	40.0	3.35	8.49	7.05	88.6	88.5	94.3	95.6
Rougher Conc 1-6 (Prod 1-6)	24.1	34.5	2.90	7.26	6.03	90.5	90.5	95.4	96.5

Test No. 40 Project No. 3785 Date: Dec-15-89 Operator: LP

Purpose: As for test 39.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 20 min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			pH
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	
Grind			-	-	-			20			
Condition 1			85	-	-				3		8.2
Rougher 1			-	25	20				1	1	8.2
Rougher 2			-	-	-					1	
Rougher 3			-	25	15				1	2	8.2
Rougher 4			-	-	-					2	
Rougher 5			-	15	15				1	3	8.1
Rougher 6			-	15	15				1	3	8.1

Stage	Roughers 1 - 6				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 40

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc 1	161.5	8.2	73.8	5.13	17.5	15.3	65.5	55.8	72.4	75.7
2. Rougher Conc 2	61.8	3.1	33.0	3.52	7.23	5.72	11.2	14.6	11.5	10.8
3. Rougher Conc 3	121.0	6.2	17.7	1.96	3.06	2.22	11.8	16.0	9.5	8.2
4. Rougher Conc 4	46.7	2.4	7.40	0.82	1.20	0.85	1.9	2.6	1.4	1.2
5. Rougher Conc 5	94.2	4.8	4.80	0.52	0.67	0.45	2.5	3.3	1.6	1.3
6. Rougher Conc 6	79.6	4.0	3.17	0.36	0.51	0.36	1.4	1.9	1.0	0.9
7. Rougher Tail	1402.0	71.3	0.74	0.062	0.07	0.04	5.7	5.8	2.5	1.9
Head (calc.)	1966.8	100.0	9.25	0.76	1.98	1.66	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc 1+2 (Prod 1-2)	11.4	62.5	4.68	14.7	12.7	76.7	70.4	83.9	86.5
Rougher Conc 1-3 (Prod 1-3)	17.5	46.8	3.73	10.6	8.99	88.5	86.3	93.4	94.8
Rougher Conc 1-4 (Prod 1-4)	19.9	42.1	3.38	9.46	8.01	90.4	88.9	94.8	96.0
Rougher Conc 1-5 (Prod 1-5)	24.7	34.8	2.82	7.75	6.55	92.9	92.2	96.4	97.3
Rougher Conc 1-6 (Prod 1-6)	28.7	30.4	2.48	6.73	5.67	94.3	94.2	97.5	98.1

Project No: 3785

Product: Comb. Prod. Test No: 39

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	0.0	0.0	0.0	100.0
147	100	11.7	11.7	11.7	88.3
104	150	9.7	9.7	21.4	78.6
74	200	9.1	9.1	30.5	69.5
53	270	8.5	8.5	39.0	61.0
38	400	7.7	7.7	46.7	53.3
-38	-400	53.3	53.3	100.0	-
	Total	100.0	100.0	-	-

Product: Comb. Prod. Test No: 40

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	1.8	1.8	1.8	98.2
147	100	4.0	4.0	5.8	94.2
104	150	8.0	8.0	13.8	86.2
74	200	12.2	12.2	26.0	74.0
53	270	9.2	9.2	35.2	64.8
38	400	9.0	9.0	44.2	55.8
-38	-400	55.8	55.8	100.0	-
	Total	100.0	100.0	-	-

Test No. 41 Project No. 3785 Date: Dec-15-89 Operator: LP

Purpose: As for test 39.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 25 min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			pH
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	
Grind			-	-	-			25			
Condition 1			85	-	-				3		8.3
Rougher 1			-	25	20				1	1	8.3
Rougher 2			-	-	-					1	
Rougher 3			-	25	15				1	2	8.3
Rougher 4			-	-	-					2	
Rougher 5			-	15	15				1	3	8.2
Rougher 6			-	15	15				1	3	8.2

Stage	Roughers 1 - 6				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 41

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution		
	(g)	(%)	Au	As	S	S(py)	Au	As	S
1. Rougher Conc 1	128.0	6.5	81.9	5.24	17.2	15.0	58.3	45.7	59.1
2. Rougher Conc 2	55.3	2.8	43.8	4.32	9.99	8.14	13.5	16.3	14.8
3. Rougher Conc 3	116.2	5.9	22.0	2.47	5.47	4.41	14.2	19.6	17.1
4. Rougher Conc 4	60.1	3.1	10.10	1.18	1.77	1.26	3.4	4.8	2.9
5. Rougher Conc 5	121.8	6.2	5.17	0.60	0.76	0.50	3.5	5.0	2.5
6. Rougher Conc 6	92.4	4.7	2.83	0.32	0.41	0.27	1.5	2.0	1.0
7. Rougher Tail	1390.4	70.8	0.73	0.070	0.07	0.04	5.6	6.6	2.6
Head (calc.)	1964.2	100.0	9.15	0.75	1.90	1.58	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc 1+2 (Prod 1-2)	9.3	70.4	4.96	15.0	12.9	71.8	62.0	74.0
Rougher Conc 1-3 (Prod 1-3)	15.2	51.6	4.00	11.3	9.61	86.0	81.5	91.0
Rougher Conc 1-4 (Prod 1-4)	18.3	44.7	3.52	9.72	8.21	89.4	86.4	93.9
Rougher Conc 1-5 (Prod 1-5)	24.5	34.7	2.78	7.45	6.26	92.9	91.4	96.4
Rougher Conc 1-6 (Prod 1-6)	29.2	29.6	2.39	6.32	5.30	94.4	93.4	97.4

Test No. 42 Project No. 3785 Date: Dec-15-89 Operator: LP

Purpose: As for test 39.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 30 min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	pH
Grind			-	-	-			30			
Condition 1			85	-	-				3		8.3
Rougher 1			-	25	20				1	1	8.3
Rougher 2			-	-	-					1	
Rougher 3			-	25	15				1	2	8.3
Rougher 4			-	-	-					2	
Rougher 5			-	15	15				1	3	8.3
Rougher 6			-	15	15				1	3	8.3

Stage	Roughers 1 - 6				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 42

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution		
	(g)	(%)	Au	As	S	S(py)	Au	As	S
1. Rougher Conc 1	140.4	7.1	78.4	4.65	15.8	13.8	59.5	42.9	56.8
2. Rougher Conc 2	66.2	3.4	45.3	4.91	12.30	10.20	16.2	21.4	20.8
3. Rougher Conc 3	129.7	6.6	19.5	2.34	4.52	3.52	13.7	20.0	15.0
4. Rougher Conc 4	69.0	3.5	7.57	0.94	1.35	0.95	2.8	4.3	2.4
5. Rougher Conc 5	133.5	6.8	3.67	0.46	0.59	0.39	2.6	4.0	2.0
6. Rougher Conc 6	104.5	5.3	2.17	0.28	0.36	0.24	1.2	1.9	1.0
7. Rougher Tail	1327.0	67.4	0.54	0.063	0.06	0.03	3.9	5.5	2.0
Head (calc.)	1970.3	100.0	9.38	0.77	1.98	1.65	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc 1+2 (Prod 1-2)	10.5	67.8	4.73	14.7	12.7	75.7	64.3	77.6
Rougher Conc 1-3 (Prod 1-3)	17.1	49.2	3.81	10.8	9.13	89.4	84.3	92.6
Rougher Conc 1-4 (Prod 1-4)	20.6	42.1	3.32	9.16	7.74	92.2	88.5	95.0
Rougher Conc 1-5 (Prod 1-5)	27.3	32.6	2.61	7.04	5.92	94.9	92.6	97.0
Rougher Conc 1-6 (Prod 1-6)	32.6	27.6	2.23	5.95	5.00	96.1	94.5	98.0

Project No: 3785

Product: Comb. Prod. Test No: 41

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	0.2	0.2	0.2	99.8
147	100	1.3	1.3	1.5	98.5
104	150	4.4	4.4	5.9	94.1
74	200	8.3	8.3	14.2	85.8
53	270	11.4	11.4	25.6	74.4
38	400	10.1	10.1	35.7	64.3
-38	-400	64.3	64.3	100.0	-
	Total	100.0	100.0	-	-

Product: Comb. Prod. Test No: 42

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	0.0	0.0	0.0	100.0
147	100	0.3	0.3	0.3	99.7
104	150	1.8	1.8	2.1	97.9
74	200	5.2	5.2	7.3	92.7
53	270	9.8	9.8	17.1	82.9
38	400	11.1	11.1	28.2	71.8
-38	-400	71.8	71.8	100.0	-
	Total	100.0	100.0	-	-

Test No. 43 Project No. 3785 Date: Dec-18-89 Operator: LP

Purpose: To investigate the effect of pulling rates on the recovery.

Procedure: As outlined below but pull hard.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13 min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	pH
Grind			-	-	-			13			
Condition 1			85	-	-				3		8.2
Rougher 1			-	25	20				1	3	8.2
Rougher 2			-	25	15				1	3	8.3
Rougher 3			-	15	15				1	3	8.3

Stage	Roughers 1 - 3				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 43

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc 1	202.9	10.3	69.0	4.95	15.7	13.6	69.3	65.7	82.0	85.4
2. Rougher Conc 2	112.9	5.7	25.7	1.82	2.94	2.16	14.4	13.4	8.5	7.6
3. Rougher Conc 3	108.1	5.5	8.73	0.81	1.09	0.74	4.7	5.7	3.0	2.5
4. Rougher Tail	1548.6	78.5	1.52	0.150	0.16	0.10	11.7	15.2	6.4	4.6
Head (calc.)	1972.5	100.0	10.2	0.78	1.97	1.64	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc 1+2 (Prod 1-2)	16.0	53.5	3.83	11.1	9.5	83.7	79.1	90.6	92.9
Rougher Conc 1-3 (Prod 1-3)	21.5	42.1	3.06	8.6	7.27	88.3	84.8	93.6	95.4

Test No. 44 Project No. 3785 Date: Dec-18-89 Operator: LP

Purpose: As for test 43.

