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An investigation of
THE RECOVERY OF COPPER, LEAD AND ZINC
from Gravity Concentration Samples

submitted by

NORANDA MINES LIMITED

Progress Report No.6

014933

Project No. L.R. 1868

NOTE:

This report refers to the samples as received.

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LAKEFIELD RESEARCH OF CANADA LIMITED
Lakefield, Ontario
December 18, 1976

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

Two samples representing additional fresh ore PPB and PPC material were received at Lakefield on March 16, 1976. These samples consisted of plus 3 inch ore pieces with very few fines and were designated Samples B-2 and C-2. Flotation testwork was conducted to compare the response of these samples with the response of the PPA, PPB and PPC samples, and this testwork was concluded with cycle tests.

Later, further testwork was also conducted on mixtures of samples, and on samples which had been in storage for a period of time. A cycle test was also conducted on a sample of B-2 ore which had been sent to Lakefield by Mattagami Lake Mines Limited for comparative purposes.

The results of the testwork were frequently discussed in meetings and telephone conversations with Mr. E. Kirkpatrick of Kerr Addison Mines Limited.

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S U M M A R Y

1. Head Sample Assays

Sample	Assays, %						Assays, oz/ton	
	Pb	Pb*	Zn	Zn*	Pb(ox.)	Zn(ox.)	Au	Ag
B-2	7.81	7.94	15.2	15.4	1.07	0.29	0.030	3.37
C-2 ✓	4.50	4.72	9.53	9.86	1.15	0.41	0.025	2.10
PPB (stockpile)	6.56	6.39	10.6	10.3	3.00	0.58	-	-
B-2 (stored 3 months)	-	7.90	-	15.7	1.14	0.35	-	-

* Average head assays as calculated from test results.

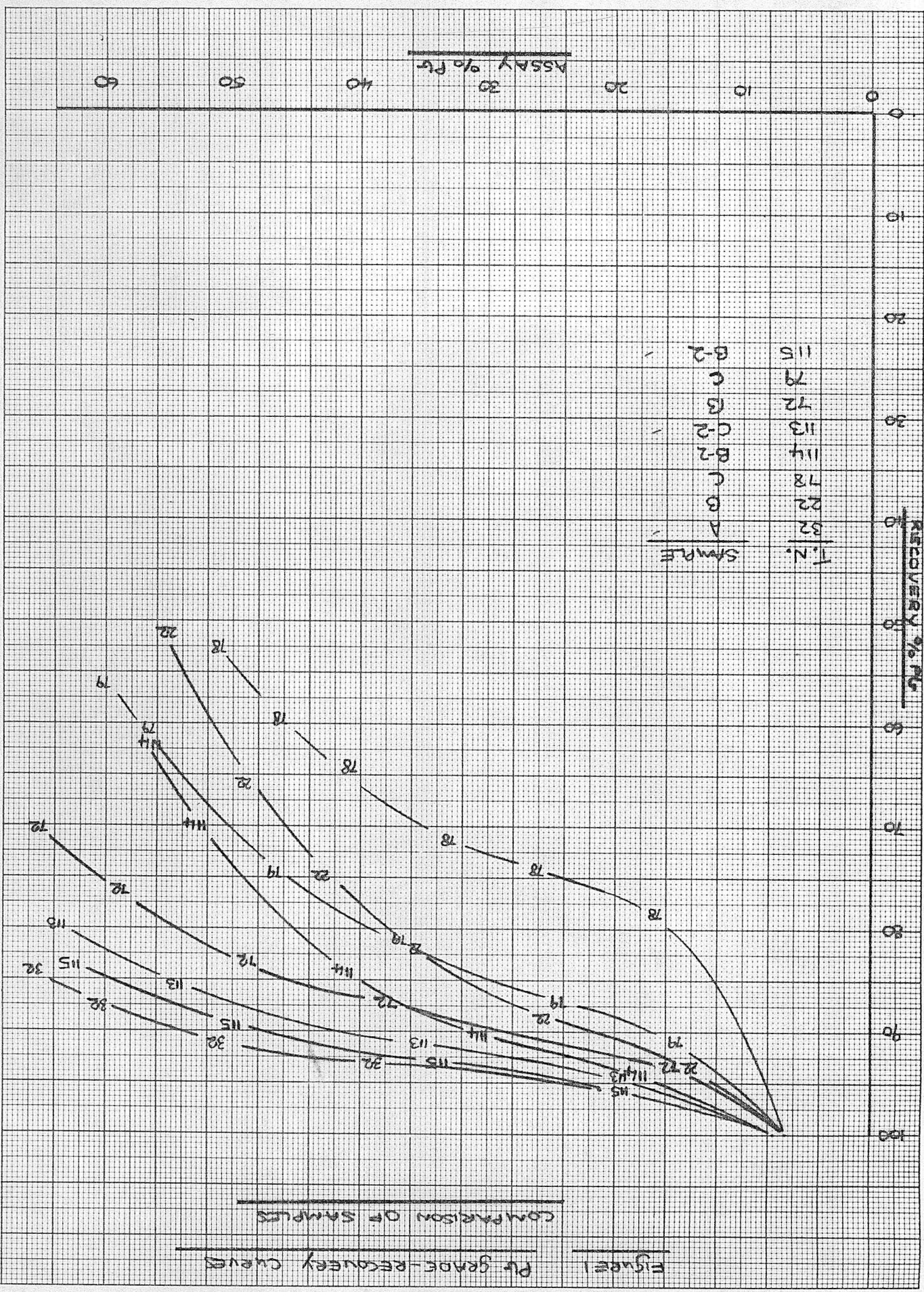
2. Comparison of Flotation Response of Samples

Flotation tests were conducted following the standard flotation conditions, but with various grinding and regrinding times. The results and conditions of this testwork are compared with the results of Samples PPA, PPB and PPC in Table 1.

Table 1 - Comparison of Samples

Test No.	Sample	Grinding Time		Weight %	Pb Cleaner Concentrate			
		Primary	Regrind		Assays, %		% Distribution	
					Pb	Zn	Pb	Zn
✓ 32	A	30	30	10.18	65.8	6.40	84.1	9.4
22	B	40	30	6.03	55.1	14.5	51.2	8.3
78	C	40	40	6.83	51.4	13.3	52.6	9.1
114	B-2	30	30	8.63	56.3 ✓	14.0	62.2 ✓	7.9
✓ 113	C-2	30	30	5.12	69.3 ✓	4.38	73.0 ✓	2.3
72	B	60	60+30	7.12	65.3	10.3	70.2	7.1
79	C	60	60+30	6.09	60.3	10.3	56.7	6.7
✓ 115	B-2	60	60+30	6.39	75.0 ✓	5.28	61.2 ✓	2.2

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



Summary - Continued

Sample C-2 responded extremely well without fine regrinding. Results were almost as good as those from Sample PPA. Higher lead concentrate grades and recoveries resulted from Sample B-2 than from Sample PPB, but fine regrinding was necessary to achieve high concentrate grades and recoveries.

3. Batch Tests on Samples B-2 and C-2

3.1. Sample B-2

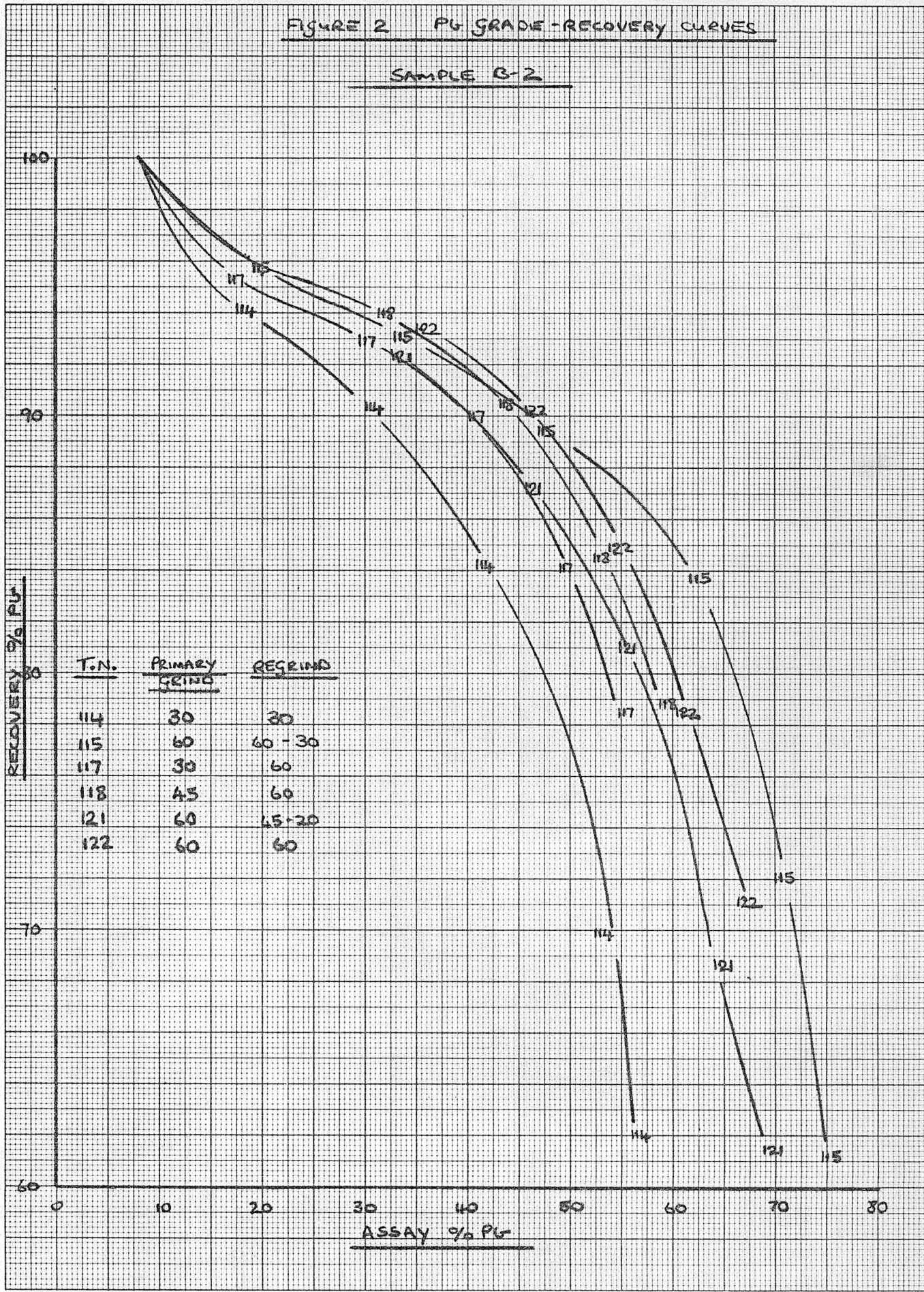
A series of flotation tests were conducted to investigate the effects of fineness of primary grinding and regrinding on the grade and recovery of lead. The results and conditions of these tests are summarized in Table 2, and the grade-recovery curves are shown in Figure 2.

Table 2 - Effect of Fineness of Grind

Test No.	Primary Grind	Regrind		Product	Weight %	Assays, %		% Dist.	
		1st	2nd			Pb	Zn	Pb	Zn
114	30	30	-	Cleaner Conc.	8.63	56.3	14.0	62.2	7.9
				Rougher Conc.	40.73	18.0	19.0	94.2	50.8
115	60	60	30	Cleaner Conc.	6.39	75.0	5.28	61.2	2.2
				Rougher Conc.	38.88	19.3	18.9	95.8	48.8
117	30	60	-	Cleaner Conc.	11.37	55.4	14.2	78.5	10.5
				Rougher Conc.	44.37	17.2	18.7	95.3	53.8
118	45	60	-	Cleaner Conc.	10.80	59.3	12.3	78.9	8.7
				Rougher Conc.	42.09	18.5	19.2	96.1	52.8
121	60	45	20	Cleaner Conc.	7.05	69.3	7.94	61.5	3.6
				Rougher Conc.	38.28	19.9	19.3	95.7	47.9
122	60	60	-	Cleaner Conc.	8.59	67.0 ✓	9.0	71.2 ✓	5.1
				Rougher Conc.	38.62	20.0	18.9	95.7	48.3

FIGURE 2 PG GRADE-RECOVERY CURVES

SAMPLE G-2



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Summary - Continued.

Concentrate grades and recoveries increased with finer regrinding.
 The grinding conditions used in test 122 were used for the cycle tests.

3.2. Sample C-2

Flotation tests were conducted on Sample C-2 to investigate the grade and recovery of a zinc concentrate, prior to conducting the cycle tests. The lead circuit conditions which were used for the cycle test were the same as in the preliminary test, test 113. The results and conditions of the zinc flotation are summarized in Table 3.

Table 3 - Zinc Flotation

Test No.	CuSO ₄ lb/ton	Collector		Product	Weight %	Assays, %		% Dist.	
		Type	Amount			Pb	Zn	Pb	Zn
116	1.0	Z-200	0.10	Zn Cleaner Conc.	11.74	0.36	55.4	0.9	67.9
				Zn Rougher Conc.	21.67	0.51	36.2	2.4	81.8
119	1.5	Z-200	0.10	Zn Cleaner Conc.	13.87	0.37	54.8	1.0	75.9
				Zn Rougher Conc.	24.99	0.56	33.2	2.8	82.9
120	1.5	AX343	0.10	Zn Cleaner Conc.	13.72	0.38	53.9	1.1	76.6
				Zn Rougher Conc.	21.20	0.51	36.9	2.4	81.0

The higher CuSO₄ additions resulted in better zinc recoveries during the cleaner flotation. Replacing Z-200 with AX343 had little effect in selectivity or recovery. The conditions of test 119 were used for the cycle tests.

Summary - Continued

4. Cycle Tests

4.1. Sample B-2

Two six-stage locked-cycle tests were conducted on Sample B-2. The flotation and grinding conditions are tabulated below.

Table 4 - Cycle Test Reagent Schedule

Stage	Grind Min./ 1000 g	Reagents Added, pounds per ton						Flotation Time	pH
		Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC		
Primary Grind	30*	3.0	1.0	0.30	0.08	-	-	-	-
Pb Rougher	-	-	-	-	0.04	0.04	0.02	12	9.4
Pb Re grind	30**	1.5	1.0	0.30	0.05	-	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	0.02	-	8	9.5
Pb 2nd Cleaner	-	0.3	0.2	0.1	-	-	-	5	9.6
Pb 3rd Cleaner	-	0.3	0.1	0.1	-	-	-	4	9.6
Pb 4th Cleaner	-	0.3	-	0.05	-	-	-	3	9.6
		CuSO ₄	Z-200	Z-11	Ca-(OH) ₂				
Zn Rougher	-	1.5	0.12	0.06	3.0	-	0.02	6	10.8
Zn 1st Cleaner	-	-	0.006	-	0.8	-	-	5	11.0
Zn 2nd Cleaner	-	-	-	-	0.8	-	-	4	11.0
Zn 3rd Cleaner	-	-	-	-	0.6	-	-	3	11.1
Zn 4th Cleaner	-	-	-	-	0.4	-	-	2½	11.2

* Ball Mill

** Rod Mill

Summary - Continued

In test 126 the lead 1st cleaner tailing was circulated to the zinc rougher, whilst in test 131 the lead circuit was closed and the lead 1st cleaner tailing was circulated to the lead rougher.

The projected results of these tests, based on the average lead and zinc assays of the last cycles and the three-product formula are shown in Table 5.

Table 5 - B-2 Cycle Test Results

Test No.	Product	Weight %	Assays, %		% Distribution	
			Pb	Zn	Pb	Zn
126	Pb Cleaner Concentrate	10.73	65.1 ✓	10.80	89.2 ✓	7.4
	Zn Cleaner Concentrate	24.34	1.85	57.5 ✓	5.7	89.7 ✓ ✓
	Zn Rougher Tailing	64.93	0.61	0.69	5.1	2.9
	Head (calculated)	100.00	7.83	15.6	100.0	100.0
131	Pb Cleaner Concentrate	11.66	61.5 ✓	10.85	91.0 ✓	8.0
	Zn Cleaner Concentrate	24.16	1.10	57.6 ✓	3.4	87.5 ✓ ✓
	Zn Rougher Tailing	64.18	0.69	1.12	5.6	4.5
	Head (calculated)	100.00	7.88	15.9	100.0	100.0

Higher-grade lead concentrates with slightly lower zinc losses were recovered when the lead 1st cleaner tailing was recirculated to the zinc rougher.

re open circuit

Summary - Continued

4.2. Sample C-2

Four six-stage locked-cycle tests were conducted on Sample C-2, to investigate the effect of ball mill and of rod mill regrinding. The reagent conditions were similar to those used on Sample B-2. The grinding conditions are summarized below in Table 6.

Table 6 - C-2 Cycle Tests Grinding Conditions

Test No.	Primary Grind		Regrind		Pb 1st Cleaner to
	Mill	Time*	Mill	Time	
127	Ball	30	Rod	30	Zn Rougher
128	Ball	30	Ball	30	Zn Rougher
129	Ball	30	Rpd	30	Pb Rougher
130	Ball	30	Ball	30	Pb Rougher

* min/2000 grams

The projected results of these tests are shown in Table 7.

Summary - Continued

Table 7 - Cycle Test Results

Test No.	Product	Weight %	Assays, %		% Distribution	
			Pb	Zn	Pb	Zn
127	Pb Cleaner Concentrate	6.51	63.5	4.78	89.5	3.1
	Zn Cleaner Concentrate	15.88	0.90	55.8	3.1	89.2
	Zn Rougher Tailing	77.61	0.44	0.85	7.4	6.6
	Head (calculated)	100.00	4.62	9.83	100.0	100.0
128	Pb Cleaner Concentrate	6.74	60.2 ✓	5.68	86.0 ✓	3.8
	Zn Cleaner Concentrate	16.33	1.64	55.4	5.7	90.5
	Zn Rougher Tailing	76.93	0.51	0.74	8.3	5.7
	Head (calculated)	100.00	4.72	10.0	100.0	100.0
129	Pb Cleaner Concentrate	6.88	61.5	4.76	90.4	3.3
	Zn Cleaner Concentrate	16.16	0.46	56.0	1.6	90.5
	Zn Rougher Tailing	76.96	0.49	0.81	8.0	6.2
	Head (calculated)	100.00	4.64	10.0	100.0	100.0
130	Pb Cleaner Concentrate	6.97	59.7 ✓	5.52	90.1	4.0 ✓
	Zn Cleaner Concentrate	15.99	0.48	52.8 ✓	1.7	88.0 ✓
	Zn Rougher Tailing	77.04	0.49	1.00	8.2	8.0
	Head (calculated)	100.00	4.62	9.59	100.0	100.0

The cycle test results were similar with both rod mill and ball mill regrinding. Recirculation of the lead 1st cleaner tailing to the lead rougher resulted in higher lead recoveries, and in lower lead contents in the zinc concentrates.

Summary - Continued

A further cycle test was conducted on Sample C-2, in which the primary grind and regrind times were increased to twice the usual level, and were the same as those used on Sample B-2.

The results of this test are summarized in Table 8.

