



Bergvesenet

Postboks 3021, 7002 Trondheim

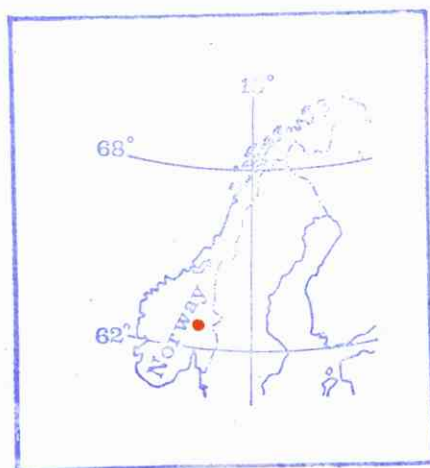
Rapportarkivet

Bergvesenet rapport nr BV 525	Intern Journal nr	Internt arkiv nr	Rapport lokalisering Trondheim	Gradering Åpen
Kommer fra ..arkiv Falconbridge	Ekstern rapport nr Sul 426-76-15	Oversendt fra Sulfidmalm A/S	Fortrolig pga	Fortrolig fra dato:
Tittel Lakefield Research Progress Report on Espedalen samples.				
Forfatter F G T Pickard		Dato 1976	Bedrift Sulfidmalm A/S	
Kommune Sør-Fron Gausdal	Fylke Oppland	Bergdistrikt Østlandske	1: 50 000 kartblad 17171 17174	1: 250 000 kartblad Lillehammer
Fagområde Oppredning	Dokument type Rapport	Forekomster Megrunnstjern		
Råstofftype Malm/metall	Emneord Cu Ni			
Sammendrag Denne har vi to eksemplarer av i Trondheim				

FOR FALCONBRIDGE NIKKELVERK A/S
A/S SULFIDMALM
Project 905-15

Lakefield Research Progress Report
on Espedalen samples

By
F. G. T. Pickard



Report No. 426/76/15

A/S SULFIDMALM
INTER-OFFICE MEMORANDUM

27.

Date: 16. mars 1977
To: Falconbridge Nikkelverk A/S
cc: R. Jahnsen, F. Nixon, D. Ellen,
Norsk Hydro v. N. A. Lenning
From: J. B. Gammon
Subject:

Rapport Nr. 426/76/15

Vennligst finn vedlagt Rapport No. 426/76/15 angående det siste metallurgiske forsøk fra Espedalen borkjerner. Resultatene synes å være lovende og jeg har bedt Lakefield om å sette i gang med de øvrige forsøk anbefalt av Pickard.

J. B. Gammon

FALCONBRIDGE NICKEL MINES LIMITED

INTER-OFFICE MEMORANDUM

DATE: March 4, 1977

TO: W. D. Harrison

COPIES TO: HTB, WBGW, file

FROM: F. G. T. Pickard

SUBJECT: Lakefield Research Progress Report # 2 on Espedalen SamplesRECEIVED
MAR 7 1977
GEOLOGY DEPT.

Copies of this report describing bench scale grinding and flotation tests on two recent composite samples of drill core from the Espedalen deposit are appended. Concentrate grades and recoveries are good considering the low grade heads tested. While no further investigations are presently in progress it is recommended that additional testwork should be carried out if justified by the potential tonnage of the deposit to investigate:

1. The recoveries which might be obtained in plant operations cannot be accurately estimated from the single cycle lab tests. Locked cycle test would provide a good indication of the potential overall recovery under plant conditions because such tests involve recirculation of cleaner tailings. About 16% of the nickel reported to the cleaner tailings products in the testwork. Cost of two locked cycle tests would be in the order of \$2,000.
2. Examination of polished sections of final tailing might provide data to permit higher nickel recoveries by modifying flotation and/or grinding techniques to enhance recovery. Cost of such an investigation should not exceed \$1,000.

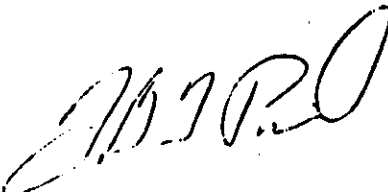
From data provided by W.B.G. Walker two composite samples were prepared at Lakefield from the drill core samples received. One was designated the high grade composite sample and assayed 0.91% Ni, 0.29% Cu and 4.30% S. The other was called the low grade composite sample and assayed 0.58% Ni, 0.24% Cu and 2.79% S.

A total of eight tests was carried out on the high grade sample. Test #13 was the best of these and produced a cleaned concentrate assaying 15.0% Ni and 5.27% Cu at 70.3% Ni and 76.8% Cu recoveries. The combined cleaner tailing contained 16.3% of the nickel. A significant proportion of this nickel should be recoverable at the 15% grade in plant operations because these tailings would be recirculated. Locked cycle lab tests would be necessary to indicate the probable overall nickel recovery obtainable which should be in the range of 75 - 79%. Additional copper recovery would also be obtained. The rougher tailing loss was 13.4% of the nickel in the mill heads. It should be possible to decrease this loss. Mineralogical examination of this tailing

can be carried out to determine the nature of the loss if further investigations are authorized.

A total of five tests was performed on the low grade sample. Tests # 14 and 16 were the best tests in this series with the best concentrate grade being produced in test # 14. In this test a cleaned concentrate assaying 9.73% Ni and 4.96% Cu at 62.3% Ni and 70.9% Cu recoveries was produced. The cleaner tailing contained 15.4% of the nickel. Again locked cycle tests would be necessary to provide data regarding the probable overall nickel recovery to be obtained in plant operations. It is estimated that it would be in the order of 66 - 70%.

FGTP:lp



F. G. T. Pickard

Progress Report No. 2

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It is the life of this Church, in leading people of this nation to realize the spiritual not carnal life, and, on any path that is possible, to the enjoyment of the field of service of Christ's Kingdom.

There is little, however, in

The Journal of Law, Economics, & Organization, V16 N1

I N T R O D U C T I O N

Mr. F.G. T. Pickard of Falconbridge Nickel Mines Limited requested that a program of testwork should be conducted to investigate the grades and recoveries of copper and nickel from two further Espedalen project samples.

These samples designated Sample A (high-grade) and Sample B (low-grade) were composited from drill core rejects received at Lakefield on December 6, 1976.

LAKEFIELD RESEARCH OF CANADA LIMITED



A.G. Scobie, P. Eng.,
Manager



K.W. Sarbutt
Project Metallurgist

Investigation by: G.A. Kosick

S U M M A R Y

1. Head Sample Assays

Sample	Assays, %				
	Cu	Cu*	Ni	Ni*	S
A (high-grade)	0.29	0.28	0.91	0.89	4.30
B (low-grade)	0.24	0.25	0.58	0.57	2.79

* Average head sample assays as calculated from test results.

2. Flotation Testwork - Sample A

The effects of fineness of primary grind, collector type, flotation time, and the use of CuSO_4 on the grades and recoveries of copper and nickel in the rougher flotation were investigated. In these tests Na_2CO_3 was added to the primary grind, and the flotation was conducted at pH 10. The results and conditions of these tests are summarized in Table 1.

