An Investigation of

THE RECOVERY OF LEAD AND ZINC

from a Grum deposit sample, Sample PPB,

submitted by

NORANDA MINES LIMITED

Progress Report No. 4

Project No. L.R. 1868

Note:

This report refers to the samples as received.

LAKEFIELD RESEARCH OF CANADA LIMITED
Lakefield, Ontario
May 3, 1976

INTRODUCTION

This report contains the results of bench-scale testwork carried out on Sample PPB from the Grum deposit submitted by Noranda Mines Limited.

The results from the short pilot plant run on this sample indicated that the response of Sample PP-B was different to that of Sample PP-A, in that more zinc was recovered in the Pb rougher flotation and this resulted in low-grade Pb cleaner concentrates. Bench testwork was directed towards investigation of ways to improve the zinc rejection in the rougher flotation and to increase the lead cleaner concentrate grade.

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

LAKEFIELD RESEARCH OF CANADA LIMITED

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S U M M A R Y

1. Head Sample Assays

Sample PP-B

Lead	Pb	-	6.93 %
Zinc	Zn	-	10.8 %
Oxide Lead	Pb ox.	-	0.97 %
Oxide Zinc	Zn ox.	-	0.32 %
Copper	Cu	-	0.11 %
Oxide Copper	Cu ox.	-	0.03 %
Iron	Fe	-	22.8 %
Bismuth	Bi	-	0.018 %
Cadmium	Cd	-	0.030 %
Mercury	Hg	-	0.011 %
Arsenic	As	-	0.23 %
Antimony	Sb	-	0.034 %
Sulphur	S	-	29.9 %
Evolution Sulphur	Evol. S	-	1.23 %
Silica	SiO_2	-	18.2 %
Alumina	Al_2O_3	-	3.65 %
Lime	CaO	-	0.32 %
Magnesia	MgO	-	0.20 %
Barium	BaO	-	0.15 %
Gold	Au	-	0.037 oz/ton
Silver	Ag	-	3.28 oz/ton

2. Preliminary Flotation Testwork

Two preliminary flotation tests were conducted to compare the response of Sample PP-B to Sample PP-A. In Test 22 the use of the Na_2CO_3, $ZnSO_4$, NaCN depressant system was investigated, and in Test 26 the $Ca(OH)_2$, Na_2S, Na_2SO_3, NaCN depressant system was investigated.

The results of these two tests along with two comparison tests on Sample PP-A are shown below in Table No. 1, and the grade-recovery curves are shown in Figure No. 1.

Summary - Continued

2. Preliminary Flotation Testwork - Continued

Table No. 1 - Preliminary Tests

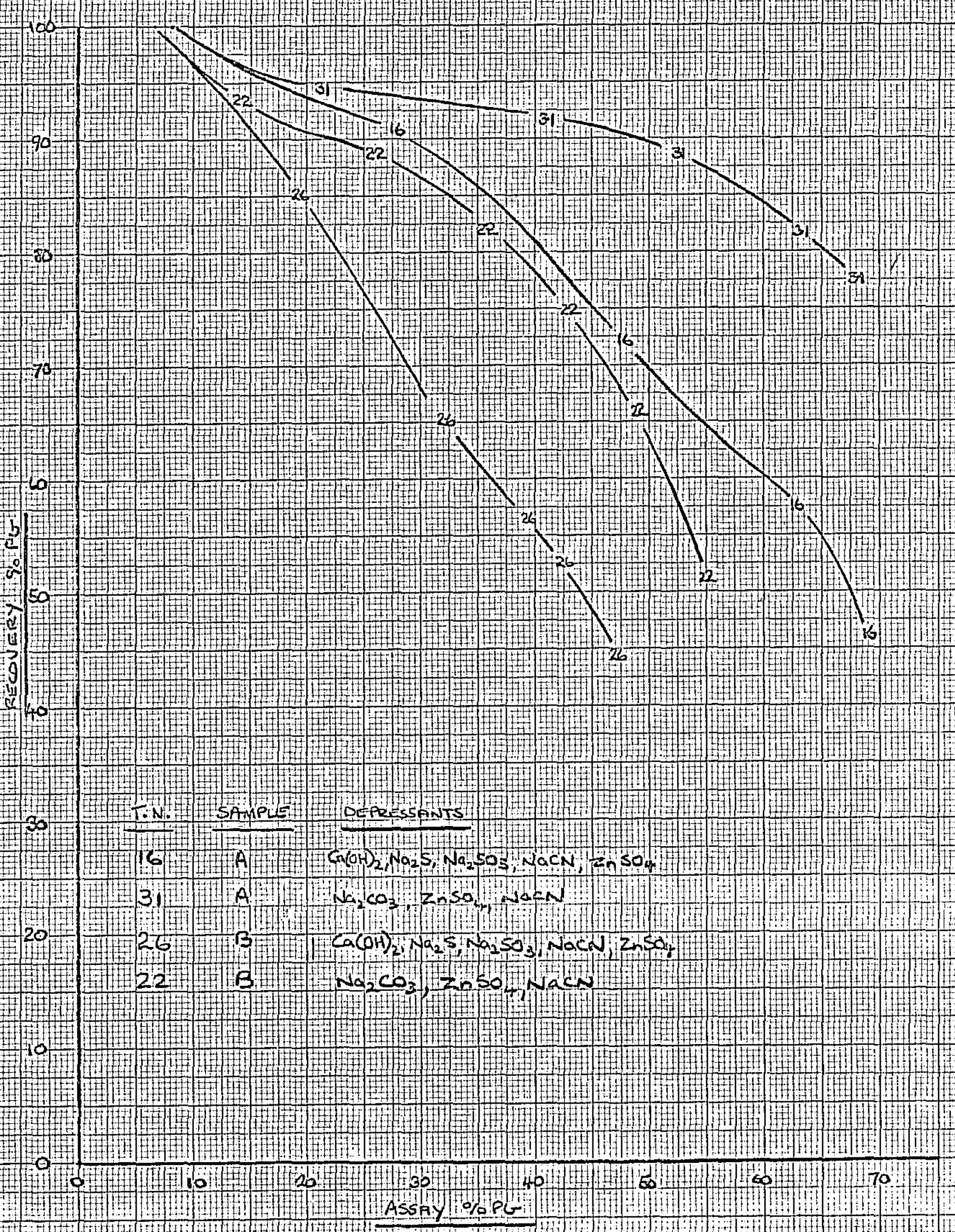
Test No.	Sample	Reagents	Product	Weight %	Assays, %		% Dist.	
					Pb	Zn	Pb	Zn
22	B	Na_2CO_3, $ZnSO_4$	Pb 5th Cl. Conc.	6.03	55.1	14.5	51.2	8.3
		NaCN	Pb Rougher Conc.	43.52	14.0	15.4	93.6	63.5
		R-242	Pb Rougher Tail.	56.48	0.74	6.76	6.4	36.5
31	A	Na_2CO_3, $ZnSO_4$	Pb 4th Cl. Conc.	9.18	68.1	6.40	77.6	8.7
		NaCN	Pb Rougher Conc.	35.70	21.3	10.49	94.5	55.4
		R-242	Pb Rougher Tail.	64.30	0.69	4.68	5.5	44.6
26	B	$Ca(OH)_2$, Na_2S	Pb 4th Cl. Conc.	6.20	47.3	17.6	44.5	10.6
		Na_2SO_3, NaCN	Pb Rougher Conc.	28.98	19.4	19.1	85.2	53.7
		$ZnSO_4$, AX343	Pb Rougher Tail.	71.02	1.37	6.72	14.8	46.3
16	A	$Ca(OH)_2$, Na_2S	Pb 4th Cl. Conc.	5.39	69.0	5.80	46.1	4.4
		Na_2SO_3, NaCN	Pb Rougher Conc.	26.29	27.9	12.2	91.0	45.0
		$ZnSO_4$, AX343	Pb Rougher Tail.	74.71	0.96	5.21	9.0	55.0

In these tests rod mill primary grinding and regrinding were used. Lead cleaner concentrate grades and recoveries were substantially lower from Sample PP-B. Pb rougher recoveries were similar, although more zinc was recovered into the Pb rougher concentrates from Sample PP-B.

Further testwork was then conducted in an attempt to improve the selectivity in the rougher flotation and increase cleaner concentrate grade and recovery.

FIGURE 1

COMPARISON OF SAMPLES A and B



Summary - Continued

3. Pb Rougher Flotation

The changes investigated in the rougher flotation were:

1) Fineness of primary grind

2) Aeration

3) SO_2 conditioning

4) Types and amounts of depressants

5) Types and amounts of collector

6) pH regulators.

3.1. Effect of Fineness of Primary Grind

Flotation tests were conducted with the fineness of primary grind varied from 37.7 percent passing 400 mesh to 98 percent passing 400 mesh. Reagent additions to the primary grind in these tests were; NaCN 0.30 lb/ton, $ZnSO_4$ 1.0 lb/ton. Na_2CO_3 and collector R-242 were also added to the primary grind but the amounts varied. The results and conditions of the rougher flotation are shown in Table No. 2.

Table No. 2 - Effect of Fineness of Primary Grind

Test No.	Primary Grind		Na_2CO_3 lb/t	R-242 lb/t	Flotation Time	Pb Rougher Concentrate				
	Mill	% -400 mesh				Weight %	Assays %		% Dist.	
							Pb	Zn	Pb	Zn
27	Ball	37.7	2.0	0.05*	9	40.84	13.9	17.1	85.9	65.8
23	Ball	65.4	3.0	0.10	9	45.30	14.2	15.8	94.3	67.8
41	Ball	65.4	4.0	0.10	12	39.11	15.2	17.1	90.7	63.2
42	Ball	88.0	5.0	0.12	12	41.93	14.8	15.7	93.4	62.3
67	Ball	98.0	5.0	0.12	6	42.13	14.8	15.5	93.2	62.4
22	Rod	65.0	3.0	0.10	9	43.52	14.0	15.4	93.6	63.5

*plus 0.05 AX-325

Summary - Continued

3.1. Effect of Fineness of Primary Grind - Continued

Grinding finer than 65 percent passing 400 mesh resulted in little improvement in zinc rejection. Pb recoveries were also similar at the finer grinds investigated. Rod mill and ball mill grinding gave similar results.

A graph of Pb recovery versus zinc recovery for these tests is shown in Figure 2.

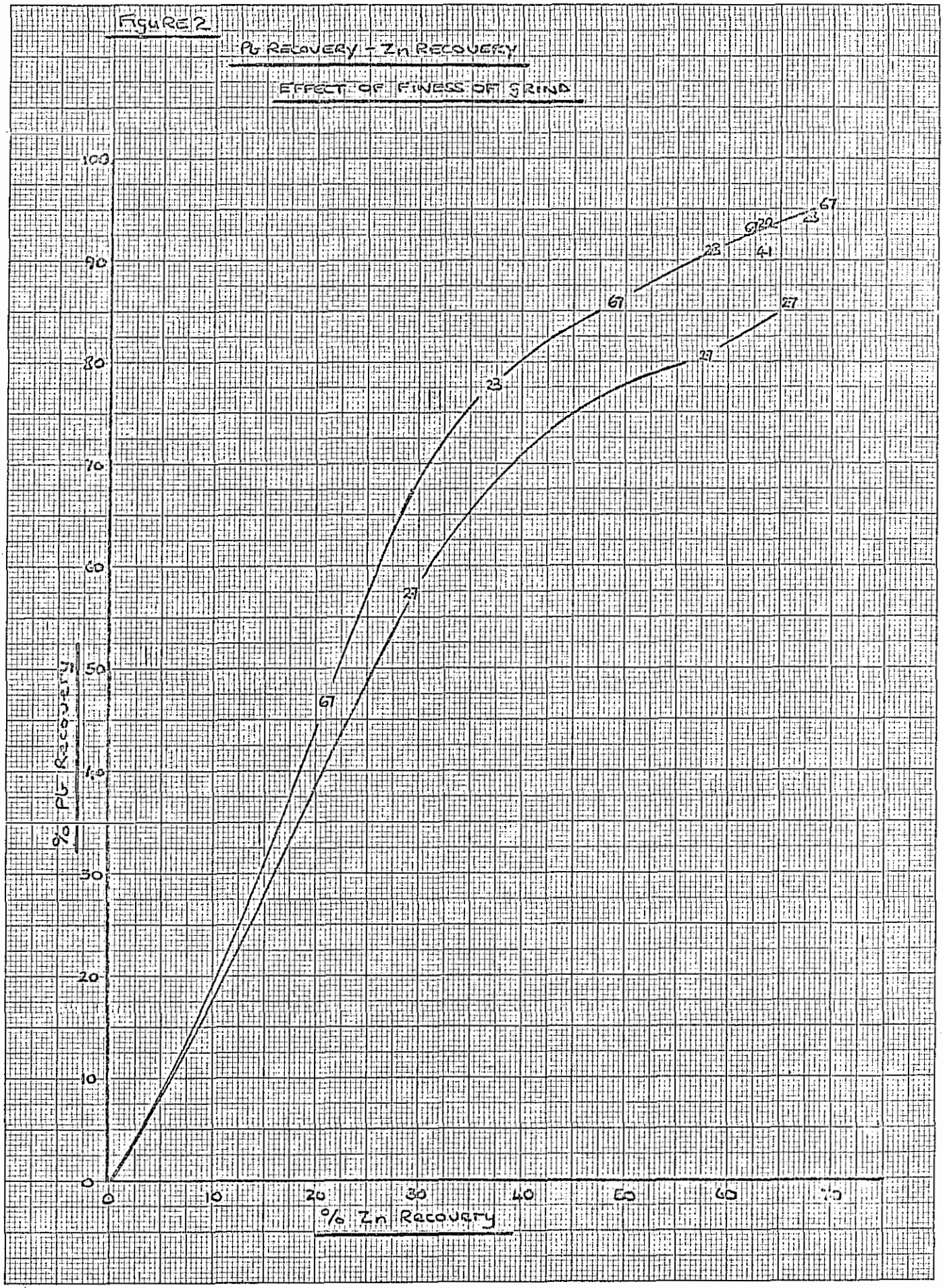


Figure 2
Pb Recovery - Zn Recovery
Effect of Fineness of Grind
100
90
80
70
60
50
40
30
20
10
0
% Pb Recovery
0
10
20
30
40
50
60
% Zn Recovery
67
23
41
27

Summary - Continued

3.2. Effect of Aeration

Two tests were conducted with a 30 minute aeration stage prior to rougher flotation. In Test 28 the ore was ground to 65.4 percent passing 400 mesh with no reagents. The pulp was then aerated for 30 minutes prior to conditioning with Na_2CO_3, $ZnSO_4$ and NaCN, and a Pb rougher concentrate was recovered using R-242 and AX-325 as collectors. In Test 61 the ore was ground to 88 percent passing 400 mesh with Na_2CO_3, $ZnSO_4$ and NaCN. The pulp was then aerated for 30 minutes and a Pb rougher concentrate was recovered with R-242 as collector.

The results of these tests are summarized in Table No. 3.

Table No. 3 - Effect of Aeration

Test No.	Grind % -400 mesh	Aeration minutes	A-325 lb/t	R-242 lb/t	Flotation Time	Pb Rougher Concentrate				
						Weight	Assays %		% Dist.	
						%	Pb	Zn	Pb	Zn
28	65.4	30	0.06	0.05	9	36.56	15.5	16.4	86.8	56.4
61	88.0	30	0.04*	0.08	9	32.72	18.0	16.9	88.1	52.3

*R-404

Weight and Pb recoveries were low in these tests, and with no improvement in zinc rejection. A graph of Pb recovery versus zinc recovery for these tests, along with that of Test 23 for comparison is shown in Figure 3.