Table 8 - Sample C-2 Fine Regrinding

Test No.	Product	Weight %	Assays, %		% Distribution	
			Pb	Zn	Pb	Zn
144	Pb Cleaner Concentrate	7.57	55.9	5.80	92.6	4.4
	Zn Cleaner Concentrate	16.19	0.68	55.9	2.4	91.1
	Zn Rougher Tailing	76.24	0.30	0.59	5.0	4.5
	Head (calculated)	100.00	4.57	9.94	100.0	100.0

Pb recovery was slightly higher than in the other cycle tests although the lead grade was lower. Zinc recovery was also slightly higher.

5. Testwork on Mattagami B-2 Sample

A 12 kg sample of minus 20 mesh B-2 ore was received from Mattagami Lake Mines for comparative testwork. Preliminary batch tests were conducted following the standard reagent balance. The pH after grinding with 2.5 lb/ton Na₂CO₃ was pH 7.6, as compared to pH 9.4 with the Lakefield B-2 sample. A cycle test was conducted in which the Na₂CO₃ addition to the rougher flotation was increased to 10.0 lb/ton. The pH in the lead rougher flotation was then pH 9.9. The results of this test are compared with the results of the Lakefield B-2 sample in Table 9.

Summary - Continued

Table 9 - Mattagami B-2 Sample

Test No.	Sample Source	Product	Weight %	Assays, %		% Distribution	
				Pb	Zn	Pb	Zn
139	B-2 Mattagami	Pb Cleaner Conc.	12.52	✓57.9	12.9	86.2	10.2
		Zn Cleaner Conc.	22.94	2.42	56.4	6.6	81.7
		Zn Rougher Tailing	64.54	0.93	2.00	7.2	8.1
		Head (calculated)	100.00	8.36	15.8	100.0	100.0
126	B-2 Lakefield	Pb Cleaner Conc.	10.73	✓65.1	10.80	89.2	7.4
		Zn Cleaner Conc.	24.34	1.85	57.5	5.7	89.7
		Zn Rougher Tailing	64.93	0.61	0.69	5.1	2.9
		Head (calculated)	100.00	7.83	15.6	100.0	100.0

In the initial batch test in which only 2.5 lb/ton Na₂CO₃ was added, pyrite flotation was strong in the lead rougher. Increasing the amount of Na₂CO₃ to 10.0 lb/ton in the cycle test resulted in reasonably good selectivity in the lead rougher, and concentrate grades decreased from 64 percent lead to 58 percent lead during the cycle test. Recoveries particularly of zinc were also lower.

Some oxidation of the Mattagami sample during storage had probably occurred, and further testwork was then conducted on samples at Lakefield which had not been kept in freezer storage. Test charges of minus 10 mesh from the B-2 and C-2 samples had been kept in frozen storage during the testwork program.

Summary - Continued

6. Testwork on PPB (Stockpile) and B-2 (Stored 3 Months)

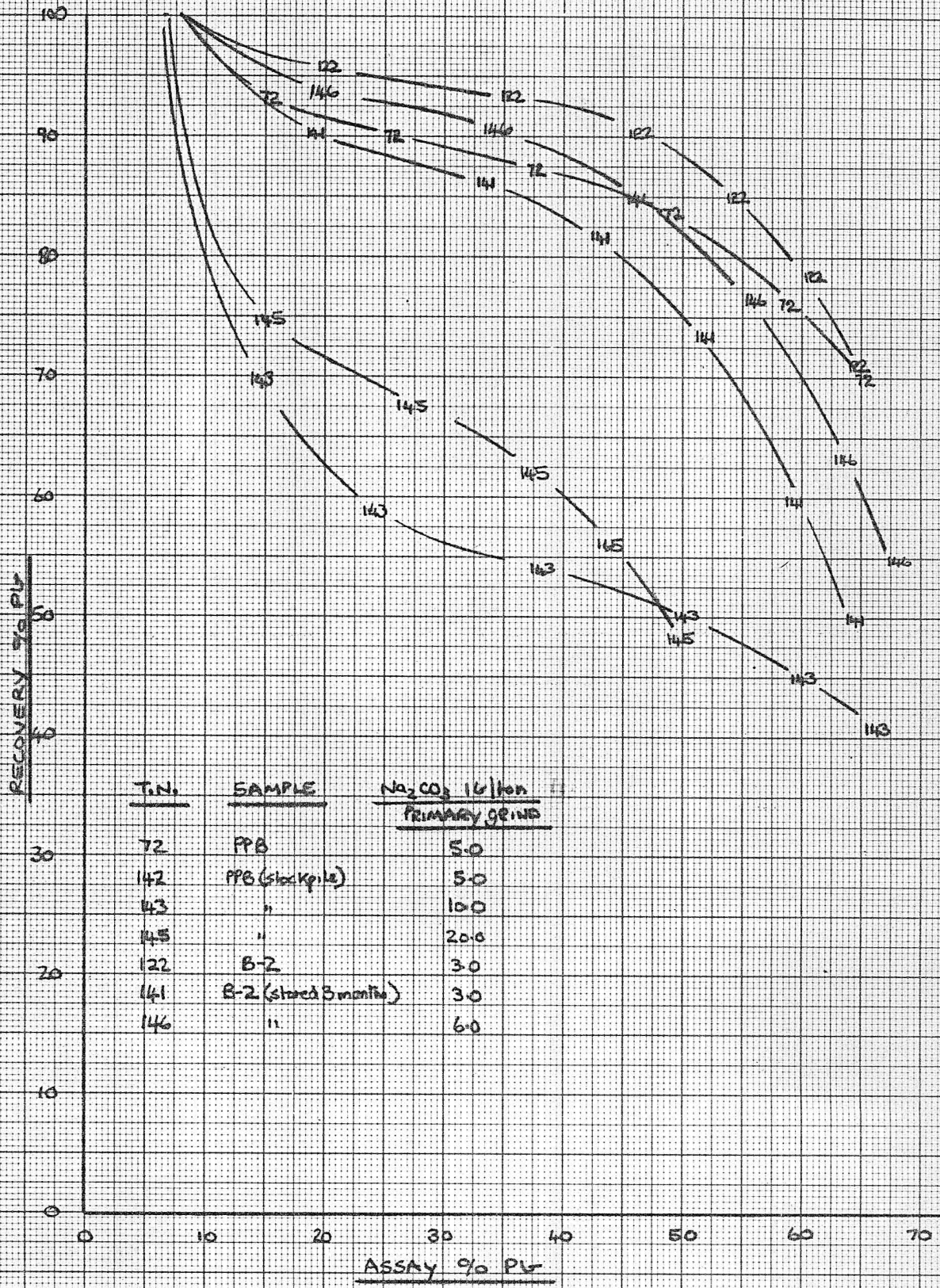
Samples were taken from the pile of minus $\frac{1}{2}$ inch PPB which had been stored outside under a tarpaulin for a period of six months, and from a minus $1\frac{1}{2}$ inch B-2 sample which had been stored in a drum at ambient temperature for a period of three months.

Flotation tests were conducted on these samples to compare their response, following the standard conditions applied to the original samples. The results and conditions of these tests are summarized in Table 10, and the grade-recovery curves are shown in Figure 3.

Table 10 - Effect of Aging

Test No.	Sample	Pb Rougher		Pb Cleaner Concentrate				
		Na ₂ CO ₃ lb/t	pH	Weight %	Assays, %		% Dist.	
					Pb	Zn	Pb	Zn
72	PPB	5.0	9.0	7.18	65.3	10.3	70.2	7.1
142	PPB (Stockpile 6 Months)	5.0	7.7	-	-	-	-	-
143	PPB (Stockpile 6 Months)	10.0	8.3	4.06	65.4	7.99	40.9	3.1
145	PPB (Stockpile 6 Months)	20.0	9.7	6.13	49.4	13.7	48.1	8.3
122	B-2	3.0	9.7	8.59	67.0	9.0	71.2	5.1
141	B-2 (Stored 3 Months)	3.0	8.5	6.16	64.0	10.3	50.0	4.0
146	B-2 (Stored 3 Months)	6.0	9.6	6.41	67.8	8.82	55.0	3.6

FIGURE 3 Pb GRADE-RECOVERY CURVES
PPB (STOCKPILE) , B-2 (STORED 2 MONTHS)



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Summary - Continued

The response of the PPB stockpile ore to the flotation conditions was very poor, and the increased Na_2CO_3 additions resulted in a slight improvement. Lead recovery from the B-2 samples which had been stored 3 months was about 20 percent lower than from the fresh sample. This loss of recovery was reduced by about 10 percent by increasing the Na_2CO_3 addition to 6.0 lb/ton.

Oxide lead content of the stockpile material had increased from 0.97 percent to 3.00 percent during the 6 months in stockpile. The oxide lead content of the B-2 sample increased slightly from 1.07 percent to 1.14 percent during the 3 months storage.

7. Testwork on Mixtures of Samples

Flotation tests were conducted on mixtures of Sample C and Sample C-2 to investigate the effect on the flotation results of mixing one of the samples which required very fine regrinding with one of the samples which responded well with coarser regrinding. The results and conditions of these tests are summarized below in Table 11.

- req'd fine regrinding
- coarse regrinding

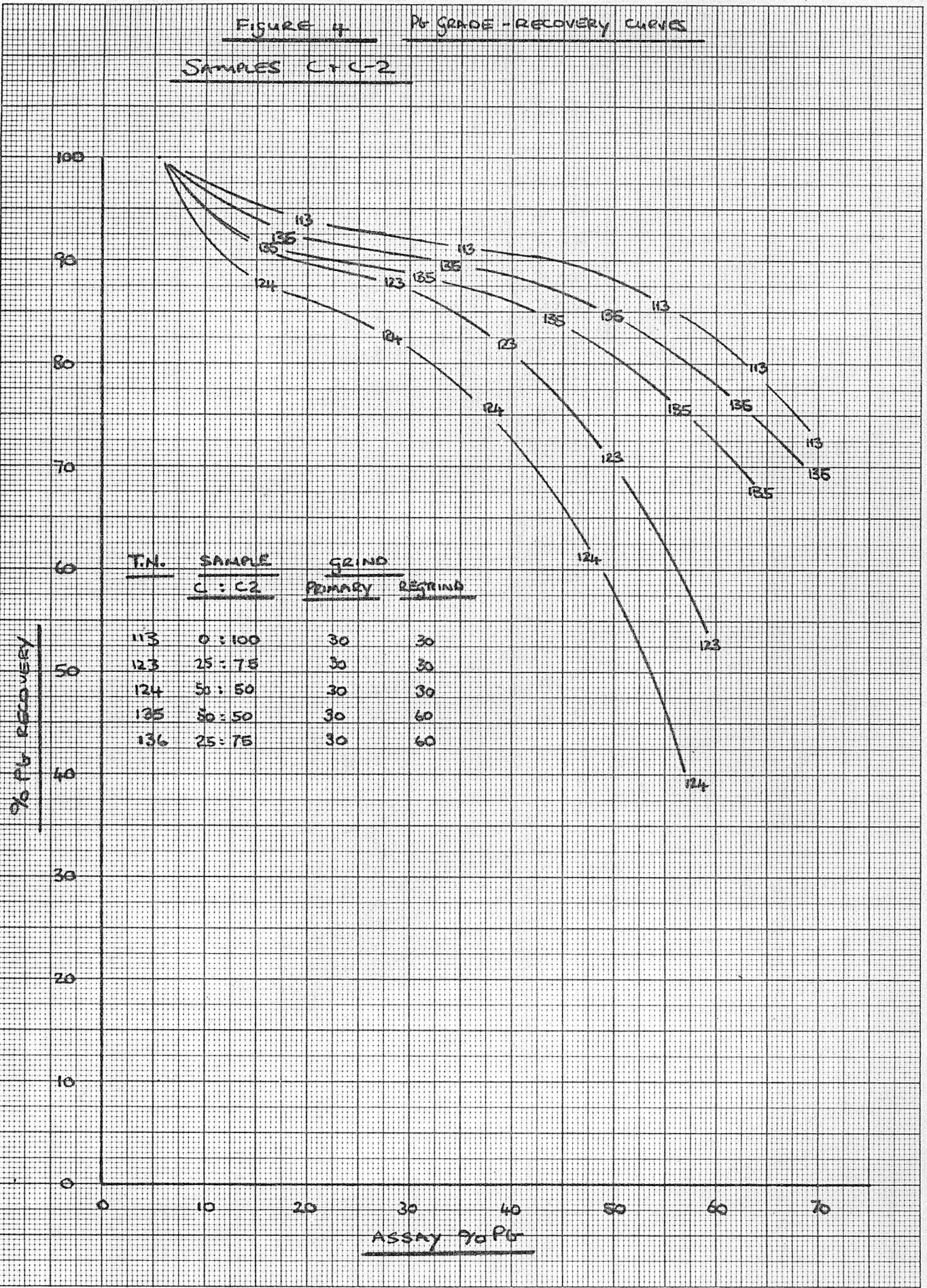
Table 11 - Mixtures of Samples

Test No.	Feed %		Grinding Time		Pb Cleaner Concentrate				
	C	C-2	Primary	Regrind	Weight %	Assays, %		% Dist.	
						Pb	Zn	Pb	Zn
113	0	100	30	30	5.12	69.3 ✓	4.38	73.0	2.3
123	25	75	30	30	4.46	59.1 ✓	7.70	52.7 ✓	3.6
124	50	50	30	30	3.89	57.7	9.04	39.3	3.6
135	50	50	30	60	6.30	63.6	9.08	67.6	5.5
136	25	75	30	60	5.43	69.5 ✓	6.35	69.2 ✓	3.4

The lead grade-recovery curves for these tests are shown in Figure 4.

FIGURE 4 Pb GRADE - RECOVERY CURVES

SAMPLES C+C-2



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Summary - Continued

With the 30 minute regrind, even the 25 percent addition of Sample PPC resulted in a high loss of lead recovery. Increasing the fineness of regrind resulted in some improvement, and recoveries were about 5 percent lower than the C-2 results.

Two flotation tests were also conducted on mixtures of C-2 and B-2.

The results and conditions of these tests are summarized below in Table 12.

Table 12

Test No.	Feed %		Grinding Time		Pb Cleaner Concentrate				
	B-2	C-2	Primary	Regrind	Weight %	Assays, %		% Dist.	
						Pb	Zn	Pb	Zn
113	-	100	30	30	5.12	69.3	4.38	73.0	2.3
133	50	50	30	30	6.91	61.1	9.83	66.6	5.4
134	50	50	30	60	6.55	67.8	7.36	70.9	3.9
122	100	-	60	60	8.59	67.0	9.0	71.2	5.1

The lead grade-recovery curves for these tests are shown in Figure 5.

Fine regrinding on the mixture was necessary in order to produce results similar to those on the separate samples.

8. Test Using Grum Water Sample

A comparative flotation test was conducted using a water sample from the Grum ore-body deposit. This test was conducted on Sample C-2, and the results are compared in Table 13.

Summary - Continued

Table 13 - Grum Water Sample

Test No.	Water	Product	Weight %	Assays, %		% Distribution	
				Pb	Zn	Pb	Zn
116	Lakefield	Pb Cleaner Conc.	4.63	69.3	3.94	70.9	1.9
		Zn Cleaner Conc.	11.74	0.36	55.4	0.9	67.9
		Zn Rougher Tail.	67.07	0.43	1.08	6.3	7.6
140	Grum	Pb Cleaner Conc.	7.73	56.9	7.07	91.5	5.4
		Zn Cleaner Conc.	11.78	0.24	58.5 ✓	0.6	68.3 ✓
		Zn Rougher Tail.	67.63	0.36	1.20	5.1	8.0

The lead concentrate grade in test 140 was low, but the recovery was very high. The froth was excessive in the cleaner stages in this test, and some change in type or amount of frother could result in some improvement in concentrate grade.

9. Grinding and Power Consumption

The conditions and power consumptions of the primary grinds and regrinds used in the cycle tests on Samples B-2 and C-2 are tabulated in Table 14, and the screen analyses in Tables 15 and 16.

Summary - Continued

Table 14 - Grinding Conditions

Sample	Primary Grind			Pb Rougher Concentrate Regrind			
	Mill	Grinding Time, min/ 2000 g	Power kWh/ton	Mill	Grinding Time	Power, kWh/ton Ro. Conc. Ore	
B-2	Lab. Ball Mill	60	18.66	Rod Mill	60	34.65	13.86
C-2	Lab. Ball Mill	30	9.33	Small Lab. Mill	30	27.72	6.93 ✓
C-2	Lab. Ball Mill	30	9.33	Rod Mill	30	27.72	6.93 ✓

Table 15 - Size Analyses - Primary Grind

Particle Size	Sample B-2			Sample C-2			
	% Retained Ind.	% Retained Cum.	% Passing Cum.	Particle Size	% Retained Ind.	% Retained Cum.	% Passing Cum.
+ 200 mesh	0.9	0.9	99.1	+ 100 mesh	0.2	0.2	99.8
270 mesh	2.4	3.3	96.7	150 mesh	1.8	2.0	98.0
31.2 µm	13.1	16.4	83.6	200 mesh	9.8	11.8	88.2
24.2 µm	9.6	26.0	74.0	35.6 µm	24.6	36.4	63.6
16.9 µm	16.2	42.2	57.8	27.6 µm	13.5	49.9	50.1
11.6 µm	15.5	57.7	42.3 ✓	19.3 µm	15.4	65.3	34.7
9.0 µm	8.3	66.0	34.0	13.3 µm	11.1	76.4	23.6
- 9.0 µm	34.0	100.0	-	10.2 µm	5.2	81.6	18.4 ✓
				- 10.2 µm	18.4	100.0	-
Total	100.0	-	-	Total	100.0	-	-

Summary - Continued

Table 16 - Size Analyses - Regrinds

B-2 Ball Mill Regrind					C-2 Rod Mill Regr.			C-2 Ball Mill Regr.		
Particle Size	% Ret.		% Pass.	Particle Size	% Ret.		% Pass.	% Ret.		% Pass.
	Ind.	Cum.	Cum.		Ind.	Cum.	Cum.	Ind.	Cum.	
+ 29.5 μm	0.3	0.3	99.7	+ 31.6 μm	0.8	0.8	99.2	2.3	2.3	97.7
22.9	0.8	1.1	98.9	24.5	4.1	4.9	95.1	4.4	6.7	93.3
15.9	6.1	7.2	92.8	12.1	10.3	15.2	84.8	13.4	20.1	79.9
11.0	18.0	25.2	74.8	11.8	18.4	33.6	66.4	18.7	38.8	61.2
8.5	14.3	39.5	60.5	9.1	12.5	46.1	53.9	11.9	50.7	49.3
- 8.5	60.5	-	-	- 9.1	53.9	-	-	49.3	-	-
Total	100.0	-	-	Total	100.0	-	-	100.0	-	-

The size analyses curves are shown in Figure 6.