Table No. 1 - Rougher Flotation - Sample A

Test No.	Grind % -200 mesh	Collector		CuSO ₄ lb/ton	Flota- tion Time	Rougher Concentrate				
		Type	Amount			Weight %	Assays, %		% Distr.	
							Cu	Ni	Cu	Ni
6	43.6	Z-11	0.15	-	8	9.33	2.12	7.41	73.2	76.5
8	83.1	Z-11	0.15	-	8	9.97	2.19	6.91	76.9	79.0
9	57.5	Z-11	0.20	0.10	11	17.97	1.28	4.26	82.1	88.9
10	57.5	Z-6	0.15	-	8	18.65	1.28	4.26	83.7	89.0
12	57.5	Z-6	0.15	-	9	16.28	1.52	4.94	84.3	88.1
13	57.5	Z-6	0.15	-	9	14.31	1.65	5.44	81.9	86.0
15	57.5	Z-6	0.15	-	11	15.91	1.50	5.07	85.0	87.3
17*	57.5	Z-6	0.15	-	11	10.43	2.00	7.00	79.1	82.7

* pH adjusted to 10.0 with $\text{Ca}(\text{OH})_2$

Summary - Continued

2. Flotation Testwork - Sample A

Fineness of primary grind had little effect on the recoveries of copper and nickel. Z-6 was a more effective collector than Z-11. Replacing Na_2CO_3 with $\text{Ca}(\text{OH})_2$ as the pH modifier resulted in lower weight and Cu-Ni recoveries to the rougher flotation.

The rougher concentrates from these tests were reground and cleaned. The results and conditions of the cleaner flotation are summarized in Table 2.

Table No. 2 - Cleaner Flotation - Sample A

Test No.	Regrind Time Minutes	Regrind % -200 mesh	pH in Cleaners	Collector lb/ton	Cleaner Concentrate				
					Weight %	Assays, %		% Distr.	
						Cu	Ni	Cu	Ni
6	15	-	9.2-10.0	0.02	2.24	7.54	17.60	62.6	43.6
8	15	97.8	10.0-10.0	0.025	2.74	6.94	16.0	67.2	50.3
9	7½	65.9	10.0-10.0	0.06	11.64	1.88	6.07	78.1	82.0
10	7½	65.9	9.0- 9.9	0.08	5.86	3.68	11.0	75.8	72.2
12	7½	65.9	10.1-10.0	0.10	6.71	3.48	10.5	79.8	77.2
13	15	86.8	10.0-10.2	0.10	4.21	5.27	15.0	76.8	70.3
15	22½	88.4	10.0-10.0	0.10	4.85	4.60	12.8	79.5	67.2
17*	15	-	10.5-10.5	0.10	1.37	9.12	19.6	47.3	30.5

* ph adjusted with $\text{Ca}(\text{OH})_2$

The Ni grade-recovery curves for these tests are shown in Figure 1.

The best results were achieved in Test 13 after regrinding to 86.8 percent minus 200 mesh. Finer regrinding resulted in higher losses of Ni in the cleaner flotation.

The use of $\text{Ca}(\text{OH})_2$ instead of Na_2CO_3 resulted in improved selectivity towards pyrite, but Ni losses were very high. Further investigation of a lime circuit might result in some improvement in recovery.

Summary - Continued

3. Flotation Testwork - Sample B

A test program similar to that conducted on Sample A was performed on Sample B. The results and conditions of the rougher flotation are summarized in Table 3.

Table 3 - Rougher Flotation - Sample B

Test No.	Grind % -200 mesh	Collector		Flotation Time min.	Rougher Concentrate				
		Type	Amount		Weight %	Assays, %		% Distribution	
						Cu	Ni	Cu	Ni
7	80.1	Z-11	0.15	8	10.42	1.86	4.04	73.0	72.5
11	65.7	Z-11	0.15	8	15.54	1.33	3.04	79.0	83.0
14	65.7	Z-6	0.15	9	12.62	1.54	3.43	77.8	77.7
16	65.7	Z-6	0.15	11	16.56	1.26	2.95	83.6	81.8
18*	65.7	Z-6	0.15	11	9.56	1.91	5.57	75.4	72.8

* pH adjusted to 10 with $\text{Ca}(\text{OH})_2$

Other tests pH adjusted to 10 with Na_2CO_3

The flotation response was similar to Sample A but with lower recoveries because of the lower head grade. Tailing assays were similar.

The results and conditions of the cleaner flotation are summarized in Table No. 4.