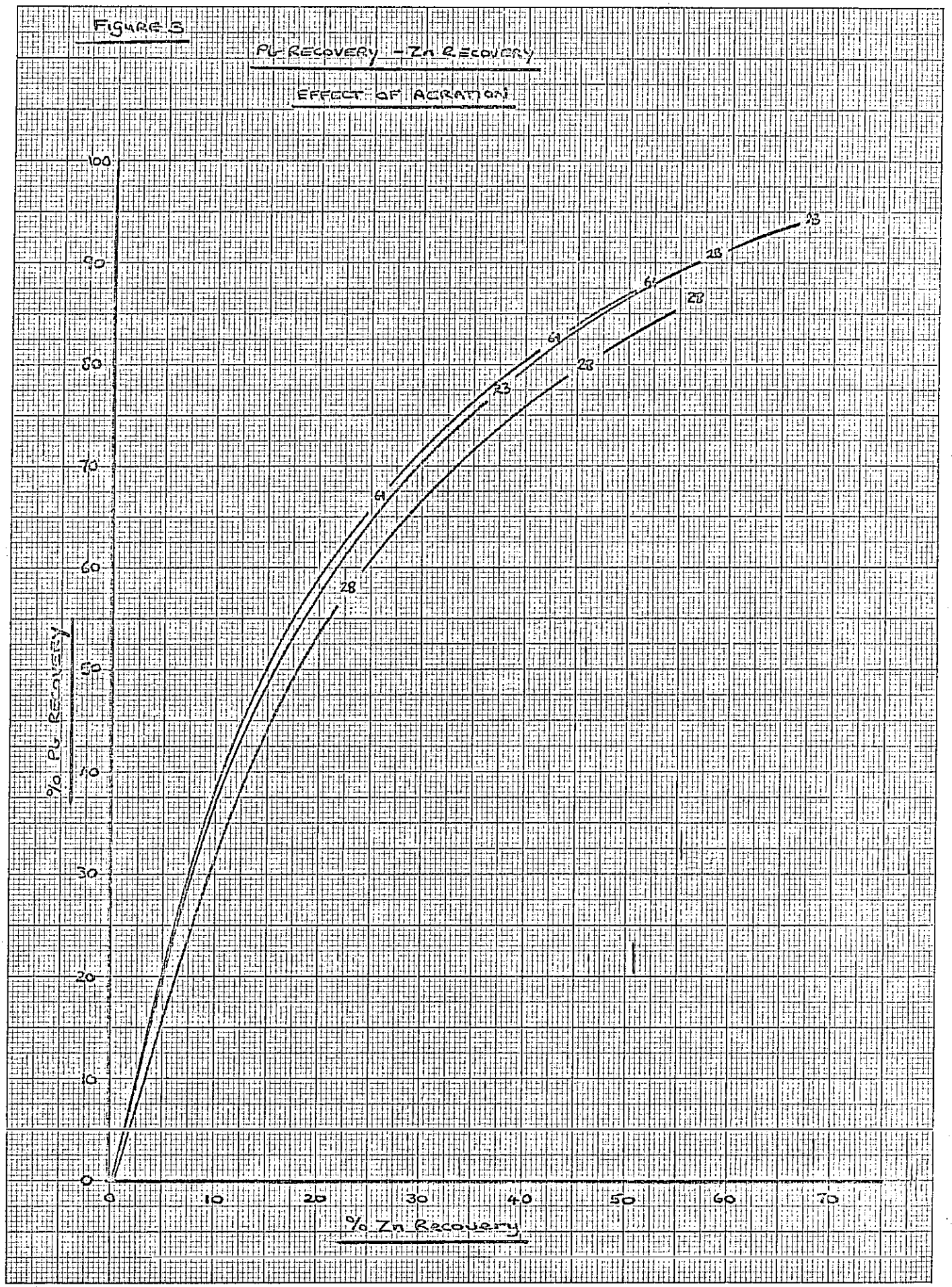


FIGURE 5
Pb RECOVERY - Zn RECOVERY
EFFECT OF AERATION
% Pb RECOVERY
% Zn Recovery
0
10
20
30
40
50
60
70
80
90
100
28
64
23
28
64
23
28
64
23

Summary - Continued

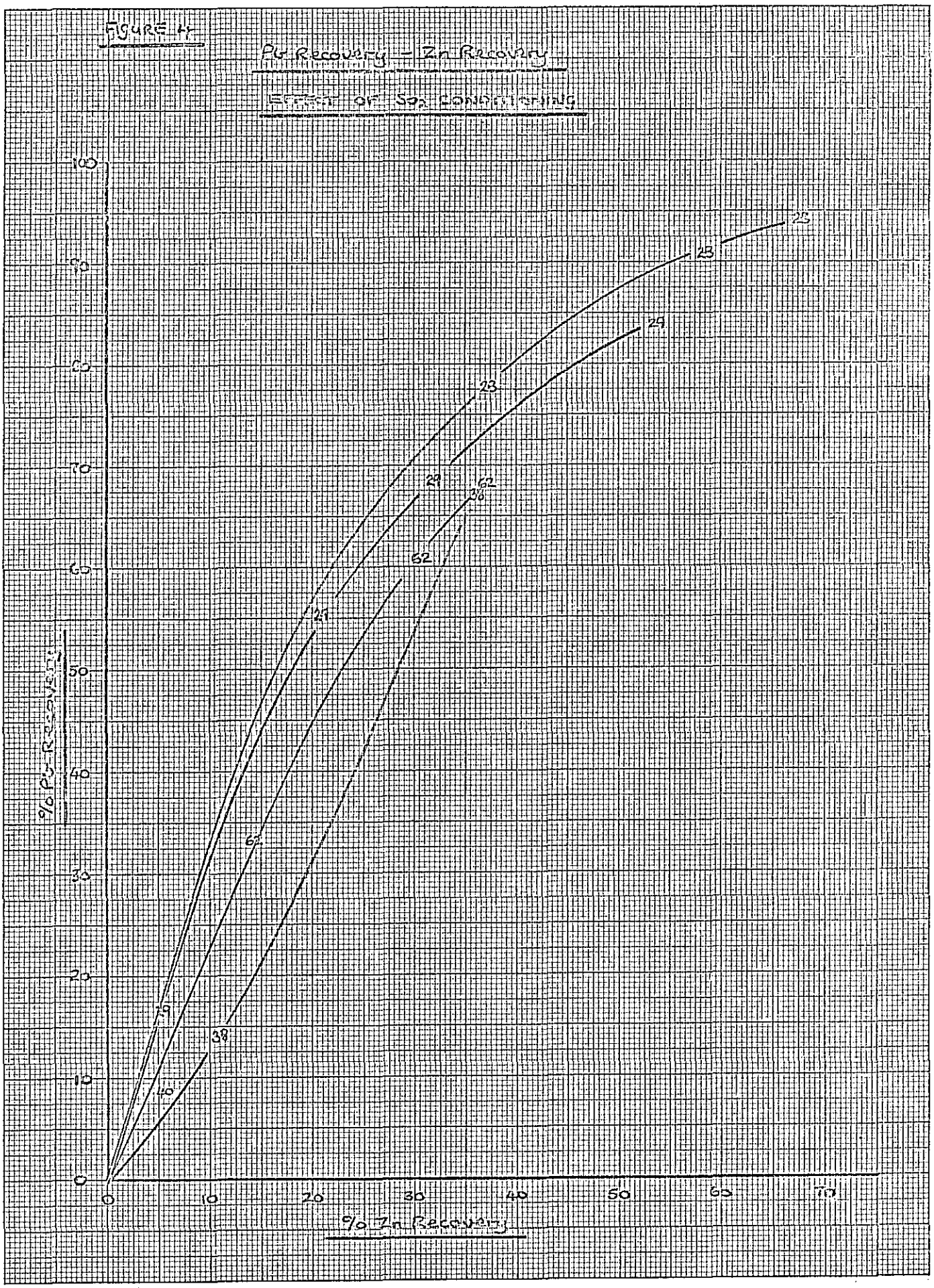
3.3. Effect of SO_2 Conditioning

Rougher flotation tests were conducted to investigate the effect of conditioning with SO_2 prior to flotation on the grades and recoveries of lead and zinc. The SO_2 conditioning pH, the use of Na_2CO_3 and $Ca(OH)_2$, and the type of collector were investigated. The results and conditions of this testwork are summarized in Table No. 4.

Table No. 4 - Effect of SO_2 Conditioning

Test No.	pH			Collector		Pb Rougher Concentrate				
						Weight	Assays %		% Dist.	
	SO_2	Na_2CO_3	$Ca(OH)_2$	Type	Amount	%	Pb	Zn	Pb	Zn
29	5.5	-	8.5	A-325 R-242	0.15 0.07	30.31	18.8	19.1	84.0	53.9
38	4.0	-	5.5	A-325	0.20	9.44	9.83	12.31	14.1	11.1
40	4.6	6.0	-	A-325 R-242	0.08 0.04	34.59	12.9	11.1	67.3	36.3
62	6.3	-	9.2	R-242 R-404	0.07 0.03	23.90	18.7	15.7	67.8	36.5

SO_2 conditioning prior to flotation gave no improvement in the Pb rougher flotation results. Pb recoveries were low and Zn rejection was poor. The Pb recovery-zinc recovery curves for these tests are shown in Figure 4.



Summary - Continued

3.4. Types and Amounts of Depressants

Various types and amounts of depressant additions were investigated in the Pb rougher flotation. These included:

1) Replacing Na_2CO_3 with $Ca(OH)_2$ or NH_4OH as the pH modifier

2) Tetrasodium-pyrophosphate as a sequestering and dispersing agent and Na_2SiO_3 as a dispersing agent.

3) Sodium pyrosulphite and sodium sulphite as auxiliary zinc depressants.

The conditions and results of the rougher flotation in these tests, along with those of Test 23 in which the standard Na_2CO_3, $ZnSO_4$ and NaCN were applied are shown in Table No. 5, and a graph of Pb recovery versus Zn recovery is shown in Figure 5.

Table No. 5 - Investigation of Various Depressant Additions

Test No.	Primary Grind % -400 mesh	Depressants Type - Amount lb/ton	Collector Type	Pb Rougher Concentrate				
				Weight %	Assay %		% Dist.	
					Pb	Zn	Pb	Zn
23	65.4	Na_2CO_3-3.0 $ZnSO_4$-1.0 NaCN-0.30	R-242 R-404	45.30	14.2	15.8	94.3	67.8
39	65.4	TSPP-4.0 $ZnSO_4$-1.0 NaCN-0.30	R-242	40.62	13.8	16.0	82.6	60.1
44	88.0	Na_2CO_3-3.0 Na_2SiO_3-2.0 $ZnSO_4$-1.0 NaCN-0.30	R-242 R-404	43.31	14.2	15.8	94.0	65.9
45	65.4	$Ca(OH)_2$-1.5 $Na_2S_2O_5$-2.0 NaCN-0.4	Z-4 Z-6	40.16	15.1	19.5	91.1	74.4
46	65.4	$Ca(OH)_2$-2.5 $Na_2S_2O_5$-2.0 Na_2S-0.5	Z-6	37.65	16.2	19.0	90.0	67.5
50*	88.0	Na_2CO_3-3.0 $ZnSO_4$-1.0 NaCN-0.30	R-242 R-404	49.98	12.6	18.0	95.3	84.3
52	88.0	Na_2CO_3-7.0 Na_2SO_3-4.0 NaCN-0.50 $ZnSO_4$-2.0	R-242 R-404	39.68	15.5	16.9	92.7	62.8
53	92.0	Na_2CO_3-7.0 Na_2SO_3-4.0 NaCN-0.50 $ZnSO_4$-2.0	R-242 R-404	36.75	16.7	16.6	92.2	58.5

*Regrind mill discharged filtered and repulped

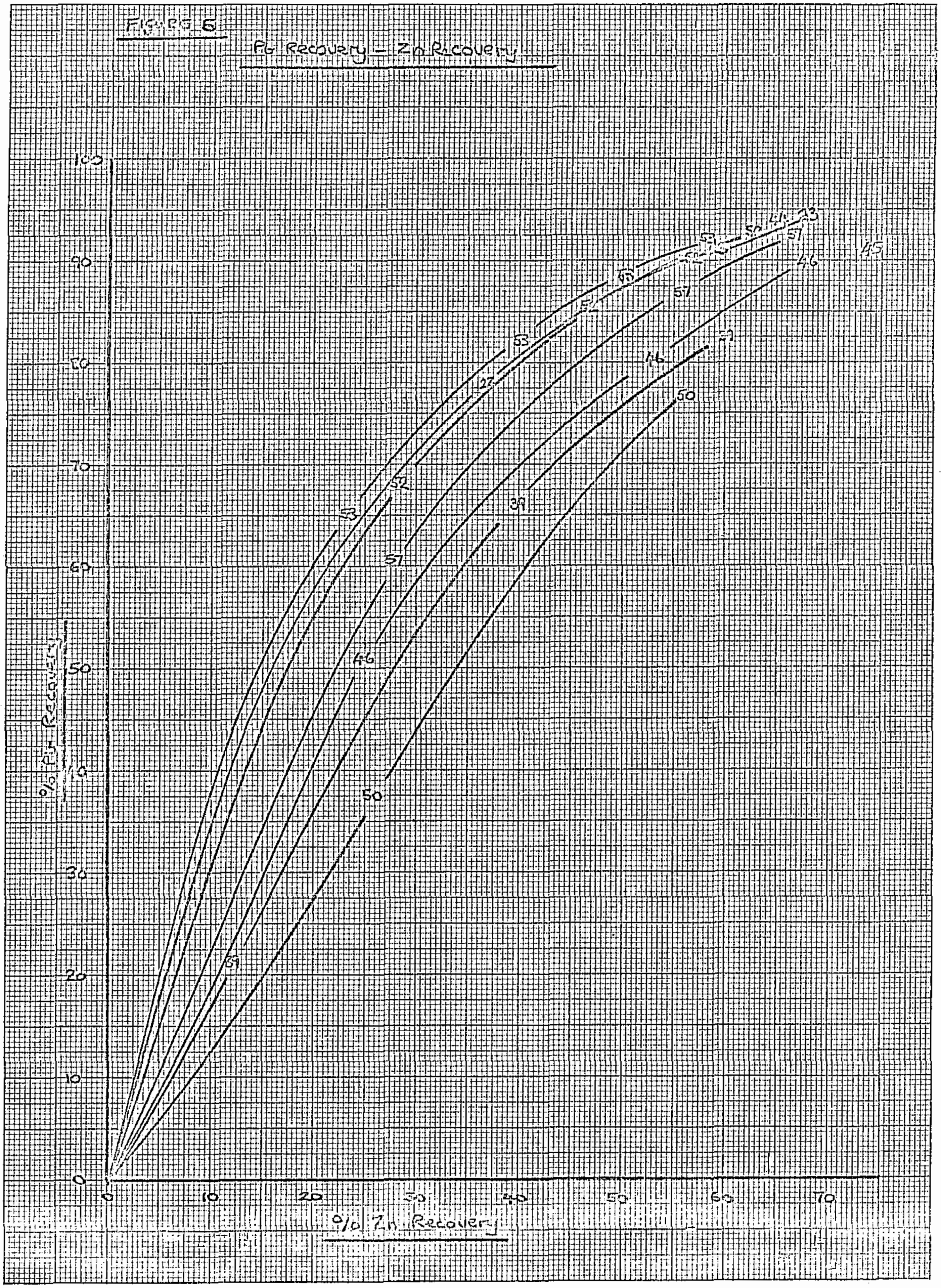
Summary - Continued

3.4. Types and Amounts of Depressants - Continued

Table No. 5 - Continued

Test No.	Primary Grind % -400 mesh	Depressants Type - Amount lb/ton	Collector Type	Pb Rougher Concentrate				
				Weight %	Assay %		% Dist.	
					Pb	Zn	Pb	Zn
57	88.0	NH_4OH-10.0 $ZnSO_4$-1.0 NaCN-0.30	R-242 R-404	39.86	15.1	17.8	92.7	66.8

High additions of Na_2SO_3 in conjunction with fine grinding resulted in a slight improvement in zinc rejection (Test 53). None of the other reagent changes investigated resulted in any improvement in zinc rejection.



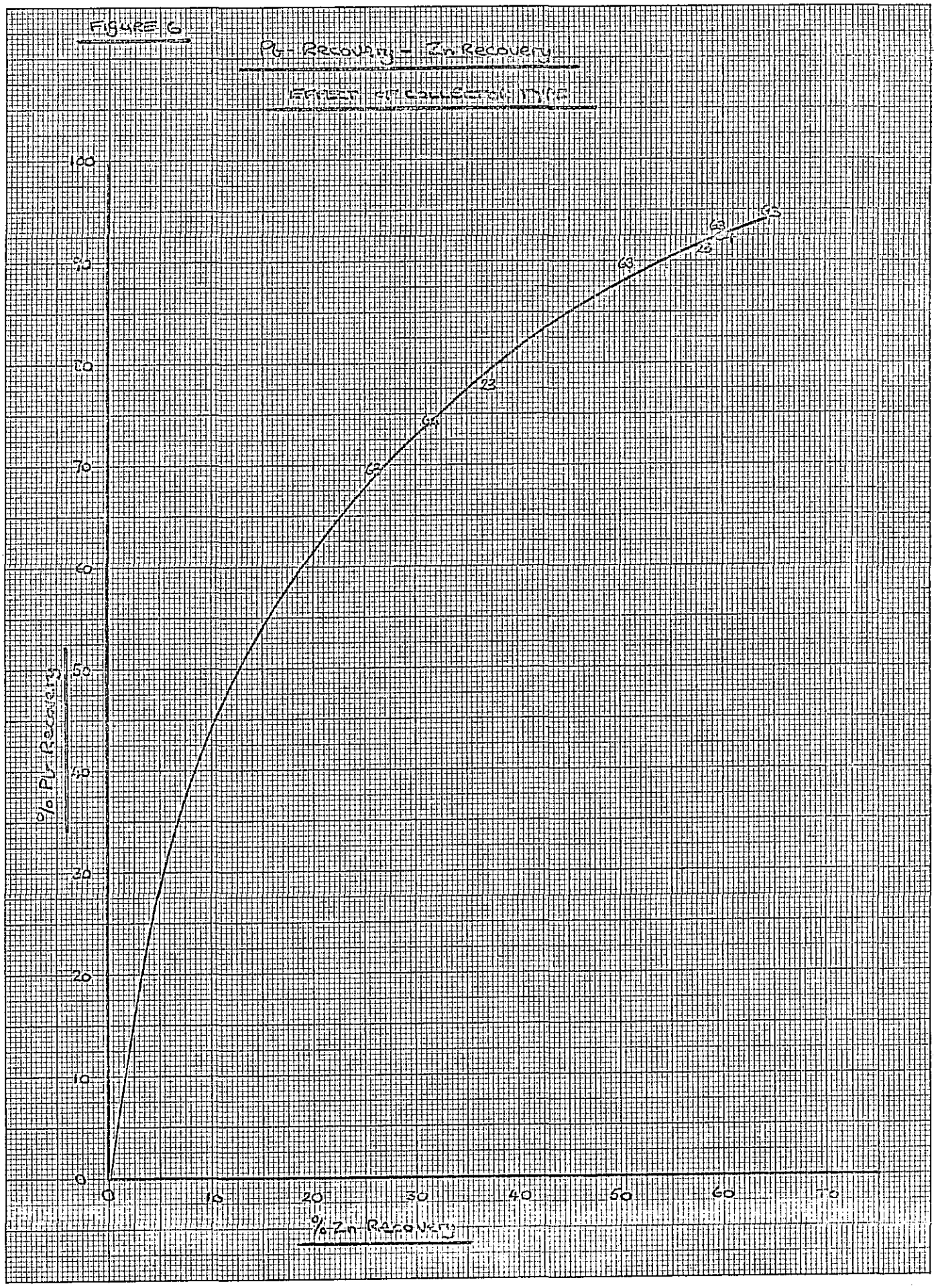
Summary - Continued

3.5. Effect of Collector Type

Flotation tests were conducted to investigate the effect of replacing R-242 with AX-325 in the rougher flotation. The results and conditions of the rougher flotation are summarized below in Table 6, and a graph of Pb recovery versus Zn recovery is shown in Figure 6.