Procedure: As outlined below but pull slow and wait for colour.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13 min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			pH
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	
Grind			-	-	-			13			
Condition 1			85	-	-				3		8.2
Rougher 1			-	25	20				1	3	8.2
Rougher 2			-	25	15				1	3	8.2
Rougher 3			-	15	15				1	3	8.3

Stage	Roughers 1 - 3				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 44

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc 1	126.2	6.4	102	8.07	23.8	20.3	68.3	66.2	80.5	83.5
2. Rougher Conc 2	40.5	2.0	40.3	3.88	6.63	4.97	8.7	10.2	7.2	6.5
3. Rougher Conc 3	19.8	1.0	27.0	2.89	4.23	2.99	2.8	3.7	2.2	1.9
4. Rougher Tail	1793.8	90.6	2.13	0.17	0.21	0.14	20.3	19.8	10.1	8.0
Head (calc.)	1980.3	100.0	9.52	0.78	1.88	1.55	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc 1+2 (Prod 1-2)	8.4	87.0	7.05	19.6	16.6	76.9	76.4	87.7	90.1
Rougher Conc 1-3 (Prod 1-3)	9.4	80.6	6.61	18.0	15.16	79.7	80.2	89.9	92.0

Test No. 43 Project No. 3785 Date: Dec-18-89 Operator: LP

Purpose: To investigate the effect of pulling rates on the recovery.

Procedure: As outlined below but pull hard.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13 min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			pH
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	
Grind			-	-	-			13			
Condition 1			85	-	-				3		8.2
Rougher 1			-	25	20				1	3	8.2
Rougher 2			-	25	15				1	3	8.3
Rougher 3			-	15	15				1	3	8.3

Stage	Roughers 1 - 3				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 43

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc 1	202.9	10.3	69.0	4.95	15.7	13.6	69.3	65.7	82.0	85.4
2. Rougher Conc 2	112.9	5.7	25.7	1.82	2.94	2.16	14.4	13.4	8.5	7.6
3. Rougher Conc 3	108.1	5.5	8.73	0.81	1.09	0.74	4.7	5.7	3.0	2.5
4. Rougher Tail	1548.6	78.5	1.52	0.150	0.16	0.10	11.7	15.2	6.4	4.6
Head (calc.)	1972.5	100.0	10.2	0.78	1.97	1.64	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc 1+2 (Prod 1-2)	16.0	53.5	3.83	11.1	9.5	83.7	79.1	90.6	92.9
Rougher Conc 1-3 (Prod 1-3)	21.5	42.1	3.06	8.6	7.27	88.3	84.8	93.6	95.4

Test No. 44 Project No. 3785 Date: Dec-18-89 Operator: LP

Purpose: As for test 43.

Procedure: As outlined below but pull slow and wait for colour.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13 min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			pH
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	
Grind			-	-	-			13			
Condition 1			85	-	-				3		8.2
Rougher 1			-	25	20				1	3	8.2
Rougher 2			-	25	15				1	3	8.2
Rougher 3			-	15	15				1	3	8.3

Stage	Roughers 1 - 3				
Flotation Cell	1000g D-1				
Speed: r.p.m.	1850				
% Solids	33				
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 44

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc 1	126.2	6.4	102	8.07	23.8	20.3	68.3	66.2	80.5	83.5
2. Rougher Conc 2	40.5	2.0	40.3	3.88	6.63	4.97	8.7	10.2	7.2	6.5
3. Rougher Conc 3	19.8	1.0	27.0	2.89	4.23	2.99	2.8	3.7	2.2	1.9
4. Rougher Tail	1793.8	90.6	2.13	0.17	0.21	0.14	20.3	19.8	10.1	8.0
Head (calc.)	1980.3	100.0	9.52	0.78	1.88	1.55	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc 1+2 (Prod 1-2)	8.4	87.0	7.05	19.6	16.6	76.9	76.4	87.7	90.1
Rougher Conc 1-3 (Prod 1-3)	9.4	80.6	6.61	18.0	15.16	79.7	80.2	89.9	92.0

Test No. 45 Project No. 3785 Date: Dec-19-89 Operator: LP

Purpose: To repeat test 34 but combine rougher concentrates and stage clean the combined scavenger concentrate once.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			pH
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	
Grind			-	-	-			13			
Condition 1			85	-	-				3		8.3
Rougher 1			-	25	20				1	3	8.3
Rougher 2			-	25	15				1	3	
Regrind			-	-	-			10			
Condition 2			50	-	-				3		8.3
Scavenger 1			-	15	15				1	3	8.3
Scavenger 2			-	15	10				1	3	
Scavenger 3			-	17	10				1	4	
		Combine scavenger concentrates.									
1st Cleaner			-	-	-				1	3	8.4

Stage	Roughers 1 & 2	Scavenger 1-3	Cleaner		
Flotation Cell	1000g D-1	1000 g D-1	250 g D-1		
Speed: r.p.m.	1850	1850	1100		
% Solids	33	33	33		
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 45

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc	139.8	7.1	105	8.6	22.9	19.2	80.6	78.6	88.6	90.9
2. Scav Cl Conc	9.6	0.5	143.0	9.52	11.5	7.43	7.5	6.0	3.1	2.4
3. Scav Cl Tail	38.8	2.0	13.2	1.57	2.25	1.58	2.8	4.0	2.4	2.1
4. Scavenger Tail	1769.3	90.4	0.93	0.10	0.12	0.08	9.0	11.5	5.9	4.6
Head (calc.)	1957.5	100.0	9.30	0.78	1.84	1.51	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Scavenger Conc (Prod 2+3)	2.5	38.9	3.15	4.1	2.7	10.4	10.0	5.5	4.5
Ro + Scav Conc (Prod 1-3)	9.6	88.0	7.20	18.1	15.0	91.0	88.5	94.1	95.4

Test No. 46 Project No. 3785 Date: Dec-20-89 Operator: LP

Purpose: To repeat test 45 but regrind combined scavenger concentrates prior to cleaning.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			pH
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	
Grind			-	-	-			13			
Condition 1			85	-	-				3		8.4
Rougher 1			-	25	20				1	3	8.4
Rougher 2			-	25	15				1	3	
Regrind			-	-	-			10			
Condition 2			50	-	-				3		8.5
Scavenger 1			-	15	15				1	3	8.5
Scavenger 2			-	15	10				1	3	
Scavenger 3			-	17	10				1	4	
		Combine scavenger concentrates.									
Regrind			-	-	-			15			
1st Cleaner			-	-	-				1	5	8.5

Stage	Roughers 1 & 2	Scavenger 1-3	Cleaner		
Flotation Cell	1000g D-1	1000 g D-1	250 g D-1		
Speed: r.p.m.	1850	1850	1100		
% Solids	33	33	33		
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 46

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc	124.8	6.3	106	8.68	23.6	19.9	73.1	69.3	83.7	87.1
2. Scav Cleaner Conc	8.4	0.4	212	12.1	17.6	12.4	9.8	6.5	4.2	3.7
3. Scav Cleaner Tail	47.4	2.4	27.0	3.82	4.04	2.41	7.1	11.6	5.4	4.0
4. Scavenger Tail	1796.6	90.9	1.00	0.11	0.13	0.08	9.9	12.6	6.6	5.2
Head (calc.)	1977.2	100.0	9.15	0.79	1.78	1.44	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Scavenger Conc (Prod 2+3)	2.8	54.8	5.07	6.08	3.9	16.9	18.1	9.6	7.7
Ro + Scav Conc (Prod 1-3)	9.1	90.2	7.56	18.2	15.0	90.1	87.4	93.4	94.8

Test No. 47 Project No. 3785 Date: Dec-19-89 Operator: LP

Purpose: To repeat test 34 but a two stage cleaner.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			pH
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	
Grind			-	-	-			13			
Condition 1			85	-	-				3		8.2
Rougher 1			-	25	20				1	3	8.2
Rougher 2			-	25	15				1	3	
Regrind			-	-	-			10			
Condition 2			50	-	-				3		8.3
Scavenger 1			-	15	15				1	3	8.3
Scavenger 2			-	15	10				1	3	
Scavenger 3			-	17	10				1	4	
	Combine rougher and scavenger concentrates.										
1st Cleaner			-	-	-				1	7	8.4
2nd Cleaner			-	5	-				1	5	8.4

Stage	Roughers 1 & 2	Scavenger 1-3	Cleaner 1 & 2		
Flotation Cell	1000g D-1	1000 g D-1	250 g D-1		
Speed: r.p.m.	1850	1850	1100		
% Solids	33	33	33		
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 47

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. 2nd Cleaner Conc	109.7	5.6	122	10.6	26.8	22.3	80.1	77.3	85.8	87.7
2. 2nd Cleaner Tail	11.7	0.6	50.4	5.70	8.45	6.01	3.5	4.4	2.9	2.5
3. 1st Cleaner Tail	69.3	3.5	14.5	1.46	2.28	1.66	6.0	6.7	4.6	4.1
4. Scavenger Tail	1777.3	90.3	0.97	0.098	0.13	0.09	10.3	11.6	6.7	5.6
Head (calc.)	1968.0	100.0	8.49	0.76	1.74	1.41	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

1st Cleaner Conc (Prod 1-2)	6.2	115	10.1	25.0	20.7	83.7	81.7	88.7	90.3
Rougher Conc (Prod 1-3)	9.7	78.5	6.98	16.8	13.8	89.7	88.4	93.3	94.4

Test No. 48 Project No. 3785 Date: Dec-22-89 Operator: LP

Purpose: To repeat test 47 but increase scavenger time and omit cleaning stage.