Summary - Continued

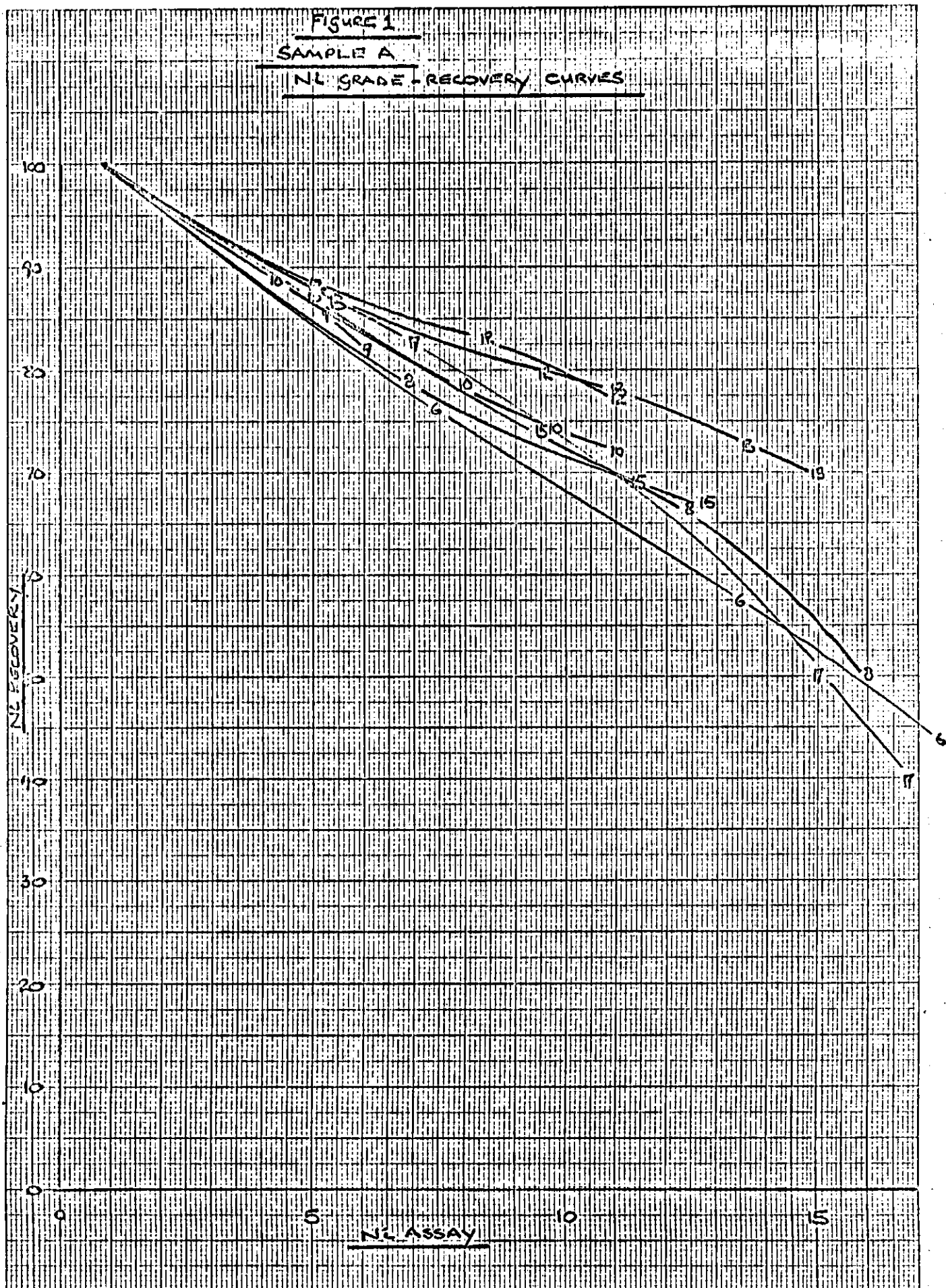
3. Flotation Testwork - Sample B

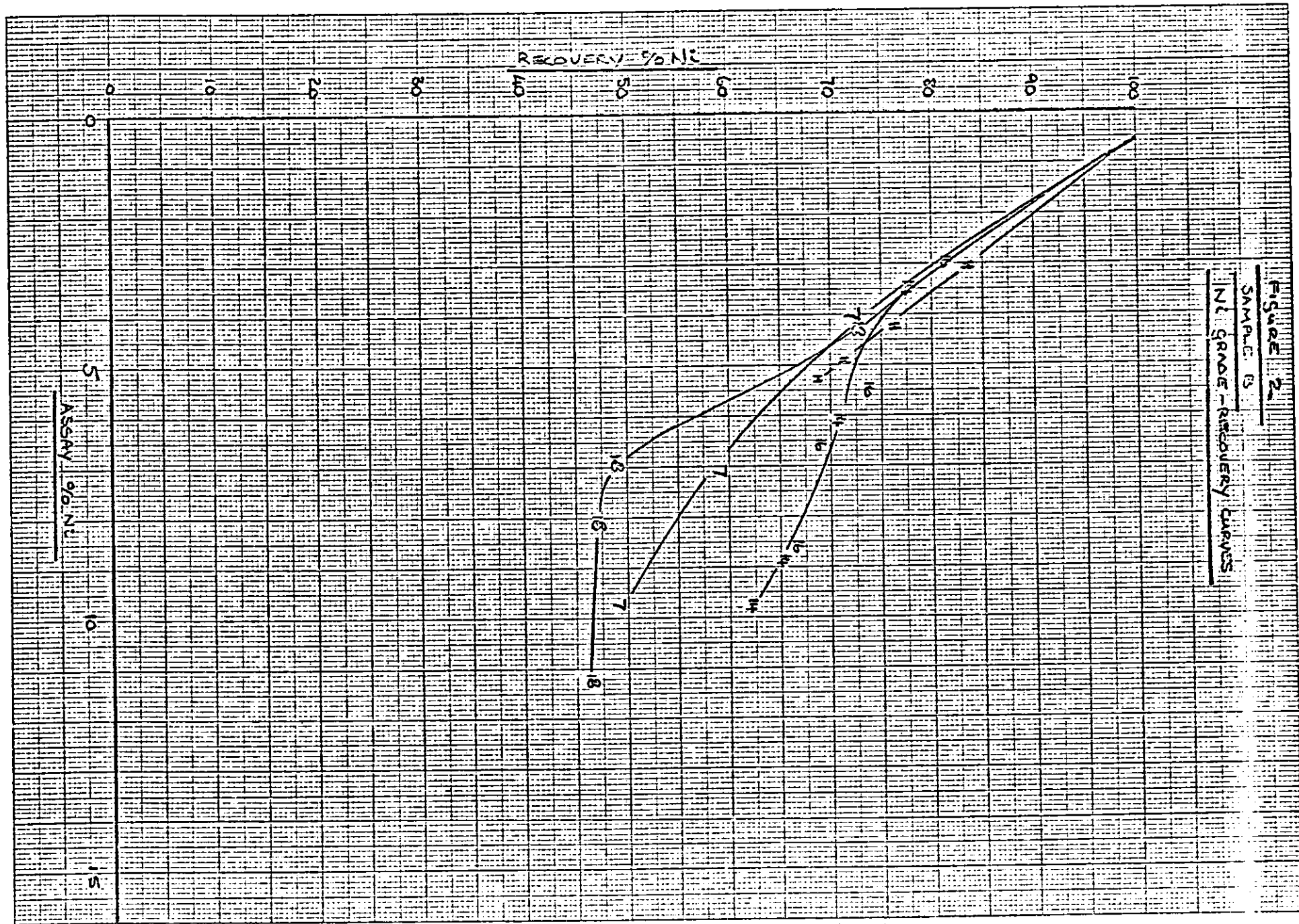
Table No. 4 - Cleaner Flotation - Sample B

Test No.	Regrind Time min.	Regrind % -200 mesh	pH in Cleaners	Collector lb/ton	Cleaner Concentrate				
					Weight %	Assays, %		% Distr.	
						Cu	Ni	Cu	Ni
7	15	89.8	10.0-10.3	0.02	2.92	5.77	9.79	63.8	49.3
11	7½	87.0	10.2-10.0	0.02	7.36	2.58	5.29	72.6	68.9
14	7½	87.0	10.0-10.0	0.10	3.57	4.96	9.73	70.9	62.3
16	22½	94.6	10.1-10.0	0.10	5.23	3.76	7.60	78.8	66.6
18	15	89.8	10.1-10.5	0.10	2.28	6.43	11.2	60.4	46.2

The Ni grade-recovery curves for these tests are shown in Figure 2. Concentrate grades were lower than those from Sample A. The use of lime in place of Na_2CO_3 as pH modifier resulted in a slight increase in concentrate grade, although the recovery was low.

FIGURE 1
SAMPLE A
NL GRADE - RECOVERY CURVES





SAMPLE PREPARATION

Four boxes containing 48 drill core samples were received at Lakefield on December 6th, 1976 and given our Reference No. 7621182. The total weight was approximately 170 pounds.

These samples were composited into two samples, Sample A (high-grade) and Sample B (low-grade).