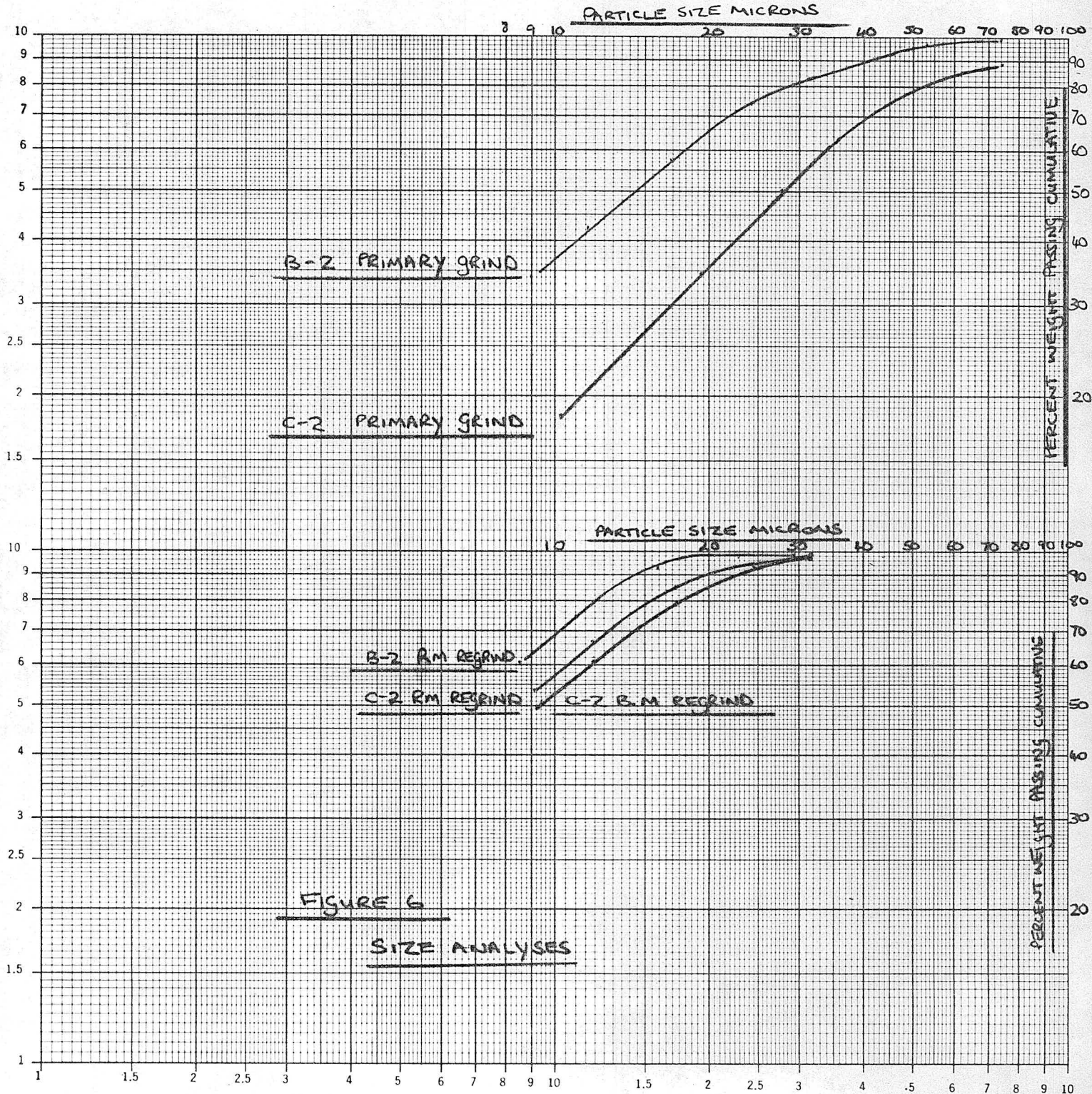


FIGURE 6
SIZE ANALYSES

SAMPLE PREPARATION

1. Samples B-2 and C-2

Four drums weighing approximately 2000 pounds were received at Lakefield on March 16, 1976, and given our reference No. 7620949.

The drums contained plus 3 inch rock pieces with very few fines. Two drums contained Sample B-2, and the other two drums contained Sample C-2.

Approximately 300 pounds of 6 inch plus 3 inch ore was removed for possible later testwork. The rest of the sample was jaw and cone-crushed to minus $\frac{1}{2}$ inch. Samples of 200 pounds of each were removed by riffing, roll-crushed to minus 10 mesh, and riffled into 2-kilogram charges plus a head sample. The test charges were stored in the freezer.

2. Mattaqami B-2 Sample

A sample of 14 kilograms of minus 20 mesh ore was received at Lakefield on July 8, 1976 and given our reference No. 7621031. The sample was roll-crushed to minus 10 mesh and riffled into 2-kilogram charges for testwork and a sample for head analysis.

3. Sample PPB (Stockpile)

Approximately 100 pounds of sample was removed from the stockpile of minus $\frac{1}{2}$ inch ore remaining from the pilot plant investigation. This was done during the early part of July and the sample had been stored for some 6 to 7 months.

The sample was dried, cone and roll-crushed to minus 10 mesh, and riffled into 2-kilogram charges for testwork.

4. Sample B-2 (Stored 3 Months)

Approximately 50 pounds of sample B-2 were riffled out of the minus $\frac{1}{2}$ inch ore which had been stored in a drum at ambient temperature for 3 months.

The sample was cone and roll-crushed to minus 10 mesh, and riffled into 2-kilogram charges for testwork.

DETAILS OF TESTS

<u>Test No.</u>	<u>Sample</u>	<u>Procedure</u>
<u>1. Cycle Tests</u>		
125	PPA	Rod mill regrind. Open Pb circuit
126	B-2	Rod mill regrind. Open Pb circuit
131	B-2	Rod mill regrind. Closed Pb circuit
127	C-2	Rod mill regrind. Open Pb circuit
128	C-2	Ball mill regrind. Open Pb circuit
129	C-2	Rod mill regrind. Closed Pb circuit
130	C-2	Ball mill regrind. Closed Pb circuit
144	C-2	Fine rod mill regrind.
<u>2. Batch Tests: Sample B-2</u>		
114	B-2	30' primary grind, 30' regrind
115	B-2	60' primary grind, 60 + 30' regrind
117	B-2	30' primary grind, 60' regrind
118	B-2	45' primary grind, 60' regrind
121	B-2	60' primary grind, 45 + 20' regrind
122	B-2	60' primary grind, 60' regrind
<u>3. Batch Tests: Sample C-2</u>		
113	C-2	30' primary grind, 30' regrind
116	C-2	Zn flotation
119	C-2	Zn flotation
120	C-2	Zn flotation
132	C-2	Ball mill regrind
140	C-2	Grum water sample

Details of Tests - Continued

<u>Test No.</u>	<u>Sample</u>	<u>Procedure</u>
<u>4. Batch Tests: Mattaqami B-2 Sample</u>		
137	MB-2	30' primary grind
138	MB-2	30' primary grind, 30' regrind
136	MB-2	Cycle test
<u>5. PPB (Stockpile), B-2 (Stored 3 Months)</u>		
141	B-2 (stored 3 mon.)	60' primary grind, 60' regrind
142	PPB (stockpile)	Low Na ₂ CO ₃
143	PPB (stockpile)	High Na ₂ CO ₃
145	PPB (stockpile)	Higher Na ₂ CO ₃
142	B-2 (stored 3 mon.)	High Na ₂ CO ₃
<u>6. Mixtures of Samples</u>		
123	75 % C-2, 25 % C	30' primary grind, 30' regrind
124	50 % C-2, 50 % C	30' primary grind, 30' regrind
133	50 % C-2, 50 % B-2	30' primary grind, 30' regrind
134	50 % C-2, 50 % B-2	30' primary grind, 60' regrind
135	50 % C-2, 50 % C	30' primary grind, 30' regrind
136	75 % C-2, 25 % C	30' primary grind, 30' regrind

1. CYCLE TESTS

Test No. 125

Purpose: To conduct a six-stage locked-cycle test on sample PPA, lot 3.

Procedure: See flowsheet.

Feed: Six charges of 2000 grams minus 10 mesh sample PPA, lot 3.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	Grind	Cond.	Froth	
Primary Grind	8.0	1.0	0.30	0.07	-	30	-	-	-
<u>Pb Circuit</u>									
Pb Rougher	-	-	-	0.01	0.02	-	1	3	9.4
	-	-	-	0.01	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
Pb Conc. Regrind	2.0	0.5	0.20	0.03	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	-	-	1	3	9.6
	-	-	-	0.01	0.01	-	1	2	-
Pb 2nd Cleaner	0.3	0.20	0.10	-	-	-	1	3½	9.7
Pb 3rd Cleaner	0.2	0.10	0.05	-	-	-	1	3	9.7
Pb 4th Cleaner	0.2	-	0.05	-	-	-	1	2	9.8
<u>Zn Circuit</u>									
	Ca-(OH) ₂	CuSO ₄	Z-200	MIBC					
Condition	2.5	1.0	-	-	-	-	2	-	10.8
Zn Rougher	-	-	0.06	0.02	-	-	1	3	-
	-	-	0.02	0.02	-	-	1	2	-
Zn 1st Cleaner	0.7	-	0.006	-	-	-	1	3	11.0
Zn 2nd Cleaner	0.6	-	-	-	-	-	1	3	11.1
Zn 3rd Cleaner	0.5	-	-	-	-	-	1	2½	11.1
Zn 4th Cleaner	0.4	-	-	-	-	-	1	2	11.2

Stage
Equipment
Speed: r.p.m.

Regrind
Lab. Rod Mill

Zn Rougher
1000 gram D-1
1400

Stage
Flotation Cell
Speed: r.p.m.

1st & 2nd Cleaners
500 gram D-1
1150

3rd & 4th Cleaners
250 gram D-1
900

Test No. 125 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate A	1.20	73.0	5.09	11.0	0.9
2. Pb Cleaner Concentrate B	1.51	69.0	6.06	13.1	1.3
3. Pb Cleaner Concentrate C	1.52	68.0	5.94	13.0	1.3
4. Pb Cleaner Concentrate D	1.60	66.8	6.43	13.4	1.5
5. Pb Cleaner Concentrate E	1.62	65.2	6.73	13.3	1.5
6. Pb Cleaner Concentrate F	1.59	66.6	6.59	13.3	1.5
7. Pb 4th Cleaner Tailing F	0.38	24.4	15.7	1.2	0.8
8. Pb 3rd Cleaner Tailing F	0.89	16.6	16.4	1.9	2.1
9. Pb 2nd Cleaner Tailing F	2.03	8.17	14.3	2.0	4.1
10. Pb 1st Cleaner Tailing F	4.09	3.18	10.4	1.6	6.0
11. Zn Cleaner Concentrate A	0.51	2.14	51.9	0.1	3.7
12. Zn Cleaner Concentrate B	0.94	1.68	56.0	0.2	7.4
13. Zn Cleaner Concentrate C	0.78	1.56	54.5	0.2	6.0
14. Zn Cleaner Concentrate D	1.30	1.52	56.0	0.2	10.3
15. Zn Cleaner Concentrate E	1.57	1.64	54.8	0.3	12.1
16. Zn Cleaner Concentrate F	1.15	1.75	54.9	0.3	8.9
17. Zn 4th Cleaner Tailing F	0.60	1.64	50.8	0.1	4.3
18. Zn 3rd Cleaner Tailing F	0.81	1.80	49.8	0.2	5.7
19. Zn 2nd Cleaner Tailing F	1.01	2.44	42.3	0.3	6.0
20. Zn 1st Cleaner Tailing F	3.15	3.00	22.7	1.2	10.1
21. Zn Rougher Tailing A	9.01	1.32	0.33	1.5	0.5
22. Zn Rougher Tailing B	11.78	1.41	0.37	2.1	0.6
23. Zn Rougher Tailing C	12.42	1.53	0.41	2.4	0.7
24. Zn Rougher Tailing D	13.12	1.57	0.52	2.5	1.0
25. Zn Rougher Tailing E	12.61	1.47	0.47	2.3	0.8
26. Zn Rougher Tailing F	12.81	1.46	0.50	2.3	0.9
Head (calculated)	100.00	7.97	7.08	100.0	100.0

Calculated Grades and Recoveries

Combined Pb Cleaner Conc.	9.04	67.9	6.19	77.1	8.0
Combined Pb Cleaner Tailings	7.39	7.26	12.47	6.7	13.0
Combined Zn Cleaner Conc.	6.25	1.67	55.0	1.3	48.4
Combined Zn Cleaner Tailings	5.57	2.58	33.2	1.8	26.1
Combined Zn Rougher Tailings	71.75	1.47	0.44	13.1	4.5

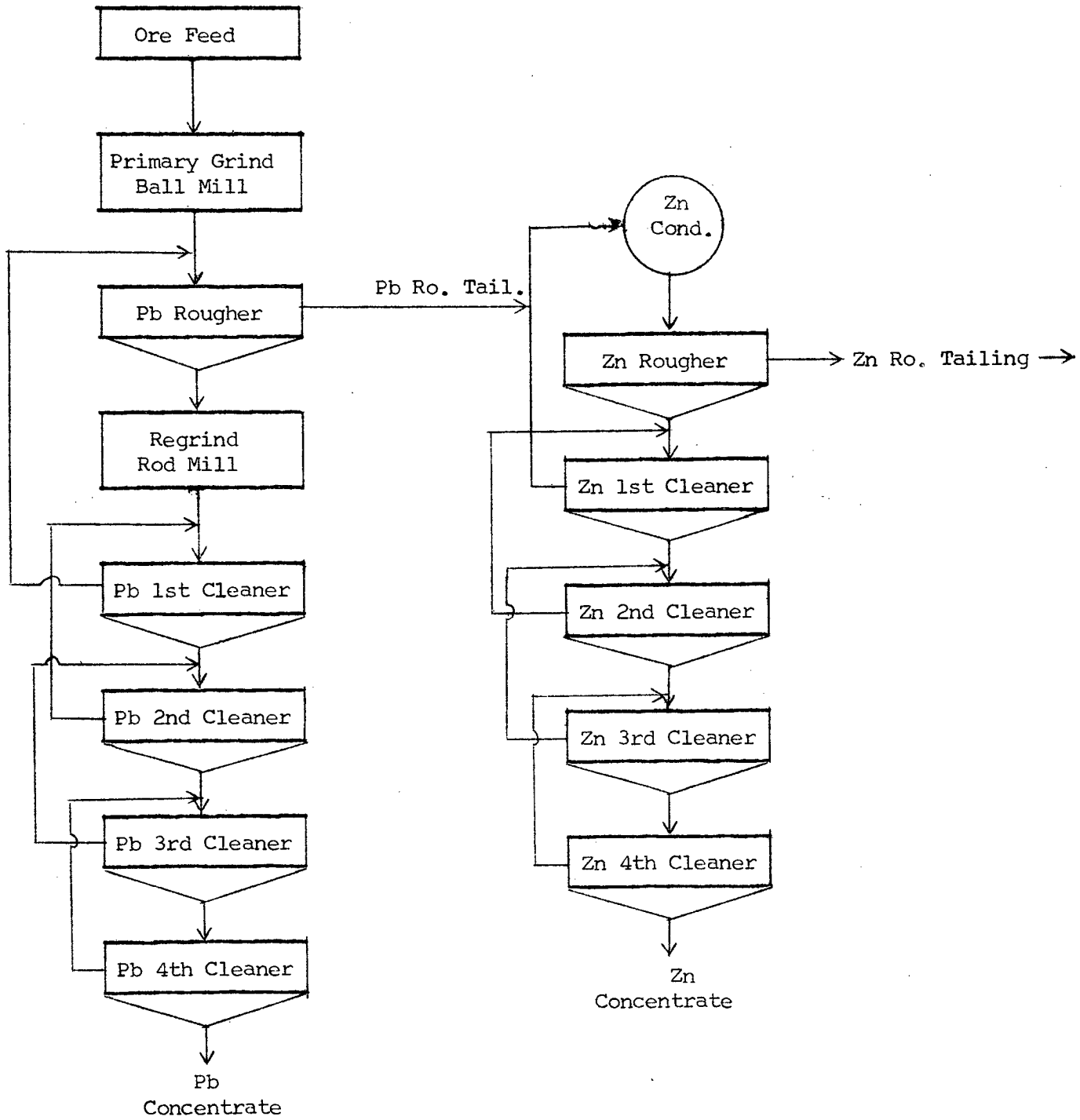
Test No. 125 - Continued

Projected Results of Cycles D, E and F

Products	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
Pb Cleaner Concentrate	9.98	66.2	6.58	82.9	9.3
Zn Cleaner Concentrate	10.92	1.63	55.2	2.2	85.1
Flotation Tailing	79.10	1.50	0.50	14.9	5.6
Head (calculated)	100.00	7.97	7.08	100.0	100.0

Test No. 125 - Continued

Flowsheet



Test No. 126

Purpose: To conduct a six-stage locked-cycle test on sample B-2.

Procedure: See flowsheet.

Feed: Six 1000-gram charges of minus 10 mesh ore sample B-2.

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.08	-	-	30	-	-	-
Pb Rougher	-	-	-	-	0.01	0.02	-	1	3	9.4
	-	-	-	0.02	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Regrind	1.5	1.0	0.30	0.05	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	4	9.5
	-	-	-	0.01	0.01	-	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	2	5	9.6
Pb 3rd Cleaner	0.3	0.1	0.10	-	-	-	-	2	4	9.6
Pb 4th Cleaner	0.3	-	0.05	-	-	-	-	2	3	9.6
	Ca-(OH) ₂	CuSO ₄	Z-200	Z-11						
Zn Condition	3.0	1.5	-	-	-	-	-	3	-	10.8
Zn Rougher (1)	-	-	0.08	0.02	-	-	-	1	3	-
	-	0.5	-	-	-	-	-	2	-	-
Zn Rougher (2)	-	-	0.04	0.04	-	0.02	-	1	3	-
Zn 1st Cleaner	0.8	-	-	-	-	-	-	1	2	11.0
	-	-	0.006	-	-	-	-	1	3	-
Zn 2nd Cleaner	0.8	-	-	-	-	-	-	1	4	11.0
Zn 3rd Cleaner	0.6	-	-	-	-	-	-	1	3	11.1
Zn 4th Cleaner	0.4	-	-	-	-	-	-	1	2½	11.2

Stage
Equipment
Speed: r.p.m.