Table No. 6 - Effect of Collector Type

Test No.	Collector lb/ton			Froth Time minutes	Pb Rougher Concentrate				
					Weight	Assays %		% Dist.	
	R-242	AX-325	R-404		%	Pb	Zn	Pb	Zn
23	0.10	-	0.04	9	45.30	14.2	15.8	94.3	67.8
63	-	0.12	0.04	12	43.30	14.9	15.8	94.7	64.4
64	0.06	0.06	0.02	9	38.31	16.3	16.4	92.6	60.0



Summary - Continued

4. Pb Cleaner Flotation

The effect of the fineness of regrind on the grades and recoveries of lead and zinc was investigated in the Pb cleaner flotation. The conditions used in the Pb rougher flotation were:

Primary Grind ; 65.4 or 88.0% minus 400 mesh

Depressants ; Na_2CO_3 5.0 lb/t, $ZnSO_4$ 1.0 lb/t, NaCN 0.30 lb/t

Collectors ; R-242 0.10-0.12 lb/t, R-404 0.04 lb/t

Flotation Time ; 9 to 12 minutes

The rougher concentrates were then reground in the rod mill with further additions of depressants. In some tests the Pb 1st, 2nd or 3rd cleaner concentrates again were reground. The results and conditions of the cleaner flotation are summarized in Table No. 7, and the grade-recovery curves are shown in Figure 7.

Summary - Continued

4. Pb Cleaner Flotation - Continued

Table No. 7 - Pb Cleaner Flotation

Test No.	Regrind Time, minutes				Final Regrind Mill Discharge % -10 μ	Cleaner Concentrate				
	Rougher Conc.	1st Cl. Conc.	2nd Cl. Conc.	3rd Cl. Conc.		Wt. %	Assay %		% Dist.	
							Pb	Zn	Pb	Zn
22	30	-	-	-	46.0	6.03	55.1	14.5	51.2	8.3
42	60	-	-	-	66.0	7.33	55.8	13.6	61.4	9.4
47	90	-	-	-	85.0	7.92	52.1	13.8	63.0	10.6
48	120	-	-	-	85.0	8.59	49.7	14.1	64.3	11.5
49	60	-	30	-	91.0	7.38	62.9	10.7	69.7	7.5
56	60	30	-	15	95.8	6.48	66.3	8.26	67.5	5.2
66*	60	-	30	-	85.0	6.44	65.6	9.83	64.3	6.1
68	30	-	30	-	82.0	7.68	61.0	11.7	70.0	8.8
71*	30	-	30	-	78.0	7.36	54.8	14.2	61.0	10.1
72	60	30	-	-	84.0	7.18	65.3	10.3	70.2	7.1
73*	30	30	30	15	88.0	6.99	58.1	12.7	61.6	8.4

*Primary Grind 65.4 percent -400 mesh Remainder 88.0 percent -400 mesh

The best cleaner flotation results were achieved in Tests 49, 56 and 72. All these tests were conducted at the finer primary grind, and the Pb rougher concentrate was reground for 60 minutes. Slightly better results were achieved in Tests 56 and 72 by further regrinding the 1st cleaner concentrate instead of the 2nd cleaner concentrate.

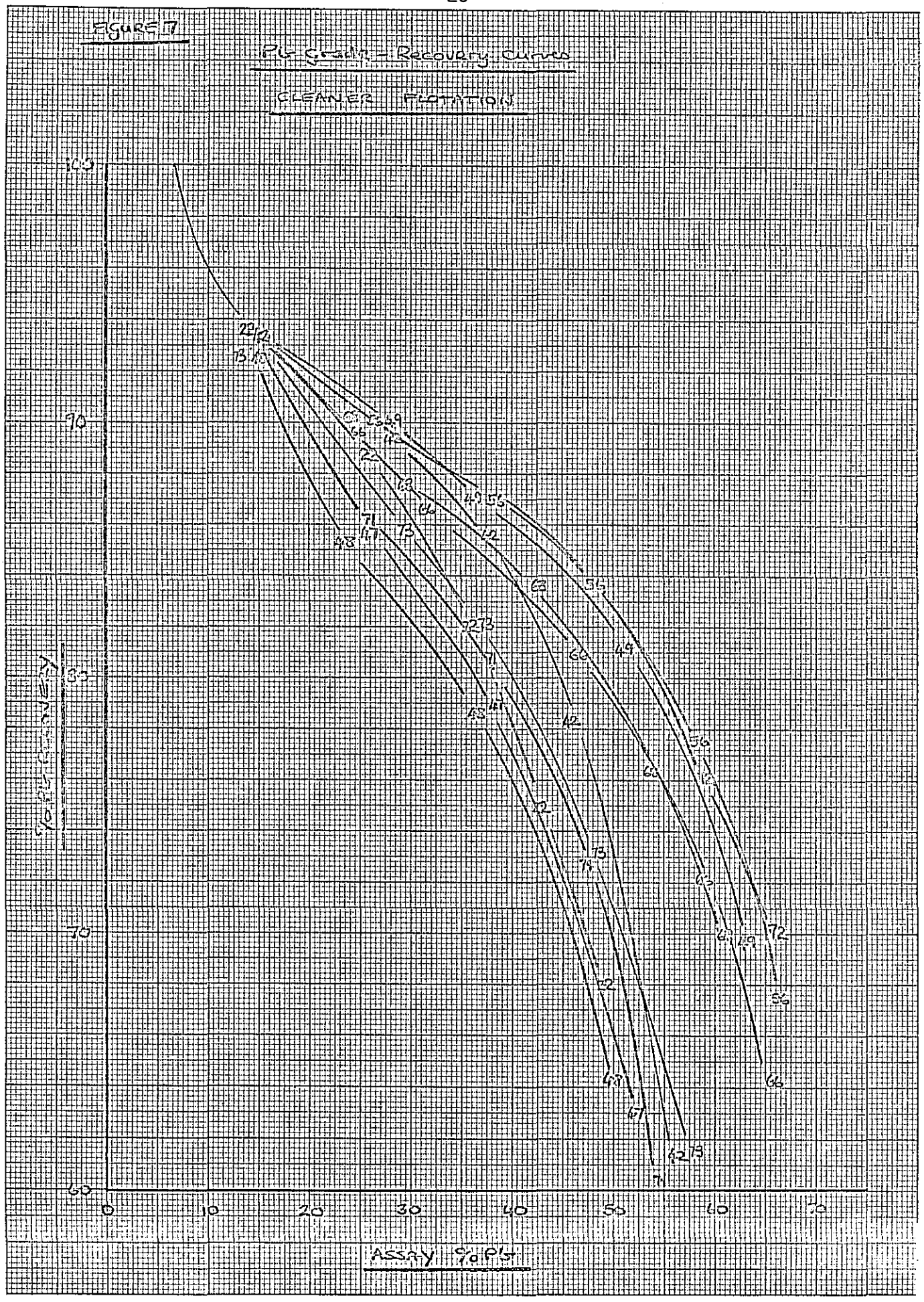
Tests in which the coarser primary grind was used or in which the Pb rougher concentrate was only reground for 30 minutes resulted in lower Pb grades and recoveries. Tests 47 and 48 in which the rougher concentrates were reground for 90 and 120 minutes gave poor results, due either to inefficiency in the regrinding or insufficient collector in the cleaner flotation.

Summary - Continued

4. Pb Cleaner Flotation - Continued

The results indicated that fine regrinding, preferably in two stages i.e. regrinding the rougher concentrate and regrinding the Pb 1st cleaner concentrate, was necessary to achieve high concentrate grades at moderate recoveries. Even after this fine regrinding, Zn levels in the cleaner concentrate remained high.

Two further flotation tests were conducted in which the use of $Ca(OH)_2$ in place of Na_2CO_3 as pH modifier throughout the cleaner circuit, and replacing rod mill regrinding with ball mill regrinding were investigated. These two tests were conducted following the procedure of Test 72 with the above mentioned changes. The results and conditions of these tests are summarized in Table No. 8, and the grade-recovery curves are shown in Figure 8.



Summary - Continued

4. Pb Cleaner Flotation - Continued

Table No. 8 - Pb Cleaner Flotation

Test No.	Regrind Mill	Final Regrind % -10 μ	pH Modifier	Pb Cleaner Concentrate				
				Weight	Assays, %		% Dist.	
				%	Pb	Zn	Pb	Zn
72	Rod	84.0	Na_2CO_3	7.18	65.3	10.3	70.2	7.1
75	Rod	84.0	$Ca(OH)_2$	6.24	65.3	9.76	63.5	5.9
76	Ball	60.0	Na_2CO_3	7.94	47.3	15.6	57.4	11.8

Replacing Na_2CO_3 with $Ca(OH)_2$ resulted in higher Pb losses in the cleaner flotation, particularly in the 1st and 2nd cleaner stages.

The 2nd regrind mill discharge after ball mill regrinding contained considerably more plus 10 micron size material than after rod mill regrinding. The ball mill regrinding times were adjusted to give power inputs similar to the rod mill regrinding, and the feed to each grinding stage was similar with regard to weight. Previously in the testwork on Sample PP-A little difference had been noted between the size distributions after rod mill and after ball mill regrinding under these conditions. This testwork however had been with comparatively short regrinding times and a much coarser regrind mill discharge. With the longer regrinding times and finer regrind mill discharges it would appear that the ball mill regrinding was not as efficient as the rod mill regrinding. Thus the reason for the large difference in results between ball mill and rod mill regrinding on Sample B may be a result of the difference in fineness of regrind.

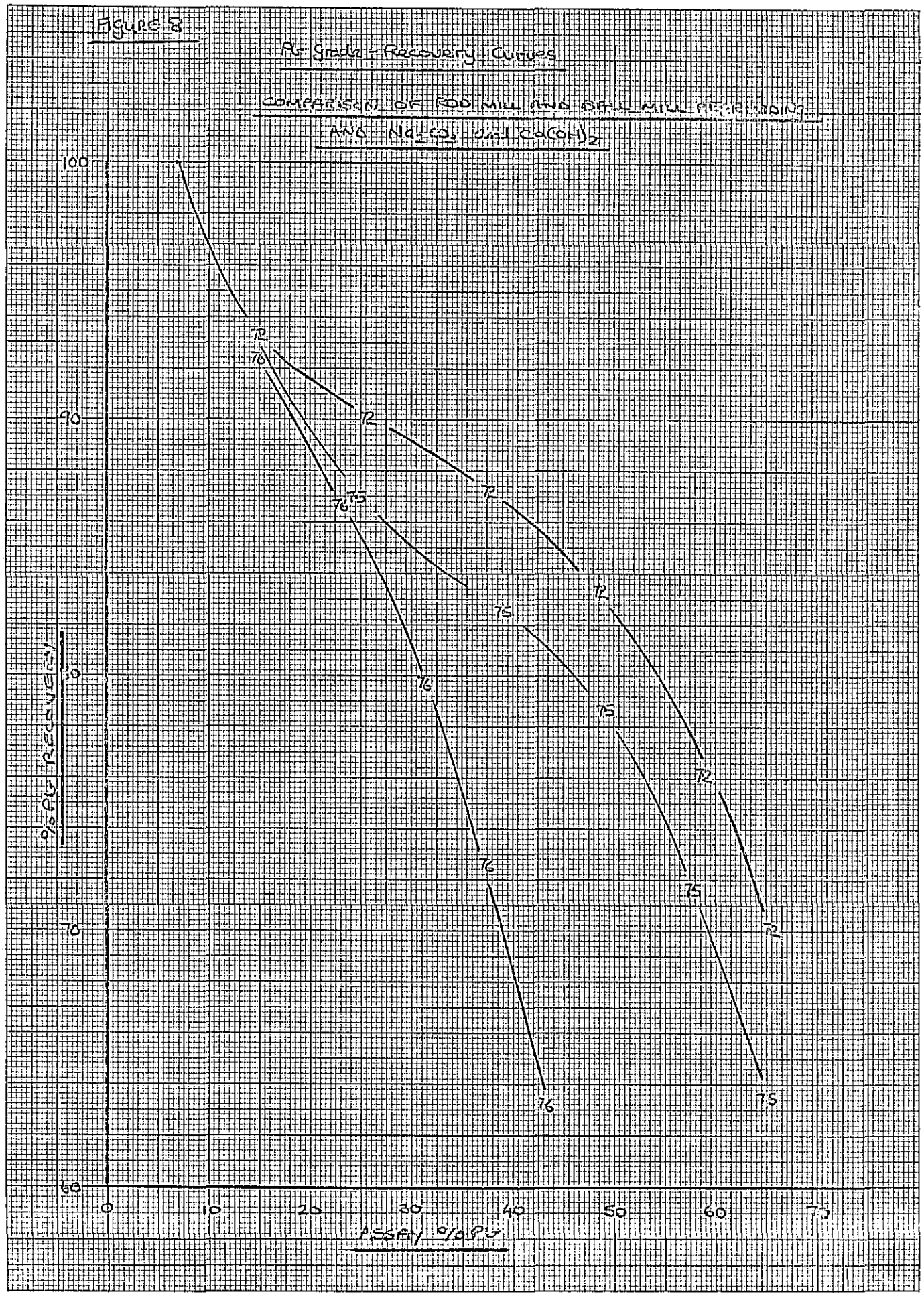


FIGURE 2
Au Grade - Recovery Curves
COMPARISON OF ROD MILL AND BALL MILL REGRINDING
AND Na2CO3 and Ca(OH)2
% Au RECOVERY
ASSAY o/oAu
100
90
80
70
60
0
10
20
30
40
50
60
70
72
76
75

SAMPLE PREPARATION

Sample PP-B was removed from the minus ½ inch crushed ore remaining from the pilot plant run in November 1975.

The ore sample was cone and roll-crushed to minus 10 mesh, and riffled into 2 kg charges for testwork plus a sample for head analysis.

Analysis of Size Fractions - Sample PP-B -10 Mesh Head

Product	Weight %	Assays, % Pb	% Distribution Pb
+ 65 mesh	62.4	6.50	48.2
- 65 mesh + 100 mesh	8.4	5.44	5.4
- 100 mesh + 150 mesh	4.5	5.66	3.0
- 150 mesh + 200 mesh	4.4	5.69	3.0
- 200 mesh + 270 mesh	2.8	6.10	2.0
- 270 mesh + 400 mesh	2.9	6.91	2.4
- 400 mesh	14.6	20.8	36.0
Head (Calculated)	100.0	8.43	100.0

DETAILS OF TESTS

Test No. 22

Purpose: To repeat the conditions of Test No. 7 on the newly-received pilot plant sample 'B'.

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

Feed: 2000 grams minus 10 mesh PP Sample B.