SAMPLE A					SAMPLE B				
Drill Hole	From metres	To	Weight Received g.	Weight Used in Composite	Drill Hole	From metres	To	Weight Received g.	Weight Used in Composite
M.G. 17.76	36	37	1100	500	M.G. 6.75	25	26	1260	500
	37	38	1213	500		26	27	1130	500
	38	39	1260	500		34	35	1130	500
	39	40	1160	500		47	48.3	1850	650
	40	41	1050	500		51	52	930	500
	41	42	1245	500		59	60	1090	500
	42	43	1235	500		60	61	1160	500
	43	44	1335	500	M.G. 12.76	30	31	1010	500
	44	45	1235	500		31	32	1150	500
	45	46	1160	500		33	34	1170	500
	46	47	1115	500		34	35	1340	500
	47	48	1225	500		35	36	1130	500
	48	49	1580	500		36	37	1130	500
	49	50	1440	500		38	39	1150	500
	50	51	1115	500		39	40	1065	500
	51	52	1050	500		40	41	1160	500
	52	53	1210	500	M.G. 13.76	47	48	1270	500
	53	54	1000	500		49	49.75	650	375
	54	55	1055	500		49.75	51	1360	625
	55	56	1210	500	M.G. 14.76	53	54	1325	500
	56	57	1100	500					
	57	58	925	500					
	58	59	1195	500					
	59	60	1055	500					
	60	61	1020	500					
	61	62	1245	500					
	62	63	1290	500					
	63	64	1305	500					

The samples for each composite were mixed thoroughly, and roll-crushed to minus 10 mesh. Charges of 1 kg for testwork and a sample for head analysis were then riffled out.

DETAILS OF TESTS

Test No. 6

Purpose: A preliminary test to investigate the grades and recoveries of copper and nickel from Sample A.

Procedure: Grind, float a rougher concentrate, and two scavenger concentrates. Regrind the rougher concentrate and clean two times.

Feed: 1000 g minus 10 mesh Sample A.

Grind: 15 minutes at 60 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton				Time, minutes			pH
	Na ₂ CO ₃	Z-11	DF-250	CuSO ₄	Grind	Cond.	Froth	
Grind	3.0	-	-	-	15	-	-	-
Rougher	-	0.05	0.02	-	-	1	-	10.0
	-	-	0.02	-	-	1	2	-
	-	0.05	0.02	-	-	1	3	-
	-	0.05	0.02	-	-	1	3	-
Scavenger No. 1	-	-	-	0.25	-	3	-	-
	-	0.05	0.02	-	-	1	3	-
Scavenger No. 2	-	0.05	0.02	-	-	1	3	-
Regrind (Ro. Conc.)	-	-	-	-	15	-	-	-
Cu-Ni 1st Cleaner	-	-	-	-	-	1	2	9.2
	-	0.02	0.01	-	-	1	3	-
Cu-Ni 2nd Cleaner	0.48	-	-	-	-	2	4	10.0

Stage	Rougher	Scav. 1 and 2	Rougher Regrind
Equipment	1000 g Agitair	1000 g Agitair	Abbe pebble mill
Speed: r.p.m.	1000	1000	-

Stage	Cu-Ni 1st and 2nd Cleaners
Equipment	500 g Agitair
Speed: r.p.m.	1000

Test No. 6 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Ni	Cu	Ni
1. 2nd Cleaner Conc.	2.24	7.54	17.60	62.6	43.6
2. 2nd Cleaner Tailing	1.61	0.96	7.76	5.7	13.8
3. 1st Cleaner Tailing	5.48	0.24	3.15	4.9	19.1
4. Scav. Conc. No. 1	6.77	0.15	1.05	3.8	7.9
5. Scav. Conc. No. 2	2.66	0.16	0.73	0.7	2.1
6. Scav. Tailing	81.22	0.074	0.15	22.3	13.5
Head (Calculated)	100.00	0.27	0.90	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	3.85	4.79	13.48	68.3	57.4
Products 1 to 3	9.33	2.12	7.41	73.2	76.5
Products 1 to 4	16.10	1.29	4.74	77.0	84.4
Products 1 to 5	18.76	1.12	4.17	77.7	86.5

Screen Analysis

Scavenger Tailing

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 65	11.7	11.7	88.3
100	15.0	26.7	73.3
150	13.6	40.3	59.7
200	16.1	56.4	43.6
270	8.6	65.0	35.0
400	10.0	75.0	25.0
- 400	25.0	100.0	-
Total	100.0	-	-

Test No. 7

Purpose: A preliminary test to investigate the grades and recoveries of copper and nickel from Sample B.

Procedure: Grind and float a rougher concentrate and two scavenger concentrates. Regrind the rougher concentrate and clean two times.

Feed: 1000 grams minus 10 mesh Sample B.

Grind: 30 minutes at 60 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton				Time, minutes			pH
	Na ₂ CO ₃	Z-11	DF-250	CuSO ₄	Grind	Cond.	Froth	
Primary Grind	3.0	-	-	-	30	-	-	-
Rougher	-	0.05	0.06	-	-	1	2	10.2
	-	0.05	0.04	-	-	1	3	-
	-	0.05	0.04	-	-	1	3	-
Scavenger No. 1	-	-	-	0.25	-	3	-	-
	-	0.05	0.02	-	-	1	3	-
Scavenger No. 2	-	0.05	0.02	-	-	1	3	-
Regrind (Rougher Concentrate)	-	-	-	-	15	-	-	-
Cu-Ni 1st Cl.	0.40	-	0.01	-	-	1	2	10.0
	-	0.02	0.01	-	-	1	3	-
Cu-Ni 2nd Cl.	0.40	-	0.01	-	-	1	3	10.3

Stage	Rougher	Scavenger 1 and 2nd	Rougher Regrind
Equipment	1000 g Agitair	1000 g Agitair	Abbe pebble mill
Speed: r.p.m.	950	950	-

Stage	Cu-Ni 1st Cl.	Cu-Ni 2nd Cl.
Equipment	500 g Agitair	500 g Agitair
Speed	950	950

Test No. 7 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Ni	Cu	Ni
1. Cleaner Concentrate	2.92	5.77	9.79	63.8	49.3
2. 2nd Cleaner Tailing	1.91	0.60	3.07	5.0	10.1
3. 1st Cleaner Tailing	5.59	0.20	1.36	4.2	13.1
4. Scavenger Conc. No. 1	3.83	0.14	0.72	2.0	4.8
5. Scavenger Conc. No. 2	3.07	0.13	0.51	1.5	2.7
6. Scavenger Tailing	82.68	0.075	0.14	23.5	20.0
Head (Calculated)	100.00	0.26	0.58	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	4.83	3.76	7.13	68.8	59.4
Products 1 to 3	10.42	1.86	4.04	73.0	72.5
Products 1 to 4	14.25	1.40	3.14	75.0	77.3
Products 1 to 5	17.32	1.17	2.68	76.5	80.0

Test No. 7 - Continued

Screen Analysis - Primary Grind

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 65	0.2	0.2	99.8
100	2.9	3.1	96.9
150	4.8	7.9	92.1
200	12.0	19.9	80.1
270	10.1	30.0	70.0
400	15.0	45.0	55.0
- 400	55.0	100.0	-
Total	100.0	-	-

Regrind

+ 100	0.5	0.5	99.5
150	1.0	1.5	98.5
200	1.7	3.2	96.8
270	2.2	5.4	94.6
400	4.8	10.2	89.8
- 400	89.8	100.0	-
Total	100.0	-	-

Test No. 8

Purpose: To repeat Test No. 6, but to investigate the effect of a finer grind.