Procedure: As outlined below.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	pH
Grind			-	-	-			13			
Condition 1			85	-	-				3		8.3
Rougher 1			-	25	20				1	3	8.3
Rougher 2			-	25	15				1	3	
Regrind			-	-	-			10			
Condition 2			50	-	-				3		8.3
Scavenger 1			-	15	15				1	3	8.3
Scavenger 2			-	15	10				1	3	
Scavenger 3			-	17	10				1	4	
Scavenger 4			-	17	10				1	4	
Scavenger 5			-	17	10				1	4	

Stage	Roughers 1 & 2	Scavenger 1-5			
Flotation Cell	1000g D-1	1000 g D-1			
Speed: r.p.m.	1850	1850			
% Solids	33	33			
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 48

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Rougher Conc	140.9	7.2	94.6	7.91	23.0	19.6	73.3	72.9	86.0	88.8
2. Scavenger Conc 1+2	36.9	1.9	73.8	5.63	7.35	4.9	15.0	13.6	7.2	5.9
3. Scavenger Conc 3	10.1	0.5	27.3	2.70	3.51	2.4	1.5	1.8	0.9	0.8
4. Scavenger Conc 4	10.0	0.5	17.2	1.82	2.36	1.6	0.9	1.2	0.6	0.5
5. Scavenger Conc 5	8.8	0.4	18.0	1.84	2.41	1.6	0.9	1.1	0.6	0.5
6. Scavenger Tail	1758.0	89.5	0.87	0.082	0.10	0.1	8.4	9.4	4.7	3.7
Head (calc.)	1964.7	100.0	9.26	0.78	1.92	1.58	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Ro Conc+Scav Conc 1-2 (Prod 1+2)	9.0	90.3	7.44	19.8	16.6	88.3	86.5	93.2	94.6
Ro Conc+Scav Conc 1-3 (Prod 1-3)	9.6	86.9	7.18	18.9	15.8	89.8	88.3	94.1	95.4
Ro Conc+Scav Conc 1-4 (Prod 1-4)	10.1	83.4	6.91	18.0	15.1	90.7	89.5	94.8	95.9
Ro Conc+Scav Conc 1-5 (Prod 1-5)	10.5	80.6	6.70	17.4	14.5	91.6	90.6	95.3	96.3

Test No. 50 Project No. 3785 Date: Jan-2-90 Operator: LP

Purpose: To quantify very fine primary grind vs. hard pull/regrind.

Procedure: As outlined below using a hard pulling rate in the scavenger and a regrind on the combined scavenger concentrate.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	pH
Grind			-	-	-			13			
Condition 1			85	-	-				3		8.2
Rougher 1			-	25	20				1	3	8.2
Rougher 2			-	15	15				1	3	
Ro Cleaner			-	-	5				1	6	8.3
Regrind	Regrind rougher tail in ball mill.							10			
Condition 2			50	-	-				3		8.3
Scavenger 1			-	15	15				1	3	8.3
Scavenger 2			-	15	10				1	3	
Scavenger 3			-	17	10				1	4	
Scavenger 4			-	17	10				1	5	
Regrind	Combine scav concs. Regrind in pebble mill.							15			
Scav Cleaner			-	5	10				1	7	8.3
			-	5	4				1	4	

Stage	Rougher & Scavenger	Cleaners			
Flotation Cell	1000g D-1	250 g D-1			
Speed: r.p.m.	1850	900			
% Solids	33	33			
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 50

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Ro Cleaner Conc	104.7	5.4	129	10.7	31.2	26.6	75.0	72.7	83.9	86.1
2. Ro Cleaner Tail	26.6	1.4	23.5	2.29	4.11	3.1	3.5	4.0	2.8	2.6
3. Scav Cleaner Conc	44.3	2.3	43.8	3.09	4.79	3.5	10.8	8.9	5.4	4.7
4. Scav Cleaner Conc	17.4	0.9	18.7	2.12	2.58	1.7	1.8	2.4	1.2	0.9
5. Scav Cleaner Tail	370.4	19.0	2.10	0.30	0.37	0.2	4.3	7.2	3.5	2.8
6. Scav Tail	1389.5	71.2	0.60	0.054	0.09	0.1	4.6	4.9	3.2	2.9
Head (calc.)	1952.9	100.0	9.22	0.79	1.99	1.66	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc (Prod 1+2)	6.7	108	9.0	25.7	21.9	78.5	76.6	86.7	88.7
Scavenger Conc (Prod 3-5)	22.1	7.04	0.7	0.9	0.6	16.9	18.5	10.1	8.4
Scavenger Cl Conc (Prod 3+4)	3.2	36.7	2.8	4.2	3.0	12.6	11.3	6.6	5.6
Ro Conc+Scav Conc (Prod 1-5)	28.8	30.5	2.6	6.7	5.6	95.4	95.1	96.8	97.1

Test No. 51 Project No. 3785 Date: Jan-3-90 Operator: LP

Purpose: As for test 50.

Procedure: As outlined below using a slow pulling rate in the scavenger and no regrind on the combined scavenger concentrate.

Feed: 2 kg -10 mesh Composite RMF

Grind: 13min/2kg at 65% solids in a laboratory ball mill

Stage	Reagents added, grams per tonne							Time, minutes			pH
			CuSO4	AX343 Ax350	DF250			Grind	Cond.	Froth	
Grind			-	-	-			13			
Condition 1			85	-	-				3		8.2
Rougher 1			-	25	20				1	3	8.2
Rougher 2			-	15	15				1	3	
Ro Cleaner			-	-	5				1	6	8.2
Regrind		Regrind rougher tail in ball mill.						45			
Condition 2			50	-	-				3		8.3
Scavenger 1			-	15	15				1	3	8.3
Scavenger 2			-	15	10				1	3	
Scavenger 3			-	17	10				1	4	
Scavenger 4			-	17	10				1	6	
		Combine scavenger concentrates.									
Scav Cleaner			-	5	10				1	7	8.3
			-	5	4				1	4	

Stage	Rougher & Scavenger	Cleaners			
Flotation Cell	1000g D-1	250 g D-1			
Speed: r.p.m.	1850	900			
% Solids	33	33			
%- mesh					

Note : AX343 and AX350 mixed in a 3:1 ratio respectively.

Test No. 51

Metallurgical Balance

Product	Weight		Assays g/t, %				% Distribution			
	(g)	(%)	Au	As	S	S(py)	Au	As	S	S(py)
1. Ro Cleaner Conc	96.3	4.9	130	10.8	31.9	27.3	68.1	64.6	80.2	83.6
2. Ro Cleaner Tail	36.5	1.9	16.2	1.54	2.76	2.1	3.2	3.5	2.6	2.4
3. Scav Cleaner Conc 1	21.2	1.1	146	10.2	13.8	9.4	16.8	13.4	7.6	6.4
4. Scav Cleaner Conc 2	3.5	0.2	25.8	*1.80	4.52	3.7	0.5	0.4	0.4	0.4
5. Scav Cleaner Tail	86.3	4.4	4.70	0.56	0.83	0.6	2.2	3.0	1.9	1.6
6. Scav Tail	1728.1	87.6	0.97	0.14	0.16	0.1	9.1	15.0	7.2	5.5
Head (calc.)	1971.9	100.0	9.32	0.82	1.94	1.59	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Rougher Conc (Prod 1+2)	6.7	98.7	8.25	23.9	20.4	71.3	68.1	82.9	86.1
Scavenger Conc (Prod 3-5)	5.6	32.4	2.44	3.42	2.4	19.5	16.8	9.9	8.4
Scavenger Cl Conc (Prod 3+4)	1.3	129	9.01	12.5	8.6	17.3	13.8	8.1	6.8
Ro Conc+Scav Conc (Prod 1-5)	12.4	68.5	5.61	14.6	12.2	90.9	85.0	92.8	94.5

* Insufficient Sample - Assay was calculated using enrichment ratio.

Project No: 3785 MB

Product: Scavenger Tail Test No: 50

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	1.5	1.1	1.1	98.9
147	100	7.4	5.2	6.3	93.7
104	150	15.3	10.8	17.1	82.9
74	200	19.2	13.5	30.6	69.4
53	270	18.9	13.3	43.9	56.1
38	400	14.6	10.3	54.2	45.8
-38	-400	64.9	45.8	100.0	-
	Total	141.8	100.0	-	-

Product: Combined Product Test No: 50

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	0.0	0.0	0.0	100.0
147	100	0.0	0.0	0.0	100.0
104	150	0.1	0.1	0.1	99.9
74	200	0.5	0.5	0.6	99.4
53	270	0.9	0.9	1.5	98.5
38	400	2.2	2.2	3.7	96.3
-38	-400	96.3	96.3	100.0	-
	Total	100.0	100.0	-	-

Project No: 3785 MB

Product: Combined Product Test No: 51

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	0.0	0.0	0.0	100.0
147	100	0.0	0.0	0.0	100.0
104	150	0.0	0.0	0.0	100.0
74	200	0.0	0.0	0.0	100.0
53	270	0.3	1.2	1.2	98.8
38	400	0.3	1.2	2.4	97.6
-38	-400	24.4	97.6	100.0	-
	Total	25.0	100.0	-	-

Product: Scavenger Tail Test No: 51

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	0.0	0.0	0.0	100.0
147	100	0.0	0.0	0.0	100.0
104	150	0.7	0.5	0.5	99.5
74	200	3.2	2.5	3.0	97.0
53	270	8.4	6.6	9.6	90.4
38	400	11.5	9.0	18.6	81.4
-38	-400	104.4	81.4	100.0	-
	Total	128.2	100.0	-	-

Test No. 1 Project No. 3785 Operator LM Date: 18/09/89

Purpose: To determine the association characteristics of gold by sequential leaching.

Cyanidation A

Procedure: The sample was pulped to 20% solids in a 2.5 L beaker and leached for a total of 24 hours with conditions as described below. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 g Roaster Feed (Sample No. 1)

Solution Volume: 1000 mL Pulp Density: 20 % Solids

Sol'n Composition: 2.0 g/L NaCN

pH Range: 10.5-11.0 .

Reagent Consumption (kg/t of cyanide feed) NaCN: 2.88 CaO: 0.32

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0-5	2.03	0.15	2.00	0.11	1.50	-	0.50	-	11.0-11.(
5-24	0.53	0.00	0.50	0.00	1.78	0.03	0.22	0.08	11.1-11
Total	2.56	0.15	2.50	0.11	1.78	0.03	0.72	0.08	

Test No. 1 Project No. 3785 Operator:LM Date: 18/09/89

NaOH Leach B

Procedure: The residue was repulped to 20% solids and leached in a 150 g/L NaOH solution for 2 hours at 100 C to decompose arsenates. The slurry was filtered and washed; the filtrate was assayed for Au and As. The residue was examined under a binocular microscope to check for the presence of of arsenates.