Grind: 40 minutes at 65 percent solids in the laboratory rod mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.08	-	40	-	-	-
Pb Circuit									
Pb Rougher	-	-	-	-	0.02	-	1	3	9.2
	-	-	-	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	-	-	-	-	-	-	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	0.2	0.1	0.05	-	-	-	1	3	9.7
Pb 4th Cleaner	0.2	-	0.05	-	-	-	1	2½	9.8
Pb 5th Cleaner	0.2	-	0.05	-	-	-	1	2	-
	$Ca(OH)_2$	$CuSO_4$		Z-200	MIBC				
Zn Circuit									
Condition	2.5	1.0	-	-	-	-	2	-	11.2
Zn Rougher	-	-	-	0.06	0.02	-	1	3	-
	-	-	-	0.02	0.02	-	1	2	-
Zn 1st Cleaner	0.3	-	-	0.005	-	-	1	3	11.4
Zn 2nd Cleaner	0.2	-	-	-	-	-	1	2½	11.5
Zn 3rd Cleaner	0.2	-	-	-	-	-	1	2	11.5

Test No. 22 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.03	55.1	14.5	51.2	8.3
2. Pb 5th Cl. Tail.	2.70	35.7	20.0	14.8	5.1
3. Pb 4th Cl. Tail.	2.59	22.5	22.6	9.0	5.6
4. Pb 3rd Cl. Tail.	3.52	12.9	21.9	7.0	7.3
5. Pb 2nd Cl. Tail.	7.51	5.90	18.5	6.8	13.2
6. Pb 1st Cl. Tail.	21.17	1.46	11.9	4.8	24.0
7. Zn Cleaner Conc.	4.80	1.42	50.2	1.1	23.0
8. Zn 3rd Cl. Tail.	0.88	2.28	24.9	0.3	2.1
9. Zn 2nd Cl. Tail.	1.25	1.99	11.1	0.4	1.3
10. Zn 1st Cl. Tail.	4.23	1.27	3.37	0.8	1.4
11. Zn Rougher Tail.	45.32	0.55	2.00	3.8	8.7
Head (Calculated)	100.00	6.49	10.5	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.73	49.1	16.2	66.0	13.4
Products 1 to 3	11.32	43.0	17.7	75.0	19.0
Products 1 to 4	14.84	35.9	18.7	82.0	26.3
Products 1 to 5	22.35	25.8	18.7	88.8	39.5
Products 1 to 6	43.52	14.0	15.4	93.6	63.5
Products 7 and 8	5.68	1.55	46.3	1.4	25.1
Products 7 to 9	6.93	1.63	39.9	1.8	26.4
Products 7 to 10	11.16	1.49	26.1	2.6	27.8
Products 7 to 11	56.48	0.74	6.76	6.4	36.5

Size Analysis

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 31.4 µm	2.6	2.6	97.4
24.3	4.2	6.8	93.2
17.0	19.0	25.8	74.2
11.7	21.4	47.2	52.8
9.0	11.3	58.5	41.5
- 9.0	41.5	100.0	-
Total	100.0	-	-

P80 ~ 20µ

Specific Gravity = 4.59

Test No. 23

Purpose: To repeat the rougher conditions of Test No. 22, but investigate the effect of grinding in the ball mill.

Procedure: Grind and float a series of lead rougher concentrates.

Feed: 2000 grams minus 10 mesh PP Sample B-1.

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

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes		pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	Cond.	Froth	
Grind	3.0	1.0	0.30	0.08	-	-	-	-
Pb Ro. Conc. No. 1	-	-	-	-	0.02	1	3	9.3
Pb Ro. Conc. No. 2	-	-	-	0.01	0.01	1	3	-
Pb Ro. Conc. No. 3	-	-	-	0.01	0.01	1	3	-

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	23.22	22.7	17.0	77.7	37.3
2. Pb Ro. Conc. No. 2	14.23	6.67	15.7	14.0	21.1
3. Pb Ro. Conc. No. 3	7.85	2.89	12.6	3.3	9.4
4. Pb Rougher Tailing	54.70	0.62	6.23	5.0	32.2
Head (Calculated)	100.00	6.70	10.58	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	37.45	16.6	16.5	91.0	58.4
Products 1 to 3	45.30	14.2	15.8	94.3	67.8

Test No. 23 - Continued

Screen Analysis

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 100	0.4	0.4	99.6
150	1.9	2.3	97.7
200	6.9	9.2	90.8
270	10.1	19.3	80.7
400	15.3	34.6	65.4
- 400	65.4	100.0	-
Total	100.0	-	-

Test No. 26

Purpose: To repeat the procedure of the lead circuit of Test No. 16 on Sample B.

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

Feed: 2000 grams minus 10 mesh PP Sample B.

Grind: 40 minutes at 65 percent solids in the laboratory rod mill.

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na_2S	Na_2-SO_3	NaCN	$Ca-(OH)_2$	AX325	MIBC	$ZnSO_4$	Grind	Cond.	Froth	
Primary Grind	0.5	1.0	0.30	-	-	-	-	40	-	-	-
Pb Circuit											
Pb Rougher	-	-	-	-	0.04	0.04	-	-	2	3	9.2
	-	1.0	-	-	0.02	0.01	-	-	1	3	-
	-	-	-	-	0.02	0.01	-	-	1	3	-
Pb Conc. Regrind	-	-	0.08	0.25	-	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	0.15	0.03	0.01	0.30	-	1	4	9.3
	-	-	-	-	0.02	0.005	-	-	1	3	-
Pb 2nd Cleaner	-	-	0.06	0.20	0.01	-	0.20	-	1	3	9.8
	-	-	-	-	0.01	0.005	-	-	1	3	-
Pb 3rd Cleaner	-	-	0.04	0.10	-	-	0.10	-	1	2	10.2
	-	-	-	-	0.01	-	-	-	1	2	-
Pb 4th Cleaner	-	-	0.02	0.10	-	-	-	-	1	3	10.5

Stage	Pb Rougher	Pb Regrind	Pb 1st & 2nd Cl.	Pb 3rd & 4th Cl.
Equipment	1000 g D-1	Rod Mill	500 g D-1	250 g D-1
Speed rpm	1800	-	1300	1000
% Solids	33	-	-	-

Test No. 26 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.20	47.3	17.6	44.5	10.6
2. Pb 4th Cl. Tail.	1.96	27.5	23.2	8.2	4.4
3. Pb 3rd Cl. Tail.	1.29	20.0	23.3	3.9	2.9
4. Pb 2nd Cl. Tail.	3.95	14.6	22.2	8.7	8.5
5. Pb 1st Cl. Tail.	15.58	8.42	18.1	19.9	27.3
6. Pb Rougher Tail.	71.02	1.37	6.72	14.8	46.3
Head (Calculated)	100.00	6.59	10.3	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.16	42.5	18.9	52.7	15.0
Products 1 to 3	9.45	39.5	19.5	56.6	17.9
Products 1 to 4	13.40	32.1	20.3	65.3	26.4
Products 1 to 5	28.98	19.4	19.1	85.2	53.7

Test No. 27

Purpose: To investigate the effect of a coarser grind on lead flotation from PP Sample B.

Procedure: Screen a 2000 gram charge of minus 10 mesh on 200 mesh. Grind the plus 200 mesh and recombine with the minus 200 mesh. Condition and float a series of lead rougher concentrates.

Feed: 2000 grams minus 10 mesh PP Sample B.

Grind: 15 minutes at 65 percent solids in the laboratory rod mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, min.		pH
	Na_2CO_3	$ZnSO_4$	NaCN	AX325	R-242	MIBC	Cond.	Froth	
Condition	2.0	1.0	0.30	-	-	-	5	-	9.9
Pb Ro. Conc. No. 1	-	-	-	0.02	0.02	0.02	1	3	-
Pb Ro. Conc. No. 2	-	-	-	0.02	0.02	-	1	3	-
Pb Ro. Conc. No. 3	-	-	-	0.01	0.01	-	1	3	-

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	15.47	24.5	20.2	57.3	29.4
2. Pb Ro. Conc. No. 2	19.31	7.99	15.7	23.3	28.5
3. Pb Ro. Conc. No. 3	6.06	5.64	13.8	5.3	7.9
4. Pb Rougher Tailing	59.16	1.58	6.14	14.1	34.2
Head (Calculated)	100.00	6.61	10.63	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	34.78	15.3	17.7	80.6	57.9
Products 1 to 3	40.84	13.9	17.1	85.9	65.8

Test No. 27 - Continued

Screen Analysis

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 65	0.3	0.3	99.7
100	9.0	9.3	90.7
150	17.6	26.9	73.1
200	15.9	42.8	57.2
270	10.0	52.8	47.2
400	9.5	62.3	37.7
- 400	37.7	100.0	-
Total	100.0	-	-

Test No. 28

Purpose: To investigate the effect of aeration on flotation selectivity of PP sample B.

Procedure: Grind, aerate and float a series of lead concentrates.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, min.		pH
	Na_2CO_3	$ZnSO_4$	NaCN	AX325	R-242	MIBC	Cond.	Froth	
Aeration	-	-	-	-	-	-	30	-	7.5
Condition	2.0	1.0	0.30	-	-	-	5	-	9.3
Pb Ro. Conc. No. 1	-	-	-	0.02	0.02	0.02	1	3	-
Pb Ro. Conc. No. 2	-	-	-	0.02	0.02	-	1	3	-
Pb Ro. Conc. No. 3	-	-	-	0.02	0.01	-	1	3	-

Metallurgical Results

Produtc	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	13.99	27.5	17.3	58.1	22.8
2. Pb Ro. Conc. No. 2	15.14	9.60	16.1	21.9	23.0
3. Pb Ro. Conc. No. 3	7.43	6.07	15.2	6.8	10.6
4. Pb Rougher Tailing	63.44	1.38	7.29	13.2	43.6
Head (Calculated)	100.00	6.63	10.61	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	29.13	17.9	16.7	80.0	45.8
Products 1 to 3	36.56	15.5	16.4	86.8	56.4

Test No. 29

Purpose: To investigate the effect of conditioning with SO_2 on the flotation of lead from PP sample B.

Procedure: Grind, condition and float a series of lead concentrates.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton							Time, min.		pH
	SO_2	Ca-$(OH)_2$	NaCN	AX325	R-242	MIBC	R-343	Cond.	Froth	
Condition (1)	3.5	-	-	-	-	-	-	5	-	7.3-5.5
(2)	-	5.0	0.20	-	-	-	-	1	-	8.5
Pb Ro. Conc. No. 1	-	-	-	0.04	0.02	0.02	-	1	3	-
Pb Ro. Conc. No. 2	-	-	-	0.03	0.02	-	-	1	3	-
Pb Ro. Conc. No. 3	-	-	-	0.03	0.01	-	-	1	3	8.3
Pb Ro. Conc. No. 4	-	-	-	-	0.02	-	0.05	1	3	-

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	3.67	30.7	15.8	16.6	5.4
2. Pb Ro. Conc. No. 2	8.34	31.5	20.0	38.7	15.5
3. Pb Ro. Conc. No. 3	5.92	15.2	20.2	13.2	11.1
4. Pb Ro. Conc. No. 4	12.38	8.51	19.0	15.5	21.9
5. Pb Rougher Tailing	69.69	1.56	7.12	16.0	46.1
Head (Calculated)	100.00	6.79	10.76	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	12.01	31.3	18.7	55.3	20.9
Products 1 to 3	17.93	26.0	19.2	68.5	32.0
Products 1 to 4	30.31	18.8	19.1	84.0	53.9

Test No. 34

Purpose: To investigate the effect of washing after a grind with SO_2 at pH 5.5 and with Na_2SiO_3.

Procedure: Grind sample with SO_2, wash sample, repulp with fresh water and float as follows.

Feed: 2000 grams minus 10 mesh PP sample B.

Grind: 20 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	H_2SO_3	Na_2SiO_3	Na_2SO_3	Na_2CO_3	NaCN	$ZnSO_4$	R-343	Grind	Cond.	Froth	
Grind	1.8	1.5	-	-	-	-	-	20	-	-	5.5
Conditioning (1)	-	-	2.0	8.0	-	-	-	-	10	-	8.5
	AF-77	R-404									
Conditioning (2)	-	-	-	-	0.5	1.5	-	-	5	-	-
Pb Rougher	0.002	0.01	-	-	-	-	0.10	-	1	4	8.5
	0.002	0.01	-	-	-	-	0.01	-	1	3	-
	0.002	-	-	-	-	-	0.01	-	1	3	8.5
Combined Ro. Conc. for regrinding.											
Ball Mill Regrind	-	-	-	1.0	-	-	-	35	-	-	-
Pb 1st Cleaner	-	-	-	-	0.3	0.9	-	-	5	-	8.2
	0.002	-	-	0.5	-	-	0.001	-	1	8	8.2
Pb 2nd Cleaner	-	-	-	-	0.2	0.6	-	-	1	6	8.2
Pb 3rd Cleaner	-	-	-	-	0.1	0.3	-	-	1	4	8.2

Stage	Pb Rougher	Pb 1st Cl.	Pb 2nd & 3rd Cl.	Pb Regrinding
Equipment	1000 g D-2	500 g D-2	250 g D-2	Laboratory Ball Mill G
Speed rpm	1500	1200	900	-

Test No. 34 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb 3rd Cl. Conc.	16.68	28.1	18.6	70.9	28.8
2. Pb 3rd Cl. Tail.	1.98	14.3	21.4	4.3	3.9
3. Pb 2nd Cl. Tail.	3.18	10.9	19.8	5.2	5.8
4. Pb 1st Cl. Tail.	12.54	4.62	15.2	8.8	17.8
5. Pb Rougher Conc.	65.62	1.09	7.17	10.8	43.7
Head (Calculated)	100.00	6.61	10.8	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	18.66	26.6	18.9	75.2	32.7
Products 1 to 3	21.84	24.3	19.0	80.4	38.5
Products 1 to 4	34.38	17.1	17.6	89.2	56.3

Screen Analyses - Pb Rougher Tailing

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 100	0.3	0.3	99.7
150	1.9	2.2	97.8
200	6.5	8.7	91.3
270	8.8	17.5	82.5
400	14.4	31.9	68.1
- 400	68.1	100.0	-
Total	100.0	-	-

Composite

+ 150	0.4	0.4	99.6
200	0.3	0.7	99.3
270	0.9	1.6	98.4
400	4.3	5.9	94.1
- 400	94.1	100.0	-
Total	100.0	-	-

Test No. 35

Purpose: To repeat Test No. 34, but without SO_2 addition in the grind and with lower NaCN and $ZnSO_4$ additions in the cleaner.

Procedure: As for Test No. 34.

Feed: 2000 grams minus 10 mesh PP sample B.

Grind: 20 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na_2SiO_3	Na_2CO_3	Na_2SO_3	NaCN	$ZnSO_4$	R-343	R-404	Grind	Cond.	Froth	
Grind	1.5	-	-	-	-	-	-	20	-	-	7.0
Conditioning (1)	-	3.5	2.0	-	-	-	-	-	10	-	9.0
(2)	-	-	-	0.5	1.5	-	-	-	5	-	-
	AF-77										
Pb Rougher	0.002	-	-	-	-	0.1	0.01	-	1	4	9.0
	0.002	-	-	-	-	0.01	0.01	-	1	3	-
	0.002	-	-	-	-	0.01	-	-	1	3	9.0
Combined Ro. Conc. for regrind and cleaning.											
Ball Mill Regrind	-	1.0	-	-	-	-	-	15	-	-	-
Pb 1st Cleaner	-	-	-	0.2	0.5	-	-	-	5	-	9.2
	0.002	-	-	-	-	0.01	-	-	1	8	-
Pb 2nd Cleaner	0.002	0.5	-	0.1	0.3	0.002	-	-	1	6	9.2
Pb 3rd Cleaner	0.002	-	-	0.05	0.1	-	-	-	1	4	9.2
Pb 4th Cleaner	0.002	0.3	-	0.02	0.05	-	-	-	1	3	9.2

Stage	Pb Rougher	Pb 1st Cl.	Pb 2nd to 4th Cl.	Pb Conc. Regrind
Equipment	1000 g D-2	500 g D-2	250 g D-2	Laboratory Ball Mill G
Speed rpm	1500	1200	900	-

Test No. 35 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb 4th Cl. Conc.	9.28	39.5	17.4	57.0	15.1
2. Pb 4th Cl. Tail.	2.71	17.1	21.8	6.7	5.5
3. Pb 3rd Cl. Tail.	7.56	10.3	19.2	12.1	13.6
4. Pb 2nd Cl. Tail.	4.51	7.52	18.1	5.3	7.7
5. Pb 1st Cl. Tail.	17.58	4.20	14.5	11.5	23.9
6. Pb Rougher Tail.	58.36	0.82	6.25	7.4	34.2
Head (Calculated)	100.00	6.43	10.67	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	11.99	34.2	18.4	63.7	20.6
Products 1 to 3	19.55	24.9	18.7	75.8	34.2
Products 1 to 4	24.06	21.7	18.6	81.1	41.9
Products 1 to 5	41.64	14.3	16.9	92.6	65.8

Test No. 38

Purpose: To investigate the effect of SO_2 in the grind and of conditioning at pH 4 on the flotation of lead from Sample B.

Procedure: Grind, condition and float a series of lead rougher concentrates.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	SO_2	$Ca(OH)_2$	AX325	MIBC	R-208	Grind	Cond.	Froth	
Grind	7.0	-	-	-	-	30	-	-	-
Condition (1)	11.7	-	-	-	-	-	10	-	6.6-4.0
(2)	-	2.5	-	-	-	-	2	-	5.5
Pb Ro. Conc. No. 1	-	-	0.05	0.03	-	-	1	2	5.0
Pb Ro. Conc. No. 2	-	-	0.05	0.01	-	-	1	2	-
Pb Ro. Conc. No. 3	-	-	0.10	-	0.06	-	1	2	-
	-	-	-	-	-	-	-	-	4.5

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	3.51	10.4	12.1	5.5	4.0
2. Pb Ro. Conc. No. 2	2.74	10.5	13.3	4.4	3.5
3. Pb Ro. Conc. No. 3	3.19	8.64	11.7	4.2	3.6
4. Pb Rougher Tailing	90.56	6.26	10.3	85.9	88.9
Head (Calculated)	100.00	6.60	10.5	100.0	100.0

Calculated Grades and Recoveries

Products 1 to 3	9.44	9.83	12.31	14.1	11.1

Test No. 39

Purpose: To investigate the effect of adding TSPP to the grind.

