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MINES BRANCH INVESTIGATION REPORT IR 71-77

IR 71-77

**AN EVALUATION OF THE METALLURGY
OF THE MILLING OPERATION
AT REEVES MACDONALD MINES LIMITED,
REMAC, BRITISH COLUMBIA**

by

W. ARTHUR WALL AND R. W. BRUCE

MINERAL PROCESSING DIVISION

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AN EVALUATION OF THE METALLURGY
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by

W. Arthur Wall* and R.W. Bruce**

- - -

SUMMARY OF RESULTS

No difficulty was experienced in floating a rougher lead concentrate with a satisfactory lead recovery but all of the lead concentrates assayed over 12 per cent zinc. Cleaning and recleaning of the lead concentrate did not appreciably reduce the zinc content. Microscopic examination of the lead concentrates showed that 50 per cent of the galena (much of it less than 10 micron in size) was present as fine inclusions in sphalerite and, to a lesser extent, in pyrite. The flotation of these middling particles due to the galena inclusions accounts for the presence of sphalerite and pyrite in the lead concentrate.

Silver occurs in the ore as the mineral argyrodite mainly as inclusions in sphalerite. This accounts for the higher than normal silver assay of the zinc concentrate.

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INTRODUCTION

Location of Property

The Annex Mine of Reeves MacDonald Mines is located south of Remac, British Columbia.

Shipment

A 300-pound sample of mill feed, representative of the Annex Mine ore, was received on October 15, 1970. Included in the same shipment, were twenty-five pounds of lead concentrate and twenty-five pounds of zinc concentrate. These concentrates were reported to be representative of the concentrates being produced from the Annex Mine ore.

Purpose of Investigation

Mr. L.M. Kinney, Vice-President, Mining, Reeves MacDonald Mines Limited in his letter of September 1, 1970 requested that an investigation be carried out to determine the possibility of increasing the lead content and reducing the zinc content of the lead concentrate. He was also interested in the possibility of increasing the silver recovery with the lead concentrate and thus reducing the silver that is presently being recovered in the zinc concentrate.

Sampling and Analysis

The samples of lead concentrate and zinc concentrate were air-dried and representative portions were removed in a Jones splitter. One portion of each concentrate was submitted for chemical analysis with the results as tabulated in Table 1.

TABLE 1

Lead and Zinc Concentrates Chemical Analyses*

Element	Pb Conc	Zn Conc
Silver oz/ton	84.41	8.585
Lead %	37.60	0.72
Zinc %	17.40	47.50
Iron %	7.49	-
Insoluble %	1.45	-
Cadmium %	-	0.78

*From Internal Reports MS-AG-70-1031 and 1038

Another representative sample of each concentrate was screened, cyclized, and the sized-fractions submitted for chemical analysis and microscopic examination. The chemical analysis of the sized fractions of the lead concentrate are shown in Table 2 and of the zinc concentrate in Table 3.

TABLE 2

Chemical Analysis* of Sized Fraction of Lead Concentrate

Size	Weight %	Assay			Distribution %		
		Ag oz/ton	Pb %	Zn %	Ag	Pb	Zn
+150 mesh	1.2	15.16	16.92	24.62	0.2	0.5	1.7
+200 mesh	5.1	14.67	18.27	28.90	0.9	2.5	8.5
+250 mesh	1.1	16.33	20.00	28.90	0.2	0.6	1.8
+40.6 micron	24.3	47.13	38.73	19.67	13.6	25.0	27.5
+30.9 micron	21.3	84.48	36.55	26.40	21.3	20.7	32.3
+22.5 micron	10.2	95.23	36.55	16.91	11.5	9.9	9.9
+15.5 micron	9.1	103.24	38.73	14.19	11.1	9.4	7.4
+11.9 micron	6.1	113.27	43.04	13.57	8.2	7.0	4.8
-11.9 (calcd)	21.6	128.83	42.46	4.93	33.0	24.4	6.1
Feed (Assay)	100.0	84.41	37.60	17.40	100.0	100.0	100.0