Procedure: Grind and float a rougher concentrate and two scavenger concentrates. Regrind the rougher concentrate and clean two times.

Feed: 1000 grams minus 10 mesh sample A.

Grind: 30 minutes at 60 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton				Time, minutes			pH
	Na ₂ CO ₃	Z - 11	DF-250	CuSO ₄	Grind	Cond.	Froth	
Primary Grind	3.0	-	-	-	30	-	-	-
Rougher	-	0.05	0.10	-	-	1	2	10.2
	-	0.05	0.02	-	-	1	3	-
	-	0.05	0.04	-	-	1	3	-
Scavenger No. 1	-	-	-	0.25	-	3	-	-
	-	0.05	0.02	-	-	1	3	-
Scavenger No. 2	-	0.05	0.02	-	-	1	3	-
Regrind	-	-	-	-	15	-	-	-
Cu-Ni 1st Cleaner	0.60	0.02	0.02	-	-	1	3	10.0
	-	0.005	-	-	-	1	3	-
Cu-Ni 2nd Cleaner	0.40	-	-	-	-	1	3	10.0

Stage	Rougher	Scavenger 1 and 2	Rougher Regrind
Equipment	1000 g Agitair	1000 g Agitair	Abbe Pebble Mill
Speed: r.p.m.	950	950	-

Stage	Cu-Ni 1st Cleaner	Cu-Ni 2nd Cleaner
Equipment	500 g Agitair	500 g Agitair
Speed: r.p.m.	950	950

Test No. 8 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Ni	Cu	Ni
1. Cleaner Concentrate	2.74	6.94	16.0	67.2	50.3
2. 2nd Cleaner Tailing	1.92	0.89	7.34	6.0	16.2
3. 1st Cleaner Tailing	5.31	0.20	2.06	3.7	12.5
4. Scavenger Conc. No. 1	5.34	0.11	0.59	2.1	3.6
5. Scavenger Conc. No. 2	5.22	0.16	0.94	3.0	5.6
6. Scavenger Tailing	79.47	0.064	0.13	18.0	11.8
Head (Calculated)	100.00	0.28	0.87	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	4.66	4.45	12.43	73.2	66.5
Products 1 to 3	9.97	2.19	6.91	76.9	79.0
Products 1 to 4	15.31	1.46	4.70	79.0	82.6
Products 1 to 5	20.53	1.13	3.75	82.0	88.2

Test No. 8 - Continued

Screen Analysis

Regrind

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 100	0.3	0.3	99.7
150	0.5	0.8	99.2
200	0.8	1.6	98.4
270	0.3	1.9	98.1
400	0.3	2.2	97.8
- 400	97.8	100.0	-
Total	100.0	-	-

Primary Grind

+ 65	0.3	0.3	99.7
100	2.7	3.0	97.0
150	3.9	6.9	93.1
200	10.0	16.9	83.1
270	4.0	20.9	79.1
400	0.6	21.5	78.5
- 400	78.5	100.0	-
Total	100.0	-	-

Test No. 9

Purpose: To repeat Test No. 6, but to investigate the effect of a 20 minute primary grind, and a 7½ minute rougher regrind.

Procedure: Grind and float a rougher concentrate and one scavenger concentrate. Regrind the rougher concentrate and clean two times.

Feed: 1000 grams minus 10 mesh sample A.

Grind: 20 minutes at 60 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton				Time, minutes			pH
	Na ₂ CO ₃	Z - 11	DF-250	CuSO ₄	Grind	Cond.	Froth	
Primary Grind	3.0	-	-	-	20	-	-	-
Rougher	-	0.05	0.05	-	-	1	2	10.2
	-	0.05	0.02	-	-	1	3	-
	-	0.05	0.02	-	-	1	3	-
	-	-	-	0.10	-	3	-	-
	-	0.05	0.02	-	-	1	3	-
Scavenger No. 1	-	-	-	0.10	-	3	-	-
	-	0.05	0.02	-	-	1	3	-
Rougher Regrind	-	0.04	-	-	7½	-	-	-
Cu-Ni 1st Cleaner	0.82	-	-	-	-	1	3	10.0
	-	0.02	0.01	-	-	1	3	-
Cu-Ni 2nd Cleaner	0.90	-	-	-	-	2	4	10.0

Stage	Rougher	Scavenger
Equipment	1000 g Agitair	1000 g Agitair
Speed: r.p.m.	950	950
Stage	Rougher Regrind	1st and 2nd Cleaners
Equipment	Abbe Pebble Mill	500 g Agitair
Speed: r.p.m.	-	950

Test No. 9 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Ni	Cu	Ni
1. Cleaner Concentrate	11.64	1.88	6.07	78.1	82.0
2. 2nd Cleaner Tailing	2.40	0.22	1.30	1.9	3.6
3. 1st Cleaner Tailing	3.93	0.15	0.73	2.1	3.3
4. Scavenger Conc	3.34	0.16	0.51	1.9	2.0
5. Scavenger Tailing	78.69	0.057	0.10	16.0	9.1
Head (Calculated)	100.00	0.28	0.86	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	14.04	1.60	5.25	80.0	85.6
Products 1 to 3	17.97	1.28	4.26	82.1	88.9
Products 1 to 4	21.03	1.12	3.73	84.0	90.9

Test No. 9 - Continued

Screen Analysis

Primary Grind

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 65	3.1	3.1	96.9
100	9.1	12.2	87.8
150	11.9	24.1	75.9
200	18.4	42.5	57.5
270	11.2	53.7	46.3
400	14.0	67.7	32.3
- 400	32.3	100.0	-
Total	100.0	-	-

Regrind

+ 100	3.0	3.0	97.0
150	3.5	6.5	93.5
200	6.9	13.4	86.6
270	8.2	21.6	78.4
400	12.5	34.1	65.9
- 400	65.9	100.0	-
Total	100.0	-	-

Test No. 10

Purpose: To investigate the effect of Z-6 in place of Z-11 as collector.

Procedure: Grind, float a rougher concentrate and two scavenger concentrates. Regrind the rougher concentrate and clean three times.

Feed: 1000 g minus 10 mesh Sample A.

Grind: 20 minutes at 60 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton				Time, minutes			pH
	Na ₂ CO ₃	Z - 6	DF-250	CuSO ₄	Grind	Cond.	Froth	
Primary Grind	3.0	-	-	-	20	-	-	-
Rougher	-	0.05	0.10	-	-	1	2	9.8
	-	0.05	0.02	-	-	1	3	-
	-	0.05	0.02	-	-	1	3	-
Scavenger No. 1	-	-	-	0.25	-	3	-	-
	-	0.05	0.02	-	-	1	3	-
Scavenger No. 2	-	0.05	0.02	-	-	1	3	-
Rougher Regrind	-	0.04	-	-	7½	-	-	-
Cu-Ni 1st Cleaner	-	-	-	-	-	1	2	9.0
	-	0.02	0.01	-	-	1	3	9.1
Cu-Ni 2nd Cleaner	-	-	-	-	-	2	4	-
Cu-Ni 3rd Cleaner	0.8	0.02	0.01	-	-	1	3½	9.9

Stage
Equipment
Speed: r.p.m.