Procedure: Grind and float a series of lead rougher concentrates.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes		pH
	TSPP	Na_2CO_3	$ZnSO_4$	NaCN	R-242	Cond.	Froth	
Grind	4.0	-	-	-	-	-	-	-
Condition	-	-	1.0	0.30	-	5	-	9.4
Pb Ro. Conc. No. 1	-	-	-	-	0.04	1	3	-
Pb Ro. Conc. No. 2	-	-	-	-	0.02	1	3	-
Pb Ro. Conc. No. 3	-	-	-	-	0.02	1	3	-

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	8.48	17.1	14.7	21.4	11.5
2. Pb Ro. Conc. No. 2	17.74	17.1	17.4	44.8	28.5
3. Pb Ro. Conc. No. 3	14.40	7.70	15.1	16.4	20.1
4. Pb Rougher Tailing	59.38	1.98	7.26	17.4	39.9
Head (Calculated)	100.00	6.77	10.82	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	26.22	17.1	16.5	66.2	40.0
Products 1 to 3	40.62	13.8	16.0	82.6	60.1

Test No. 40

Purpose: To repeat Test No. 38, but omit SO_2 from grind, condition at slightly higher pH and neutralize with soda ash.

Procedure: As for Test No. 38.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes		pH
	SO_2	Na_2CO_3	AX-325	R-242	MIBC	Cond.	Froth	
Condition (1)	8.75	-	-	-	-	10	-	8.4-4.6
(2)	-	2.5	-	-	-	2	-	6.0
Pb Ro. Conc. No. 1	-	-	0.04	0.02	0.015	1	2	-
Pb Ro. Conc. No. 2	-	-	0.04	0.02	-	1	2	5.5

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	4.88	11.9	11.7	8.7	5.4
2. Pb Ro. Conc. No. 2	29.71	13.1	11.0	58.6	30.9
3. Pb Rougher Tailing	65.41	3.31	10.3	32.7	63.7
Head (Calculated)	100.00	6.64	10.6	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	34.59	12.9	11.1	67.3	36.3

Test No. 41

Purpose: To perform the standard lead rougher procedure and investigate the effect of a very fine regrind.

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

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.05	-	-	30	-	-	-
Pb Rougher	1.0	-	-	0.02	0.01	-	-	1	3	9.0
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Conc. Regrind	2.0	1.0	0.40	0.06	-	-	60	-	-	-
Pb 1st Cleaner	-	-	-	-	-	-	-	1	4	9.6
	-	-	-	-	0.01	-	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	9.5
	-	-	-	0.005	0.005	-	-	1	3	-
Pb 3rd Cleaner	-	0.1	0.05	-	-	0.6	-	1	4	10.4
Pb 4th Cleaner	-	-	0.05	-	-	0.3	-	1	3	10.8

Stage	Pb Rougher	Pb Regrind	Pb 1st to 3rd Cl.	Pb 4th Cl.
Equipment	1000 g D-1	Laboratory Ball Mill	500 g D-1	250 g D-1
Speed rpm	1800	-	1300	1000
% Solids	33	-	-	-

Test No. 41 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.64	49.5	15.0	50.2	9.4
2. Pb 4th Cl. Tail.	3.02	27.7	20.0	12.8	5.7
3. Pb 3rd Cl. Tail.	4.90	18.6	21.3	13.9	9.9
4. Pb 2nd Cl. Tail.	5.57	7.42	19.6	6.3	10.3
5. Pb 1st Cl. Tail.	18.98	2.57	15.5	7.5	27.9
6. Pb Rougher Tail.	60.89	1.00	6.39	9.3	36.8
Head (Calculated)	100.00	6.55	10.6	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.66	42.7	16.6	63.0	15.1
Products 1 to 3	14.56	34.6	18.2	76.9	25.0
Products 1 to 4	20.13	27.1	18.6	83.2	35.3
Products 1 to 5	39.11	15.2	17.1	90.7	63.2

Size Analysis - Ball Mill Regrind

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 30.2 µm	1.7	1.7	98.3
23.4	2.9	4.6	95.4
16.4	7.9	12.5	87.5
11.2	16.1	28.6	71.4
8.7	11.8	40.4	59.6
- 8.7	59.6	100.0	-
Total	100.0	-	-

Specific Gravity = 4.54

Test No. 42

Purpose: To repeat Test No. 41, but with a finer primary grind and with regrind in the rod mill.

Procedure: As for Test No. 41.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	5.0	1.0	0.30	0.08	-	-	60	-	-	-
Pb Rougher	-	-	-	-	0.01	-	-	1	3	9.1
	-	-	-	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	-	-	-	-	-	-	-	1	4	9.1
	-	-	-	-	0.01	-	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	9.3
	-	-	-	0.005	0.005	-	-	1	3	-
Pb 3rd Cleaner	-	-	0.05	-	-	0.6	-	1	4	10.5
Pb 4th Cleaner	-	-	0.05	-	-	0.5	-	1	3	10.8

Stage	Pb Rougher	Pb Regrind	Pb Cleaners
Equipment	1000 g D-1	Laboratory Rod Mill	500 g D-1
Speed rpm	1800	-	1300
% Solids	33	-	-

Test No. 42 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.33	55.8	13.6	61.4	9.4
2. Pb 4th Cl. Tail.	4.10	27.6	20.7	17.0	8.0
3. Pb 3rd Cl. Tail.	3.68	13.0	23.2	7.2	8.1
4. Pb 2nd Cl. Tail.	6.18	4.06	18.4	3.8	10.8
5. Pb 1st Cl. Tail.	20.64	1.28	13.3	4.0	26.0
6. Pb Rougher Tail.	58.07	0.76	6.88	6.6	37.7
Head (Calculated)	100.00	6.66	10.6	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	11.43	45.7	16.1	78.4	17.4
Products 1 to 3	15.11	37.7	17.9	85.6	25.5
Products 1 to 4	21.29	28.0	18.0	89.4	36.3
Products 1 to 5	41.93	14.8	15.7	93.4	62.3

Size Analysis - Regrind Mill Discharge

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 30.8 µm	0.2	0.2	99.8
23.9	0.3	0.5	99.5
* 16.7	4.0	4.5	95.5
11.5	19.2	23.7	76.3
8.9	15.7	39.4	60.6
- 8.9	60.6	100.0	-
Total	100.0	-	-

Specific Gravity = 4.46

*combined for assay

Test No. 43

Purpose: To investigate the bulk flotation of Pb-Zn and separation of Pb from bulk cleaner concentrate after collector desorption.

Procedure: As indicated below and on flowsheet.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	$Ca(OH)_2$	Na_2SO_3	Na_2SiO_3	Z-6/ Z-3*	$CuSO_4$	AF-77	Z-3	Grind	Cond.	Froth	
Grind	2.0	3.0	2.0	0.05	-	-	-	30	-	-	10.5
Conditioning (1)	-	-	-	-	1.5	-	-	-	15	-	10.2
Pb-Zn Bulk (1)	-	-	-	0.05**	-	0.02	-	-	4	5	-
(2)	-	-	-	0.04	-	0.02	-	-	4	5	-
(3)	-	-	-	0.03	-	-	-	-	4	5	10.2
Combined Cl. Conc. for regrind and cleaning.											
Regrind	1.0	1.0	-	-	-	-	-	30	-	-	10.5
Pb-Zn Bulk 1st Cl.											
(1)	-	-	-	-	0.4	0.004	0.02	-	5	5	10.4
(2)	-	-	-	-	-	0.002	0.02	-	4	5	10.5
Pb-Zn Bulk 2nd Cl.											
(1)	0.5	-	-	-	-	-	0.02	-	3	4	10.3
(2)	-	-	-	-	-	0.002	0.01	-	3	4	-
Pb-Zn Bulk 3rd Cl.											
(1)	0.2	-	-	-	-	-	-	-	3	3	10.5
(2)	-	-	-	-	-	0.003	-	-	3	3	-
		Na_2S	A.C.								
Desorbtion of collector from Pb-Zn bulk 3rd Cl. Conc.											
Conditioning	-	3.0	0.3	-	-	-	-	-	20	-	-
De-watering, filtration and repulping with fresh water											
		Na_2CO_3									
Pb Rougher	-	1.0	-	-	-	0.02	0.03	-	5	5	9.5
Pb 1st Cleaner	-	0.2	-	-	-	0.002	0.02	-	5	4	9.8
Pb 2nd Cleaner	-	0.1	-	-	-	-	-	-	5	3	9.8

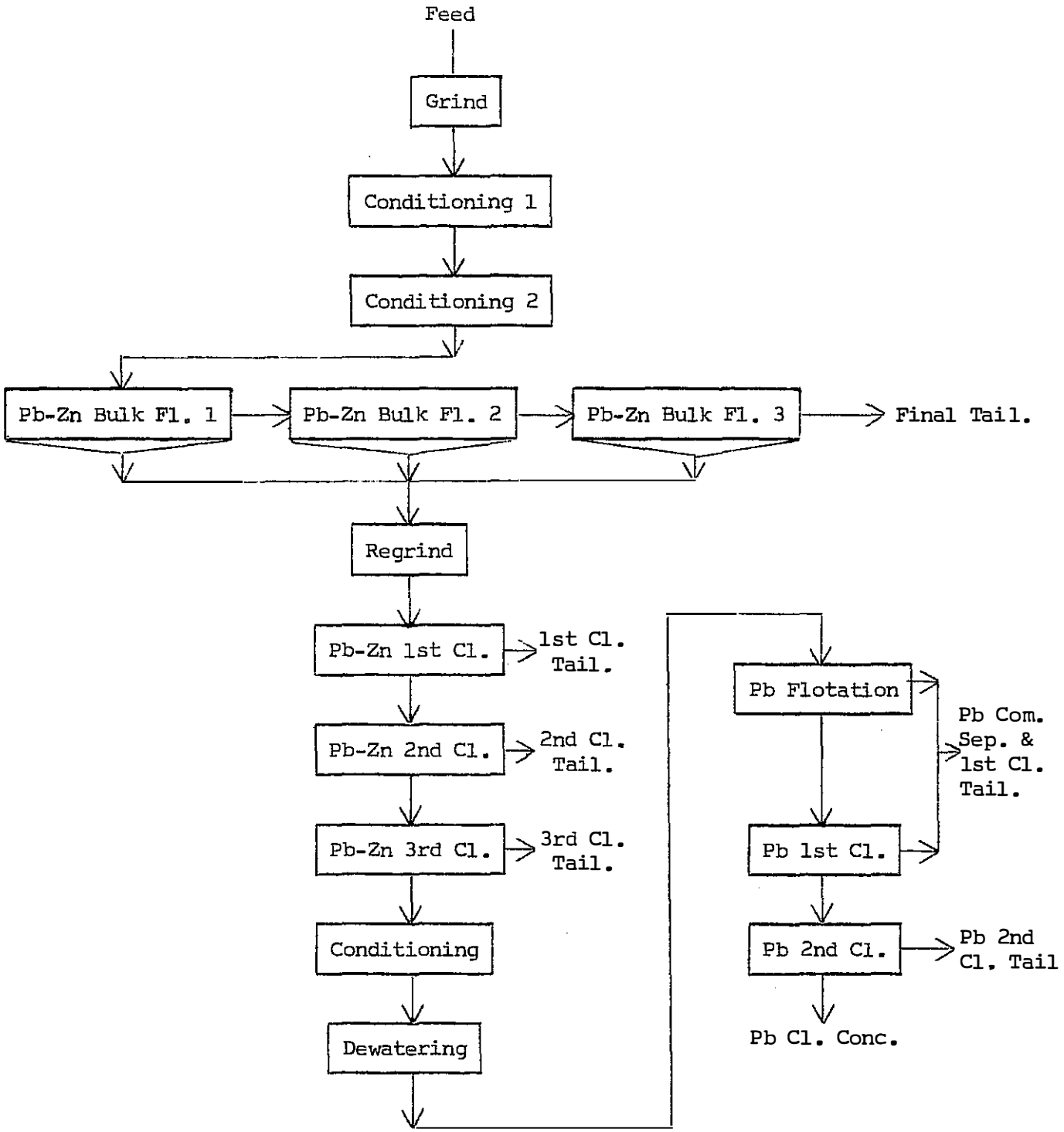
*mixture 1:1 **collector added 0.0073 lb/t/min.

Stage	Bulk Ro. Flot.	Bulk 1st-3rd Cl.	Pb-Zn Regrind	Pb Rougher
Equipment	1000 g D-2	1000 g D-2	Lab. Ball Mill G	1000 g D-2
Speed rpm	1700	1500	-	1500

Stage	Pb 1st & 2nd Cl.
Equipment	500 g D-2
Speed rpm	1200

Test No. 43 - Continued

Flowsheet



Test No. 43 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Concentrate	12.93	22.0	31.7	43.9	39.1
2. Pb 2nd Cl. Tailing	5.74	20.9	37.4	18.5	20.5
3. Pb 1st plus Sepr. Tail.	12.33	7.19	25.9	13.7	30.5
4. Pb-Zn Bulk 3rd Cl. Tail.	2.95	11.90	10.2	5.4	2.9
5. Pb-Zn Bulk 2nd Cl. Tail.	5.28	7.44	4.22	6.2	2.1
6. Pb-Zn Bulk 1st Cl. Tail.	22.68	2.37	1.18	8.2	2.6
7. Pb-Zn Bulk Rougher Tail.	38.09	0.70	0.64	4.1	2.3
Head (Calculated)	100.00	6.48	10.47	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	18.67	21.66	33.56	62.4	59.6
Products 1 to 3	31.00	15.90	30.45	76.1	90.1
Products 1 to 4	33.95	15.55	28.69	81.5	93.0
Products 1 to 5	39.23	14.46	25.39	87.7	95.1
Products 1 to 6	61.91	10.03	16.52	95.9	97.7
Products 6 and 7	60.77			12.3	4.9

Test No. 44

Purpose: To repeat Test 42, but add sodium silicate to the primary grind and lead regrind.

Procedure: As for Test No. 41.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na_2-SiO_3	Na_2-CO_3	$ZnSO_4$	NaCN	R-242	R-404	$Ca-(OH)_2$	Grind	Cond.	Froth	
Primary Grind	2.0	3.0	1.0	0.30	0.08	-	-	60	-	-	-
Pb Rougher	-	1.0	-	-	-	0.01	-	-	1	3	9.0
	-	-	-	-	0.02	0.01	-	-	1	3	-
	-	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Regrind	2.0	2.0	1.0	0.30	-	-	-	60	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	0.01	-	-	1	4	9.4
	-	-	-	-	0.01	0.01	-	-	1	4	-
Pb 2nd Cleaner	-	0.3	0.2	0.10	-	-	-	-	1	3	9.4
	-	-	-	-	0.005	0.005	-	-	1	3	-
Pb 3rd Cleaner	-	-	0.1	0.05	-	-	0.6	-	1	4	10.4
Pb 4th Cleaner	-	-	-	0.05	-	-	-	-	1	3	10.7

Test No. 44 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.79	53.5	13.7	47.4	7.7
2. Pb 4th Cl. Tail.	4.58	30.5	19.2	21.4	8.5
3. Pb 3rd Cl. Tail.	5.07	15.4	20.8	11.9	10.2
4. Pb 2nd Cl. Tail.	8.28	5.38	17.6	6.8	14.1
5. Pb 1st Cl. Tail.	19.59	2.18	13.5	6.5	25.4
6. Pb Rougher Tail.	56.69	0.69	6.24	6.0	34.1
Head (Calculated)	100.00	6.54	10.4	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	10.37	43.3	16.1	68.8	16.2
Products 1 to 3	15.44	34.2	17.7	80.7	26.4
Products 1 to 4	23.72	24.1	17.6	87.5	40.5
Products 1 to 5	43.31	14.2	15.8	94.0	65.9

Test No. 45

Purpose: To investigate the effect of using $Na_2S_2O_5$ and $Ca(OH)_2$ as sphalerite and pyrite depressants on the grade and recovery of lead.