Feed: 250 grams cyanidation A residue

Test No. 1 Project No. 3785 Operator LM Date: 18/09/89

Cyanidation C

Procedure: The sample was pulped to 20% solids in a 2.5 L beaker and leached for a total of 2 hours with conditions as described below. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 grams NaOH leach B residue

Solution Volume: 1000 mL Pulp Density: 20 % Solids

Sol'n Composition: 20.0 g/L NaCN

pH Range: 10.5-11.5 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 3.28 CaO: -

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 2	21.05	0.00	20.00	0.00	19.18	-	0.82	-	12.3
Total	21.05	0.00	20.00	0.00	19.18	-	0.82	-	

Test No. 1 Project No. 3785 Operator:LM Date: 18/09/89

Aqua Regia Leach D

Procedure: The residue was repulped to 20% solids in aqua regia solution (3 parts HCl : 1 part HNO3) and leached for 2 hours at 100 C, to decompose all sulphides and associated gold. Examination under a binocular microscope showed that some sulphides remained; the residue was repulped with 1 L of aqua regia and leached for a further 2 hours at 100 C. The slurry was filtered and washed. The filtrate and residue were assayed for Au, Fe and As.

Feed: 250 grams cyanidation C residue

Test No. 1

Product	Amount	Assays (mg/L, g/t, %)			%Distribution		
	ml, g	Au	As	Fe	Au	As	Fe
1A-cyanidation filtrate	1735	6.29	-	-	43.7	-	-
1B-NaOH filtrate	2025	0.024	882**	*	0.2	7.6	-
1C-cyanidation filtrate	1665	0.20	-	-	1.3	-	-
1D-aqua regia filtrate	4025	3.38	5370	12380	54.5	92.4	100.0
residue	73.1	1.02	0.022	0.43	0.3	0.0	0.0
Head (calc.)	250.0	99.9	9.36	19.9	100.0	100.0	100.0
Direct assays		104	9.36				

* not assayed
** calculated

Test No. 2 Project No. 3785 Operator LM Date: 13/09/89

Purpose: To determine the association characteristics of gold by sequential leaching.

Cyanidation A

Procedure: The sample was pulped to 20% solids in a 2.5 L beaker and leached for a total of 24 hours with conditions as described below. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 g Transfer Dust (Sample No. 2)

Solution Volume: 1000 mL Pulp Density: 20 % Solids

Sol'n Composition: 2.0 g/L NaCN

pH Range: 10.5-11.0 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 4.96 CaO: 3.00

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0-1.5	2.11	0.90	2.00	0.65	1.65	-	0.35	-	11.0-10.5
1.5-6	0.37	0.30	0.35	0.22	1.70	-	0.30	-	11.0-10.9
6-24	0.32	0.00	0.30	0.00	1.41	0.11	0.59	0.76	10.9-11.0
Total	2.80	1.20	2.65	0.87	1.41	0.11	1.24	0.76	

Test No. 2 Project No. 3785 Operator:LM Date: 18/09/89

NaOH Leach B

Procedure: The residue was repulped to 20% solids and leached in a 150 g/L NaOH solution for 2 hours at 100 C to decompose arsenates. The slurry was filtered and washed; the filtrate was assayed for Au and As. The residue was examined under a binocular microscope to check for the presence of of arsenates.

Feed: 250 grams cyanidation A residue

Test No. 2 Project No. 3785 Operator LM Date: 18/09/89

Cyanidation C

Procedure: The sample was pulped to 20% solids in a 2.5 L beaker and leached for a total of 2 hours with conditions as described below. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 grams NaOH leach B residue

Solution Volume: 1000 mL Pulp Density: 20 % Solids

Sol'n Composition: 20.0 g/L NaCN

pH Range: 10.5-11.5 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 2.28 CaO: -

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 2	21.05	0.00	20.00	0.00	19.43	-	0.57	-	12.3
Total	21.05	0.00	20.00	0.00	19.43	-	0.57	-	

Test No. 2 Project No. 3785 Operator:LM Date: 18/09/89

Aqua Regia Leach D

Procedure: The residue was repulped to 20% solids in aqua regia solution (3 parts HCl : 1 part HNO3) and leached for 2 hours at 100 C, to decompose all sulphides and associated gold. Examination under a binocular microscope showed that some sulphides remained; the residue was repulped with 1 L of aqua regia and leached for a further 2 hours at 100 C. The slurry was filtered and washed. The filtrate and residue were assayed for Au, Fe and As.

Feed: 250 grams cyanidation C residue

Test No. 2

Product	Amount	Assays (mg/L, g/t, %)			%Distribution		
	ml, g	Au	As	Fe	Au	As	Fe
1A-cyanidation filtrate	1500	19.70	-	-	81.8	-	-
1B-NaOH filtrate	1825	0.09	1731**	*	0.4	64.5	-
1C-cyanidation filtrate	1450	2.39	-	-	9.6	-	-
1D-aqua regia filtrate	3635	0.80	479	19660	8.1	35.5	99.3
residue	81.9	0.42	0.010	0.58	0.1	0.0	0.7
Head (calc.)	250.0	144	1.96	28.8	100.0	100.0	100.0
Direct assays		104	1.96				

* not assayed
** calculated

Test No. 3 Project No. 3785 Operator LM Date: 13/09/89

Purpose: To determine the association characteristics of gold by sequential leaching.

Cyanidation A

Procedure: The sample was pulped to 20% solids in a 2.5 L beaker and leached for a total of 24 hours with conditions as described below. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 g Roaster Calcine (Sample No. 3)

Solution Volume: 1000 mL Pulp Density: 20 % Solids

Sol'n Composition: 2.0 g/L NaCN

pH Range: 10.5-11.0 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 5.08 CaO: 3.44

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0-2.5	2.11	1.07	2.00	0.77	1.30	-	0.70	-	11.0-10.5
2.5-24	0.74	0.20	0.70	0.14	1.43	0.05	0.57	0.86	11.2-11.0
Total	2.85	1.27	2.70	0.91	1.43	0.05	1.27	0.86	

Test No. 3 Project No. 3785 Operator:LM Date: 18/09/89

NaOH Leach B

Procedure: The residue was repulped to 20% solids and leached in a 150 g/L NaOH solution for 2 hours at 100 C to decompose arsenates. The slurry was filtered and washed; the filtrate was assayed for Au and As. The residue was examined under a binocular microscope to check for the presence of of arsenates.

Feed: 250 grams cyanidation A residue

Test No. 3 Project No. 3785 Operator LM Date: 18/09/89

Cyanidation C

Procedure: The sample was pulped to 20% solids in a 2.5 L beaker and leached for a total of 2 hours with conditions as described below. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 grams NaOH leach B residue

Solution Volume: 1000 mL Pulp Density: 20 % Solids

Sol'n Composition: 20.0 g/L NaCN

pH Range: 10.5-11.5 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.52 CaO: -

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 2	21.05	0.00	20.00	0.00	19.87	-	0.13	-	12.5
Total	21.05	0.00	20.00	0.00	19.87	-	0.13	-	

Test No. 3 Project No. 3785 Operator:LM Date: 18/09/89

Aqua Regia Leach D

Procedure: The residue was repulped to 20% solids in aqua regia solution (3 parts HCl : 1 part HNO3) and leached for 2 hours at 100 C, to decompose all sulphides and associated gold. Examination under a binocular microscope showed that some sulphides remained; the residue was repulped with 1 L of aqua regia and leached for a further 2 hours at 100 C. The slurry was filtered and washed. The filtrate and residue were assayed for Au, Fe and As.

Feed: 250 grams cyanidation C residue

Test No. 3

Product	Amount	Assays (mg/L, g/t, %)			%Distribution		
	ml, g	Au	As	Fe	Au	As	Fe
1A-cyanidation filtrate	1625	15.6	-	-	86.4	-	-
1B-NaOH filtrate	1860	0.052	1537**	*	0.3	65.3	-
1C-cyanidation filtrate	1450	1.47	-	-	7.3	-	-
1D-aqua regia filtrate	2110	0.80	719	32940	5.8	34.7	100.0
residue	84.5	1.01	0.13	1.00	0.3	0.0	0.0
Head (calc.)	250.0	117	1.75	27.8	100.0	100.0	100.0
Direct assays		137	1.75				

* not assayed
** calculated

Test No. 4 Project No. 3785 Operator LM Date: 18/09/89

Purpose: To determine the association characteristics of gold by sequential leaching.

Cyanidation A

Procedure: The sample was pulped to 20% solids in a 2.5 L beaker and leached for a total of 24 hours with conditions as described below. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 grams Calcine residue (Sample No. 4)

Solution Volume: 1000 mL Pulp Density: 20 % Solids

Sol'n Composition: 2.0 g/L NaCN

pH Range: 10.5-11.5 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 3.40 CaO: 1.00

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 4	2.11	0.40	2.00	0.29	1.75	-	0.25	-	11.0-10.
4 - 24	0.26	0.00	0.25	0.00	1.40	0.04	0.60	0.25	11.0-11.
Total	2.37	0.40	2.25	0.29	1.40	0.04	0.85	0.25	

Test No. 4 Project No. 3785 Operator:LM Date: 18/09/89

NaOH Leach B

Procedure: The residue was repulped to 20% solids and leached in a 150 g/L NaOH solution for 2 hours at 100 C to decompose arsenates. The slurry was filtered and washed; the filtrate was assayed for Au and As. The residue was examined under a binocular microscope to check for the presence of of arsenates.