Rougher
1000 g Agitair
950

Scavenger 1 and 2
1000 g Agitair
950

Stage
Equipment
Speed: r.p.m.

Rougher Regrind
Abbe Pebble Mill
-

1st to 3rd Cleaners
500 g Agitair
950

Test No. 10 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Ni	Cu	Ni
1. Cleaner Concentrate	5.86	3.68	11.0	75.8	72.2
2. 3rd Cleaner Tailing	0.97	0.43	1.99	1.5	2.2
3. 2nd Cleaner Tailing	1.96	0.28	2.02	1.9	4.4
4. 1st Cleaner Tailing	9.86	0.13	0.92	4.5	10.2
5. 1st Scavenger Conc.	3.72	0.12	0.43	1.6	1.8
6. 2nd Scavenger Conc.	4.42	0.10	0.44	1.6	2.2
7. Scavenger Tailing	73.21	0.051	0.086	13.1	7.0
Head (Calculated)	100.00	0.28	0.89	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.83	3.22	9.72	77.3	74.4
Products 1 to 3	8.79	2.56	8.00	79.2	78.8
Products 1 to 4	18.65	1.28	4.26	83.7	89.0
Products 1 to 5	22.37	1.08	3.62	85.3	90.8
Products 1 to 6	26.79	0.92	3.10	86.9	93.0

Test No. 11

Purpose: To repeat Test No. 7, but to investigate the effect of a coarser primary grind, a coarser regrind, and no scavenger stage.

Procedure: Grind, float a rougher concentrate and clean three times.

Feed: 1000 grams minus 10 mesh sample B.

Grind: 20 minutes at 60 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton				Time, minutes			pH
	Na ₂ CO ₃	Z-11	DF-250	CuSO ₄	Grind	Cond.	Froth	
Primary Grind	3.0	-	-	-	20	-	-	-
	-	-	-	0.25	-	3	-	-
Rougher (1)	1.2	0.05	0.12	-	-	2	2	9.9
(2)	-	0.05	0.02	-	-	1	3	-
(3)	-	0.05	0.06	-	-	1	3	-
Regrind	-	-	-	-	7½	-	-	-
Cu-Ni 1st Cleaner	2.0	-	0.01	-	-	1	2	10.2
	-	0.02	0.01	-	-	1	3	-
Cu-Ni 2nd Cleaner	-	-	0.01	-	-	1	3	9.8
Cu-Ni 3rd Cleaner	0.8	-	0.01	-	-	1	3	10.0

Stage	Rougher	Rougher (Regrind)	1st to 3rd Cleaners
Equipment	1000 g Agitair	Abbe Pebble Mill	500 g Agitair
Speed: r.p.m.	950		950

Test No. 11 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Ni	Cu	Ni
1. Cleaner Concentrate	7.36	2.58	5.29	72.6	68.9
2. 3rd Cleaner Tailing	0.81	0.44	1.78	1.4	2.6
3. 2nd Cleaner Tailing	1.91	0.31	1.46	2.3	4.9
4. 1st Cleaner Tailing	5.46	0.13	0.74	2.7	7.2
5. Rougher Tailing	84.46	0.065	0.11	21.0	16.4
Head (Calculated)	100.00	0.26	0.57	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.17	2.37	4.94	74.0	71.5
Products 1 to 3	10.08	1.98	4.28	76.3	76.4
Products 1 to 4	15.54	1.33	3.04	79.0	83.6

Screen Analysis

Rougher Tailing

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 65	2.3	2.3	97.7
100	6.2	8.5	91.5
150	9.4	17.9	82.1
200	16.4	34.3	65.7
270	12.3	46.6	53.4
400	12.4	59.0	41.0
- 400	41.0	100.0	-
Total	100.0	-	-

Test No. 12

Purpose: To repeat Test 10, but with increased collector additions and flotation time in the cleaner flotation.

Procedure: Grind, float a rougher concentrate. Regrind the rougher concentrate and clean 3 times.

Feed: 1000 grams minus 10 mesh Sample A.

Grind: 20 minutes at 60 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton				Time, minutes			pH
	Na ₂ CO ₃	Z - 6	DF-250	CuSO ₄	Grind	Cond.	Froth	
Primary Grind	3.0	-	-	-	20	-	-	-
Rougher 1	-	0.05	0.12	-	-	2	2	10.2
2	-	0.05	0.01	-	-	1	3	-
3	-	0.05	0.01	-	-	1	4	-
Rougher Regrind	1.0	0.05	-	-	7½	-	-	-
Cu-Ni 1st Cleaner	-	-	0.01	-	-	1	3	10.1
	-	0.03	0.01	-	-	2	4	-
Cu-Ni 2nd Cleaner	0.1	-	-	-	-	2	4	10.0
Cu-Ni 3rd Cleaner	0.34	0.02	0.01	-	-	1	4	10.0

Stage	Rougher	Rougher Regrind	1st to 3rd Cleaners
Equipment	1000 g Agitair	Abbe Pebble Mill	500 g Agitair
Speed: r.p.m.	950		950

Test No. 12 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Ni	Cu	Ni
1. Cleaner Concentrate	6.71	3.48	10.5	79.8	77.2
2. 3rd Cleaner Tailing	0.86	0.50	2.77	1.5	2.6
3. 2nd Cleaner Tailing	1.39	0.22	2.16	1.0	3.3
4. 1st Cleaner Tailing	7.32	0.079	0.62	2.0	5.0
5. Rougher Tailing	83.72	0.055	0.13	15.7	11.9
Head (Calculated)	100.00	0.29	0.91	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.57	3.14	9.62	81.3	79.8
Products 1 to 3	8.96	2.69	8.46	82.3	83.1
Products 1 to 4	16.28	1.52	4.94	84.3	88.1

Test No. 13

Purpose: To repeat Test No. 12, but to investigate the effect of a 15 minute regrind.

Procedure: Grind, float a rougher concentrate. Regrind the rougher concentrate and clean three times.