Regrind
Laboratory Rod Mill

Zn Roughers & Cleaners
500 gram D-1
1200

Test No. 126 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Cleaner Concentrate A	0.87	69.8	8.25	7.8	0.5
Pb Cleaner Concentrate B	1.46	66.5	10.4	12.4	1.0
Pb Cleaner Concentrate C	1.46	65.7	10.3	12.2	1.0
Pb Cleaner Concentrate D	1.27	67.6	9.62	11.0	0.8
Pb Cleaner Concentrate E	1.66	64.7	10.9	13.7	1.2
Pb Cleaner Concentrate F	1.53	65.6	10.7	12.8	1.0
Pb 4th Cleaner Tailing F	0.97	41.4	20.4	5.1	1.2
Pb 3rd Cleaner Tailing F	1.71	27.7	24.8	6.0	2.7
Pb 2nd Cleaner Tailing F	3.14	14.7	26.3	5.9	5.3
Pb 1st Cleaner Tailing F	4.93	3.06	21.8	2.0	6.9
Zn Cleaner Concentrate A	2.12	0.94	54.6	0.2	7.4
Zn Cleaner Concentrate B	2.59	1.42	57.1	0.5	9.5
Zn Cleaner Concentrate C	2.90	1.35	57.8	0.5	10.7
Zn Cleaner Concentrate D	2.87	1.54	57.2	0.6	10.5
Zn Cleaner Concentrate E	3.10	2.03	57.2	0.8	11.3
Zn Cleaner Concentrate F	2.82	1.65	57.8	0.6	10.4
Zn 4th Cleaner Tailing F	0.85	3.22	47.2	0.4	2.6
Zn 3rd Cleaner Tailing F	1.96	3.64	39.4	0.9	5.0
Zn 2nd Cleaner Tailing F	3.41	3.52	22.6	1.5	4.9
Zn 1st Cleaner Tailing F	7.68	1.94	8.39	1.9	4.1
Zn Rougher Tailing A	6.67	0.41	0.76	0.3	0.3
Zn Rougher Tailing B	6.96	0.41	0.51	0.3	0.2
Zn Rougher Tailing C	8.18	0.42	0.54	0.4	0.3
Zn Rougher Tailing D	8.42	0.52	0.56	0.6	0.3
Zn Rougher Tailing E	9.52	0.57	0.68	0.7	0.4
Zn Rougher Tailing F	10.94	0.64	0.69	0.9	0.5
Head (calculated)	100.00	7.83	15.6	100.0	100.0

Calculated Grades and Recoveries

Combined Pb Cleaner Conc.	8.25	66.3	10.2	69.9	5.5
Combined Pb Cleaner Tailings	10.75	13.8	23.5	19.0	16.1
Combined Zn Cleaner Conc.	16.41	1.52	57.0	3.2	59.8
Combined Zn Cleaner Tailings	13.90	2.65	18.7	4.7	16.6
Combined Zn Rougher Tailings	50.69	0.50	0.63	3.2	2.0

Test No. 126 - Continued

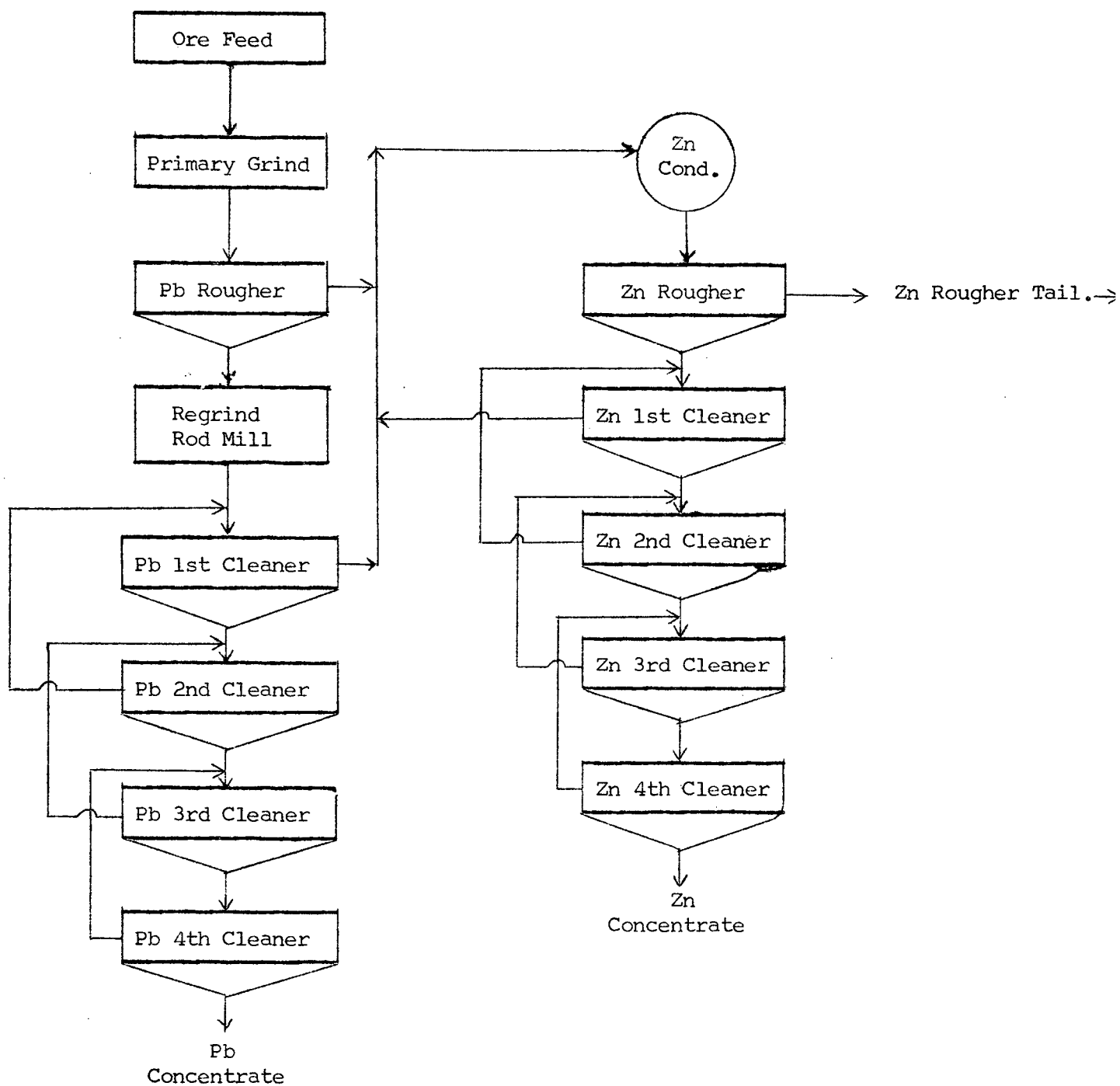
Projected Results - Cycles E & F

Products	Weight	Assays, %				% Distribution			
	%	Pb	Zn	Au*	Ag*	Pb	Zn	Au	Ah
Pb Cleaner Concentrate	10.73	65.1	10.80	0.070	22.36	89.2	7.4	15.9	76.0
Zn Cleaner Concentrate	24.34	1.85	57.5	0.030	1.76	5.7	89.7	15.4	13.6
Zn Scavenger Tailing	64.93	0.61	0.69	0.050	0.51	5.1	2.9	68.7	10.4
Head	100.00	7.83	15.6	0.050	3.16	100.0	100.0	100.0	100.0

* Assays in ounces per ton

Test No. 126 - Continued

Flowsheet



Test No. 131

Purpose: To repeat the cycle test conditions of test No. 126 on sample B-2, but with the lead circuit closed.

Procedure: See the flowsheet of test 129.

Feed: Six 1000-gram charges of minus 10 mesh ore sample B-2.

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.08	-	-	30	-	-	-
<u>Pb Circuit</u>										
Pb Rougher	-	-	-	-	0.01	0.02	-	1	3	9.4
	-	-	-	0.02	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Regrind	1.5	1.0	0.30	0.05	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	4	9.6
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	2	5	9.7
Pb 3rd Cleaner	0.3	0.1	0.10	-	-	-	-	2	4	9.7
Pb 4th Cleaner	0.3	-	0.05	-	-	-	-	2	3	9.7
<u>Zn Circuit</u>	Ca-(OH) ₂	CuSO ₄	Z-200	Z-11						
Zn Condition	3.0	1.5	-	-	-	-	-	3	-	10.8
Zn Rougher (1)	-	-	0.08	0.02	-	-	-	1	3	-
	-	0.5	-	-	-	-	-	2	-	-
Zn Rougher (2)	-	-	0.04	0.04	0.02	-	-	1	3	-
Zn 1st Cleaner	0.8	-	-	-	-	-	-	1	2	11.0
	-	-	0.006	-	-	-	-	1	3	-
Zn 2nd Cleaner	0.8	-	-	-	-	-	-	1	4	11.0
Zn 3rd Cleaner	0.6	-	-	-	-	-	-	1	3	11.1
Zn 4th Cleaner	0.4	-	-	-	-	-	-	1	2½	11.2

Stage
Equipment
Speed: r.p.m.

Regrind
Lab. Rod Mill

Zn Roughers & Cleaners
500 gram D-1
1200

Test No. 131 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Cleaner Concentrate A	0.79	67.5	9.08	6.8	0.5
Pb Cleaner Concentrate B	1.30	67.0	9.80	11.1	0.8
Pb Cleaner Concentrate C	1.73	64.1	10.7	14.1	1.2
Pb Cleaner Concentrate D	1.83	62.8	11.3	14.5	1.3
Pb Cleaner Concentrate E	1.70	61.5	11.2	13.3	1.2
Pb Cleaner Concentrate F	1.58	61.5	10.5	12.3	1.0
Pb 4th Cleaner Tailing F	0.85	38.1	22.0	4.1	1.2
Pb 3rd Cleaner Tailing F	1.94	27.4	26.0	6.8	3.2
Pb 2nd Cleaner Tailing F	3.22	14.1	28.3	5.8	5.7
Pb 1st Cleaner Tailing F	5.52	4.19	25.2	2.9	8.8
Zn Cleaner Concentrate A	1.96	0.92	56.5	0.2	7.0
Zn Cleaner Concentrate B	3.13	1.09	55.5	0.4	10.9
Zn Cleaner Concentrate C	2.96	0.99	57.7	0.4	10.7
Zn Cleaner Concentrate D	3.00	1.02	57.2	0.4	10.8
Zn Cleaner Concentrate E	3.15	1.09	57.1	0.4	11.2
Zn Cleaner Concentrate F	3.03	1.11	58.1	0.4	11.1
Zn 4th Cleaner Tailing F	0.82	1.82	42.2	0.2	2.2
Zn 3rd Cleaner Tailing F	1.49	2.03	30.0	0.4	2.8
Zn 2nd Cleaner Tailing F	2.45	1.87	18.0	0.6	2.8
Zn 1st Cleaner Tailing F	4.34	1.57	9.06	0.9	2.5
Zn Rougher Tailing A	5.96	0.35	0.52	0.3	0.2
Zn Rougher Tailing B	7.82	0.51	0.68	0.5	0.3
Zn Rougher Tailing C	9.74	0.60	1.00	0.7	0.6
Zn Rougher Tailing D	9.52	0.62	0.97	0.8	0.6
Zn Rougher Tailing E	10.08	0.69	1.24	0.9	0.8
Zn Rougher Tailing F	10.08	0.69	0.99	0.9	0.6
Head (calculated)	100.00	7.88	15.9	100.0	100.0

Calculated Grades and Recoveries

Pb Cleaner Concentrates	8.93	63.6	10.6	72.1	6.0
Pb Cleaner Tailings	11.53	13.36	26.0	19.6	18.9
Zn Cleaner Concentrate	17.23	1.04	57.0	2.2	61.7
Zn Cleaner Tailings	9.10	1.75	17.9	2.0	10.3
Zn Rougher Tailings	53.11	0.60	0.94	4.1	3.1

Test No. 131 - Continued

Metallurgical Results

Products	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
Pb Cleaner Concentrate	11.66	61.5	10.85	91.0	8.0
Zn Cleaner Concentrate	24.16	1.10	57.6	3.4	87.5
Zn Rougher Tailing	64.18	0.69	1.12	5.6	4.5
Head	100.00	7.88	15.9	100.0	100.0

Test No. 127

Purpose: To conduct a six-stage locked-cycle test on Sample C-2.
 Procedure: See flowsheet of test 126.
 Feed: Six 2000-gram charges minus 10 mesh sample C-2.
 Grind: 30 minutes per 2 kilograms at 65 percent solids in the laboratory ball mill.
 Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	2.5	1.0	0.30	0.07	-	-	30	-	-	-
<u>Pb Circuit</u>										
Pb Rougher	-	-	-	0.01	0.02	0.02	-	1	3	9.6
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Re grind	1.0	0.5	0.20	0.03	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	3	9.7
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	4	9.8
Pb 3rd Cleaner	0.2	0.1	0.05	-	-	-	-	1	3	9.8
Pb 4th Cleaner	0.2	-	0.05	-	-	-	-	1	2	9.8
<u>Zn Circuit</u>										
	Ca-(OH) ₂	CuSO ₄	Z-200	Z-11						
Condition	1.5	1.5	-	-	-	-	-	2	-	10.8
Zn Rougher	-	-	0.06	0.01	-	-	-	1	3	-
	-	-	0.04	0.02	0.02	-	-	1	3	-
Zn 1st Cleaner	0.8	-	-	-	-	-	-	1	2	11.0
	-	-	0.01	-	-	-	-	1	2	-
Zn 2nd Cleaner	0.6	-	-	-	-	-	-	1	2	11.1
	-	-	0.005	-	-	-	-	1	2	-
Zn 3rd Cleaner	0.5	-	-	-	-	-	-	1	3	11.2
Zn 4th Cleaner	0.4	-	-	-	-	-	-	1	3	11.2

Stage
Equipment

Regrind
Rod Mill

Test No. 127 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Cleaner Concentrate A	0.50	65.4	3.94	7.1	0.2
Pb Cleaner Concentrate B	0.80	66.0	4.32	11.4	0.4
Pb Cleaner Concentrate C	0.96	64.8	4.86	13.4	0.5
Pb Cleaner Concentrate D	0.96	62.4	5.11	13.0	0.5
Pb Cleaner Concentrate E	0.91	62.5	4.80	12.3	0.4
Pb Cleaner Concentrate F	0.77	66.1	4.34	11.0	0.3
Pb 4th Cleaner Tailing F	0.41	40.8	7.87	3.6	0.4
Pb 3rd Cleaner Tailing F	1.03	31.1	10.6	6.9	1.1
Pb 2nd Cleaner Tailing F	1.77	16.8	12.8	6.4	2.3
Pb 1st Cleaner Tailing F	3.07	3.78	12.6	2.6	3.9
Zn Cleaner Concentrate A	1.59	0.31	55.8	0.1	9.0
Zn Cleaner Concentrate B	2.70	0.62	52.4	0.4	14.4
Zn Cleaner Concentrate C	2.65	0.83	54.5	0.5	14.7
Zn Cleaner Concentrate D	2.33	0.78	55.6	0.4	13.2
Zn Cleaner Concentrate E	2.29	0.84	56.2	0.4	13.1
Zn Cleaner Concentrate F	2.50	1.06	55.6	0.5	14.1
Zn 4th Cleaner Tailing	0.30	6.71	31.5	0.4	1.0
Zn 3rd Cleaner Tailing	0.74	6.23	21.3	1.1	1.6
Zn 2nd Cleaner Tailing	1.20	5.01	10.5	1.3	1.3
Zn 1st Cleaner Tailing	3.61	1.57	6.65	1.2	2.4
Zn Rougher Tailing A	8.11	0.33	0.55	0.6	0.5
Zn Rougher Tailing B	11.83	0.38	0.70	1.0	0.8
Zn Rougher Tailing C	11.35	0.35	0.60	0.9	0.7
Zn Rougher Tailing D	12.07	0.36	0.65	0.9	0.8
Zn Rougher Tailing E	13.18	0.53	1.15	1.4	1.5
Zn Rougher Tailing F	12.37	0.43	0.73	1.2	0.9
Head (calculated)	100.00	4.62	9.83	100.0	100.0

Calculated Grades and Recoveries

Combined Pb Cleaner Conc.	4.90	64.4	4.63	68.2	2.3
Combined Pb Cleaner Tailings	6.28	14.4	12.02	19.5	7.7
Combined Zn Cleaner Conc.	14.06	0.77	54.90	2.3	78.5
Combined Zn Cleaner Tailings	5.85	3.13	10.57	4.0	6.3
Combined Zn Rougher Tailings	68.91	0.40	0.75	6.0	5.2

Test No. 127 - Continued

Metallurgical Results

Products	Weight	Assays, %				% Distribution			
	%	Pb	Zn	Au*	Ag*	Pb	Zn	Au	Ag
Pb Cleaner Conc.	6.51	63.5	4.78	0.160	24.06	89.5	3.1	33.9	76.2
Zn Cleaner Conc.	15.88	0.90	55.8	0.030	1.22	3.1	89.2	15.5	9.4
Zn Rougher Tail.	77.61	0.44	0.85	0.020	0.38	7.4	6.6	50.6	14.4
Head	100.00	4.62	9.83	0.031	2.06	100.0	100.0	100.0	100.0

* Assays in ounces per ton

Test No. 128 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Cleaner Concentrate A	0.41	58.4	5.14	5.1	0.2
Pb Cleaner Concentrate B	0.51	58.8	5.27	6.4	0.3
Pb Cleaner Concentrate C	0.64	59.8	5.38	8.1	0.3
Pb Cleaner Concentrate D	0.79	58.7	5.20	9.8	0.4
Pb Cleaner Concentrate E	0.87	59.4	5.48	11.0	0.5
Pb Cleaner Concentrate F	0.92	61.0	5.87	11.9	0.5
Pb 4th Cleaner Tailing F	0.66	43.3	8.49	6.1	0.6
Pb 3rd Cleaner Tailing F	1.38	34.5	10.3	10.0	1.4
Pb 2nd Cleaner Tailing F	2.18	19.4	12.6	9.0	2.7
Pb 1st Cleaner Tailing F	2.41	5.25	13.0	2.7	3.1
Zn Cleaner Concentrate A	1.71	0.32	57.2	0.1	9.7
Zn Cleaner Concentrate B	2.36	0.80	55.8	0.4	13.1
Zn Cleaner Concentrate C	2.57	1.28	54.7	0.7	14.0
Zn Cleaner Concentrate D	2.25	1.35	56.6	0.7	12.7
Zn Cleaner Concentrate E	2.44	1.63	54.2	0.8	13.2
Zn Cleaner Concentrate F	2.30	1.64	56.6	0.8	13.0'
Zn 4th Cleaner Tailing F	0.30	12.3	26.8	0.7	0.8
Zn 3rd Cleaner Tailing F	0.88	12.2	19.8	2.3	1.7
Zn 2nd Cleaner Tailing F	1.51	10.2	10.9	3.3	1.6
Zn 1st Cleaner Tailing F	5.90	2.56	9.41	3.2	5.5
Zn Rougher Tailing A	8.85	0.38	0.54	0.7	0.5
Zn Rougher Tailing B	11.08	0.43	0.63	1.0	0.7
Zn Rougher Tailing C	11.57	0.53	0.68	1.3	0.8
Zn Rougher Tailing D	11.46	0.53	0.71	1.3	0.8
Zn Rougher Tailing E	12.22	0.54	0.74	1.4	0.9
Zn Rougher Tailing F	11.83	0.48	0.75	1.3	0.9
Head (calculated)	100.00	4.72	10.0	100.0	100.0

Calculated Grades and Recoveries

Pb Cleaner Concentrates	4.14	59.5	5.44	52.2	2.2
Pb Cleaner Tailings	0.63	19.8	11.86	27.8	7.8
Zn Cleaner Concentrates	13.63	1.21	55.75	3.5	75.7
Zn Cleaner Tailings	8.59	5.23	11.34	9.5	9.7
Zn Rougher Tailings	67.01	0.49	0.68	7.0	4.6