Feed: 250 grams cyanidation A residue

Test No. 4 Project No. 3785 Operator LM Date: 18/09/89

Cyanidation C

Procedure: The sample was pulped to 20% solids in a 2.5 L beaker and leached for a total of 2 hours with conditions as described below. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 grams NaOH leach B residue

Solution Volume: 1000 mL Pulp Density: 20 % Solids

Sol'n Composition: 20.0 g/L NaCN

pH Range: 10.5-11.5 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.00 CaO: -

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 2	21.05	0.00	20.00	0.00	20.00	-	0.00	-	12.4
Total	21.05	0.00	20.00	0.00	20.00	-	0.00	-	

Test No. 4 Project No. 3785 Operator:LM Date: 18/09/89

Aqua Regia Leach D

Procedure: The residue was repulped to 20% solids in aqua regia solution (3 parts HCl : 1 part HNO3) and leached for 2 hours at 100 C, to decompose all sulphides and associated gold. Examination under a binocular microscope showed that some sulphides remained; the residue was repulped with 1 L of aqua regia and leached for a further 2 hours at 100 C. The slurry was filtered and washed. The filtrate and residue were assayed for Au, Fe and As.

Feed: 250 grams cyanidation C residue

Test No. 4

Product	Amount	Assays (mg/L, g/t, %)			%Distribution		
	ml, g	Au	As	Fe	Au	As	Fe
1A-cyanidation filtrate	1460	0.15	-	-	33.0	-	-
1B-NaOH filtrate	1660	0.015	1581**	*	3.8	71.9	-
1C-cyanidation filtrate	1645	0.16	-	-	39.7	-	-
1D-aqua regia filtrate	1600	0.08	641	41240	19.3	28.1	100
residue	95.6	0.29	0.052	1.29	4.2	0.0	0.
Head (calc.)	250.0	2.65	1.46	26.4	100.0	100.0	10(
Direct assays		2.40	1.46				

* not assayed
** calculated

Test No. 5 Project No. 3785 Operator LM Date: 14/09/89

Purpose: To determine the association characteristics of gold by sequential leaching.

Cyanidation A

Procedure: The sample was pulped to 20% solids in a 2.5 L beaker and leached for a total of 24 hours with conditions as described below. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 g Hot Cottrell Dust (Sample No. 5)

Solution Volume: 1000 mL Pulp Density: 20 % Solids

Sol'n Composition: 2.0 g/L NaCN

pH Range: 10.5-11.0 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 8.68 CaO: 3.52

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0-4	2.11	1.03	2.00	0.74	0.50	-	1.50	-	11.0-10.1
4-24	1.58	0.22	1.50	0.16	1.33	0.02	0.67	0.88	11.0-10.6
Total	3.69	1.25	3.50	0.90	1.33	0.02	2.17	0.88	

Test No. 5 Project No. 3785 Operator:LM Date: 18/09/89

NaOH Leach B

Procedure: The residue was repulped to 20% solids and leached in a 150 g/L NaOH solution for 2 hours at 100 C to decompose arsenates. The slurry was filtered and washed; the filtrate was assayed for Au and As. The residue was examined under a binocular microscope to check for the presence of of arsenates.

Feed: 250 grams cyanidation A residue

Test No. 5 Project No. 3785 Operator LM Date: 14/09/89

Cyanidation C

Procedure: The sample was pulped to 20% solids in a 2.5 L beaker and leached for a total of 2 hours with conditions as described below. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 grams NaOH leach B residue

Solution Volume: 1000 mL Pulp Density: 20 % Solids

Sol'n Composition: 20.0 g/L NaCN

pH Range: 10.5-11.5 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 8.68 CaO: -

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0-2	21.05	0.00	20.00	0.00	19.91	-	0.09	-	12.2
Total	21.05	0.00	20.00	0.00	19.91	-	0.09	-	

Test No. 5 Project No. 3785 Operator:LM Date: 18/09/89

Aqua Regia Leach D

Procedure: The residue was repulped to 20% solids in aqua regia solution (3 parts HCl : 1 part HNO_3) and leached for 2 hours at 100 C, to decompose all sulphides and associated gold. Examination under a binocular microscope showed that some sulphides remained; the residue was repulped with 1 L of aqua regia and leached for a further 2 hours at 100 C. The slurry was filtered and washed. The filtrate and residue were assayed for Au, Fe and As.

Feed: 250 grams cyanidation C residue

Test No. 5

Product	Amount	Assays (mg/L, g/t, %)			%Distributi	
	ml, g	Au	As	Fe	Au	As
1A-cyanidation filtrate	1415	6.93	-	-	85.6	-
1B-NaOH filtrate	1895	0.008	2764**	*	0.1	80.3
1C-cyanidation filtrate	1580	0.89	-	-	12.3	-
1D-aqua regia filtrate	2420	0.08	532		1.7	19.7
residue	107.2	0.37	0.029	0.50	0.3	0.0
Head (calc.)	250.0	45.8	2.61	0.21	100.0	100.0
Direct assays		49.6	2.61			

* not assayed
** calculated

Test No. 6 Project No. 3785 Operator LM Date: 14/09/89

Purpose: To determine the association characteristics of gold by sequential leaching.

Cyanidation A

Procedure: The sample was pulped to 20% solids in a 2.5 L beaker and leached for a total of 24 hours with conditions as described below. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 g Dust Treatment Residue (Sample No. 6)

Solution Volume: 1000 mL Pulp Density: 20 % Solids

Sol'n Composition: 2.0 g/L NaCN

pH Range: 10.5-11.0 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 4.36 CaO: 1.60

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0-4	2.11	0.49	2.00	0.35	1.30	-	0.70	-	11.0-10.6
4-24	0.74	0.13	0.70	0.09	1.61	0.05	0.39	0.39	11.2-10.9
Total	2.85	0.62	2.70	0.44	1.61	0.05	1.09	0.39	

Test No. 6 Project No. 3785 Operator:LM Date: 18/09/89

NaOH Leach B

Procedure: The residue was repulped to 20% solids and leached in a 150 g/L NaOH solution for 2 hours at 100 C to decompose arsenates. The slurry was filtered and washed; the filtrate was assayed for Au and As. The residue was examined under a binocular microscope to check for the presence of of arsenates.

Feed: 250 grams cyanidation A residue

Test No. 6 Project No. 3785 Operator LM Date: 14/09/89

Cyanidation C

Procedure: The sample was pulped to 20% solids in a 2.5 L beaker and leached for a total of 2 hours with conditions as described below. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 grams NaOH leach B residue

Solution Volume: 1000 mL Pulp Density: 20 % Solids

Sol'n Composition: 20.0 g/L NaCN

pH Range: 10.5-11.5 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 4.36 CaO: -

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0-2	21.05	0.00	20.00	0.00	19.50	0.00	0.50	0.00	12.4
Total	21.05	0.00	20.00	0.00	19.50	0.00	0.50	0.00	

Test No. 6 Project No. 3785 Operator:LM Date: 18/09/89

Aqua Regia Leach D

Procedure: The residue was repulped to 20% solids in aqua regia solution (3 parts HCl : 1 part HNO3) and leached for 2 hours at 100 C, to decompose all sulphides and associated gold. Examination under a binocular microscope showed that some sulphides remained; the residue was repulped with 1 L of aqua regia and leached for a further 2 hours at 100 C. The slurry was filtered and washed. The filtrate and residue were assayed for Au, Fe and As.

Feed: 250 grams cyanidation C residue

Test No. 6:

Product	Amount	Assays (mg/L, g/t, %)			%Distribution		
	ml, g	Au	As	Fe	Au	As	Fe
1A-cyanidation filtrate	1520	0.10	-	-	8.5	-	-
1B-NaOH filtrate	1715	0.046	3647**	*	4.4	82.6	-
1C-cyanidation filtrate	1585	0.89	-	-	79.3	-	-
1D-aqua regia filtrate	1870	0.05	706	26500	5.3	17.4	100.0
residue	97.7	0.45	0.020	0.47	2.5	0.0	0.0
Head (calc.)	250.0	7.12	3.03	19.8	100.0	100.0	100.0
Direct assays		8.13	3.03				

* not assayed
** calculated

Test No. 7 Project No. 3785 Operator LM Date: 02/10/89

Purpose: To determine the amount of exposed gold by direct cyanidation of a sample of Giant Yellowknife classifier O/F.

Procedure: The sample was pulped to 33% solids in a 2.5 L bottle and leached for a total of 48 hours with conditions as described below. The pulp was filtered and washed with water.

Feed: 500 g Classifier O/F (Sample No. 7)

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 0.5 g/L NaCN

pH Range: 10.5-11.0 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.20 CaO: 0.60

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0-4.5	0.53	0.29	0.50	0.21	0.45	-	0.05	-	11.1-10.6
4.5-23.5	0.05	0.06	0.05	0.04	0.45	-	0.05	-	11.0-10.4
23.5-48	0.05	0.10	0.05	0.07	0.50	0.02	0.00	0.30	11.0-10.9
Total	0.63	0.45	0.60	0.32	0.50	0.02	0.10	0.30	

Test No. 7

Product	Amount ml, g	Au assays mg/L, g/t	%Distribution Au
preg+wash	1770	0.91	30.9
residue	498.6	7.23	69.1
Head (calc.)	498.6	10.5	100.0

Test No. 8 Project No. 3785 Operator LM Date: 02/10/89

Purpose: To determine the amount of exposed gold by direct cyanidation of a sample of Giant Yellowknife float tails

Procedure: The sample was pulped to 33% solids in a 2.5 L bottle and leached for a total of 48 hours with conditions as described below. The pulp was filtered and washed with water.

Feed: 500 g Float Tails (Sample No. 8)

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 0.5 g/L NaCN

pH Range: 10.5-11.0 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.08 CaO: 0.44

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0-4.5	0.53	0.24	0.50	0.17	0.48	-	0.02	-	11.0-10.7
4.5-23.5	0.02	0.06	0.02	0.04	0.50	-	0.00	-	11.0-10.7
23.5-48	0.00	0.05	0.00	0.04	0.48	0.03	0.02	0.25	11.0-11.0
Total	0.55	0.35	0.52	0.25	0.48	0.03	0.04	0.22	

Test No. 8

Product	Amount ml, g	Au assays mg/L, g/t	%Distribution Au
preg+wash	1720	0.11	38.8
residue	498.4	0.60	61.2
Head (calc.)	498.4	0.98	100.0

Test No. 11 Project No. 3785 Operator LM Date: 17/10/89

Purpose: To investigate recovery of gold by direct cyanidation of Giant Yellowknife mill feed.