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

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	$Ca(OH)_2$	$Na_2S_2O_5$	NaCN	Z-4	MIBC	Z-6	$ZnSO_4$	Grind	Cond.	Froth	
Grind	1.5	2.0	0.4	0.05	-	-	-	30	-	-	-
Pb Rougher	0.4	-	-	-	0.02	-	-	-	1	3	10.0
	-	-	-	0.025	-	-	-	-	1	3	-
	0.25	-	-	-	0.01	0.01	-	-	1	3	10.0
	-	-	-	-	0.02	0.02	-	-	1	3	-
Pb Ro. Regrind	1.5	1.0	0.20	0.025	-	-	0.60	30	-	-	-
Pb 1st Cleaner	-	-	-	-	-	-	-	-	1	1	10.6
	-	-	-	0.02	-	-	-	-	1	1	-
	-	-	-	-	-	0.02	-	-	1	2	-
	-	-	-	-	-	0.01	-	-	1	2	-
	-	-	-	-	-	0.005	-	-	1	2	-
Pb 2nd Cleaner	0.20	-	0.20	-	-	0.005	-	-	5	2	11.3
	-	-	-	-	-	0.010	-	-	1	3	-
Pb 3rd Cleaner	0.20	-	0.20	-	-	-	-	-	5	-	11.5

Stage	Rougher	Pb Regrind	Pb 1st & 2nd Cl.	Pb 3rd Cl.
Equipment	1000 g D-1	Lab. Ball Mill	500 g D-1	250 g D-1
Speed rpm	1800	-	1200	1000

Test No. 45 - Continued

Metallurgical Results

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb 3rd Cl. Conc.	15.69	26.6	27.2	62.8	40.5
2. Pb 3rd Cl. Tail.	1.56	22.4	15.3	5.3	2.3
3. Pb 2nd Cl. Tail.	8.31	12.1	19.3	15.1	15.2
4. Pb 1st Cl. Tail.	14.60	3.58	11.8	7.9	16.4
5. Pb Rougher Tail.	59.84	0.99	4.50	8.9	25.6
Head (Calculated)	100.00	6.64	10.5	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	17.25	26.2	26.1	68.1	42.8
Products 1 to 3	25.56	21.6	23.9	83.2	58.0
Products 1 to 4	40.16	15.1	19.5	91.1	74.4

Test No. 46

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

Procedure: Grind and float 3 rougher concentrates.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes		pH
	$Ca(OH)_2$	$Na_2S_2O_5$	Na_2S	Z-6	MIBC	Cond.	Froth	
Grind	2.5	2.0	0.5	0.05	-	-	-	-
Pb Rougher (1)	0.2	-	-	0.02	0.02	1	3	10.5
(2)	-	-	-	0.02	0.01	1	3	-
(3)	-	-	-	0.01	0.01	1	3	-

Stage Rougher
Flotation Cell 1000 g D-1
Speed rpm 1800

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	12.59	27.4	20.7	51.0	24.6
2. Pb Conc. No. 2	14.91	13.4	20.0	29.5	28.1
3. Pb Conc. No. 3	10.15	6.32	15.5	9.5	14.8
4. Pb Ro. Tail.	62.35	1.09	5.52	10.0	32.5
Head (Calculated)	100.00	6.77	10.6	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	27.50	19.8	20.3	80.5	52.7
Products 1 to 3	37.65	16.2	19.0	90.0	67.5

Test No. 46 - Continued

Size Analysis - Composite Ball Mill

Particle Size	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 150 mesh	1.4	1.4	98.6
200	7.4	8.8	91.2
270	10.1	18.9	81.1
32.6 µm	15.6	34.5	65.5
25.3	10.0	44.5	55.5
17.6	11.6	56.1	43.9
12.1	12.0	68.1	31.9
9.4	6.4	74.5	25.5
- 9.4	25.5	100.0	-
Total	100.0	-	-

Specific Gravity = 4.04

Test No. 47

Purpose: To repeat Test No. 42, but increase the regrind time to 90 minutes.

Procedure: As for Test No. 41.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	5.0	1.0	0.30	0.08	-	-	60	-	-	-
Pb Rougher	-	-	-	-	0.01	-	-	1	3	9.1
	-	-	-	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	-	-	90	-	-	-
Pb 1st Cleaner	-	-	-	0.02	0.01	-	-	1	4	9.5
	-	-	-	0.01	0.01	-	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	9.5
	-	-	-	0.005	0.005	-	-	1	3	-
Pb 3rd Cleaner	-	-	0.05	-	-	0.6	-	1	4	10.6
Pb 4th Cleaner	-	-	0.05	-	-	0.5	-	1	3	10.9

Stage Regrind
Equipment Lab. Rod Mill

Test No. 47 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	2.97	63.0	10.7	28.6	3.1
2. Pb 4th Cl. Tail.	4.95	45.5	15.7	34.4	7.5
3. Pb 3rd Cl. Tail.	5.39	19.4	21.1	16.0	10.9
4. Pb 2nd Cl. Tail.	8.61	5.27	16.5	6.9	13.7
5. Pb 1st Cl. Tail.	17.38	2.69	14.3	7.1	23.9
6. Pb Rougher Tail.	60.70	0.76	7.01	7.0	40.9
Head (Calculated)	100.00	6.55	10.4	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.92	52.1	13.8	63.0	10.6
Products 1 to 3	13.31	38.8	16.8	79.0	21.5
Products 1 to 4	21.92	25.7	16.7	85.9	35.2
Products 1 to 5	39.30	15.5	15.6	93.0	59.1

Size Analysis - Regrind Mill Discharge

Particle Size	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 16.5 µm	0.8	0.8	99.2
11.3	8.6	9.4	90.6
8.8	13.8	23.2	76.8
- 8.8	76.8	100.0	-
Total	100.0	-	-

Specific Gravity = 4.56

Test No. 48

Purpose: To repeat Tests No. 42 and 47, but increase the regrind time to 120 minutes.

Procedure: As for Test No. 41.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	5.0	1.0	0.30	0.08	-	-	60	-	-	-
Pb Rougher	-	-	-	-	0.01	-	-	1	3	9.1
	-	-	-	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	0.06	-	-	120	-	-	-
Pb 1st Cleaner	-	-	-	-	-	-	-	1	4	9.3
	-	-	-	-	0.01	-	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	9.4
	-	-	-	0.005	0.005	-	-	1	3	-
Pb 3rd Cleaner	-	-	0.05	-	-	0.6	-	1	4	10.4
Pb 4th Cleaner	-	-	0.05	-	-	0.5	-	1	3	10.7

Stage Regrind
Equipment Laboratory Rod Mill

Test No. 48 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	4.20	60.7	11.06	38.4	4.4
2. Pb 4th Cl. Tail.	4.39	39.1	17.0	25.9	7.1
3. Pb 3rd Cl. Tail.	5.73	16.5	20.6	14.3	11.2
4. Pb 2nd Cl. Tail.	9.82	4.50	16.2	6.7	15.1
5. Pb 1st Cl. Tail.	16.25	2.95	14.2	7.2	21.9
6. Pb Rougher Tail.	59.61	0.84	7.14	7.5	40.3
Head (Calculated)	100.00	6.63	10.5	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.59	49.7	14.1	64.3	11.5
Products 1 to 3	14.32	36.4	16.7	78.6	22.7
Products 1 to 4	24.14	23.4	16.5	85.3	37.8
Products 1 to 5	40.39	15.2	15.6	92.5	59.7

Size Analysis - Regrind Mill Discharge

Particle Size	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 30.2 µm	0.5	0.5	99.5
23.5	0.7	1.2	98.8
16.4	2.0	3.2	96.8
11.3	8.6	11.8	88.2
8.7	10.8	22.6	77.4
- 8.7	77.4	100.0	-
Total	100.0	-	-

Specific Gravity = 4.55

Test No. 49

Purpose: To investigate the effect of a two-stage regrind.

Procedure: Grind and float a lead rougher concentrate. Regrind the rougher concentrate and clean twice. Regrind the 2nd cleaner concentrate and clean three more times.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	Ca-$(OH)_2$	Grind	Cond.	Froth	
Primary Grind	5.0	1.0	0.30	0.08	-	-	60	-	-	-
Pb Rougher	-	-	-	-	0.01	-	-	1	3	9.2
	-	-	-	0.02	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 1st Regrind	2.0	1.0	0.30	0.05	-	-	60	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	4	9.4
	-	-	-	0.005	0.01	-	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	9.4
	-	-	-	0.005	0.005	-	-	1	3	-
Pb 2nd Regrind	1.0	0.5	0.15	0.02	-	-	30	-	-	-
Pb 3rd Cleaner	-	-	-	-	0.005	-	-	1	3	9.5
	-	-	-	0.005	0.005	-	-	1	3	-
Pb 4th Cleaner	-	-	0.05	-	-	0.5	-	1	5	10.4
Pb 5th Cleaner	-	-	0.05	-	-	0.3	-	1	4	10.8

Stage	Pb Rougher	Pb 1st Regrind	Pb 1st - 4th Cl.	Pb 2nd Regrind
Equipment	1000 g D-1	Lab. Rod Mill	500 g D-1	Lab. Rod Mill
Speed rpm	1800	-	1300	-
% Solids	33	-	-	-

Stage	Pb 5th Cl.
Equipment	250 g D-1
Speed rpm	1000

Test No. 49 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.68	69.2	8.68	59.0	4.7
2. Pb 5th Cl. Tail.	1.70	41.8	17.4	10.7	2.8
3. Pb 4th Cl. Tail.	3.30	23.0	22.2	11.4	7.1
4. Pb 3rd Cl. Tail.	5.46	7.24	23.8	5.9	12.5
5. Pb 2nd Cl. Tail.	5.38	3.79	18.1	3.1	9.4
6. Pb 1st Cl. Tail.	18.27	1.22	13.6	3.3	23.9
7. Pb Rougher Tail.	60.21	0.73	6.82	6.6	39.6
Head (Calculated)	100.00	6.66	10.4	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.38	62.9	10.7	69.7	7.5
Products 1 to 3	10.68	50.6	14.2	81.1	14.6
Products 1 to 4	16.14	35.9	17.5	87.0	27.1
Products 1 to 5	21.52	27.9	17.6	90.1	36.5
Products 1 to 6	39.79	15.6	15.8	93.4	60.4

Size Analysis - 2nd Regrind Mill Discharge

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 27.7 µm	0.7	0.7	99.3
21.5	0.9	1.6	98.4
15.0	1.9	3.5	96.5
10.3	4.5	8.0	92.0
8.0	7.6	15.6	84.4
- 8.0	84.4	100.0	-
Total	100.0	-	-

Specific Gravity = 5.35

Test No. 50

Purpose: To investigate the effect of filtering and washing the ore after grinding on the flotation of lead.

Procedure: Grind a charge of ore, filter and wash. Repulp the filter-cake with fresh water, condition and float a series of lead concentrates.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes		pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	MIBC	Cond.	Froth	
Primary Grind	-	-	-	-	-	-	-	-	-
Filter the ground pulp, wash and repulp.									
Condition	3.0	1.0	0.30	-	-	-	5	-	9.4
Pb Ro. Conc. No. 1	-	-	-	0.05	0.02	0.03	1	3	-
Pb Ro. Conc. No. 2	-	-	-	0.01	0.01	-	1	3	-
Pb Ro. Conc. No. 3	-	-	-	0.02	0.01	-	1	3	-

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	15.65	15.9	17.5	37.5	25.7
2. Pb Ro. Conc. No. 2	15.45	16.9	21.1	39.4	30.6
3. Pb Ro. Conc. No. 3	18.88	6.47	15.8	18.4	28.0
4. Pb Rougher Tailing	50.02	0.62	3.32	4.7	15.7
Head (Calculated)	100.00	6.63	10.6	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	31.10	16.4	19.3	76.9	56.3
Products 1 to 3	49.98	12.6	18.0	95.3	84.3

Test No. 51

Purpose: To study the effect of $FeSO_4$ additions in the lead flotation circuit.

Procedure: As indicated below.

Feed: 2000 grams minus 10 mesh Sample B.

Grind: 40 minutes at 65 percent solids in a laboratory ball mill 'B'.

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na_2CO_3	Sod. Sil.	$FeSO_4$	Na_2S	NaCN	Z-6/Z-3	AF-77	Grind	Cond.	Froth	
Grind	3.0	2.0	-	2.6	-	-	-	40	-	-	9.8
Conditioning (1)	1.0	-	1.0	-	-	-	-	-	5	-	10.1
(2)	-	-	-	-	0.3	-	-	-	3	-	-
Pb Rougher (1)	-	-	-	-	-	0.1	0.01	-	2	5	-
(2)	-	-	-	-	-	0.01	-	-	2	5	-
(3)	-	-	-	-	-	0.01	-	-	2	3	-
Combined Ro. Conc. 1 to 3 for regrind and cleaning.											
Regrind	1.0	-	-	0.5	-	-	-	30	-	-	10.0
						Z-3					
Conditioning	-	1.0	0.5	-	0.5	-	-	-	5	-	-
Pb 1st Cl. (1)	-	-	-	-	-	0.001	0.01	-	2	5	10.0
(2)	-	-	-	-	-	-	-	-	2	4	10.0
Pb 2nd Cleaner	0.2	0.5	0.2	-	0.2	-	-	-	5	8	10.0
Pb 3rd Cleaner	0.1	0.02	0.1	-	0.05	-	-	-	5	6	10.0

Stage	Pb Rougher	Pb 1st & 2nd Cl.	Pb 3rd Cl.	Pb Ro. Conc. Regrind
Equipment	1000 g D-2	500 g D-2	250 g D-2	Lab. Ball Mill 'G'
Speed rpm	1500	1200	900	-

Test No. 51 - Continued

Metallurgi al Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	9.01	30.5	20.4	42.5	17.5
2. Pb 3rd Cl. Tail.	2.26	16.9	23.5	5.9	5.1
3. Pb 2nd Cl. Tail.	4.67	16.9	20.5	12.2	9.1
4. Pb 1st Cl. Tail.	20.08	9.15	18.9	28.4	36.2
5. Pb Rougher Tail.	63.98	1.11	5.24	11.0	32.1
Head (Calculated)	100.00	6.47	10.5	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	11.27	27.8	21.0	48.4	22.6
Products 1 to 3	15.94	24.6	20.9	60.6	31.7
Products 1 to 4	36.02	16.0	19.8	89.0	67.9

Test No. 52

Purpose: To investigate the effect of extra depressants on the flotation of lead.

Procedure: Grind and float a series of lead rougher concentrates.

Feed: 2000 grams minus 10 mesh PP sample B.

Grind: 60 minutes at 65 percent solids in the laboratory ball mill containing 28 lb. steel balls.

Conditions:

Stage	Reagents Added, pounds per ton						Time, min.		pH
	Na_2CO_3	Na_2SO_3	NaCN	$ZnSO_4$	R-242	R-404	Cond.	Froth	
Primary Grind	5.0	4.0	0.50	2.0	0.08	-	-	-	-
Pb Ro. Conc. No. 1	2.0	-	-	-	-	0.02	1	3	9.8
Pb Ro. Conc. No. 2	-	-	-	-	0.01	0.01	1	3	-
Pb Ro. Conc. No. 3	-	-	-	-	0.01	0.01	1	3	-
Pb Ro. Conc. No. 4	-	-	-	-	0.02	-	1	3	-

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	15.50	29.3	18.2	68.3	26.4
2. Pb Ro. Conc. No. 2	11.71	9.57	18.3	16.9	20.1
3. Pb Ro. Conc. No. 3	7.23	4.80	15.1	5.2	10.2
4. Pb Ro. Conc. No. 4	5.24	2.96	12.5	2.3	6.1
5. Pb Rougher Tailing	60.32	0.80	6.59	7.3	37.2
Head (Calculated)	100.00	6.65	10.7	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	27.21	20.8	18.2	85.2	46.5
Products 1 to 3	34.44	17.4	17.6	90.4	56.7
Products 1 to 4	39.68	15.5	16.9	92.7	62.8

Test No. 52 - Continued

Size Analysis - 60 Minute Grind

Particle Size	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 200 mesh	0.9	0.9	99.1
270	2.6	3.5	96.5
33.1 µm	13.5	17.0	83.0
25.6	8.5	25.5	74.5
17.9	13.6	39.1	60.9
12.3	16.1	55.2	44.8
9.5	8.7	63.9	36.1
- 9.5	36.1	100.0	-
Total	100.0	-	-

Specific Gravity = 3.98

Test No. 53

Purpose: To repeat Test No. 52, but with a finer grind.

Procedure: As for Test No. 52.

Feed: 2000 grams minus 10 mesh PP sample B.

Grind: 60 minutes at 65 percent solids in the laboratory ball mill containing 40 pounds steel balls.

Conditions:

Stage	Reagents Added, pounds per ton						Time, min.		pH
	Na_2CO_3	Na_2SO_3	$ZnSO_4$	NaCN	R-242	R-404	Cond.	Froth	
Primary Grind	5.0	4.0	2.0	0.50	0.08	-	-	-	-
Pb Ro. Conc. No. 1	2.0	-	-	-	-	0.02	1	3	9.8
Pb Ro. Conc. No. 2	-	-	-	-	0.01	0.01	1	3	-
Pb Ro. Conc. No. 3	-	-	-	-	0.01	0.01	1	3	-
Pb Ro. Conc. No. 4	-	-	-	-	0.02	-	1	3	-

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	14.29	30.3	17.1	65.1	23.4
2. Pb Ro. Conc. No. 2	9.60	12.0	18.4	17.3	16.9
3. Pb Ro. Conc. No. 3	6.45	6.56	16.3	6.4	10.1
4. Pb Ro. Conc. No. 4	6.41	3.53	13.2	3.4	8.1
5. Pb Rougher Tailing	63.25	0.82	6.87	7.8	41.5
Head (Calculated)	100.00	6.65	10.5	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	23.89	22.9	17.6	82.4	40.3
Products 1 to 3	30.34	19.5	17.3	88.8	50.4
Products 1 to 4	36.75	16.7	16.6	92.2	58.5

Test No. 53 - Continued

Size Analysis - 60 Minute Large Mill

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 270 mesh	1.4	1.4	98.6
33.1 µm	7.9	9.3	90.7
25.6	7.8	17.1	82.9
17.9	13.2	30.3	69.7
12.3	17.4	47.7	52.3
9.5	10.0	57.7	42.3
- 9.5	42.3	100.0	-
Total	100.0	-	-

Specific Gravity = 3.99

Test No. 56

Purpose: To investigate the effect of a three-stage regrind.