Test No. 128 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Cleaner Concentrate	6.74	60.2	5.68	86.0	3.8
Zn Cleaner Concentrate	16.33	1.64	55.4	5.7	90.5
Zn Rougher Tailing	76.93	0.51	0.74	8.3	5.7
Head (calculated)	100.0	4.72	10.0	100.0	100.0

Test No. 129 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Cleaner Concentrate A	0.36	63.5	3.62	4.9	0.2
Pb Cleaner Concentrate B	0.91	65.5	4.48	12.9	0.4
Pb Cleaner Concentrate C	1.01	62.9	4.86	13.7	0.5
Pb Cleaner Concentrate D	1.00	63.6	4.84	13.7	0.5
Pb Cleaner Concentrate E	0.91	61.8	4.63	12.2	0.4
Pb Cleaner Concentrate F	1.07	61.3	4.87	14.2	0.5
Pb 4th Cleaner Tailing F	0.54	35.3	10.6	4.1	0.6
Pb 3rd Cleaner Tailing F	1.38	24.8	12.8	7.4	1.8
Pb 2nd Cleaner Tailing F	2.44	11.0	14.1	5.8	3.4
Pb 1st Cleaner Tailing F	3.63	2.62	13.2	2.0	4.8
Zn Cleaner Concentrate A	1.58	0.31	55.6	0.1	8.8
Zn Cleaner Concentrate B	2.43	0.41	54.0	0.2	13.2
Zn Cleaner Concentrate C	2.74	0.51	51.1	0.3	14.0
Zn Cleaner Concentrate D	2.53	0.42	53.6	0.2	13.6
Zn Cleaner Concentrate E	2.36	0.42	56.5	0.2	13.4
Zn Cleaner Concentrate F	2.52	0.56	55.5	0.3	14.0
Zn 4th Cleaner Tailing F	0.20	2.48	24.3	0.1	0.5
Zn 3rd Cleaner Tailing F	0.55	2.30	17.6	0.3	1.0
Zn 2nd Cleaner Tailing F	1.12	1.67	9.89	0.4	1.1
Zn 1st Cleaner Tailing F	3.85	0.95	6.04	0.8	2.3
Zn Rougher Tailing A	8.60	0.37	0.55	0.7	0.5
Zn Rougher Tailing B	10.52	0.46	0.85	1.0	0.9
Zn Rougher Tailing C	11.23	0.40	0.62	0.7	0.7
Zn Rougher Tailing D	11.69	0.45	0.78	1.1	0.9
Zn Rougher Tailing E	12.63	0.50	0.82	1.4	1.0
Zn Rougher Tailing F	12.20	0.48	0.80	1.3	1.0
Head (calculated)	100.00	4.63	10.0	100.0	100.0

Calculated Grades and Recoveries

Combined Pb Cleaner Conc.	5.26	63.0	4.67	71.5	2.5
Combined Pb Cleaner Tailings	7.99	11.2	13.2	19.3	10.6
Combined Zn Cleaner Conc.	14.16	0.44	54.2	1.3	77.0
Combined Zn Cleaner Tailings	5.72	1.28	8.54	1.6	4.9
Combined Zn Rougher Tailings	66.87	0.43	0.75	6.2	5.0

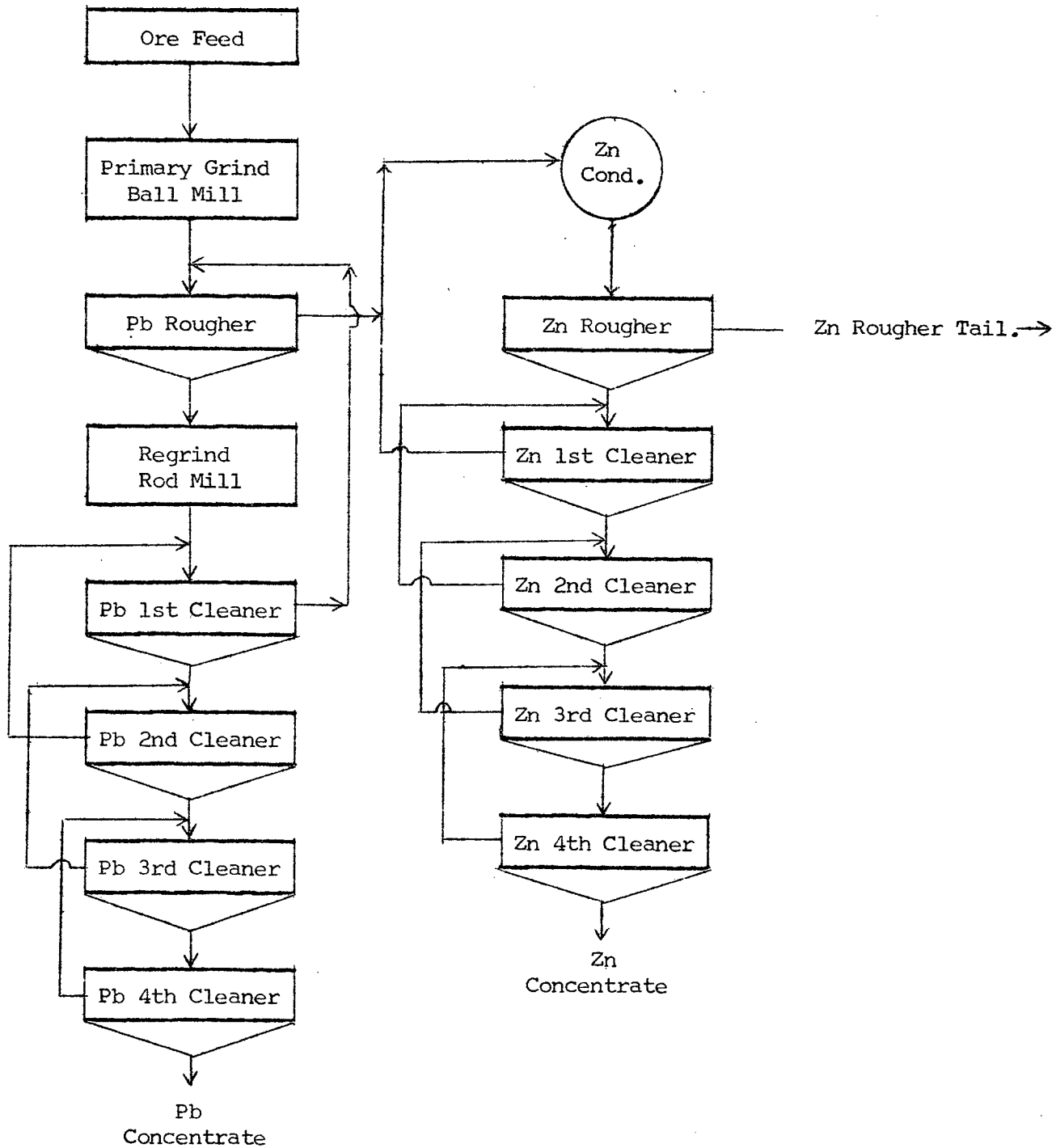
Test No. 129 - Continued

Metallurgical Results

Products	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
Pb Cleaner Concentrate	6.88	61.5	4.76	90.4	3.3
Zn Cleaner Concentrate	16.16	0.46	56.0	1.6	90.5
Zn Rougher Tailing	76.96	0.49	0.81	8.0	6.2
Head (calculated)	100.00	4.64	10.0	100.0	100.0

Test No. 129 - Continued

Flowsheet



Test No. 130 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Cleaner Concentrate A	0.49	59.0	5.06	6.3	0.3
Pb Cleaner Concentrate B	0.79	59.8	5.54	10.2	0.5
Pb Cleaner Concentrate C	1.04	57.2	5.68	12.9	0.6
Pb Cleaner Concentrate D	0.90	58.6	5.67	11.4	0.5
Pb Cleaner Concentrate E	0.97	58.8	5.48	12.3	0.6
Pb Cleaner Concentrate F	0.91	60.6	5.56	11.9	0.5
Pb 4th Cleaner Tailing F	0.58	37.9	9.34	4.8	0.6
Pb 3rd Cleaner Tailing F	1.35	28.6	11.4	8.4	1.6
Pb 2nd Cleaner Tailing F	2.52	14.7	13.4	8.0	3.5
Pb 1st Cleaner Tailing F	3.70	5.14	13.4	4.0	5.1
Zn Cleaner Concentrate A	2.08	0.42	49.2	0.2	10.7
Zn Cleaner Concentrate B	2.36	0.44	50.2	0.2	12.4
Zn Cleaner Concentrate C	2.42	0.50	52.2	0.3	13.2
Zn Cleaner Concentrate D	2.21	0.36	53.6	0.2	12.4
Zn Cleaner Concentrate E	2.46	0.42	52.0	0.2	13.2
Zn Cleaner Concentrate F	2.21	0.54	53.6	0.2	12.3
Zn 4th Cleaner Tailing F	0.17	3.13	33.5	0.1	0.6
Zn 3rd Cleaner Tailing F	0.63	2.62	25.9	0.4	1.7
Zn 2nd Cleaner Tailing F	1.02	2.48	12.9	0.5	1.4
Zn 1st Cleaner Tailing F	3.19	1.31	7.81	0.9	2.6
Zn Rougher Tailing A	8.67	0.35	0.53	0.7	0.5
Zn Rougher Tailing B	10.37	0.40	0.66	0.9	0.7
Zn Rougher Tailing C	11.72	0.41	0.69	1.0	0.8
Zn Rougher Tailing D	11.90	0.49	0.85	1.3	1.1
Zn Rougher Tailing E	12.89	0.50	0.99	1.4	1.3
Zn Rougher Tailing F	12.75	0.48	1.00	1.3	1.3
Head (calculated)	100.00	4.62	9.59	100.0	100.0

Calculated Grades and Recoveries

Pb Cleaner Concentrates	5.10	58.9	5.54	65.0	3.0
Pb Cleaner Tailings	8.15	14.3	12.76	25.2	10.8
Zn Cleaner Concentrates	13.74	0.45	51.82	1.3	74.2
Zn Cleaner Tailings	5.01	1.77	11.99	1.9	6.3
Zn Rougher Tailings	68.00	0.44	0.81	6.6	5.7

Test No. 130 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Cleaner Concentrate	6.97	59.7	5.52	90.1	4.0
Zn Cleaner Concentrate	15.99	0.48	52.8	1.7	88.0
Zn Rougher Tailing	77.04	0.49	1.00	8.2	8.0
Head (calculated)	100.00	4.62	9.59	100.0	100.0

Test No. 144

Purpose: To perform a six-stage cycle test on sample C-2, but use the finer grind of the B procedure.

Procedure: See flowsheet for test 126.

Feed: Six 1000 gram charges minus 10 mesh ore sample C-2.

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.08	-	-	30	-	-	-
<u>Pb Circuit</u>										
Pb Rougher	-	-	-	-	0.01	0.02	-	1	3	9.7
	-	-	-	0.02	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Re grind	1.5	1.0	0.30	0.05	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	4	9.6
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	2	5	9.8
Pb 3rd Cleaner	0.3	0.1	0.10	-	-	-	-	2	4	9.9
Pb 4th Cleaner	0.3	-	0.05	-	-	-	-	2	3	9.9
<u>Zn Circuit</u>										
	Ca-(OH) ₂	CuSO ₄	Z-200	Z-11	Tee-*					
					A					
Condition	3.0	1.5	-	-	-	-	-	3	-	10.9
Zn Rougher	-	-	0.08	0.01	-	0.01	-	1	3	-
	-	-	0.04	0.02	0.02	-	-	1	3	-
Zn 1st Cleaner	0.8	-	-	-	-	-	-	1	2	11.1
	-	-	0.01	-	0.01	-	-	1	3	-
Zn 2nd Cleaner	0.8	-	-	-	-	-	-	1	4	11.2
Zn 3rd Cleaner	0.6	-	-	-	-	-	-	1	3	11.3
Zn 4th Cleaner	0.4	-	-	-	-	-	-	1	2	11.3

* Teefroth A

Test No. 144 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Cleaner Concentrate A	0.74	67.4	3.77	10.9	0.3
Pb Cleaner Concentrate B	1.15	63.3	4.75	15.9	0.5
Pb Cleaner Concentrate C	1.24	58.1	5.49	15.8	0.7
Pb Cleaner Concentrate D	1.31	53.4	5.74	15.3	0.8
Pb Cleaner Concentrate E	1.32	55.4	6.15	16.0	0.8
Pb Cleaner Concentrate F	1.05	56.5	5.36	13.0	0.6
Pb 4th Cleaner Tailing F	0.40	18.0	11.8	1.6	0.5
Pb 3rd Cleaner Tailing F	0.78	7.56	12.9	1.3	1.0
Pb 2nd Cleaner Tailing F	1.81	3.82	12.5	1.5	2.3
Pb 1st Cleaner Tailing F	3.85	1.15	11.6	1.0	4.5
Zn Cleaner Concentrate A	1.73	0.30	54.2	0.1	9.4
Zn Cleaner Concentrate B	2.40	0.38	56.3	0.2	13.6
Zn Cleaner Concentrate C	2.64	0.54	54.5	0.3	14.5
Zn Cleaner Concentrate D	2.55	0.56	56.2	0.3	14.4
Zn Cleaner Concentrate E	2.57	0.65	55.8	0.4	14.4
Zn Cleaner Concentrate F	2.63	0.70	55.9	0.4	14.8
Zn 4th Cleaner Tailing	0.45	2.17	20.3	0.2	0.9
Zn 3rd Cleaner Tailing	1.02	1.70	10.4	0.4	1.1
Zn 2nd Cleaner Tailing	1.56	1.40	4.96	0.5	0.8
Zn 1st Cleaner Tailing	3.69	0.68	1.50	0.5	0.6
Zn Rougher Tailing A	7.29	0.26	0.47	0.4	0.3
Zn Rougher Tailing B	10.52	0.33	0.52	0.8	0.6
Zn Rougher Tailing C	11.87	0.32	0.55	0.8	0.6
Zn Rougher Tailing D	11.65	0.30	0.57	0.8	0.6
Zn Rougher Tailing E	11.88	0.29	0.59	0.8	0.7
Zn Rougher Tailing F	11.90	0.31	0.59	0.8	0.7
Head (calculated)	100.00	4.57	9.94	100.0	100.0

Calculated Grades and Recoveries

Pb Cleaner Concentrates	6.81	58.3	5.33	86.9	3.7
Pb Cleaner Tailings	6.84	3.57	12.0	5.4	8.3
Zn Cleaner Concentrates	14.52	0.54	55.5	1.7	81.1
Zn Cleaner Tailings	6.72	1.10	4.91	1.6	3.4
Zn Rougher Tailings	65.11	0.30	0.55	4.4	3.5

Test No. 144 - Continued

Metallurgical Results - Projected Results of Cycles E and F

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Cleaner Concentrate	7.57	55.9	5.80	92.6	4.4
Zn Cleaner Concentrate	16.19	0.68	55.9	2.4	91.1
Zn Rougher Tailing	76.24	0.30	0.59	5.0	4.5
Head (calculated)	100.00	4.57	9.94	100.0	100.0

2. BATCH TESTS: SAMPLE B-2

Test No. 114

Purpose: To perform a standard flotation test on the newly-received sample B-2.

Procedure: As for test No. 113.

Feed: 2000 grams minus 10 mesh sample B-2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.01	0.02	0.02	-	1	3	9.8
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Re grind	1.0	0.5	0.20	0.03	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	3	9.9
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	10.0
	-	-	-	0.005	-	-	-	1	1	-
Pb 3rd Cleaner	0.2	0.1	0.05	-	-	0.005	-	1	3	10.0
Pb 4th Cleaner	0.2	-	0.05	-	-	-	-	1	2	10.0

Test No. 114 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	8.63	56.3	14.0	62.2	7.9
2. Pb 4th Cleaner Tailing	1.75	34.6	21.5	7.8	2.5
3. Pb 3rd Cleaner Tailing	5.54	20.1	24.4	14.3	8.9
4. Pb 2nd Cleaner Tailing	7.26	6.55	23.7	6.1	11.3
5. Pb 1st Cleaner Tailing	17.55	1.69	17.6	3.8	20.2
6. Pb Rougher Tailing	59.27	0.78	12.7	5.8	49.2
Head (calculated)	100.00	7.81	15.3	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	10.38	52.6	15.3	70.0	10.4
Products 1 to 3	15.92	41.3	18.4	84.3	19.3
Products 1 to 4	23.18	30.4	20.1	90.4	30.6
Products 1 to 5	40.73	18.0	19.0	94.2	50.8

Test No. 115

Purpose: To investigate the effect of a finer grind on sample B-2.

Procedure: Grind and float a lead rougher concentrate. Re grind the concentrate and clean once. Re grind the 1st cleaner concentrate and clean four more times.

Feed: 2000 grams minus 10 mesh sample B-2.

Grind: 60 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH.
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.08	-	60	-	-	-
Pb Rougher	-	-	-	-	0.01	-	1	3	9.7
	-	-	-	0.02	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
Pb 1st Re grind	1.5	1.0	0.30	0.05	-	60	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	1	4	9.9
	-	-	-	0.01	0.01	-	1	4	-
Pb 2nd Re grind	1.0	1.0	0.20	0.03	-	30	-	-	-
Pb 2nd Cleaner	-	-	-	-	0.005	-	1	4	9.8
	-	-	-	0.005	0.005	-	1	4	-
Pb 3rd Cleaner	0.3	0.2	0.10	-	-	-	2	3	9.8
	-	-	-	0.005	-	-	1	3	-
Pb 4th Cleaner	0.3	0.1	0.10	-	-	-	2	3	9.9
	-	-	-	0.003	-	-	1	2	-
Pb 5th Cleaner	0.3	-	0.05	-	-	-	2	4	10.0

Stage	Roughers	Pb Re grinds	1st to 4th Cl.	5th Cleaner
Equipment	1000 g D-1	Rod Mill	500 g D-1	250 g D-1
Speed: r.p.m.	1800		1300	1000
% Solids	33			

Test No. 115 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	6.39	75.0	5.28	61.2	2.2
2. Pb 5th Cleaner Tailing	1.62	52.6	14.8	10.9	1.6
3. Pb 4th Cleaner Tailing	2.50	36.2	20.8	11.6	3.5
4. Pb 3rd Cleaner Tailing	3.58	12.7	26.3	5.8	6.3
5. Pb 2nd Cleaner Tailing	7.75	3.76	25.2	3.7	13.0
6. Pb 1st Cleaner Tailing	17.04	1.19	19.7	2.6	22.2
7. Pb Rougher Tailing	61.12	0.54	12.6	4.2	51.2
Head (calculated)	100.00	7.83	15.1	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	8.01	70.5	7.21	72.1	3.8
Products 1 to 3	10.51	62.3	10.4	83.7	7.3
Products 1 to 4	14.09	49.7	14.5	89.5	13.6
Products 1 to 5	21.84	33.4	18.3	93.2	26.6
Products 1 to 6	38.88	19.3	18.9	95.8	48.8

Size Analysis - Composite

Particle Size (Microns)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 28.1	0.2	0.2	99.8
21.8	1.0	1.2	98.8
15.2	2.8	4.0	96.0
10.4	7.5	11.5	88.5
8.1	11.6	23.1	76.9
- 8.1	76.9	100.0	-
Total	100.0	-	-

Specific Gravity = 5.03

Test No. 117

Purpose: To investigate the effect of the standard primary grind and one stage of regrind on sample B-2.