Procedure: The sample was pulped to 33% solids in a 2.5 L bottle and leached for a total of 48 hours with conditions as described below. The pulp was filtered and washed with water.

Feed: 1000 g mill feed (Sample No. 9)

Solution Volume: 2000 mL Pulp Density: 33 % Solids

Sol'n Composition: 0.5 g/L NaCN

pH Range: 10.5-11.0 with Ca(OH)2

Grind: 30 min/2 kg at 65 % solids in a lab ball mill

Reagent Consumption (kg/t of cyanide feed) NaCN: 1.05 CaO: 0.74

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0-4.5	1.05	0.45	1.00	0.32	0.20	-	0.80	-	11.0-10.4
4.5-8	0.84	0.30	0.80	0.22	1.00	-	0.00	-	11.0-10.7
8-24	0.00	0.14	0.00	0.10	1.00	-	0.00	-	11.0-10.7
24-48	0.00	0.19	0.00	0.14	0.76	0.05	0.24	0.73	11.0-10.7
Total	1.89	1.08	1.80	0.78	0.76	0.05	1.04	0.73	

Test No. 11

Product	Amount ml, g	Au assays mg/L, g/t	%Distribution Au
preg+wash	2920	1.66	51.4
residue	990.0	4.63	48.6
Head (calc.)	990.0	9.53	100.0

Test No. 12 Project No. 3785 Operator LM Date: 17/10/89

Purpose: To repeat Test No. 11 at a lower pH.

Procedure: The sample was pulped to 33% solids in a 2.5 L bottle and leached for a total of 48 hours with conditions as described below. The pulp was filtered and washed with water.

Feed: 1000 g mill feed (Sample No. 9)

Solution Volume: 2000 mL Pulp Density: 33 % Solids

Sol'n Composition: 0.5 g/L NaCN

pH Range: 8.5 with Ca(OH)2

Grind: 30 min/2 kg at 65 % solids in a lab ball mill

Reagent Consumption (kg/t of cyanide feed) NaCN: 1.23 CaO: 0.00

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0-4.5	1.05	0.00	1.00	0.00	0.20	-	0.80	-	10.0-10.0
4.5-8	0.84	0.00	0.80	0.00	0.80	-	0.20	-	10.0-9.9
8-24	0.21	0.00	0.20	0.00	1.00	-	0.00	-	9.9-10.0
24-48	0.00	0.00	0.00	0.00	0.78	0.00	0.22	0.00	10.0-9.7
Total	2.10	0.00	2.00	0.00	0.78	0.00	1.22	0.00	

Test No. 12

Product	Amount ml, g	Au assays mg/L, g/t	%Distribution Au
preg+wash	2990	1.67	51.4
residue	988.5	4.78	48.6
Head (calc.)	988.5	9.83	100.0

Test No. 14 Project No. 3785 Operator:LM Date: 18/09/89

Purpose: To determine the association characteristics of gold from the dust treatment residue.

NaOH Leach

Procedure: The sample was pulped with water to 20% solids and leached in a 2 L beaker and leached with 150 g/L NaOH at 80 C for a total of 2 hours. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 grams "dust treatment residue" - Sample No. 6

Test No. 14 Project No. 3785 Operator LM Date: 17/10/89

Cyanidation

Procedure: The sample was pulped to 20% solids in a 2.5 L beaker and leached for a total of 24 hours with conditions as described below. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 grams NaOH leach A residue

Solution Volume: 1000 mL Pulp Density: 20 % Solids

Sol'n Composition: 10.0 g/L NaCN

pH Range: 10.5-11.5 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 23.47 CaO: -

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0-2	10.53	0.00	10.00	0.00	9.45	-	0.55	-	11.3-11.5
2-15	0.58	0.00	0.55	0.00	8.75	-	1.25	-	11.5-11.5
15-24	1.32	0.00	1.25	0.00	6.31	0.00	3.69	0.00	11.5-11.5
Total	12.43	0.00	11.80	0.00	6.31	0.00	5.49	0.00	

Results:

Product	Amount	Assays (mg/L, g/t, %)		% Distribution	
	ml, g	Au	As	Au	As
14A-NaOH filtrate	800	0.24	4180	8.5	1.2
14A-NaOH wash	1080	0.05	715	2.4	0.3
14B-cyanidation filtrate	1540	1.07	10.1	73.2	0.0
residue	233.9	1.53	1.19	15.9	98.5
Head (calc.)	250.0	9.01	1.13	100.0	100.0

Calculated Grades and Recoveries

1+2	1880	0.13	2189.47	10.9	1.5
1-3	3420	0.55	1208.12	84.1	1.5

Test No. 16 Project No. 3785 Operator: LM Date: 25/10/89

Purpose: To repeat Test No. 4 but water wash the sample prior to cyanidation to investigate the presence of water soluble gold.

Water Wash

Procedure: The sample was pulped to 20% solids, filtered and washed. The residue was repulped to 20% solids, filtered and washed again. The filtrate was assayed for Au.

Feed: 250 g calcine residue (Sample No. 4)

Test No. 16 Project No. 3785 Operator LM Date: 25/10/89

Cyanidation A

Procedure: The sample was pulped to 20% solids in a 2.5 L beaker and leached for a total of 24 hours with conditions as described below. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 g Calcine Residue (Sample No. 4)

Solution Volume: 1000 mL Pulp Density: 20 % Solids

Sol'n Composition: 2.0 g/L NaCN

pH Range: 10.5-11.0 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 3.80 CaO: 0.08

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 5.5	2.11	0.06	2.00	0.04	1.65	-	0.35	-	11.0-11.2
5.5 - 24	0.37	0.00	0.35	0.00	1.40	0.02	0.60	0.02	11.2-11.4
Total	2.48	0.06	2.35	0.04	1.40	0.02	0.95	0.02	

Test No. 16 Project No. 3785 Operator:LM Date: 18/09/89

NaOH Leach B

Procedure: The residue was repulped to 20% solids and leached in a 150 g/L NaOH solution for 2 hours at 100 C to decompose arsenates. The slurry was filtered and washed; the filtrate was assayed for Au and As.

Feed: 250 grams cyanidation A residue

Test No. 16C Project No. 3785 Operator LM Date: 14/09/89

Cyanidation C

Procedure: The sample was pulped to 20% solids in a 2.5 L beaker and leached for a total of 2 hours with conditions as described below. The slurry was agitated mechanically throughout. The pulp was filtered and washed with water.

Feed: 250 grams NaOH leach B residue

Solution Volume: 1000 mL Pulp Density: 20 % Solids

Sol'n Composition: 20.0 g/L NaCN

pH Range: 10.5-11.5 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.00 CaO: -

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0-2	21.05	0.00	20.00	0.00	20.00	0.00	0.00	0.00	12.3
Total	21.05	0.00	20.00	0.00	20.00	0.00	0.00	0.00	

Test No. 16 Project No. 3785 Operator:LM Date: 18/09/89

Aqua Regia Leach D

Procedure: The residue was repulped to 20% solids in aqua regia solution (3 parts HCl : 1 part HNO3) and leached for 2 hours at 100 C, to decompose all sulphides and associated gold. Examination under a binocular microscope showed that some sulphides remained; the residue was repulped with 1 L of aqua regia and leached for a further 2 hours at 100 C. The slurry was filtered and washed. The filtrate and residue were assayed for Au, Fe and As.

Feed: 250 grams cyanidation C residue

Test No. 16

Product	Amount	Assays (mg/L, g/t, %)			%Distribution		
	ml, g	Au	As	Fe	Au	As	Fe
preleach filtrate	1890	0.069	-	-	12.2	-	-
16A-cyanidation filtrate	1530	0.077	-	-	11.0	-	-
16B-NaOH filtrate	1160	0.005	531	-	0.5	-	-
16C-cyanidation filtrate	2525	0.062	-	-	14.6	-	-
16D-aqua regia filtrate	2690	0.24	802	24800	60.4	-	-
residue	95.9	0.13	0.009	0.45	1.2	-	-
Head (calc.)	250.0	4.27	1.11	26.7	100.0	-	-

Test No. 17 Project No. 3785 Operator LM Date: 26/10/89

Purpose: To investigate recovery of Au from reground calcine residue.

Procedure: The sample was pulped to 33% solids in a 2.5 L bottle and leached for a total of 24 hours with conditions as described below. The pulp was filtered and washed with water.

Feed: 500 g calcine residue (Sample No. 4)

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 2.0 g/L NaCN

pH Range: 10.5-11 with Ca(OH)2

Grind: 30 min/500 g at 65 % in a lab pebble mill

Reagent Consumption (kg/t of cyanide feed) NaCN: 1.25 CaO: 0.79

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0-5.5	2.11	0.32	2.00	0.23	1.50	-	0.50	-	11.0-10.4
5.5-7.5	0.53	0.30	0.50	0.22	1.88	-	0.12	-	11.1-11.0
7.5-24	0.13	0.00	0.12	0.00	2.00	0.06	0.00	0.39	11.0-10.7
Total	2.77	0.62	2.62	0.45	2.00	0.06	0.62	0.39	

Test No. 17

Product	Amount ml, g	Au assays mg/L, g/t	%Distribution Au
preg+wash	1800	0.16	17.4
residue	496.1	2.76	82.6
Head (calc.)	496.1	3.34	100.0

Project No: 3785

Product: Cyanide Residue Test No: 17 S.G.- 3.36

Mesh	Weight Grams	% Weight		
		Ind.	Cum.	Passing
270m	0.22	0.4	0.4	99.6
34.4µ	1.12	2.2	2.7	97.3
26.7	2.86	5.7	8.4	91.6
18.6	7.12	14.2	22.6	77.4
12.8	10.10	20.2	42.8	57.2
9.9	4.01	8.0	50.9	49.1
-9.9	24.57	49.1	100.0	-
Total	50.00	100.0	-	-

Test No. 18 Project No. 3785 Operator LM Date: 18/09/8

Purpose: To investigate the recovery of free gold from calcine residue by gravity separation.