Procedure: Grind and float a lead rougher concentrate. Regrind the rougher concentrate and clean twice. Regrind the 1st cleaner concentrate and clean a 2nd and 3rd time. Regrind the 3rd cleaner concentrate and clean twice more.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	Grind	Cond.	Froth	
Primary Grind	5.0	1.0	0.30	0.08	-	60	-	-	-
Pb Rougher	-	-	-	-	0.01	-	1	3	9.2
	-	-	-	0.02	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
Pb 1st Regrind	2.0	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	1.0	0.75	0.20	0.03	-	30	-	-	-
Pb 2nd Cleaner	-	-	-	-	0.005	-	1	4	9.5
	-	-	-	0.005	0.005	-	1	3	-
Pb 3rd Cleaner	0.3	0.2	0.05	-	-	-	1	3	9.6
	-	-	-	0.005	-	-	1	3	-
Pb 3rd Regrind	1.0	0.5	0.10	0.02	-	15	-	-	-
Pb 4th Cleaner	-	-	-	-	0.005	-	1	3	9.6
	-	-	-	0.005	0.005	-	1	3	-
Pb 5th Cleaner	0.3	0.1	0.05	-	-	-	1	2	9.7
	-	-	-	0.003	-	-	1	2	-
Pb 6th Cleaner	0.4	-	0.10	-	-	-	1	3	9.8

Stage: Pb Regrind
Equipment: Lab. Rod Mill

Test No. 56 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	4.50	72.2	6.18	51.1	2.7
2. Pb 6th Cl. Tail.	1.98	52.8	13.0	16.4	2.5
3. Pb 5th Cl. Tail.	2.01	31.9	20.0	10.1	3.9
4. Pb 4th Cl. Tail.	2.64	14.6	24.9	6.1	6.4
5. Pb 3rd Cl. Tail.	3.37	6.25	23.0	3.3	7.5
6. Pb 2nd Cl. Tail.	7.22	2.75	20.2	3.1	14.1
7. Pb 1st Cl. Tail.	17.88	1.21	14.0	3.4	24.3
8. Pb Rougher Tail.	60.40	0.69	6.60	6.5	38.6
Head (Calculated)	100.00	6.36	10.3	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.48	66.3	8.26	67.5	5.2
Products 1 to 3	8.49	58.1	11.0	77.6	9.1
Products 1 to 4	11.13	47.8	14.3	83.7	15.5
Products 1 to 5	14.50	38.1	16.3	87.0	23.0
Products 1 to 6	21.72	26.4	17.6	90.1	37.1
Products 1 to 7	39.60	15.0	16.0	93.5	61.4

Size Analysis - 3rd Regrind Mill Discharge

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
*+ 26.9 µm	0.2	0.2	99.8
* 20.9	0.6	0.8	99.2
* 14.6	1.2	2.0	98.0
10.0	2.2	4.2	95.8
7.7	4.0	8.2	91.8
- 7.7	91.8	100.0	-
Total	100.0	-	-

Specific Gravity = 5.65

*combined for assay

Test No. 57

Purpose: To investigate the effect of substituting NH_4OH for Na_2CO_3 on lead rougher flotation.

Procedure: Grind and float a series of lead rougher concentrates.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes		pH
	NH_4OH	$ZnSO_4$	NaCN	R-242	R-404	Cond.	Froth	
Primary Grind	1.0	1.0	0.30	0.08	-	-	-	-
Pb Ro. Conc. No. 1	-	-	-	0.01	0.02	1	3	9.3
Pb Ro. Conc. No. 2	-	-	-	0.02	0.01	1	3	-
Pb Ro. Conc. No. 3	-	-	-	0.01	0.01	1	3	-

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	15.68	25.1	18.9	60.6	27.9
2. Pb Ro. Conc. No. 2	15.85	10.8	18.6	26.4	27.8
3. Pb Ro. Conc. No. 3	8.33	4.45	14.1	5.7	11.1
4. Pb Rougher Tailing	60.14	0.79	5.87	7.3	33.2
Head (Calculated)	100.00	6.49	10.6	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	31.53	17.9	18.7	87.0	55.7
Products 1 to 3	39.86	15.1	17.8	92.7	66.8

Test No. 58

Purpose: To reduce grinding times by reducing the size of the test charge.

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

Feed: 500 grams minus 10 mesh PP sample B.

Grind: 20 minutes at 65 percent solids in the laboratory rod mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	Grind	Cond.	Froth	
Primary Grind	4.0	1.0	0.30	0.08	-	20	-	-	-
Pb Rougher	2.0	-	-	-	0.01	-	1	3	9.1
	-	-	-	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	-	15	-	-	-
Pb 1st Cleaner	0.5	-	-	-	0.01	-	1	4	9.3
	-	-	-	0.01	0.01	-	1	4	-
Pb 2nd Cleaner	0.4	0.2	0.10	-	-	-	1	3	9.3
	-	-	-	0.005	0.005	-	1	3	-
Pb 3rd Cleaner	0.4	0.1	0.05	-	-	-	1	4	9.4
Pb 4th Cleaner	0.4	-	0.05	-	-	-	1	3	9.5

Stage	Pb Rougher	Pb Regrind	Pb Cleaners
Equipment	500 g D-1	Lab. Rod Mill	250 g D-1
Speed rpm	1300	-	1000
% Solids	18	-	-

Test No. 58 - Continued

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.77	52.8	12.9	56.2	8.5
2. Pb 4th Cl. Tail.	4.35	26.8	19.1	18.3	8.1
3. Pb 3rd Cl. Tail.	3.97	11.6	18.7	7.2	7.2
4. Pb 2nd Cl. Tail.	7.47	3.93	15.9	4.6	11.6
5. Pb 1st Cl. Tail.	23.74	1.54	12.4	5.7	28.7
6. Pb Rougher Tail.	53.70	0.95	6.84	8.0	35.9
Head (Calculated)	100.00	6.37	10.3	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	11.12	42.6	15.3	74.5	16.6
Products 1 to 3	15.09	34.5	16.2	81.7	23.8
Products 1 to 4	22.56	24.4	16.1	86.3	35.4
Products 1 to 5	46.30	12.7	14.2	92.0	64.1

Test No. 61

Purpose: To investigate the effect of aeration after grinding with depressants.

Procedure: Grind, aerate and float a series of lead concentrates.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes		pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	-	-	-	-	-
Aeration	-	-	-	-	-	30	-	8.8-8.4
Pb Ro. Conc. No. 1	1.0	-	-	0.05	0.02	1	3	9.2
Pb Ro. Conc. No. 2	-	-	-	0.02	0.01	1	3	-
Pb Ro. Conc. No. 3	-	-	-	0.01	0.01	1	3	-

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	15.70	28.6	17.4	67.0	25.8
2. Pb Ro. Conc. No. 2	10.35	10.1	17.4	15.6	17.0
3. Pb Ro. Conc. No. 3	6.67	5.51	15.1	5.5	9.5
4. Pb Rougher Tailing	67.28	1.18	7.50	11.9	47.7
Head (Calculated)	100.00	6.70	10.6	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	26.05	21.2	17.4	82.6	42.8
Products 1 to 3	32.72	18.0	16.9	88.1	52.3

Test No. 62

Purpose: To investigate the effect of grinding with SO_2 followed by aeration and raising the pH to 9 with $Ca(OH)_2$.

Procedure: Grind, aerate, condition with lime and float a series of lead concentrates.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes		pH
	SO_2	$Ca(OH)_2$	R-242	R-404	AX325	Cond.	Froth	
Primary Grind	2.0	-	-	-	-	-	-	-
Aeration	-	-	-	-	-	15	-	7.2-6.3
Condition	-	1.5	-	-	-	2	-	9.2
Pb Ro. Conc. No. 1	-	-	0.05	0.02	-	1	3	-
Pb Ro. Conc. No. 2	-	-	0.02	0.01	-	1	3	-
Pb Ro. Conc. No. 3	-	-	-	-	0.02	1	3	-

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	10.05	21.7	14.3	33.1	14.0
2. Pb Ro. Conc. No. 2	9.93	18.3	17.0	27.6	16.4
3. Pb Ro. Conc. No. 3	3.92	12.0	15.9	7.1	6.1
4. Pb Rougher Tailing	76.10	2.78	8.60	32.2	63.5
Head (Calculated)	100.00	6.58	10.3	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	19.98	20.0	15.6	60.7	30.4
Products 1 to 3	23.90	18.7	15.7	67.8	36.5

Test No. 63

Purpose: To repeat the standard lead rougher procedure, but substitute ethyl xanthate for 242.

Procedure: Grind and float a series of rougher concentrates.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes		pH
	Na_2CO_3	$ZnSO_4$	NaCN	AX-325	R-404	MIBC	Cond.	Froth	
Grind	5.0	1.0	0.30	0.07	-	-	-	-	-
Pb Ro. Conc. No. 1	-	-	-	-	0.02	0.02	1	3	9.0
Pb Ro. Conc. No. 2	-	-	-	0.02	0.01	0.01	1	3	-
Pb Ro. Conc. No. 3	-	-	-	0.01	0.01	0.005	1	3	-
Pb Ro. Conc. No. 4	-	-	-	0.02	-	0.005	1	3	-

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	16.60	28.6	16.6	69.5	25.9
2. Pb Ro. Conc. No. 2	15.03	9.17	17.4	20.2	24.6
3. Pb Ro. Conc. No. 3	7.03	3.48	13.4	3.6	8.9
4. Pb Ro. Conc. No. 4	4.64	2.04	11.5	1.4	5.0
5. Pb Rougher Tailing	56.70	0.65	6.69	5.3	35.6
Head (Calculated)	100.00	6.83	10.6	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	31.63	19.4	17.0	89.7	50.5
Products 1 to 3	38.66	16.5	16.3	93.3	59.4
Products 1 to 4	43.30	14.9	15.8	94.7	64.4

Test No. 64

Purpose: To repeat Test No. 63, but use a mixture of xanthate and 242 as lead collector.

Procedure: As for Test No. 63.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton							Time, min.		pH
	Na_2CO_3	Zn-SO_4	NaCN	AX325	R-242	R-404	MIBC	Cond.	Froth	
Grind	5.0	1.0	0.30	0.04	0.04	-	-	-	-	-
Pb Ro. Conc. No. 1	-	-	-	-	-	0.02	0.01	1	3	9.3
Pb Ro. Conc. No. 2	-	-	-	0.01	0.01	-	0.005	1	3	-
Pb Ro. Conc. No. 3	-	-	-	0.01	0.01	-	-	1	3	-

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	18.53	27.1	17.6	74.4	31.1
2. Pb Ro. Conc. No. 2	13.17	7.61	16.4	14.8	20.6
3. Pb Ro. Conc. No. 3	6.61	3.44	13.2	3.4	8.3
4. Pb Rougher Tailing	61.69	0.81	6.81	7.4	40.0
Head (Calculated)	100.00	6.75	10.5	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	31.70	19.0	17.1	89.2	51.7
Products 1 to 3	38.31	16.3	16.4	92.6	60.0

Test No. 65

Purpose: To investigate the effect of adding all the collector to the mill and none to the cell.

Procedure: Grind and float a lead rougher concentrate.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes		pH
	Na_2CO_3	$ZnSO_4$	NaCN	AX325	R-242	R-404	Cond.	Froth	
Grind	5.0	1.0	0.30	0.07	0.07	0.04	-	-	-
Pb Rougher	-	-	-	-	-	-	1	9	9.4

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Rougher Conc.	33.2	18.4	17.2	89.7	54.6
2. Pb Rougher Tail.	66.8	1.05	7.10	10.3	45.4
Head (Calculated)	100.0	6.81	10.5	100.0	100.0

Test No. 66

Purpose: To repeat Test No. 49, but with a coarser primary grind and replace lime with soda ash in 4th and 5th Pb cleaners.

Procedure: As for Test No. 49.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	Grind	Cond.	Froth	
Primary Grind	4.0	1.0	0.30	0.06	-	30	-	-	-
Pb Rougher	-	-	-	-	0.01	-	1	3	9.0
	-	-	-	0.02	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
Pb 1st Regrind	2.0	1.0	0.30	0.05	-	60	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	1	4	9.3
	-	-	-	0.005	0.01	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	1	3	9.3
	-	-	-	0.005	0.005	-	1	3	-
Pb 2nd Regrind	1.0	0.5	0.15	0.02	-	30	-	-	-
Pb 3rd Cleaner	-	-	-	-	0.005	-	1	3	9.4
	-	-	-	0.005	0.005	-	1	3	-
Pb 4th Cleaner	0.3	0.2	0.05	-	-	-	1	5	9.5
Pb 5th Cleaner	0.2	-	0.05	-	-	-	1	4	9.6

Stage Pb Regrind
Equipment Rod Mill

Test No. 66 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.44	65.6	9.83	64.3	6.1
2. Pb 5th Cl. Tail.	1.62	31.6	21.3	7.8	3.3
3. Pb 4th Cl. Tail.	3.42	17.0	23.8	8.8	7.9
4. Pb 3rd Cl. Tail.	6.80	5.54	22.8	5.7	15.0
5. Pb 2nd Cl. Tail.	6.18	3.19	17.4	3.0	10.4
6. Pb 1st Cl. Tail.	18.91	1.08	12.9	3.1	23.5
7. Pb Rougher Tail.	56.63	0.84	6.20	7.3	33.8
Head (Calculated)	100.00	6.57	10.4	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.06	58.8	12.1	72.1	9.4
Products 1 to 3	11.48	46.3	15.6	80.9	17.3
Products 1 to 4	18.28	31.2	18.3	86.6	32.3
Products 1 to 5	24.46	24.1	18.1	89.6	42.7
Products 1 to 6	43.37	14.1	15.8	92.7	66.2

Size Analysis

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 29.6 µm	0.4	0.4	99.6
23.0	1.0	1.4	98.6
16.0	3.1	4.5	95.5
11.0	5.6	10.1	89.9
8.5	10.0	20.1	79.9
- 8.5	79.9	100.0	-
Total	100.0	-	-

Specific Gravity = 5.06

Test No. 67

Purpose: To investigate the effect of a finer primary grind.

Procedure: Grind and float a series of lead concentrates.

Feed: 2000 grams minus 10 mesh PP sample B.

Grind: 120 minutes at 60 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	Grind	Cond.	Froth	
Primary Grind	5.0	1.0	0.30	0.10	-	120	-	-	-
Pb Ro. Conc. No. 1	-	-	-	0.02	0.01	-	1	3	8.8
Pb Ro. Conc. No. 2	-	-	-	0.01	0.01	-	1	3	-
Pb Ro. Conc. No. 3	-	-	-	0.01	0.01	-	1	3	-

Metallurgical Results

Product	Weight	Assays %		% Distribution	
	%	Pb	Zn	Pb	Zn
1. Pb Ro. Conc. No. 1	15.97	19.6	13.8	46.7	21.0
2. Pb Ro. Conc. No. 2	16.39	16.0	17.9	39.2	28.0
3. Pb Ro. Conc. No. 3	9.77	5.00	14.4	7.3	13.4
4. Pb Ro. Conc. No. 4	6.09	2.39	11.7	2.2	6.8
5. Pb Rougher Tailing	51.78	0.60	6.21	4.6	30.8
Head (Calculated)	100.00	6.70	10.5	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	32.36	17.8	15.9	85.9	49.0
Products 1 to 3	42.13	14.8	15.5	93.2	62.4
Products 1 to 4	48.22	13.2	15.0	95.4	69.2

Test No. 67 - Continued

Size Analysis - Ball Mill - 120 Minute Grind - Sample B

Particle Size	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 270 mesh	0.3	0.3	99.7
33.7 µm	3.5	3.8	96.2
26.2	5.4	9.2	90.8
18.3	11.9	21.1	78.9
12.6	18.2	39.3	60.7
9.7	11.4	50.7	49.3
- 9.7	49.3	100.0	-
Total	100.0	-	-

Specific Gravity = 3.97

Test No. 68

Purpose: To repeat Test No. 49, but reduce the 1st regrind stage to 30 minutes grinding time.

Procedure: As for Test No. 49.

Feed: 2000 grams minus 10 mesh PP sample B (2nd sample).