Procedure: Grind and float a lead rougher concentrate. Regrind the concentrate and clean four times.

Feed: 2000 grams minus 10 mesh sample B-2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	30	-	-	-
Pb Rougher	-	-	-	-	0.01	-	1	3	9.6
	-	-	-	0.02	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
Pb Regrind	1.0	1.0	0.30	0.05	-	60	-	-	9.5
Pb 1st Cleaner	-	-	-	-	0.01	-	1	4	-
	-	-	-	0.01	0.01	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	2	3	9.7
	-	-	-	0.01	-	-	1	3	-
Pb 3rd Cleaner	0.3	0.1	0.10	-	-	-	2	3	9.8
	-	-	-	0.003	-	-	1	2	-
Pb 4th Cleaner	0.3	-	0.05	-	-	-	2	4	9.9

Stage Pb Regrind
 Equipment Rod Mill

Test No. 117 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	11.37	55.4	14.2	78.5	10.5
2. Pb 4th Cleaner Tailing	2.35	19.1	26.6	5.6	4.1
3. Pb 3rd Cleaner Tailing	4.05	11.7	26.7	5.9	7.0
4. Pb 2nd Cleaner Tailing	7.12	3.38	23.0	3.0	10.6
5. Pb 1st Cleaner Tailing	19.48	0.96	17.1	2.3	21.6
6. Pb Rougher Tailing	55.63	0.68	12.8	4.7	46.2
Head (calculated)	100.00	8.03	15.4	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	13.72	49.2	16.3	84.1	14.6
Products 1 to 3	17.77	40.6	18.7	90.0	21.6
Products 1 to 4	24.89	30.0	19.9	93.0	32.2
Products 1 to 5	44.37	17.2	18.7	95.3	53.8

Size Analysis - Composite

Particle Size (Microns)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 29.8	0.4	0.4	99.6
23.1	1.5	1.9	98.1
16.2	12.4	14.3	85.7
11.1	22.7	37.0	63.0
8.6	13.7	50.7	49.3
- 8.6	49.3	100.0	-
Total	100.0	-	-

Specific Gravity = 4.59

Test No. 118

Purpose: To repeat test No. 117, but with a slightly finer primary grind.

Procedure: As for test No. 117.

Feed: 2000 grams minus 10 mesh sample B-2.

Grind: 45 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	Grind	Cond.	Froth	
Primary Grind	2.5	1.0	0.30	0.08	-	45	-	-	-
Pb Rougher	-	-	-	-	0.01	-	1	3	9.7
	-	-	-	0.02	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
Pb Regrind	1.5	1.0	0.30	0.05	-	60	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	1	4	9.8
	-	-	-	0.01	0.01	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	2	3	9.8
	-	-	-	0.01	-	-	1	3	-
Pb 3rd Cleaner	0.3	0.1	0.10	-	-	-	2	3	9.9
	-	-	-	0.005	-	-	1	2	-
Pb 4th Cleaner	0.3	-	0.05	-	-	-	2	4	9.9

Stage Pb Regrind
Equipment Rod Mill

Test No. 118 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	10.80	59.3	12.3	78.9	8.7
2. Pb 4th Cleaner Tailing	2.26	20.5	26.1	5.7	3.9
3. Pb 3rd Cleaner Tailing	3.83	12.6	26.8	5.9	6.7
4. Pb 2nd Cleaner Tailing	7.27	3.96	24.4	3.5	11.6
5. Pb 1st Cleaner Tailing	17.93	0.94	18.7	2.1	21.9
6. Pb Rougher Tailing	57.91	0.54	12.5	3.9	47.2
Head (calculated)	100.00	8.12	15.3	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	13.06	52.6	14.7	84.6	12.6
Products 1 to 3	16.89	43.5	17.4	90.5	19.3
Products 1 to 4	24.16	31.6	19.5	94.0	30.9
Products 1 to 5	42.09	18.5	19.2	96.1	52.8

Size Analysis - Composite

Particle Size (Microns)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 29.5	0.4	0.4	99.6
22.9	0.9	1.3	98.7
15.9	8.2	9.5	90.5
11.0	20.5	30.0	70.0
8.5	14.4	44.4	55.6
- 8.5	55.6	100.0	-
Total	100.0	-	-

Specific Gravity = 4.60

Test No. 121

Purpose: To repeat test No. 115, but reduce the regrind times.

Procedure: As for test No. 115.

Feed: 2000 grams minus 10 mesh sample B-2.

Grind: 60 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.08	-	60	-	-	-
Pb Rougher	-	-	-	-	0.01	-	1	3	9.6
	-	-	-	0.02	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
Pb 1st Regrind	1.5	1.0	0.25	0.04	-	45	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	1	4	9.9
	-	-	-	0.01	0.01	-	1	4	-
Pb 2nd Regrind	1.0	0.5	0.15	0.02	-	20	-	-	-
Pb 2nd Cleaner	-	-	-	-	0.005	-	1	4	9.7
	-	-	-	0.005	0.005	-	1	4	-
Pb 3rd Cleaner	0.3	0.2	0.10	-	-	-	2	3	9.8
	-	-	-	0.005	-	-	1	3	-
Pb 4th Cleaner	0.3	0.1	0.10	-	-	-	2	3	9.9
	-	-	-	0.003	-	-	1	2	-
Pb 5th Cleaner	0.3	-	0.05	-	-	-	2	4	9.9

Test No. 121 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	7.05	69.3	7.94	61.5	3.6
2. Pb 5th Cleaner Tailing	1.40	40.3	19.2	7.1	1.7
3. Pb 4th Cleaner Tailing	3.17	31.1	22.1	12.4	4.5
4. Pb 3rd Cleaner Tailing	3.51	14.1	25.8	6.2	5.9
5. Pb 2nd Cleaner Tailing	7.13	5.61	25.0	5.0	11.6
6. Pb 1st Cleaner Tailing	16.02	1.69	19.8	3.4	20.6
7. Pb Rougher Tailing	61.72	0.57	13.0	4.4	52.1
Head (calculated)	100.00	7.95	15.4	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	8.45	64.5	9.81	68.7	5.3
Products 1 to 3	11.62	55.4	13.2	81.1	9.8
Products 1 to 4	15.13	45.8	16.1	87.3	15.7
Products 1 to 5	22.26	32.9	18.9	92.3	27.3
Products 1 to 6	38.28	19.9	19.3	95.7	47.9

Size Analysis - Composite

Particle Size (Microns)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 27.7	0.8	0.8	99.2
21.5	1.3	2.1	97.9
15.0	2.9	5.0	95.0
10.3	10.8	15.8	84.2
8.0	13.8	29.6	70.4
- 8.0	70.4	100.0	-
Total	100.0	-	-

Specific Gravity = 5.02

Test No. 122

Purpose: To repeat tests No. 117 and 118, but with a still finer primary grind.

Procedure: As for test No. 117, except concentrate cleaned five times.

Feed: 2000 grams minus 10 mesh sample B-2.

Grind: 60 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.08	-	60	-	-	-
Pb Rougher	-	-	-	-	0.01	-	1	3	9.7
	-	-	-	0.02	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
Pb Re grind	1.5	1.0	0.30	0.05	-	60	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	1	4	9.8
	-	-	-	0.01	0.01	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	2	3	9.8
	-	-	-	0.01	-	-	1	3	-
Pb 3rd Cleaner	0.3	0.1	0.10	-	-	-	2	3	9.9
	-	-	-	0.005	-	-	1	2	-
Pb 4th Cleaner	0.3	-	0.05	-	-	-	2	4	9.9
Pb 5th Cleaner	-	-	-	-	-	-	2	3	9.6

Test No. 122 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	8.59	67.0	9.00	71.2	5.1
2. Pb 5th Cleaner Tailing	1.86	32.3	22.4	7.4	2.8
3. Pb 4th Cleaner Tailing	2.27	22.9	24.9	6.4	3.7
4. Pb 3rd Cleaner Tailing	3.11	13.1	25.6	5.1	5.3
5. Pb 2nd Cleaner Tailing	5.59	4.62	24.6	3.3	9.1
6. Pb 1st Cleaner Tailing	17.20	1.10	19.6	2.3	22.3
7. Pb Rougher Tailing	61.38	0.57	12.7	4.3	51.7
Head (calculated)	100.00	8.08	15.1	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	10.45	60.8	11.4	78.6	7.9
Products 1 to 3	12.72	54.1	13.8	85.0	11.6
Products 1 to 4	15.83	46.0	16.1	90.1	16.9
Products 1 to 5	21.42	35.2	18.3	93.4	26.0
Products 1 to 6	38.62	20.0	18.9	95.7	48.3

Size Analyses

Composite

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 29.5 μ m	0.3	0.3	99.7
22.9	0.8	1.1	98.9
15.9	6.1	7.2	92.8
11.0	18.0	25.2	74.8
8.5	14.3	39.5	60.5
- 8.5	60.5	100.0	-
Total	100.0	-	-

Specific Gravity = 4.56

Test No. 122 - Continued

Size Analyses - Continued

30 Minute Primary Grind

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 200 mesh	0.9	0.9	99.1
270	2.4	3.3	96.7
31.2 μm	13.1	16.4	83.6
24.2	9.6	26.0	74.0
16.9	16.2	42.2	57.8
11.6	15.5	57.7	42.3
9.0	8.3	66.0	34.0
- 9.0	34.0	100.0	-
Total	100.0	-	-

Specific Gravity = 4.09

3. BATCH TESTS: SAMPLE C-2

Test No. 113

Purpose: To perform a standard flotation test on the newly-received sample C-2.

Procedure: Grind and float a lead rougher concentrate. Re grind the concentrate and clean four times.

Feed: 2000 grams minus 10 mesh sample C-2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.01	0.02	0.02	-	1	3	9.9
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Re grind	1.0	0.5	0.20	0.03	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	3	9.9
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	10.0
	-	-	-	0.005	-	-	-	1	1	-
Pb 3rd Cleaner	0.2	0.1	0.05	-	-	0.005	-	1	3	10.0
Pb 4th Cleaner	0.2	-	0.05	-	-	0.005	-	1	2	10.1

Stage	Rougher	Pb Re grind
Equipment	1000 gram D-1	Lab. Rod Mill
Speed: r.p.m.	1800	
% Solids	33	

Stage	1st to 3rd Cl.	4th Cleaner
Equipment	500 gram D-1	250 gram D-1
Speed: r.p.m.	1300	1000

Test No. 113 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	5.12	69.3	4.38	73.0	2.3
2. Pb 4th Cleaner Tailing	0.96	34.6	10.1	6.8	1.0
3. Pb 3rd Cleaner Tailing	1.60	17.7	12.7	5.8	2.0
4. Pb 2nd Cleaner Tailing	4.94	5.57	12.8	5.7	6.4
5. Pb 1st Cleaner Tailing	11.32	1.15	12.7	2.7	14.6
6. Pb Rougher Tailing	76.06	0.38	9.56	5.0	73.7
Head (calculated)	100.00	4.86	9.87	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.08	63.8	5.28	79.8	3.3
Products 1 to 3	7.68	54.2	6.83	85.6	5.3
Products 1 to 4	12.62	35.2	9.17	91.3	11.7
Products 1 to 5	23.94	19.1	10.8	94.0	26.3

Test No. 113 - Continued

Size Analyses

Rod Mill Regrind

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 31.6 µm	0.8	0.8	99.2
24.5	4.1	4.9	95.1
17.1	10.3	15.2	84.8
11.8	18.4	33.6	66.4
9.1	12.5	46.1	53.9
- 9.1	53.9	100.0	-
Total	100.0	-	-

Specific Gravity = 3.98

30 Minute Primary Grind

+ 100 mesh	0.2	0.2	99.8
150	1.8	2.0	98.0
200	9.8	11.8	88.2
35.6 µm	24.6	36.4	63.6
27.6	13.5	49.9	50.1
19.3	15.4	65.3	34.7
13.3	11.1	76.4	23.6
10.2	5.2	81.6	18.4
- 10.2	18.4	100.0	-
Total	100.0	-	-

Specific Gravity = 3.38

Test No. 116

Purpose: To repeat test No. 113, but slightly increase lead rougher reagents and flotation time, and add a zinc flotation circuit.

Procedure: Grind and float a lead rougher concentrate. Re grind the concentrate and clean four times. Combine the lead rougher and 1st cleaner tailings and float a zinc concentrate. Clean the zinc concentrate.

Feed: 2000 grams minus 10 mesh sample C-2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	2.5	1.0	0.30	0.07	-	-	30	-	-	-
<u>Pb Circuit</u>										
Pb Rougher	-	-	-	0.02	0.02	0.02	-	1	4	9.7
	-	-	-	0.02	0.01	-	-	1	4	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Re grind	1.0	0.5	0.20	0.03	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	3	9.9
	-	-	-	0.01	0.01	-	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	9.9
	-	-	-	0.005	-	-	-	1	2	-
Pb 3rd Cleaner	0.2	0.1	0.05	-	-	0.005	-	1	4	9.8
Pb 4th Cleaner	0.2	-	0.05	-	-	0.005	-	1	3	9.9
<u>Zn Circuit</u>	Ca-(OH) ₂	CuSO ₄	Z-200							
Condition	1.5	1.0	-	-	-	-	-	2	-	10.8
Zn Rougher	-	-	0.06	-	-	0.02	-	1	3	-
	-	-	0.04	-	-	0.02	-	1	3	-
Zn 1st Cleaner	0.3	-	-	-	-	0.01	-	2	2	11.0
	-	-	0.01	-	-	-	-	1	2	-
Zn 2nd Cleaner	0.3	-	-	-	-	0.005	-	2	2	11.1
	-	-	0.005	-	-	-	-	1	1	-
Zn 3rd Cleaner	0.2	-	-	-	-	0.005	-	2	2	11.1

Stage	Pb Re grind	Pb 1st to 3rd Cl.	Pb 4th Cleaner
Equipment	Rod Mill	500 gram D-1	250 gram D-1
Speed: r.p.m.		1300	1000
Stage	Zn 1st & 2nd Cl.	Zn 3rd Cleaner	
Equipment	500 gram D-1	250 gram D-1	
Speed: r.p.m.	1300	1000	

Test No. 116 - Continued

Metallurgical Results

Products	Weight	Assays, %				% Distribution			
	%	Pb	Zn	Au*	Ag*	Pb	Zn	Au	Ag
1. Pb Cl. Conc.	4.68	69.3	3.94	0.130	25.30	70.9	1.9	26.4	56.3
2. Pb 4th Cl.Tail.	1.30	36.3	9.99	0.100	15.30	10.3	1.4	5.6	9.5
3. Pb 3rd Cl.Tail.	1.62	15.8	12.7	0.050	10.19	5.5	2.1	3.5	7.9
4. Pb 2nd Cl.Tail.	3.66	5.69	13.7	0.050	4.19	4.6	5.2	7.9	7.3
5. Zn Cl. Conc.	11.74	0.36	55.4	0.020	1.03	0.9	67.9	10.2	5.7
6. Zn 3rd Cl.Tail.	1.11	0.66	39.3	0.030	1.49	0.2	4.6	1.4	0.8
7. Zn 2nd Cl.Tail.	2.45	0.81	21.7	0.070	1.48	0.4	5.5	7.5	1.7
8. Zn 1st Cl.Tail.	6.37	0.66	5.75	0.030	0.73	0.9	3.8	8.3	2.2
9. Zn Ro. Tailing	67.07	0.43	1.08	0.010	0.27	6.3	7.6	29.2	8.6
Head (calculated)	100.00	4.58	9.58	0.023	2.10	100.0	100.0	100.0	100.0

Calculated Grades and Recoveries

Products 1+2	5.98	62.1	5.26	0.123	23.13	81.2	3.3	32.0	65.8
Products 1 to 3	7.60	52.2	6.84	-	20.37	86.7	5.4	35.5	73.7
Products 1 to 4	11.26	37.1	9.07	-	15.11	91.3	10.6	43.4	81.0
Products 5+6	12.85	0.39	54.0	-	1.07	1.1	72.5	11.6	6.5
Products 5 to 7	15.30	0.45	48.8	-	1.14	1.5	78.0	19.1	8.2
Products 5 to 8	21.67	0.51	36.2	-	1.02	2.4	81.8	27.4	10.4

* oz/ton

Test No. 119

Purpose: To repeat test No. 116, but increase the CuSO₄ addition to the zinc circuit.

Procedure: Grind and float a lead concentrate. Regrind the concentrate and clean once. Combine the lead rougher and the 1st cleaner tailings and float a zinc concentrate. Clean the zinc concentrate three times.

Feed: 2000 grams minus 10 mesh sample C-2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	2.5	1.0	0.30	0.07	-	-	30	-	-	-
<u>Pb Circuit</u>										
Pb Rougher	-	-	-	0.02	0.02	0.02	-	1	4	9.7
	-	-	-	0.02	0.01	-	-	1	4	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Regrind	1.0	0.5	0.20	0.03	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	3	9.9
	Ca-			0.01	0.01			1	4	
<u>Zn Circuit</u>	(OH) ₂	Z-200	CuSO ₄							
Condition	1.5	-	1.5	-	-	-	-	2	-	10.5
Zn Rougher	-	0.06	-	-	-	0.04	-	1	3	-
	-	0.04	-	-	-	0.04	-	1	4	-
Zn 1st Cleaner	0.3	-	-	-	-	0.01	-	2	2	11.0
	-	0.015	-	-	-	0.01	-	1	3	-
Zn 2nd Cleaner	0.3	-	-	-	-	0.005	-	2	2	11.2
	-	0.010	-	-	-	0.005	-	1	2	-
Zn 3rd Cleaner	0.2	0.005	-	-	-	0.005	-	2	3	11.3

Comments: Poor frothing in zinc circuit.

Test No. 119 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb 1st Cleaner Concentrate	12.04	37.7	9.02	91.7	10.8
2. Zn 3rd Cleaner Concentrate	13.87	0.37	54.8	1.0	75.9
3. Zn 3rd Cleaner Tailing	1.86	1.10	21.0	0.4	3.9
4. Zn 2nd Cleaner Tailing	2.17	1.10	6.84	0.5	1.5
5. Zn 1st Cleaner Tailing	7.09	0.61	2.19	0.9	1.6
6. Zn Rougher Tailing	62.97	0.43	1.01	5.5	6.3
Head (calculated)	100.00	4.95	10.0	100.0	100.0

Calculated Grades and Recoveries

Products 2 plus 3	15.73	0.46	50.8	1.4	79.8
Products 2 to 4	17.90	0.53	45.5	1.9	81.3
Products 2 to 5	24.99	0.56	33.2	2.8	82.9

Test No. 120

Purpose: To repeat test No. 119, but substitute AX-343 for Z-200 as collector in the zinc circuit.

Procedure: As for test No. 119.