Feed: 2 kg calcine residue

Grind: none

Procedure: The sample was pulped with water in a large beaker and passed over a Wilfley table, producing a Wilfley concentrate and Wilfley tails. The Wilfley concentrate was passed over a Mozley Mineral Separator, filtered and assayed for Au.

Results:

Product	Weight		Assays	% Distribution
	g	%	Au (g/t)	Au
Mozley conc.	0.2	0.01	2600	4.5
Mozley tails.	214.5	10.99	8.14	23.2
Wilfley tails.	1740.9	89.00	3.13	72.3
Head (calc.)	1955.6	100.0	3.85	100.0

Calculated Grades and Recoveries

1 + 2	214.7	11.00	9.71	27.7
2 - 3	1955.4	99.99	3.68	95.5

Test No. 22A Project No. 3785 Operato SA Date: 11/15/89

Purpose: To examine the recovery of gold from the flotation rougher tailing.

Procedure: The sample was pulped with water in a 2.5 liter bottle. Lime and NaCN were added and the cyanidation was carried out on the rolls in one 48 hour stage. The pulp was filtered and the residue washed three times with water.

Feed: 500 g rougher tailing from test 22

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 1.0 g/L NaCN

pH Range: 10.0 with Ca(OH)2

Grind: nil

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.80 CaO: 0.16

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 1	1.05	0.10	1.00	0.08	0.85	-	0.15	-	10.1-10
1 - 5	0.16	-	0.15	-	0.95	-	0.05	-	10.1-10
5 - 23	0.05	-	0.05	-	0.85	-	0.15	-	10.0-10
23 - 31	0.16	-	0.15	-	0.95	-	0.05	-	10.0-10
31 - 48	0.05	-	0.05	-	1.00	0.00	0.00	0.08	10.0-10
Total	1.47	0.10	1.40	0.08	1.00	0.00	0.40	0.08	

Test No. 22A

Metallurgical Results

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. Preg and Wash Sol'n	1790 mL	0.16	35.5
2. Residue	485.5 g	1.07	64.5
Head (calc.)	485.5 g	1.66	100.0

Test No. 23A Project No. 3785 Operato SA Date: 11/15/89

Purpose: To examine the recovery of gold from the flotation 2nd rougher tailing.

Procedure: As for test No. 22A

Feed: 500 g 2nd rougher tailing from test 23

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 1.0 g/L NaCN

pH Range: 10.0 with Ca(OH)2

Grind: nil

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.80 CaO: 0.22

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 1	1.05	0.15	1.00	0.11	0.85	-	0.15	-	10.1-10.1
1 - 5	0.16	-	0.15	-	0.95	-	0.05	-	10.1-10.(
5 - 23	0.05	-	0.05	-	0.85	-	0.15	-	10.0-10.(
23 - 31	0.16	-	0.15	-	1.00	-	0.00	-	10.0-10.0
31 - 48	-	-	-	-	0.95	0.00	0.05	0.11	10.0-10.(
Total	1.42	0.15	1.35	0.11	0.95	0.00	0.40	0.11	

Test No. 23A

Metallurgical Results

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. Preg and Wash Sol'n	1770 mL	0.13	32.6
2. Residue	489.6 g	0.97	67.4
Head (calc.)	489.6 g	1.44	100.0

Test No. 24A Project No. 3785 Operator: SA Date: 11/15/89

Purpose: To examine the recovery of gold from the flotation 3rd rougher tailing.

Procedure: As for test No. 22A

Feed: 500 g 3rd rougher tailing from test 24

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 1.0 g/L NaCN

pH Range: 10.0 with Ca(OH)2

Grind: nil

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.78 CaO: 0.22

Time	Added, Grams				Residual		Consumed		
	Actual		Equivalent		Grams		Grams		pl
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 1	1.05	0.15	1.00	0.11	0.85	-	0.15	-	10.1-
1 - 5	0.16	-	0.15	-	0.95	-	0.10	-	10.1-
5 - 23	0.05	-	0.05	-	0.85	-	0.15	-	10.0-
23 - 31	0.16	-	0.15	-	1.00	-	0.00	-	10.0-
31 - 48	-	-	-	-	0.96	0.00	0.01	0.11	10.0-
Total	1.42	0.15	1.35	0.11	0.96	0.00	0.41	0.11	

Test No. 24A

Metallurgical Results

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. Preg and Wash Sol'n	1785 mL	0.094	36.9
2. Residue	486.0 g	0.59	63.1
Head (calc.)	486.0 g	0.94	100.0

Test No. 25A Project No. 3785 Operator: SA Date: 11/15/89

Purpose: To examine the recovery of gold from the flotation 4th rougher tailing.

Procedure: As for test No. 22A

Feed: 500 g 4th rougher tailing from test 25

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 1.0 g/L NaCN

pH Range: 10.0 with Ca(OH)2

Grind: nil

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.82 CaO: 0.22

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 1	1.05	0.15	1.00	0.11	0.85	-	0.15	-	10.1-10
1 - 5	0.16	-	0.15	-	0.90	-	0.05	-	10.1-10
5 - 23	0.11	-	0.10	-	0.85	-	0.15	-	10.0-10
23 - 31	0.16	-	0.15	-	1.00	-	0.00	-	10.0-10
31 - 48	-	-	-	-	0.99	0.00	0.04	0.11	10.0-10
Total	1.48	0.15	1.40	0.11	0.99	0.00	0.41	0.11	

Test No. 25A

Metallurgical Results

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. Preg and Wash Sol'n	1770 mL	0.087	32.9
2. Residue	483.0 g	0.65	67.1
Head (calc.)	483.0 g	0.97	100.0

Test No. 26A Project No. 3785 Operator LP Date: Dec.7/89

Purpose: To investigate the cyanidation response of the rougher tailing from test 26.

Procedure: The sample was pulped with water in a 2.5 liter bottle. Lime and NaCN were added and the cyanidation was carried out on rolls in one 48 hour stage. The pulp was filtered and the residue washed three times with water.

Feed: 500 g rougher tailing from test 26

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 1.0 g/L NaCN

pH Range: 10.5-11.0 with Ca(OH)2

Grind: nil

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.36 CaO: 0.42

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 2.5	1.05	0.10	1.00	0.08	0.84	0.00	0.16	0.08	10.9-9
2.5 - 19.5	0.17	0.17	0.16	0.13	1.00	0.00	0.00	0.13	11.0-1(
19.5 - 48	0.00	0.00	0.00	0.00	0.98	0.00	0.02	0.00	10.8-1(
Total	1.22	0.27	1.16	0.21	0.98	0.00	0.18	0.21	

Test No. 26A

Metallurgical Balance

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. 48 h Preg + Wash	1860 mL	0.067	47.2
2. 48 h Residue	497.3 g	0.28	52.8
Head (calc)	500.0 g	0.53	100.0

Test No. 27A Project No. 3785 Operator LP Date: Dec.7/89

Purpose: To investigate the cyanidation response of the rougher tailing from test 27.

Procedure: As for test 26.

Feed: 500 g rougher tailing from test 27

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 1.0 g/L NaCN

pH Range: 10.5-11.0 with Ca(OH)2

Grind: nil

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.44 CaO: 0.32

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 2.5	1.05	0.10	1.00	0.08	0.85	0.00	0.15	0.08	11.0-10.
2.5 - 19.5	0.16	0.10	0.15	0.08	1.00	0.00	0.00	0.08	10.9-10
19.5 - 48	0.00	0.00	0.00	0.00	0.93	0.00	0.07	0.00	10.7-10
Total	1.21	0.20	1.15	0.16	0.93	0.00	0.22	0.16	

Test No. 27

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. 48 h Preg + Wash	1740 mL	0.14	40.8
2. 48 h residue	497.0 g	0.71	59.2
Head (calc)	500.0 g	1.19	100.0

Test No. 30A Project No. 3785 Operator: LP Date: Nov. 28/

Purpose: To investigate the recovery of gold from the rougher concentrate through cyanidation.

Procedure: The sample was pulped with water in a 1 liter bottle. NaCN and lime were added and the cyanidation was carried out on rolls in one 48 hou stage. The pulp was filtered and the residue washed three times wit water.

Feed: 130 grams rougher concentrate from test 30

Solution Volume: 260 mL Pulp Density: 33 % Solids

Sol'n Composition: 5.0 g/L NaCN

pH Range: 9.5 with Ca(OH)2

Grind: nil

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 1	1.37	-	1.30	-	1.17	-	0.13	-	10.5-1
1 - 18	0.14	-	0.13	-	0.98	-	0.32	-	10.1-1
18 - 26	0.34	-	0.32	-	1.23	-	0.07	-	10.6-1(
26 - 48	0.07	-	0.07	-	1.09	-	0.21	-	10.6-1
Total	1.92	0.00	1.82	0.00	1.09	0.00	0.73	0.00	

Reagent Consumption (kg/t of cyanide feed) NaCN: 4.89 CaO: 0.00

Test No. 30 A

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. 48 h Preg + Wash	1010 mL	7.97	54.2
2. 48 h Residue	149.3 g	45.5	45.8
Head (calc)	149.3 g	99.4	100.0

Test No. 30B Project No. 3785 Operator: LP Date: Nov. 28

Purpose: To investigate the recovery of gold from the scavenger concentrate through cyanidation.

Procedure: As for test 30A.

Feed: 120 grams scavenger concentrate from test 30

Solution Volume: 240 mL Pulp Density: 33 % Solids

Sol'n Composition: 5.0 g/L NaCN

pH Range: 9.5 with Ca(OH)2

Grind: nil

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 1	1.26	-	1.20	-	0.86	-	0.34	-	10.2-1
1 - 18	0.36	-	0.34	-	0.93	-	0.27	-	10.2-1
18 - 26	0.28	-	0.27	-	1.12	-	0.08	-	10.6-1
26 - 48	0.08	-	0.08	-	0.98	-	0.22	-	10.6-1
Total	1.98	0.00	1.89	0.00	0.98	0.00	0.91	0.00	

Reagent Consumption (kg/t of cyanide feed) NaCN: 7.43 CaO: 0.00

Test No. 30 B

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. 48 h Preg + Wash	940 mL	1.04	40.2
2. 48 h residue	122.4 g	11.9	59.8
Head (calc)	122.4 g	19.9	100.0

Test No. 30C Project No. 3785 Operator: LP Date: Nov. 28

Purpose: To investigate the recovery of gold from the scavenger tailing through cyanidation.