Feed: 1000 grams minus 10 mesh (Sample A)

Grind: 20 minutes at 60 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton			Time, minutes			pH
	Na ₂ CO ₃	Z-6	DF-250	Grind	Cond.	Froth	
Primary Grind	3.0	-	-	20	-	-	-
Rougher (1)	-	0.05	0.12	-	2	2	10.2
(2)	-	0.05	0.01	-	1	3	-
(3)	-	0.05	0.01	-	1	4	-
Rougher Regrind	1.0	0.05	-	15	-	-	-
Cu-Ni 1st Cleaner	-	-	0.01	-	1	3	10.0
	-	0.03	0.01	-	2	4	-
Cu-Ni 2nd Cleaner	0.3	-	-	-	2	4	10.0
Cu-Ni 3rd Cleaner	0.63	0.02	0.01	-	1	4	10.2

Stage	Rougher	Rougher Regrind	1st to 3rd Cleaners
Equipment	1000 g Agitair	Abbe pebble mill	500 g Agitair
Speed: r.p.m.	950		950

Test No. 13 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Ni	Cu	Ni
1. Cleaner Concentrate	4.21	5.27	15.0	76.8	70.3
2. 3rd Cleaner Tailing	0.58	0.64	3.53	1.3	2.3
3. 2nd Cleaner Tailing	1.59	0.27	3.78	1.5	5.6
4. 1st Cleaner Tailing	7.93	0.085	0.95	2.3	8.4
5. Rougher Tailing	85.69	0.061	0.14	18.1	13.4
Head (Calculated)	100.00	0.29	0.90	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	4.79	4.71	13.6	78.1	72.6
Products 1 to 3	6.38	3.60	11.0	79.6	78.2
Products 1 to 4	14.31	1.65	54.4	81.9	86.6

Screen Analysis

Regrind

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 100	0.3	0.3	99.7
150	0.7	1.0	99.0
200	2.2	3.2	96.8
270	2.4	5.6	94.4
400	7.6	13.2	86.8
- 400	86.8	100.0	-
Total	100.0	-	-

Test No. 14

Purpose: To repeat the procedure of Test 12, but on Sample B.

Procedure: Grind, float a rougher concentrate and two scavenger concentrates. Regrind the rougher concentrate and clean 3 times.

Feed: 1000 grams minus 10 mesh Sample B.

Grind: 20 minutes at 60 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	Z - 6	DF-250	CuSO ₄	CMC6CTE	Grind	Cond.	Froth	
Primary Grind	3.0	-	-	-	-	20	-	-	-
Rougher 1	-	0.05	0.14	-	-	-	2	2	10.0
2	-	0.05	0.01	-	-	-	1	3	-
3	-	0.05	0.01	-	-	-	1	4	-
Scavenger No. 1	-	-	-	0.25	-	-	3	-	-
	-	0.05	0.02	-	-	-	1	3	-
Scavenger No. 2	-	0.05	0.02	-	-	-	1	3	-
Rougher Regrind	1.0	0.05	-	-	-	7½	-	-	-
Cu-Ni 1st Cl.	-	-	0.01	-	-	-	1	3	10.0
	-	0.03	0.01	-	-	-	2	4	-
Cu-Ni 2nd Cl.	-	-	-	-	0.05	-	2	4	9.9
Cu-Ni 3rd Cl.	0.56	-	-	-	0.03	-	1	-	10.0
	-	0.02	0.01	-	-	-	1	4	-

Stage
Equipment
Speed: r.p.m.

Rougher
1000 g Agitair
950

Scavenger 1 and 2
1000 g Agitair
950

Stage
Equipment
Speed: r.p.m.

Rougher Regrind
Abbe Pebble Mill
-

1st to 3rd Cleaners
500 g Agitair
950

Test No. 14 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Ni	Cu	Ni
1. 3rd Cleaner Conc.	3.57	4.96	9.73	70.9	62.3
2. 3rd Cleaner Tailing	1.10	0.46	1.64	2.0	3.2
3. 2nd Cleaner Tailing	1.87	0.29	1.65	2.2	5.5
4. 1st Cleaner Tailing	6.08	0.11	0.61	2.7	6.7
5. Scav. Conc. No. 1	2.54	0.12	0.36	1.2	1.6
6. Scav. Conc. No. 2	4.50	0.11	0.42	2.0	3.4
7. Scavenger Tailing	80.34	0.059	0.12	19.0	17.3
Head (Calculated)	100.00	0.25	0.56	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	4.67	3.90	7.82	72.9	65.5
Products 1 to 3	6.54	2.87	6.06	75.1	71.0
Products 1 to 4	12.62	1.54	3.43	77.8	77.7
Products 1 to 5	15.16	1.30	2.92	79.0	79.3
Products 1 to 6	19.66	1.03	2.35	81.0	82.7

Screen Analysis

Regrind

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 100	0.2	0.2	99.8
150	0.6	0.8	99.2
200	2.3	3.1	96.9
270	2.6	5.7	94.3
400	7.3	13.0	87.0
- 400	87.0	100.0	-
Total	100.0	-	-

Test No. 15

Purpose: To repeat Test No. 13, but to investigate the effect of a longer rougher flotation and regrind times.

Procedure: Grind, float a rougher concentrate, regrind the rougher concentrate. Clean three times.

Feed: 1000 grams minus 10 mesh Sample A.

Grind: 20 minutes at 60 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton			Time, minutes			pH
	Na ₂ CO ₃	Z - 6	DF-250	Grind	Cond.	Froth	
Primary Grind	3.0	-	-	20	-	-	-
Rougher 1	-	0.05	0.18	-	2	3	10.0
2	-	0.05	0.01	-	1	4	-
3	-	0.05	0.01	-	1	4	-
Rougher Regrind	-	0.05	-	22½	-	-	-
Cu-Ni 1st Cleaner	-	-	0.01	-	1	3	-
	0.71	0.03	0.01	-	2	4	10.0
Cu-Ni 2nd Cleaner	0.60	-	-	-	2	4	10.0
Cu-Ni 3rd Cleaner	0.60	0.02	0.01	-	1	4	10.0

Stage
Equipment
Speed: r.p.m.

Rougher
1000 g Agitair
950

Rougher Regrind
Abbe Pebble Mill

1st-3rd Cleaners
500 g Agitair
950

Test No. 15 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Ni	Cu	Ni
1. Cleaner Concentrate	4.85	4.60	12.8	79.5	67.2
2. 3rd Cleaner Tailing	0.73	0.35	2.08	0.9	1.7
3. 2nd Cleaner Tailing	1.56	0.26	3.18	1.5	5.4
4. 1st Cleaner Tailing	8.77	0.098	1.37	3.1	13.0
5. Rougher Tailing	84.09	0.050	0.14	15.0	12.7
Head (Calculated)	100.00	0.28	0.92	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	5.58	4.05	11.40	80.4	68.9
Products 1 to 3	7.14	3.22	9.60	81.9	74.3
Products 1 to 4	15.91	1.50	5.07	85.0	87.3

Screen Analysis

Composite

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 100	0.4	0.4	99.6
150	1.1	1.5	98.5
200	2.1	3.6	96.4
270	2.3	5.9	94.1
400	5.7	11.6	88.4
- 400	88.4	100.0	-
Total	100.0	-	-

Test No. 16

Purpose: To repeat Test No. 15, but use Sample B.

Procedure: Grind, float a rougher concentrate, regrind the rougher concentrate. Clean three times.

Feed: 1000 grams minus 10 mesh Sample B.