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	$Ca(OH)_2$	Grind	Cond.	Froth	
Primary Grind	5.0	1.0	0.30	0.08	-	-	60	-	-	-
Pb Rougher	-	-	-	-	0.01	-	-	1	3	9.0
	-	-	-	0.02	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 1st Regrind	2.0	1.0	0.20	0.03	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	4	9.3
	-	-	-	0.01	0.01	-	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	-	1	3	9.4
	-	-	-	0.005	0.005	-	-	1	3	-
Pb 2nd Regrind	1.0	0.5	0.15	0.02	-	-	30	-	-	-
Pb 3rd Cleaner	-	-	-	-	0.005	-	-	1	3	9.2
	-	-	-	0.005	0.005	-	-	1	3	-
Pb 4th Cleaner	0.3	0.2	0.05	-	-	-	-	1	5	9.4
Pb 5th Cleaner	-	-	0.05	-	-	0.3	-	1	4	10.2

Stage Pb Regrind
Equipment Rod Mill

Test No. 68 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.68	61.0	11.7	70.0	8.8
2. Pb 5th Cl. Tail.	1.83	23.3	23.6	6.4	4.2
3. Pb 4th Cl. Tail.	3.75	12.9	23.5	7.2	8.6
4. Pb 3rd Cl. Tail.	6.89	3.79	20.6	3.9	13.8
5. Pb 2nd Cl. Tail.	5.24	3.36	16.5	2.6	8.4
6. Pb 1st Cl. Tail.	14.81	1.38	12.0	3.1	17.3
7. Pb Rougher Tail.	59.80	0.76	6.67	6.8	38.9
Head (Calculated)	100.00	6.69	10.3	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.51	53.7	14.0	76.4	13.0
Products 1 to 3	13.26	42.2	16.7	83.6	21.6
Products 1 to 4	20.15	29.1	18.0	87.5	35.4
Products 1 to 5	25.39	23.8	17.7	90.1	43.8
Products 1 to 6	40.20	15.5	15.6	93.2	61.1

Size Analysis

Particle Size	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 30.1 µm	0.2	0.2	99.8
23.4	0.4	0.6	99.4
16.3	2.4	3.0	97.0
11.2	8.8	11.8	88.2
8.7	13.5	25.3	74.7
- 8.7	74.7	100.0	-
Total	100.0	-	-

Specific Gravity = 4.95

Test No. 71

Purpose: To repeat Test No. 68, but reduce both primary grind and lead 1st regrind to 30 minutes each.

Procedure: As for Test No. 49.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	Grind	Cond.	Froth	
Primary Grind	4.0	1.0	0.30	0.06	-	30	-	-	-
Pb Rougher	1.0	-	-	-	0.01	-	1	3	9.3
	-	-	-	0.02	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
Pb 1st Regrind	2.0	1.0	0.20	0.03	-	30	-	-	-
Pb 1st Cleaner	-	-	-	0.005	0.01	-	1	5	9.3
	-	-	-	0.01	0.01	-	1	4	-
Pb 2nd Cleaner	0.3	0.2	0.10	-	-	-	1	4	9.3
	-	-	-	0.005	0.005	-	1	3	-
Pb 2nd Regrind	1.5	0.5	0.15	0.02	-	30	-	-	-
Pb 3rd Cleaner	-	-	-	-	0.005	-	1	4	9.4
	-	-	-	0.005	0.005	-	1	3	-
Pb 4th Cleaner	0.3	0.2	0.10	-	-	-	1	5	9.5
Pb 5th Cleaner	0.4	-	0.05	-	-	-	1	4	9.7

Stage Pb Regrinds
Equipment Laboratory Rod Mill

Test No. 71 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.36	54.8	14.2	61.0	10.1
2. Pb 5th Cl. Tail.	2.76	28.1	21.2	11.7	5.6
3. Pb 4th Cl. Tail.	4.02	13.2	22.5	8.0	8.7
4. Pb 3rd Cl. Tail.	8.09	4.47	19.2	5.5	15.0
5. Pb 2nd Cl. Tail.	5.89	3.48	16.9	3.1	9.6
6. Pb 1st Cl. Tail.	15.20	1.37	11.8	3.1	17.3
7. Pb Rougher Tail.	56.68	0.88	6.15	7.6	33.7
Head (Calculated)	100.00	6.61	10.4	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	10.12	47.5	16.1	72.7	15.7
Products 1 to 3	14.14	37.8	17.9	80.7	24.4
Products 1 to 4	22.23	25.6	18.4	86.2	39.4
Products 1 to 5	28.12	21.0	18.1	89.3	49.0
Products 1 to 6	43.32	14.1	15.9	92.4	66.3

Size Analysis - 3rd Cleaner Concentrate

Particle Size	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 39.6 µm	0.4	0.4	99.6
23.0	0.8	1.2	98.8
16.0	1.9	3.1	96.9
11.0	13.4	16.5	83.5
8.5	14.9	31.4	68.6
- 8.5	68.6	100.0	-
Total	100.0	-	-

Specific Gravity = 4.93

Test No. 72

Purpose: To repeat Test No. 49, but upstage the Pb 2nd regrind to the 1st cleaner concentrate and increase depressants to the 2nd regrind mill.

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

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	Grind	Cond.	Froth	
Primary Grind	5.0	1.0	0.30	0.08	-	60	-	-	-
Pb Rougher	-	-	-	-	0.01	-	1	3	9.0
	-	-	-	0.02	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
Pb 1st Regrind	2.0	1.0	0.30	0.05	-	60	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	1	4	9.2
	-	-	-	0.01	0.01	-	1	4	-
Pb 2nd Regrind	1.5	1.0	0.20	0.03	-	30	-	-	-
Pb 2nd Cleaner	-	-	-	-	0.005	-	1	4	9.3
	-	-	-	0.005	0.005	-	1	4	-
Pb 3rd Cleaner	0.3	0.2	0.10	-	-	-	2	3	9.4
	-	-	-	0.005	-	-	1	3	-
Pb 4th Cleaner	0.3	0.1	0.10	-	-	-	2	3	9.4
	-	-	-	0.003	-	-	1	2	-
Pb 5th Cleaner	0.3	-	0.05	-	-	-	2	4	9.5

Stage Pb Regrinds
Equipment Laboratory Rod Mill

Test No. 72 - Continued

Metallurgical Results

Product	Weight %	Assays %			% Distribution		
		Pb	Zn	Ag*	Pb	Zn	Ag
1. Pb Cleaner Conc.	7.18	65.3	10.3	21.48	70.2	7.1	51.1
2. Pb 5th Cl. Tail.	1.48	26.9	22.5	13.34	6.0	3.2	6.5
3. Pb 4th Cl. Tail.	2.75	17.4	24.8	9.60	7.2	6.5	8.7
4. Pb 3rd Cl. Tail.	4.01	6.34	22.2	4.39	3.8	8.5	5.8
5. Pb 2nd Cl. Tail.	7.75	2.42	18.9	2.57	2.8	14.0	6.6
6. Pb 1st Cl. Tail.	18.43	1.21	12.8	1.39	3.3	22.6	8.5
7. Pb Rougher Tail.	58.40	0.77	6.82	0.66	6.7	38.1	12.8
Head (Calculated)	100.00	6.68	10.5	3.02	100.0	100.0	100.0

*oz/ton

Calculated Grades and Recoveries

Products 1 and 2	8.66	58.7	12.4	20.09	76.2	10.3	57.6
Products 1 to 3	11.41	48.8	15.4	17.56	83.4	16.8	66.3
Products 1 to 4	15.42	37.7	17.2	14.14	87.2	25.3	72.1
Products 1 to 5	23.17	25.9	17.7	10.27	90.0	39.3	78.7
Products 1 to 6	41.60	15.0	15.5	6.34	93.3	61.9	87.2

Size Analysis

Particle Size	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 30.6 µm	1.4	1.4	98.6
23.7	1.0	2.4	97.6
16.6	2.2	4.6	95.4
11.4	7.3	11.9	88.1
8.8	7.4	19.3	80.7
- 8.8	80.7	100.0	-
Total	100.0	-	-

Specific Gravity = 4.75

Test No. 73

Purpose: To repeat Test No. 71, but add a third regrind stage.

Procedure: Grind and float a lead concentrate. Regrind the rougher concentrate and clean once. Regrind the first cleaner concentrate and clean a second and third time. Regrind the 3rd cleaner concentrate and clean three more times.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	Ca-$(OH)_2$	Grind	Cond.	Froth	
Primary Grind	4.0	1.0	0.30	0.06	-	-	30	-	-	-
Pb Rougher	1.0	-	-	-	0.01	-	-	1	3	9.2
	-	-	-	0.02	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 1st Regrind	2.0	1.0	0.20	0.03	-	-	30	-	-	-
Pb 1st Cleaner	-	-	-	0.005	0.01	-	-	1	5	9.4
	-	-	-	0.01	0.01	-	-	1	4	-
Pb 2nd Regrind	2.0	1.0	0.20	0.02	-	-	30	-	-	-
Pb 2nd Cleaner	-	-	-	-	0.005	-	-	1	4	9.4
	-	-	-	0.005	0.005	-	-	1	4	-
Pb 3rd Cleaner	0.3	0.2	0.10	-	-	-	-	1	4	9.4
	-	-	-	0.005	-	-	-	1	3	-
Pb 3rd Regrind	1.0	0.5	0.15	0.01	-	-	15	-	-	-
Pb 4th Cleaner	-	-	-	-	0.005	-	-	1	3	9.3
	-	-	-	0.005	-	-	-	1	3	-
Pb 5th Cleaner	0.3	0.2	0.10	-	-	-	-	1	5	9.4
Pb 6th Cleaner	-	-	0.05	-	-	0.2	-	1	4	10.0

Stage: Pb Regrinds
Equipment: Laboratory Rod Mill

Test No. 73 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.25	64.6	10.5	51.5	5.2
2. Pb 6th Cl. Tail.	1.74	38.4	19.4	10.1	3.2
3. Pb 5th Cl. Tail.	2.94	25.9	22.3	11.6	6.2
4. Pb 4th Cl. Tail.	4.69	12.5	23.4	8.9	10.4
5. Pb 3rd Cl. Tail.	4.46	5.40	20.8	3.7	8.8
6. Pb 2nd Cl. Tail.	10.35	2.35	16.0	3.7	15.6
7. Pb 1st Cl. Tail.	17.27	1.19	11.4	3.1	18.5
8. Pb Rougher Tail.	53.30	0.92	6.38	7.4	32.1
Head (Calculated)	100.00	6.59	10.6	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.99	58.1	12.7	61.6	8.4
Products 1 to 3	9.93	48.6	15.6	73.2	14.6
Products 1 to 4	14.62	37.0	18.1	82.1	25.0
Products 1 to 5	19.08	29.6	18.7	85.8	33.8
Products 1 to 6	29.43	20.0	17.8	89.5	49.4
Products 1 to 7	46.70	13.1	15.4	92.6	67.9

Size Analysis Pb Conc?

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 28.6 µm	0.1	0.1	99.9
22.2	0.4	0.5	99.5
15.5	1.8	2.3	97.7
10.6	7.2	9.5	90.5
8.2	13.2	22.7	77.3
- 8.2	77.3	100.0	-
Total	100.0	-	-

Specific Gravity = 5.23

Test No. 75

Purpose: To repeat Test No. 72, but substitute lime for soda ash in the lead cleaners.

Procedure: As for Test No. 72, but combine the lead rougher and lead 1st cleaner tailing and float a zinc concentrate. Clean the zinc concentrate three times.

Feed: 2000 grams minus 10 mesh PP sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	Ca-$(OH)_2$	Grind	Cond.	Froth	
Primary Grind	5.0	1.0	0.30	0.08	-	-	60	-	-	-
Pb Circuit										
Pb Rougher	-	-	-	-	0.01	-	-	1	3	9.2
	-	-	-	0.02	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 1st Regrind	-	1.0	0.30	0.05	-	1.0	60	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	-	1	4	9.7
	-	-	-	0.01	0.01	-	-	1	4	-
Pb 2nd Regrind	-	0.5	0.20	0.03	-	0.5	30	-	-	-
Pb 2nd Cleaner	-	-	-	-	0.005	-	-	1	4	9.6
	-	-	-	0.005	0.005	-	-	1	4	-
Pb 3rd Cleaner	-	0.2	0.10	-	-	0.2	-	1	3	10.0
	-	-	-	0.005	-	-	-	1	3	-
Pb 4th Cleaner	-	0.1	0.10	-	-	0.1	-	1	3	10.2
	-	-	-	0.003	-	-	-	1	2	-
Pb 5th Cleaner	-	-	0.05	-	-	0.05	-	1	4	10.3
				Z-200	$CuSO_4$					
Zn Circuit (Pb rougher tailing + Pb 1st cleaner tailing)										
Condition	-	-	-	-	1.5	2.0	-	2	-	10.4
Zn Rougher	-	-	-	0.06	-	-	-	1	4	-
	-	-	-	0.02	-	-	-	1	3	-
Zn 1st Cleaner	-	-	-	-	-	0.4	-	1	3	11.0
	-	-	-	0.005	-	-	-	1	2	-
Zn 2nd Cleaner	-	-	-	-	-	0.2	-	1	4	11.1
Zn 3rd Cleaner	-	-	-	-	-	0.2	-	1	3	11.2

Stage Pb Regrinds
Equipment Laboratory Rod Mill

Test No. 75 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.24	65.3	9.76	63.5	5.9
2. Pb 5th Cl. Tail.	1.70	30.9	21.7	8.2	3.6
3. Pb 4th Cl. Tail.	2.33	19.2	22.5	7.0	5.1
4. Pb 3rd Cl. Tail.	3.30	7.34	21.2	3.8	6.8
5. Pb 2nd Cl. Tail.	9.15	3.21	17.8	4.5	15.8
6. Zn Cleaner Conc.	7.00	1.61	55.2	1.7	37.7
7. Zn 3rd Cl. Tail.	2.52	2.73	35.7	1.1	8.8
8. Zn 2nd Cl. Tail.	3.96	2.83	17.3	1.7	6.7
9. Zn 1st Cl. Tail.	8.63	1.85	5.33	2.5	4.5
10. Zn Rougher Tail.	55.17	0.70	0.95	6.0	5.1
Head (Calculated)	100.00	6.42	10.3	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.94	57.9	12.3	71.7	9.5
Products 1 to 3	10.27	49.1	14.6	78.7	14.6
Products 1 to 4	13.57	39.0	16.2	82.5	21.4
Products 1 to 5	22.72	24.6	16.9	87.0	37.2
Products 6 and 7	9.52	1.91	50.0	2.8	46.5
Products 6 to 8	13.48	2.18	40.4	4.5	53.2
Products 6 to 9	22.11	2.05	26.7	7.0	57.7

Test No. 76

Purpose: To repeat Test No. 72, but regrind in the ball mill.

Procedure: As for Test No. 72.

Feed: 2000 grams minus 10 mesh Sample B.

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

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na_2CO_3	$ZnSO_4$	NaCN	R-242	R-404	Grind	Cond.	Froth	
Primary Grind	5.0	1.0	0.30	0.08	-	60	-	-	-
Pb Rougher	-	-	-	-	0.01	-	1	3	9.2
	-	-	-	0.02	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
	-	-	-	0.01	0.01	-	1	3	-
Pb 1st Regrind	2.0	1.0	0.30	0.05	-	45	-	-	-
Pb 1st Cleaner	-	-	-	-	0.01	-	1	4	9.4
	-	-	-	0.01	0.01	-	1	4	-
Pb 2nd Regrind	1.5	1.0	0.20	0.03	-	23	-	-	-
Pb 2nd Cleaner	-	-	-	-	0.005	-	1	4	9.5
	-	-	-	0.005	0.005	-	1	4	-
Pb 3rd Cleaner	0.3	0.2	0.10	-	-	-	2	3	9.6
	-	-	-	0.005	-	-	1	3	-
Pb 4th Cleaner	0.3	0.1	0.10	-	-	-	2	3	9.6
	-	-	-	0.003	-	-	1	2	-
Pb 5th Cleaner	0.3	-	0.05	-	-	-	2	4	9.7

Stage	Rougher	Pb Regrinds	Pb 1st - 4th Cl.	Pb 5th Cl.
Equipment	1000 g D-1	Lab. Ball Mill	500 g D-1	250 g D-1
Speed rpm	1800	-	1200	1000

Test No. 76 - Continued

Metallurgical Results

Product	Weight %	Assays %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.94	47.3	15.6	57.4	11.9
2. Pb 5th Cl. Tail.	1.54	24.7	20.6	5.8	3.0
3. Pb 4th Cl. Tail.	3.17	19.3	21.3	9.4	6.5
4. Pb 3rd Cl. Tail.	3.94	11.7	19.9	7.1	7.5
5. Pb 2nd Cl. Tail.	7.69	5.91	17.3	7.0	12.8
6. Pb 1st Cl. Tail.	15.23	2.45	13.0	5.7	19.0
7. Pb Rougher Tail.	60.49	0.83	6.74	7.6	39.3
Head (Calculated)	100.00	6.54	10.4	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.48	43.6	16.4	63.2	14.9
Products 1 to 3	12.65	37.5	17.6	72.6	21.4
Products 1 to 4	16.59	31.4	18.2	79.7	28.9
Products 1 to 5	24.28	23.3	17.9	86.7	41.7
Products 1 to 6	39.51	15.3	16.0	92.4	60.7

Size Analysis - 2nd Cleaner Concentrate

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 31.1 µm	0.4	0.4	99.6
24.1	1.0	1.4	98.6
16.8	5.2	6.6	93.4
11.6	14.7	21.3	78.7
8.9	13.0	34.3	65.7
- 8.9	65.7	100.0	-
Total	100.0	-	-

Specific Gravity = 4.69

LAKEFIELD RESEARCH OF CANADA LIMITED
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