Procedure: As for test 30A.

Feed: 500 grams scavenger tailing from test 30

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 1.0 g/L NaCN

pH Range: 10.5-11 with Ca(OH)2

Grind: nil

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 1	1.05	0.30	1.00	0.23	0.95	-	0.05	-	11.0-1
1 - 18	0.05	0.10	0.05	0.08	0.95	0.03	0.05	0.28	11.0-1
18 - 26	0.05	0.00	0.05	0.00	1.00	0.03	0.00	0.00	11.1-1
26 - 48	0.00	0.00	0.00	0.00	1.00	0.03	0.00	0.00	11.0-1
Total	1.15	0.40	1.10	0.31	1.00	0.03	0.10	0.28	

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.20 CaO: 0.57

Test No. 30 C

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. 48 h Preg + Wash	2180 mL	0.066	37.6
2. 48 h residue	487.9 g	0.49	62.4
Head (calc)	500.0 g	0.77	100.0

Test No. 31 Project No. 3785 Operator: LP Date: Dec. 12/8

Purpose: To investigate the cyanidation response of the rougher tail from test 31.

Procedure: The sample was pulped with water in a 2.5 liter bottle. NaCN and lime were added and the cyanidation was carried out on rolls in one 48 hour stage. The pulp was filtered and the residue washed three times with water.

Feed: 500 grams rougher tailing from test 31

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 1.0 g/L NaCN

pH Range: 10.5-11 with Ca(OH)2

Grind: nil

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 4	1.05	0.15	1.00	0.11	0.83	0.00	0.17	0.11	10.9-10
4 - 23.5	0.18	0.15	0.17	0.11	0.99	0.00	0.01	0.11	10.9-10
23.5 - 31	0.00	0.07	0.00	0.05	0.99	0.02	0.00	0.03	11.0-10
31 - 48	0.00	0.00	0.00	0.00	0.83	0.01	0.16	0.01	10.9-10
Total	1.23	0.37	1.17	0.27	0.83	0.01	0.34	0.26	

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.70 CaO: 0.53

Test No. 31

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. 48 h Preg + Wash	1800 mL	0.14	40.0
2. 48 h Residue	484.8 g	0.78	60.0
Head (calc)	484.8 g	1.30	100.0

Test No. 32 Project No. 3785 Operator: LP Date: Dec. 12/89

Purpose: To investigate the cyanidation response of the rougher tail from test 32.

Procedure: As for test 31.

Feed: 500 grams rougher tailing from test 32

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 1.0 g/L NaCN

pH Range: 10.5-11 with Ca(OH)2

Grind: nil

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 4	1.05	0.15	1.00	0.11	0.84	0.00	0.16	0.11	11.0-10.
4 - 23.5	0.17	0.15	0.16	0.11	1.00	0.01	0.00	0.10	10.9-10.
23.5 - 31	0.00	0.05	0.00	0.04	1.00	0.02	0.00	0.03	10.9-10.9
31 - 48	0.00	0.00	0.00	0.00	1.00	0.01	0.16	0.01	10.9-10.
Total	1.22	0.35	1.16	0.26	1.00	0.01	0.16	0.25	

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.35 CaO: 0.54

Test No. 32

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. 48 h Preg + Wash	2120 mL	0.08	44.9
2. 48 h Residue	462.5 g	0.45	55.1
Head (calc)	462.5 g	0.82	100.0

Test No. 33R Project No. 3785 Operator: LP Date: Dec. 29/89

Purpose: To repeat test 33.

Procedure: As for test 31.

Feed: 500 grams rougher tailing from test 33

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 1.0 g/L NaCN

pH Range: 10.5-11 with Ca(OH)2

Grind: nil

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 2	1.05	0.15	1.00	0.11	0.82	0.00	0.18	0.11	11.2-10.3
2 - 7.5	0.19	0.13	0.18	0.10	1.00	0.01	0.00	0.09	11.2-10.8
7.5 - 24	0.00	0.05	0.00	0.04	1.00	0.00	0.00	0.05	11.1-10.7
24 - 48	0.00	0.05	0.00	0.04	1.00	0.02	0.00	0.02	11.1-10.8
Total	1.24	0.38	1.18	0.29	1.00	0.02	0.18	0.27	

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.36 CaO: 0.54

Test No. 33R

Metallurgical Balance

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. 48 h Preg + Wash	1860 mL	0.05	43.8
2. 48 h Residue	497.4 g	0.24	56.2
Head (calc)	497.4 g	0.43	100.0

Test No. 35 Project No. 3785 Operator: LP Date: Dec. 12/89

Purpose: To repeat test 11.

Procedure: The sample was pulped with water in a 4.0 liter bottle. NaCN and lime were added and the cyanidation was carried out on rolls in one 48 hour stage. The pulp was filtered and the residue washed three times with water.

Feed: 1000 grams minus 10 mesh Mill Feed

Solution Volume: 2000 mL Pulp Density: 33 % Solids

Sol'n Composition: 0.5 g/L NaCN

pH Range: 10.5-11 with Ca(OH)2

Grind: 30 min/2 kg 65% solids

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 1.5	1.05	0.47	1.00	0.36	0.23	0.02	0.77	0.34	11.3-10.8
1.5 - 16.5	0.81	0.12	0.77	0.09	0.71	0.00	0.29	0.11	11.2-10.4
16.5 - 23	0.31	0.30	0.29	0.23	1.00	0.03	0.00	0.20	11.0-10.8
23 - 48	0.00	0.00	0.00	0.00	0.83	0.00	0.17	0.03	10.8-10.3
Total	2.17	0.89	2.06	0.68	0.83	0.00	1.23	0.68	

Reagent Consumption (kg/t of cyanide feed) NaCN: 1.23 CaO: 0.68

Test No. 35

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. 48 h Preg + Wash	3640 mL	1.34	53.3
2. 48 h Residue	996.7 g	4.28	46.7
Head (calc)	996.7 g	9.17	100.0

Test No. 49 Project No. 3785 Operator: LP Date: 3/01/90

Purpose: To investigate the effect of a fine grind on the cyanidation response of the calcine residue with a water prewash prior to grinding.

Water Wash

Procedure: The sample was pulped to 20% solids, filtered and washed. The residue was repulped to 20% solids, filtered and washed again. The filtrate was assayed for Au.

Feed: 500 g calcine residue (Sample No. 4)

Test No. 49 Project No. 3785 Operator LP Date: 3/01/90

Cyanidation A

Procedure: The sample was pulped with water in a 2 liter bottle. NaCN and lime were added and the cyanidation was carried out on rolls in a 48 hour stage. The pulp was filtered and the residue washed three times with water.

Feed: 500 g Calcine Residue (Sample No. 4)

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 2.0 g/L NaCN

pH Range: 10.5-11.0 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 2.43 CaO: 1.07

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 1.5	2.10	0.45	2.00	0.34	1.66	0.00	0.34	0.34	11.1-10.5
1.5 - 18	0.36	0.15	0.34	0.11	1.62	0.00	0.38	0.11	11.0-10.7
18 - 48	0.40	0.10	0.38	0.08	1.52	0.00	0.48	0.08	11.0-10.8
Total	2.86	0.70	2.72	0.53	1.52	0.00	1.20	0.53	

Test No. 49

Metallurgical Balance

Product	Amount	Assays (mg/L, g/t, %)			%Distribution		
	ml, g	Au	As	Fe	Au	As	Fe
Prewash Filtrate	1940	0.11	-	-	11.8	-	-
Cyanidation Filtrate	1880	0.20	-	-	20.8	-	-
Residue	493.2	2.47	1.41	26.7	67.4	-	-
Head (calc.)	500.0	3.62	-	-	100.0	-	-

Project No: 3785

Product: 48h Cyanide Residue Test No: 49 S.G.-3.49

Mesh	Weight Grams	% Weight		
		Ind.	Cum.	Passing
38.4µ	0.00	0.0	0.0	100.0
29.8	0.33	0.7	0.7	99.3
20.8	2.12	4.2	4.9	95.1
14.3	6.71	13.4	18.3	81.7
11.0	4.28	8.6	26.9	73.1
-11.0	36.56	73.1	100.0	-
Total	50.00	100.0	-	-

Test No. 51A Project No. 3785 Operator: LP Date: Jan. 3/90

Purpose: To investigate the cyanidation response of the scavenger tailing.

Procedure: The sample was pulped with water in a 2 liter bottle. NaCN and lime were added and the cyanidation was carried out on rolls in one 48 hour stage. The pulp was filtered and the residue washed three times with water.

Feed: 500 g scavenger tailing from test 51

Solution Volume: 1000 mL Pulp Density: 33 % Solids

Sol'n Composition: 1.0 g/L NaCN

pH Range: 10.5-11 with Ca(OH)2

Reagent Consumption (kg/t of cyanide feed) NaCN: 0.73 CaO: 0.73

Time	Added, Grams				Residual		Consumed		pH
	Actual		Equivalent		Grams		Grams		
Hours	NaCN	Ca(OH)2	NaCN	CaO	NaCN	CaO	NaCN	CaO	
0 - 2	1.05	0.20	1.00	0.15	0.76	0.00	0.24	0.15	11.0-10.
2 - 22	0.25	0.15	0.24	0.11	0.90	0.00	0.10	0.11	11.2-10
22 - 48	0.11	0.10	0.10	0.08	1.00	0.00	0.00	0.08	11.2-10
Total	1.41	0.45	1.34	0.34	1.00	0.00	0.34	0.34	

Test No. 51A

Product	Amount	Assays mg/L, g/t Au	% Distribution Au
1. 48 h Preg + Wash	1880 mL	0.066	24.6
2. 48 h Residue	464.5 g	0.82	75.4
Head (calc)	464.5 g	1.09	100.0

LAKEFIELD RESEARCH
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