Grind: 20 minutes at 60 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton			Time, minutes			pH
	Na ₂ CO ₃	Z-6	DF-250	Grind	Cond.	Froth	
Primary Grind	3.0	-	-	20	-	-	-
Rougher (1)	0.6	0.05	0.16	-	2	3	10.0
(2)	-	0.05	0.01	-	1	4	-
(3)	-	0.05	0.01	-	1	4	-
Rougher Regrind	-	0.05	-	22½	-	-	-
Cu-Ni 1st Cl.	1.0	-	0.01	-	1	3	10.1
	-	0.03	0.01	-	2	4	-
Cu-Ni 2nd Cl.	0.4	-	-	-	2	4	10.0
Cu-Ni 3rd Cl.	0.4	0.02	0.01	-	1	4	10.0

Stage	Rougher	Rougher Regrind	1st-3rd Cleaners
Equipment	1000 g Agitair	Abbe Pebble Mill	500 g Agitair
Speed: r.p.m.	950	-	950

Test No. 16 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Ni	Cu	Ni
1. Cleaner Conc.	.23	3.76	7.60	78.8	66.6
2. 3rd Cleaner Tailing	1.07	0.20	1.29	0.8	2.3
3. 2nd Cleaner Tailing	1.80	0.19	1.64	1.4	4.9
4. 1st Cleaner Tailing	8.49	0.076	0.56	2.6	8.0
5. Rougher Tailing	83.44	0.049	0.13	16.4	18.2
Head (Calculated)	100.00	0.25	0.60	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.30	3.16	6.53	79.6	68.9
Products 1 to 3	8.10	2.50	5.44	81.0	73.8
Products 1 to 4	16.56	1.26	2.95	83.6	81.8

Screen Analysis

Regrind

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 100	0.1	0.1	99.9
150	0.1	0.2	99.8
200	0.2	0.4	99.6
270	0.6	1.0	99.0
400	4.4	5.4	94.6
- 400	94.6	100.0	-
Total	100.0	-	-

Test No. 17

Purpose: To investigate the effect of using Ca(OH)_2 in place of Na_2CO_3 as the pH modifier on the grades and recoveries of copper and nickel.

Procedure: Grind, float a rougher and two scavenger concentrates. Re grind for 15 minutes and clean three times.

Feed: 1000 grams minus 10 mesh (Sample A).

Grind: 20 minutes at 60 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton				Time, minutes			pH
	Ca(OH)_2	Z - 6	DF-250	H_2SO_4	Grind	Cond.	Froth	
Primary Grind	0.50	-	-	-	20	-	-	-
	0.20	-	-	-	-	2	-	10.0
Rougher (1)	-	0.05	0.15	-	-	2	3	-
(2)	-	0.05	0.01	-	-	1	4	-
(3)	-	0.05	0.01	-	-	1	4	-
Scavenger 1	-	0.05	-	0.44	-	1	3	8.5
Scavenger 2	-	0.05	-	-	-	1	3	-
Rougher Re grind	0.25	0.05	-	-	15	-	-	-
Cu-Ni 1st Cl.	0.20	-	0.01	-	-	1	3	10.5
	-	0.03	0.01	-	-	2	4	-
Cu-Ni 2nd Cl.	0.12	-	-	-	-	2	4	10.1
Cu-Ni 3rd Cl.	0.22	0.02	0.02	-	-	1	4	10.5

Stage	Rougher and Scavenger	Rougher Re grind	1st-3rd Cleaners
Equipment	1000 g Agitair	Abbe Pebble mill	500 g Agitair
Speed: r.p.m.	950		950

Test No. 17 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Ni	Cu	Ni
1. Cleaner Conc.	1.37	9.12	19.6	47.3	30.5
2. 3rd Cleaner Tail.	0.72	5.83	11.5	15.9	9.4
3. 2nd Cleaner Tail.	0.87	2.15	10.6	7.1	10.4
4. 1st Cleaner Tail.	7.47	0.31	3.82	8.8	32.4
5. 1st Scav. Conc.	2.22	0.18	0.95	1.5	2.4
6. 2nd Scav. Conc.	2.52	0.15	0.83	1.4	2.4
7. Scav. Tailing	84.83	0.056	0.13	18.0	12.5
Head (Calculated)	100.00	0.26	0.88	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	2.09	7.99	16.81	63.2	39.9
Products 1 to 3	2.96	6.27	14.98	70.3	50.3
Products 1 to 4	10.43	2.00	7.00	79.1	82.7
Products 1 to 5	12.65	1.68	5.93	80.6	85.1
Products 1 to 6	15.17	1.43	5.08	82.0	87.5

Test No. 18

Purpose: To repeat Test No. 17 using Sample B.

Procedure: As for Test No. 17.

Feed: 1000 grams minus 10 mesh Sample B.

Grind: 20 minutes at 60 % solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton				Time, minutes			pH
	Ca(OH) ₂	Z - 6	DF-250	H ₂ SO ₄	Grind	Cond.	Froth	
Primary Grind	0.50	-	-	-	20	-	-	-
	0.52	-	-	-	-	2	-	10.0
Rougher (1)	-	0.05	0.15	-	-	2	3	-
(2)	-	0.05	0.01	-	-	1	4	-
(3)	-	0.05	0.01	-	-	1	4	-
Scavenger (1)	-	0.05	-	0.48	-	1	3	8.5
Scavenger (2)	-	0.05	-	-	-	1	3	-
Rougher Regrind	0.25	0.05	-	-	15	-	-	-
Cu-Ni 1st Cleaner	0.11	-	0.01	-	-	1	3	10.1
	-	0.03	0.01	-	-	2	4	-
Cu-Ni 2nd Cleaner	-	-	-	-	-	2	4	10.0
Cu-Ni 3rd Cleaner	0.26	0.02	0.17	-	-	1	4	10.5

Stage	Rougher and Scavenger	Ro. Regrind	1st to 3rd Cleaners
Equipment	1000 g Agitair	Abbe Pebble	500 g Agitair
Speed: r.p.m.	950	Mill	950

Test No. 18 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Cu	Ni	Cu	Ni
1. Cleaner Concentrate	2.28	6.43	11.2	60.4	46.2
2. 3rd Cleaner Tailing	0.40	2.60	3.62	4.3	2.6
3. 2nd Cleaner Tailing	1.22	0.96	3.71	4.8	8.2
4. 1st Cleaner Tailing	5.66	0.25	1.54	5.9	15.8
5. 1st Scav. Conc.	3.23	0.16	0.77	2.1	4.5
6. 2nd Scav. Conc.	2.63	0.15	0.58	1.6	2.8
7. Scavenger Tailing	84.58	0.060	0.13	20.9	19.9
Head (Calculated)	100.00	0.24	0.55	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	2.68	5.86	10.07	64.7	15.70
Products 1 to 3	3.90	4.33	8.08	69.5	57.0
Products 1 to 4	9.56	1.91	4.21	75.4	72.8
Products 1 to 5	12.79	1.47	3.34	77.5	77.3
Products 1 to 6	15.42	1.25	2.87	79.1	80.1

LAKEFIELD RESEARCH OF CANADA LIMITED
 Lakefield, Ontario
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