Feed: 2000 grams minus 10 mesh sample C-2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	2.5	1.0	0.30	0.07	-	-	30	-	-	-
<u>Pb Circuit</u>										
Pb Rougher	-	-	-	0.02	0.02	0.02	-	1	4	9.8
	-	-	-	0.02	0.01	-	-	1	4	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Re grind	1.0	0.5	0.20	0.03	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	3	9.9
	-	-	-	0.01	0.01	-	-	1	4	-
<u>Zn Circuit</u>	Ca-(OH) ₂	AX-343	CuSO ₄			TEB				
Condition	1.5	-	1.5	-	-	-	-	2	-	10.5
	-	0.06	-	-	-	0.04	-	1	3	-
	-	0.04	-	-	-	0.04	-	1	4	-
Zn 1st Cleaner	0.3	-	-	-	-	0.01	-	2	2	11.0
	-	0.015	-	-	-	0.01	-	1	3	-
Zn 2nd Cleaner	0.3	-	-	-	-	0.005	-	1	2	11.1
	-	0.010	-	-	-	0.005	-	1	2	-
Zn 3rd Cleaner	0.2	-	-	-	-	-	-	2	1	11.2
	-	0.005	-	-	-	0.005	-	1	2	-

Comments: Froth still poor in the zinc circuit.

Test No. 120 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb 1st Cleaner Conc.	11.12	38.9	8.77	91.3	10.2
2. Zn 3rd Cleaner Conc.	13.72	0.38	53.9	1.1	76.6
3. Zn 3rd Cleaner Tailing	0.58	1.25	21.7	0.2	1.3
4. Zn 2nd Cleaner Tailing	1.42	0.99	9.13	0.3	1.3
5. Zn 1st Cleaner Tailing	5.48	0.66	3.17	0.8	1.8
6. Zn Rougher Tailing	67.68	0.44	1.26	6.3	8.8
Head (calculated)	100.00	4.73	9.65	100.0	100.0

Calculated Grades and Recoveries

Products 2 plus 3	14.30	0.41	52.6	1.3	77.9
Products 2 to 4	15.72	0.46	48.7	1.6	79.2
Products 2 to 5	21.20	0.51	36.9	2.4	81.0

Test No. 132

Purpose: To perform standard test on sample C-2, but regrind in the small ball mill.

Procedure: Grind and float a lead rougher concentrate. Regrind the concentrate and clean four times.

Feed: 2000 grams minus 10 mesh sample C-2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	2.5	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.01	0.02	0.02	-	1	3	9.6
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Regrind	1.0	0.5	0.20	0.03	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	3	9.8
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	9.9
	-	-	-	0.005	-	-	-	1	1	-
Pb 3rd Cleaner	0.2	0.1	0.05	-	-	0.005	-	1	3	9.9
Pb 4th Cleaner	0.2	-	0.05	-	-	0.005	-	1	2	10.0

Stage Pb Regrind
 Equipment Ball Mill
 (20 lb. steel)

Test No. 132 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	3.21	62.6	5.61	41.9	1.8
2. Pb 4th Cleaner Tailing	1.69	43.9	8.13	15.5	1.4
3. Pb 3rd Cleaner Tailing	1.73	30.9	10.5	11.1	1.8
4. Pb 2nd Cleaner Tailing	4.67	15.9	12.7	15.5	6.0
5. Pb 1st Cleaner Tailing	11.93	3.02	12.7	7.5	15.3
6. Pb Rougher Tailing	76.77	0.53	9.51	8.5	73.7
Head (calculated)	100.00	4.79	9.91	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	4.90	56.2	6.48	57.4	3.2
Products 1 to 3	6.63	49.6	7.53	68.5	5.0
Products 1 to 4	11.30	35.7	9.67	84.0	11.0
Products 1 to 5	23.23	18.9	11.22	91.5	26.3

Size Analysis - Ball Mill Reqrind

Particle Size Microns	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 31.6	2.3	2.3	97.7
24.5	4.4	6.7	93.3
17.1	13.4	20.1	79.9
11.8	18.7	38.8	61.2
9.1	11.9	50.7	49.3
- 9.1	49.3	100.0	-
Total	100.0	-	-

Test No. 140

Purpose: To investigate the effect of using Grum water when performing the standard test on sample C-2.

Procedure: As for test No. 116, but Grum water used for all dilution throughout the test (Grum water pH 7.3).

Feed: 2000 grams minus 10 mesh sample C-2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.07	-	-	30	-	-	-
<u>Pb Circuit</u>										
Pb Rougher	-	-	-	0.02	0.02	-	-	1	4	9.7
	-	-	-	0.02	0.01	-	-	1	4	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Re grind	1.0	0.5	0.20	0.03	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	3	9.8
	-	-	-	0.01	0.01	-	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	9.9
	-	-	-	0.005	-	-	-	1	2	-
Pb 3rd Cleaner	0.2	0.1	0.05	-	-	-	-	1	4	10.0
Pb 4th Cleaner	0.2	-	0.05	-	-	-	-	1	3	10.0
	Ca-(OH) ₂	CuSO ₄	Z-200							
<u>Zn Circuit</u> (Pb rougher plus 1st cleaner tailing)										
Condition	1.5	1.0	-	-	-	-	-	2	-	10.9
	-	-	0.06	-	-	0.02	-	1	3	-
	-	-	0.04	-	-	0.02	-	1	3	-
Zn 1st Cleaner	0.3	-	-	-	-	0.01	-	2	2	11.2
	-	-	0.01	-	-	-	-	1	2	-
Zn 2nd Cleaner	0.2	-	-	-	-	0.005	-	2	2	11.4
	-	-	0.005	-	-	-	-	1	1	-
Zn 3rd Cleaner	0.2	-	-	-	-	0.005	-	2	2	11.5

Test No. 140 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	7.73	56.9	7.07	91.5	5.4
2. Pb 4th Cleaner Tailing	0.54	4.45	14.2	0.5	0.8
3. Pb 3rd Cleaner Tailing	0.77	3.03	14.6	0.5	1.1
4. Pb 2nd Cleaner Tailing	2.80	1.42	13.8	0.8	3.8
5. Zn Cleaner Concentrate	11.78	0.24	58.5	0.6	68.3
6. Zn 3rd Cleaner Tailing	1.14	0.54	42.3	0.1	4.8
7. Zn 2nd Cleaner Tailing	1.53	0.57	26.2	0.2	4.0
8. Zn 1st Cleaner Tailing	6.08	0.55	6.31	0.7	3.8
9. Zn Rougher Tailing	67.63	0.36	1.20	5.1	8.0
Head (calculated)	100.00	4.81	10.1	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	8.27	53.5	7.53	92.0	6.2
Products 1 to 3	9.04	49.2	8.14	92.5	7.3
Products 1 to 4	11.84	37.9	9.48	93.3	11.1
Products 5 plus 6	12.92	0.27	57.1	0.7	73.1
Products 5 to 7	14.45	0.30	53.8	0.9	77.1
Products 5 to 8	20.53	0.37	39.7	1.6	80.9

4. BATCH TESTS: MATTAGAMI SAMPLE

Test No. 137

Purpose: To perform a preliminary test on the Grum sample received from Mattagami Lake.

Procedure: Grind and float three lead rougher concentrates.

Feed: 900 grams minus 10 mesh Mattagami Lake sample.

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	ZnSO ₄	NaCN	R-242	MIBC	Grind	Cond.	Froth	
Primary Grind	2.5	1.0	0.30	0.07	-	15	-	-	7.6
Condition	2.0	-	-	-	-	-	2	-	9.2
Pb Ro. Conc. No.1	4.0	-	-	0.01	0.02	-	2	3	9.7
Pb Ro. Conc. No.2	-	-	-	0.02	-	-	1	3	-
Pb Ro. Conc. No.3	-	-	-	0.02	-	-	1	3	-

Test No. 137 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Rougher Conc. No.1	15.86	24.5	17.6	44.7	17.5
2. Pb Rougher Conc. No.2	20.34	16.7	22.2	39.1	28.3
3. Pb Rougher Conc. No.3	10.75	6.09	19.0	7.5	12.8
4. Pb Rougher Tailing	53.05	1.43	12.5	8.7	41.4
Head (calculated)	100.00	8.70	16.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	36.20	20.1	20.2	83.8	45.8
Products 1 to 3	46.95	16.9	19.9	91.3	58.6

Test No. 138

Purpose: To perform the standard test on the sample from Mattagami Lake.

Procedure: Grind and float a lead rougher concentrate and a zinc rougher concentrate. Regrind the lead concentrate and clean four times. Clean the zinc concentrate three times.

Feed: 1000 grams minus 10 mesh Mattagami Lake sample.

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	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	10.0	1.0	0.30	0.07	-	-	15	-	-	-
<u>Pb Circuit</u>										
Pb Rougher	-	-	-	0.01	0.02	0.02	-	1	3	9.9
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Regrind	2.0	0.5	0.20	0.03	-	-	15	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	3	9.8
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	9.8
	-	-	-	0.005	-	-	-	1	1	-
Pb 3rd Cleaner	0.2	0.1	0.05	-	-	-	-	1	3	9.9
Pb 4th Cleaner	0.2	-	0.05	-	-	-	-	1	2	9.8
<u>Zn Circuit</u>										
	Ca (OH) ₂	CuSO ₄	Z-200							
Condition	2.0	1.5	-	-	-	-	-	2	-	10.3
Zn Rougher	-	-	0.06	-	-	0.02	-	1	3	-
	-	-	0.04	-	-	0.02	-	1	3	-
Zn 1st Cleaner	0.6	-	-	-	-	0.01	-	1	2	10.9
	-	-	0.01	-	-	-	-	1	2	-
Zn 2nd Cleaner	0.3	-	-	-	-	-	-	1	3	11.1
Zn 3rd Cleaner	0.2	-	-	-	-	-	-	1	2	11.2

Test No. 138 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	7.78	53.6	14.4	50.1	7.0
2. Pb 4th Cleaner Tailing	4.55	30.8	22.6	16.9	6.4
3. Pb 3rd Cleaner Tailing	3.35	19.1	24.9	7.7	5.2
4. Pb 2nd Cleaner Tailing	5.16	9.55	24.4	5.9	7.9
5. Pb 1st Cleaner Tailing	18.49	3.77	19.3	8.4	22.4
6. Zn Cleaner Concentrate	6.54	1.19	56.0	0.9	22.9
7. Zn 3rd Cleaner Tailing	2.34	2.03	41.8	0.6	6.1
8. Zn 2nd Cleaner Tailing	6.04	2.71	26.1	2.0	9.9
9. Zn 1st Cleaner Tailing	8.35	2.44	12.8	2.4	6.7
10. Zn Rougher Tailing	37.40	1.13	2.32	5.1	5.5
Head (calculated)	100.00	8.32	16.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	12.33	45.2	17.4	67.0	13.4
Products 1 to 3	15.68	39.6	19.0	74.7	18.6
Products 1 to 4	20.84	32.2	20.4	80.6	26.5
Products 1 to 5	39.33	18.8	19.9	89.0	48.9
Products 6 plus 7	8.88	1.41	52.3	1.5	29.0
Products 6 to 8	14.92	1.94	41.7	3.5	38.9
Products 6 to 9	23.27	2.12	31.3	5.9	45.6

Test No. 139

Purpose: To perform a six-stage locked-cycle test on the ore sample received from Mattagami Lake.

Procedure: As for test No. 126.

Feed: Six 1000 gram charges of minus 10 mesh ore sample.

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	10.0	1.0	0.30	0.08	-	-	30	-	-	-
<u>Pb Circuit</u>										
Pb Rougher	-	-	-	-	0.01	-	-	1	3	9.8
	-	-	-	0.02	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Re grind	2.0	1.0	0.30	0.04	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	4	9.7
	-	-	-	0.01	0.01	-	-	1	4	-
Pb 2nd Cleaner	0.4	0.2	0.10	-	-	-	-	2	5	9.8
Pb 3rd Cleaner	0.4	0.1	0.10	-	-	-	-	2	4	9.8
Pb 4th Cleaner	0.4	-	0.05	-	-	-	-	2	3	9.8
<u>Zn Circuit</u>										
	Ca-(OH) ₂	CuSO ₄	Z-200	Z-11	Tee-A*					
Zn Condition	2.0	1.5	-	-	-	-	-	3	-	10.8
Zn Rougher (1)	-	-	0.08	0.02	-	-	-	1	2	-
Zn Rougher (2)	-	-	0.04	0.02	0.01	0.02	-	1	3	-
Zn Rougher (3)	-	-	0.02	-	-	-	-	1	2	-
Zn 1st Cleaner	0.8	-	-	-	-	-	-	1	2	11.2
	-	-	0.01	-	0.01	-	-	1	3	-
Zn 2nd Cleaner	0.6	-	-	-	-	-	-	1	4	11.2
Zn 3rd Cleaner	0.5	-	-	-	-	-	-	1	2½	11.3
Zn 4th Cleaner	0.4	-	-	-	-	-	-	1	2	11.3

* Teefroth A

Stage	Pb Rougher	Pb Re grind	1st to 3rd Pb Cleaners
Equipment	500 g D-1	Lab. Rod Mill	500 g D-1
Speed: r.p.m.	1300		1300

Stage	4th Cleaner	Zn Rougher & Cleaners
Equipment	250 g D-1	500 g D-1
Speed: r.p.m.	1000	1100

Test No. 139 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc. A	1.05	64.2	10.7	8.1	0.7
2. Pb Cleaner Conc. B	1.46	62.6	11.5	10.9	1.1
3. Pb Cleaner Conc. C	1.76	58.4	13.1	12.3	1.5
4. Pb Cleaner Conc. D	1.83	59.0	13.2	12.9	1.5
5. Pb Cleaner Conc. E	1.71	56.0	12.4	11.5	1.3
6. Pb Cleaner Conc. F	1.74	57.5	13.1	12.0	1.4
7. Pb 4th Cl. Tailing F	0.79	34.2	23.5	3.2	1.2
8. Pb 3rd Cl. Tailing F	1.74	26.9	26.0	5.6	2.9
9. Pb 2nd Cl. Tailing F	3.34	15.9	27.0	6.4	5.7
10. Pb 1st Cl. Tailing F	4.86	4.18	21.7	2.4	6.7
11. Zn Cleaner Conc. A	1.85	1.16	53.8	0.3	6.3
12. Zn Cleaner Conc. B	2.62	2.25	54.2	0.7	9.0
13. Zn Cleaner Conc. C	2.73	2.00	53.1	0.7	9.2
14. Zn Cleaner Conc. D	2.82	2.14	57.0	0.7	10.1
15. Zn Cleaner Conc. E	2.49	2.42	55.2	0.7	8.7
16. Zn Cleaner Conc. F	2.65	2.71	57.0	0.8	9.5
17. Zn 4th Cl. Tailing F	1.09	5.00	48.9	0.7	3.4
18. Zn 3rd Cl. Tailing F	2.23	4.77	41.2	1.3	5.7
19. Zn 2nd Cl. Tailing F	3.60	4.12	26.5	1.8	5.9
20. Zn 1st Cl. Tailing F	4.67	2.93	7.59	1.6	2.2
21. Zn Rougher Tailing A	5.65	0.62	0.91	0.4	0.3
22. Zn Rougher Tailing B	8.03	0.83	1.69	0.8	0.9
23. Zn Rougher Tailing C	9.13	0.83	1.67	0.9	1.0
24. Zn Rougher Tailing D	9.83	0.87	1.85	1.0	1.1
25. Zn Rougher Tailing E	9.99	0.95	2.06	1.1	1.3
26. Zn Rougher Tailing F	10.34	0.98	2.08	1.2	1.4
Head (calculated)	100.00	8.36	15.8	100.0	100.0

Calculated Grades and Recoveries

Comb. Pb Cleaner Conc.	9.55	59.2	12.5	67.7	7.5
Comb. Pb Cl. Tailings	10.73	13.7	24.2	17.6	16.5
Comb. Zn Cl. Conc.	15.16	2.16	55.1	3.9	52.8
Comb. Zn Cl. Tailings	11.59	3.85	23.8	5.4	17.2
Comb. Zn Ro. Tailings	52.97	0.87	1.78	5.4	6.0

Test No. 139 - Continued

Projected Results of Cycles D, E and F

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Cleaner Concentrate	12.52	57.5 ✓	12.9	86.2 ✓	10.2
Zn Cleaner Concentrate	22.94	2.42	56.4 ✓	6.6	81.7
Zn Rougher Tailing	64.54	0.93	2.00	7.2	8.1
Head (Assumed)	100.00	8.36	15.8	100.0	100.0

5. TESTS ON PPB (STOCKPILE); B-2 (STORED 3 MONTHS)

Test No. 141

Purpose: To perform the standard B-2 sample flotation test on B sample ore which had been stored at ambient temperature for three months.

Procedure: Grind and float a lead rougher concentrate. Regrind the concentrate and clean five times.

Feed: 2000 grams minus 10 mesh PP sample B-2 (stored 3 months).

Grind: 60 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.08	-	-	60	-	-	-
<u>Pb Circuit</u>										
Pb Rougher	-	-	-	-	0.01	0.02	-	1	3	8.5
	-	-	-	0.02	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Regrind	2.0	1.0	0.30	0.05	-	-	60	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	4	9.4
	-	-	-	0.01	0.01	-	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	2	3	9.6
	-	-	-	0.01	-	-	-	1	3	-
Pb 3rd Cleaner	0.3	0.1	0.10	-	-	-	-	2	3	9.7
	-	-	-	0.005	-	-	-	1	2	-
Pb 4th Cleaner	0.3	-	0.05	-	-	-	-	2	4	9.8
Pb 5th Cleaner	0.2	-	0.05	-	-	-	-	2	3	9.8

Stage	Rougher	Pb Regrind
Equipment	1000 g D-1	Rod Mill
Speed: r.p.m.	1800	
% Solids	33	

Stage	1st to 4th Cl.	5th Cleaner
Equipment	500 g D-1	250 g D-1
Speed: r.p.m.	1300	1000

Test No. 141 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	6.16	64.1	10.3	50.0	4.0
2. Pb 5th Cleaner Tailing	1.82	43.0	18.3	9.9	2.1
3. Pb 4th Cleaner Tailing	3.29	32.8	21.3	13.6	4.5
4. Pb 3rd Cleaner Tailing	3.93	16.8	24.2	8.4	6.1
5. Pb 2nd Cleaner Tailing	5.41	6.46	22.4	4.4	7.7
6. Pb 1st Cleaner Tailing	17.63	1.85	19.9	4.1	22.4
7. Pb Rougher Tailing	61.76	1.23	13.5	9.6	53.2
Head (calculated)	100.00	7.91	15.7	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	7.98	59.3	12.1	59.9	6.1
Products 1 to 3	11.27	51.6	14.8	73.5	10.6
Products 1 to 4	15.20	42.6	17.2	81.9	16.7
Products 1 to 5	20.61	33.1	18.6	86.3	24.4
Products 1 to 6	38.24	18.7	19.2	90.4	46.8

Test No. 142

Purpose: To perform a flotation on PP-B ore which had been stockpiled for 6 months, dto determine the amount of deterioration.

Procedure: Grind and float a lead rougher concentrate. Discard products.

Feed: 2000 grams minus 10 mesh PP sample B (stockpiled 6 months).

Grind: 60 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	5.0	1.0	0.30	0.08	-	-	60	-	-	-
Pb Rougher	-	-	-	-	0.01	0.02	-	1	3	7.7

Note: At the low pH 7.7, pyrite floated strongly and the test was abandoned.

Test No. 143

Purpose: To perform a second test on PP-B Stockpile ore, but with 10 lb/ton of Na₂CO₃ to the grind.

Procedure: Grind and float a lead rougher concentrate. Regrind the concentrate and clean once. Again regrind the concentrate and clean four more times.

Feed: 2000 grams minus 10 mesh PP sample B (stockpile)

Grind: 60 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	10.0	1.0	0.30	0.08	-	-	60	-	-	-
<u>Pb Circuit</u>										
Pb Rougher	-	-	-	-	0.01	0.02	-	1	3	8.3
	-	-	-	0.02	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 1st Regrind	4.0	1.0	0.30	0.05	-	-	60	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	4	9.5
	-	-	-	0.01	0.01	-	-	1	4	-
Pb 2nd Regrind	2.0	1.0	0.20	0.03	-	-	30	-	-	-
Pb 2nd Cleaner	-	-	-	-	0.005	-	-	1	4	9.8
	-	-	-	0.005	0.005	-	-	1	4	-
Pb 3rd Cleaner	0.3	0.2	0.10	-	-	-	-	2	3	9.9
	-	-	-	0.005	-	-	-	1	3	-
Pb 4th Cleaner	0.3	0.1	0.10	-	-	-	-	2	3	10.0
	-	-	-	0.003	-	-	-	1	2	-
Pb 5th Cleaner	0.3	-	0.05	-	-	-	-	2	4	10.0

Comments: Some pyrite floated in rougher, but more selective than test 142.

Stage	Rougher	Regrinds	1st-4th Cl.	5th Cleaner
Equipment	1000 g D-1	Rod Mill	500 g D-1	250 g D-1
Speed: r.p.m.	1800		1300	1000
% Solids	33			

Test No. 143 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	4.06	65.4	7.99	40.9	3.1
2. Pb 5th Cleaner Tailing	0.84	31.9	18.8	4.1	1.5
3. Pb 4th Cleaner Tailing	1.63	20.8	20.6	5.2	3.2
4. Pb 3rd Cleaner Tailing	2.78	8.74	19.4	3.8	5.2
5. Pb 2nd Cleaner Tailing	6.92	4.62	17.4	4.9	11.5
6. Pb 1st Cleaner Tailing	15.75	4.52	13.6	11.0	20.4
7. Pb Rougher Tailing	68.02	2.87	8.49	30.1	55.1
Head (calculated)	100.00	6.49	10.5	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	4.90	59.7	9.84	45.0	4.6
Products 1 to 3	6.53	49.9	12.5	50.2	7.8
Products 1 to 4	9.31	37.6	14.6	54.0	13.0
Products 1 to 5	16.23	23.6	15.8	58.9	24.5
Products 1 to 6	31.98	14.2	14.7	69.9	44.9

Test No. 145

Purpose: To investigate the effect on the stockpile PP-B sample of increased Na₂CO₃.

Procedure: Grind and float a lead rougher concentrate. Re grind the concentrate and clean four times.

Feed: 2000 grams minus 10 mesh PP sample B (stockpile).

Grind: 60 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	20.0	1.0	0.30	0.08	-	-	60	-	-	-
Pb Rougher	-	-	-	-	0.01	0.02	-	1	3	9.7
	-	-	-	0.02	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Re grind	4.0	1.0	0.30	0.05	-	-	60	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	4	9.8
	-	-	-	0.01	0.01	-	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	9.9
	-	-	-	0.01	-	-	-	1	3	-
Pb 3rd Cleaner	0.3	0.1	0.10	-	-	-	-	1	3	10.0
	-	-	-	0.005	-	-	-	1	2	-
Pb 4th Cleaner	0.3	-	0.05	-	-	-	-	1	4	10.0

Stage
Equipment

Pb Re grind
Laboratory Rod Mill

Test No. 145 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	6.13	49.4	13.7	48.1	8.3
2. Pb 4th Cleaner Tailing	2.00	25.4	21.4	8.1	4.2
3. Pb 3rd Cleaner Tailing	2.44	14.9	21.7	5.8	5.2
4. Pb 2nd Cleaner Tailing	5.21	6.64	18.7	5.5	9.7
5. Pb 1st Cleaner Tailing	15.69	2.90	13.2	7.2	20.5
6. Pb Rougher Tailing	68.53	2.32	7.68	25.3	52.1
Head (calculated)	100.00	6.29	10.1	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	8.13	43.5	15.6	56.1	12.5
Products 1 to 3	10.57	36.9	17.0	62.0	17.7
Products 1 to 4	15.78	26.9	17.6	67.5	27.4
Products 1 to 5	31.47	14.9	15.4	74.7	47.9

Test No. 146

Purpose: To repeat test No. 141 (Sample B-2, stored 3 months), but increase Na₂CO₃ addition to primary grind.

Procedure: As for test No. 141.

Feed: 2000 grams minus 10 mesh PP sample B-2 (stored 3 months).

Grind: 60 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	6.0	1.0	0.30	0.08	-	-	60	-	-	-
Pb Rougher	-	-	-	-	0.01	0.02	-	1	3	9.6
	-	-	-	0.02	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Regrind	2.0	1.0	0.30	0.05	-	-	60	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	4	9.7
	-	-	-	0.01	0.01	-	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	2	3	9.8
	-	-	-	0.01	-	-	-	1	3	-
Pb 3rd Cleaner	0.3	0.1	0.10	-	-	-	-	2	3	9.9
	-	-	-	0.005	-	-	-	1	2	-
Pb 4th Cleaner	0.3	-	0.05	-	-	-	-	2	4	9.9
Pb 5th Cleaner	0.2	-	0.05	-	-	-	-	2	3	10.0

Test No. 146 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	6.41	67.8	8.82	55.0	3.6
2. Pb 5th Cleaner Tailing	1.51	44.5	17.8	8.5	1.7
3. Pb 4th Cleaner Tailing	2.96	35.2	21.3	13.2	4.0
4. Pb 3rd Cleaner Tailing	3.83	17.2	25.7	8.3	6.3
5. Pb 2nd Cleaner Tailing	6.56	6.79	24.5	5.6	10.2
6. Pb 1st Cleaner Tailing	16.88	1.51	20.5	3.3	22.1
7. Pb Rougher Tailing	61.85	0.78	13.2	6.1	52.1
Head (calculated)	100.00	7.90	15.7	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	7.92	63.4	10.5	63.5	5.3
Products 1 to 3	10.88	55.7	13.5	76.7	9.3
Products 1 to 4	14.71	45.7	16.6	85.0	15.6
Products 1 to 5	21.27	33.7	19.1	90.6	25.8
Products 1 to 6	38.15	19.4	19.7	93.9	47.9

6. MIXTURES OF SAMPLES

Test No. 123

Purpose: To investigate the flotation of lead from a mixture of original C sample and C-2 in the ratio of 1 of C sample to 3 of C-2 sample.

Procedure: Grind and float a lead rougher concentrate. Regrind the concentrate and clean four times.

Feed: 1500 grams sample C-2 plus 500 grams original sample C.

Grind: 30 minutes at 65 percent solids.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.01	0.02	0.02	-	1	3	9.5
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Regrind	1.0	0.5	0.20	0.03	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	3	9.6
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	9.7
	-	-	-	0.005	-	-	-	1	1	-
Pb 3rd Cleaner	0.3	0.1	0.05	-	-	-	-	1	3	9.8
Pb 4th Cleaner	0.2	-	0.05	-	-	-	-	1	2	9.8

Stage	Rougher	Pb Regrind	Cleaners
Equipment	1000 g D-1	Rod Mill	500 g D-1
Speed: r.p.m.	1800		1300
% Solids	33		

Test No. 123 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	4.46	59.1	7.70	52.7	3.6
2. Pb 4th Cleaner Tailing	2.69	33.5	12.8	18.0	3.6
3. Pb 3rd Cleaner Tailing	3.29	16.9	14.9	11.1	5.1
4. Pb 2nd Cleaner Tailing	5.17	5.90	14.2	6.1	7.7
5. Pb 1st Cleaner Tailing	13.98	1.23	12.0	3.4	17.6
6. Pb Rougher Tailing	70.41	0.62	8.48	8.7	62.4
Head (calculated)	100.00	5.01	9.56	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	7.15	49.5	9.62	70.7	7.2
Products 1 to 3	10.44	39.2	11.28	81.8	12.3
Products 1 to 4	15.61	28.2	12.25	87.9	20.0
Products 1 to 5	29.59	15.4	12.13	91.3	37.6

Test No. 124

Purpose: To investigate the flotation of lead from a 1 to 1 mixture of original sample C and sample C-2.

Procedure: As for test No. 123.

Feed: 1000 grams original sample C plus 1000 grams sample C-2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.01	0.02	0.02	-	1	3	9.4
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Re grind	1.0	0.5	0.20	0.03	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	3	9.6
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	9.7
	-	-	-	0.005	-	-	-	1	1	-
Pb 3rd Cleaner	0.3	0.1	0.05	-	-	-	-	1	3	9.7
Pb 4th Cleaner	0.2	-	0.05	-	-	-	-	1	2	9.7

Test No. 124 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	3.89	57.7	9.04	39.3	3.6
2. Pb 4th Cleaner Tailing	3.48	35.8	14.0	21.8	4.9
3. Pb 3rd Cleaner Tailing	4.14	20.2	16.4	14.6	6.9
4. Pb 2nd Cleaner Tailing	5.40	7.35	15.6	7.0	8.6
5. Pb 1st Cleaner Tailing	15.33	1.73	12.1	4.6	18.8
6. Pb Rougher Tailing	67.76	1.07	8.32	12.7	57.2
Head (calculated)	100.00	5.71	9.85	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	7.37	47.4	11.4	61.1	8.5
Products 1 to 3	11.51	37.6	13.2	75.7	15.4
Products 1 to 4	16.91	27.9	14.0	82.7	24.0
Products 1 to 5	32.24	15.5	13.1	87.3	42.8

Test No. 133

Purpose: To investigate the possible grade and recovery of lead from a 1:1 mixture of samples B-2 and C-2.

Procedure: As for test No. 132.

Feed: 1000 grams minus 10 mesh sample B-2 plus 1000 grams minus 10 mesh sample C-2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Primary Grind	2.5	1.0	0.30	0.08	-	-	30	-	-	-
Pb Rougher	-	-	-	0.01	0.01	0.02	-	1	3	9.7
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc., Re grind	1.0	0.5	0.20	0.04	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	4	9.8
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	9.8
	-	-	-	0.005	-	-	-	1	2	-
Pb 3rd Cleaner	0.2	0.1	0.05	-	-	0.005	-	1	4	-
Pb 4th Cleaner	0.2	-	0.05	-	-	-	-	1	3	-

Stage Pb Re grind
 Equipment Rod Mill

Test No. 133 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.91	61.1	9.83	66.6	5.4
2. Pb 4th Cleaner Tailing	1.89	31.3	18.8	9.3	2.8
3. Pb 3rd Cleaner Tailing	2.14	17.4	22.0	5.9	3.8
4. Pb 2nd Cleaner Tailing	6.14	7.83	20.4	7.6	10.0
5. Pb 1st Cleaner Tailing	13.88	1.47	16.1	3.2	17.9
6. Pb Rougher Tailing	69.04	0.68	10.9	7.4	60.1
Head (calculated)	100.00	6.34	12.5	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	8.80	54.7	11.8	75.9	8.2
Products 1 to 3	10.94	47.4	13.8	81.8	12.0
Products 1 to 4	17.08	33.2	16.1	89.4	22.0
Products 1 to 5	30.96	19.0	16.1	92.6	39.9

Test No. 134

Purpose: To repeat the test on a 1:1 mixture of B-2 and C-2, but increase the regrind time.

Procedure: As for test No. 132.

Feed: 1000 grams minus 10 mesh sample B-2, plus 1000 grams minus 10 mesh sample C-2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	R-404	MIBC	Grind	Cond.	Froth	
Grind	2.5	1.0	0.30	0.08	-	-	30	-	-	-
Pb Rougher	-	-	-	0.01	0.01	0.02	-	1	3	9.7
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Regrind	1.0	0.75	0.25	0.05	-	-	60	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	4	9.7
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	9.8
	-	-	-	0.005	-	-	-	-	2	-
Pb 3rd Cleaner	0.2	0.1	0.05	-	-	0.005	-	1	4	9.8
Pb 4th Cleaner	0.2	-	0.05	-	-	-	-	1	3	-

Test No. 134 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	6.55	67.8	7.36	70.9	3.9
2. Pb 4th Cleaner Tailing	1.71	31.9	16.9	8.7	2.3
3. Pb 3rd Cleaner Tailing	3.10	17.9	22.2	8.9	5.6
4. Pb 2nd Cleaner Tailing	5.48	3.92	20.7	3.4	9.2
5. Pb 1st Cleaner Tailing	16.93	0.76	16.2	2.1	22.2
6. Pb Rougher Tailing	66.23	0.57	10.6	6.0	56.8
Head (calculated)	100.00	6.26	12.4	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	8.26	60.4	9.34	79.6	6.2
Products 1 to 3	11.36	38.8	12.85	88.5	11.8
Products 1 to 4	16.84	34.2	15.40	91.9	21.0
Products 1 to 5	33.77	17.4	15.80	94.0	43.2

Test No. 135 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	6.30	63.6	9.08	67.6	5.5
2. Pb 4th Cleaner Tailing	1.78	27.7	17.6	8.3	3.0
3. Pb 3rd Cleaner Tailing	3.40	14.8	18.4	8.5	6.1
4. Pb 2nd Cleaner Tailing	5.54	4.15	15.3	3.9	8.2
5. Pb 1st Cleaner Tailing	18.19	0.95	11.6	2.9	20.4
6. Pb Rougher Tailing	64.79	0.81	9.03	8.8	56.8
Head (calculated)	100.00	5.93	10.3	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	8.08	55.7	11.0	75.9	8.5
Products 1 to 3	11.48	43.6	13.2	84.4	14.6
Products 1 to 4	17.02	30.7	13.9	88.3	22.8
Products 1 to 5	35.21	15.4	12.7	91.2	43.2

Test No. 136 - Continued

Metallurgical Results

Products	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Concentrate	5.43	69.5	6.35	69.2	3.4
2. Pb 4th Cleaner Tailing	1.26	29.7	14.8	6.9	1.8
3. Pb 3rd Cleaner Tailing	2.69	17.4	16.7	8.6	4.4
4. Pb 2nd Cleaner Tailing	5.18	5.01	15.6	4.8	7.9
5. Pb 1st Cleaner Tailing	14.44	1.00	12.7	2.6	18.0
6. Pb Rougher Tailing	71.00	0.61	9.25	7.9	64.5
Head (calculated)	100.00	5.45	10.2	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.69	62.0	7.94	76.1	5.2
Products 1 to 3	9.38	49.2	10.5	84.7	9.6
Products 1 to 4	14.56	33.5	12.3	89.5	17.5
Products 1 to 5	29.00	17.3	12.5	92.1	35.5

Lakefield Research of Canada Limited

Lakefield, Ontario

December 18, 1976 / tmg

A P P E N D I X

Mineralogical Examination

of Grum Project Head Samples

submitted by

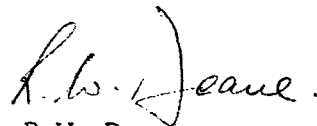
NORANDA MINES LIMITED

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

Two Grum project head samples identified as samples No. B-2 and C-2 were received in the Mineralogical Laboratory from Noranda Mines Limited on April 6, 1976.

The samples were submitted for determination of the percent distribution by association of the constituent minerals and for comparison with a head sample identified as sample No. PP-C. This latter sample had been submitted for cursory mineralogical examination earlier in the year.

LAKEFIELD RESEARCH OF CANADA LIMITED


R.W. Deane,

Mineralogist.

S U M M A R Y

The samples were similar with respect to mineral composition, but differed in the nature and distribution of the mineral associations.

Sample C-2 differed from samples PP-C and B-2.

P R E P A R A T I O N A N D P R O C E D U R E

A portion of each sample was briquetted and polished for microscopic examination in reflected light and for point-counting.

R E S U L T S

The results of the examination are shown in the following tabulation. It will be noted that samples PP-C and B-2 were similar with respect to the distribution by association of the minerals and in the percentage of mineral composition. Sample C-2 differed materially; it contained less sulphides, exhibited less complex intergrowths and generally was coarser-grained than either PP-C or B-2.

Results - Continued

Mineral Association	Weight % (Calc.) Distribution Sample No.		
	PP-C	B-2	C-2
Sphalerite - liberated	2.7	2.4	5.1
Galena - liberated	0.7	1.9	4.1
Chalcopyrite - liberated	0.2	-	-
Pyrite - liberated	9.3	5.7	7.1
Gangue - liberated	3.0	5.2	29.7
Sphalerite + pyrite + galena + gangue	7.8	10.0	1.6
Sphalerite + pyrite + galena	5.4	3.8	0.6
Sphalerite + pyrite + gangue	0.4	0.7	1.1
Sphalerite + pyrite	2.4	1.4	0.5
Sphalerite + galena + gangue	-	2.0	0.2
Sphalerite + galena	1.0	3.0	0.5
Sphalerite + gangue	0.2	0.6	1.2
Galena + sphalerite + pyrite + gangue	4.8	4.8	0.2
Galena + sphalerite + pyrite	2.8	3.4	0.2
Galena + sphalerite + gangue	-	0.7	-
Galena + sphalerite	0.7	1.1	0.5
Galena + gangue	0.1	0.7	0.9
Galena + pyrite	0.8	0.7	0.5
Pyrite + sphalerite + galena + gangue	9.9	14.0	3.0
Pyrite + sphalerite + galena	19.6	11.9	1.4
Pyrite + sphalerite + gangue	-	3.2	3.0
Pyrite + sphalerite + chalcopyrite	2.3	-	-
Pyrite + sphalerite	8.4	4.1	3.7
Pyrite + galena	5.6	2.3	0.8
Pyrite + gangue	3.9	-	-
Pyrite + chalcopyrite	0.2	0.5	2.4
Gangue + sphalerite + galena + gangue	4.3	9.9	2.2
Gangue + sphalerite + galena	1.6	2.2	8.3
Gangue + sphalerite + pyrite	0.1	0.7	3.5
Gangue + sphalerite	0.2	2.0	6.8
Gangue + galena + pyrite	0.1	-	1.7
Gangue + galena	0.2	1.1	7.7
Gangue + pyrite	1.3	-	1.5
Total	100.0	100.0	100.0

Results - Continued

100

Sample No. PP-C	Sample No. B-2	Sample No. C-2
SL	SL	SL
GL	GL	
PL	PL	GL
GaL	GaL	PL
Approx. Weight	S+	GaL
	G+	
P+	P+	S+
		G+
0	Ga+	P+
		Ga+

Table of Comparison

SL - liberated sphalerite

GL - liberated galena

PL - liberated pyrite

GaL - liberated gangue

S+ etc. - sphalerite plus other minerals where the point-count was on sphalerite.