*From Internal Report MS-AG-70-1049 and 1129

TABLE 3

Chemical Analysis* of Sized Fractions of Zinc Concentrate

Size	Weight %	Assay			Distribution %		
		Ag oz/ton	Pb %	Zn %	Ag	Pb	Zn
+150 mesh	8.5	6.27	0.60	31.60	6.2	7.1	5.7
+200 mesh	16.4	7.92	0.68	41.10	15.1	15.5	14.2
+250 mesh	2.6	9.22	0.66	43.25	2.8	2.4	2.4
+40.6 micron	19.3	11.55	0.64	48.35	26.0	17.1	19.6
+30.9 micron	21.8	7.17	0.43	50.75	18.2	13.0	23.3
+22.5 micron	4.5	6.42	0.44	53.95	3.4	2.8	5.1
+15.5 micron	5.7	6.43	0.55	54.35	4.3	4.3	6.5
+11.9 micron	3.2	7.00	0.97	54.90	2.6	4.3	3.7
-11.9 (calcd)	18.0	10.23	1.34	51.51	21.4	33.5	19.5
Feed (Assay)	100.0	8.585	0.72	47.50	100.0	100.0	100.0

*From Internal Reports MS-AG-70-1134 and 1140.

Representative hand specimens were selected from the ore, as received, for microscopic examination. The remainder of the ore was crushed to minus 10 mesh and split into 2000-gram portions. One 2000-gram sample, selected at random was sub-divided into fractions for chemical analysis, semi-quantitative spectrochemical analysis, and mineralogical examination. The results of the chemical analysis are shown in Table 4 and the results of the semi-quantitative spectrochemical analysis in Table 5.

TABLE 4

Chemical Analysis* of Mill Feed

Silver	4.375 oz/ton
Lead	1.19 per cent
Non-Sulphide Lead	0.38 " "
Zinc	10.75 " "
Iron	4.97 " "

*From Internal Reports MS-AG-70-1031, 1038 and 1053.

TABLE 5

Semi-Quantitative Spectrochemical Analysis* of Mill Feed

Principal Constituents	>1%	Mg, Fe, Zn, Ca
Major Constituents	<1.0% >0.1%	Pb, Si,
Minor Constituents	<0.1%	Mn, Ga, Al, Ni, Ti, Ag, Cu
Not Detected		Ba, Be, B, Sb, Ge, As, Mo, W, Sn Cr, Nb, Ta, Bi, Sr, Co, Na, Zr, In, V

*From Internal Report MS-AG-70-300

MINERALOGICAL EXAMINATIONS*

A number of polished sections were prepared from the hand specimens and examined under the ore microscope to identify the ore minerals and to determine their grain sizes and textural relationships. The 48 to 325-mesh fraction was screened from the head sample and separated into sink and float products by means of heavy liquids and the products were examined.

Polished sections of the eight size-fractions from the lead concentrate and of the eight size-fractions from the zinc concentrate were prepared and examined microscopically to identify the ore minerals and to evaluate their liberation. The minus 11.9-micron fractions were not examined because of the size of particles.

Representative samples of the cleaner lead concentrates obtained in Tests 3 to 7 inclusive also were submitted for microscopic examination.

Results of Investigation

The minerals identified in the ore were sphalerite, pyrite, galena, argyrodite(?), magnetite, pyrrhotite, dolomite, mica, calcite, and quartz. The most abundant ore minerals were sphalerite, pyrite, and galena, with only traces of magnetite and pyrrhotite.

*Mines Branch Investigation Report IR 71-22 by R.G. Pinard.

Argyrodite was the only silver-bearing mineral found in the ore. The ore minerals occur in a wide variety of associations and are intimately intergrown.

The sphalerite in the ore occurs mainly in a massive form. Few areas of the sphalerite are free from inclusions and most of it is riddled with grains of other minerals consisting mainly of galena, pyrite, gangue, and argyrodite.

The galena is present largely as inclusions in or associated with sphalerite. Galena contains only a few inclusions of other minerals.

The only silver-bearing mineral occurring in the ore is believed to be argyrodite (Ag_8GeS_6). The argyrodite occurs as very small grains mainly as inclusions in sphalerite and as grains adhering to sphalerite and rarely to galena.

Examination of the zinc concentrate showed that the sphalerite consists mainly of free grains even in the plus 150-mesh fraction. Relatively few grains of the sphalerite are contaminated by galena, pyrite, or gangue.

Examination of polished sections of the lead concentrate show the galena content to be evenly distributed between free grains and small inclusions in sphalerite and to a lesser extent in pyrite. Small inclusions of galena, many less than 10 microns in size, were found in otherwise free grains of sphalerite and pyrite. The presence of sphalerite and pyrite in the lead concentrate may be due to these inclusions of galena which cause the particle to float.

Examination of the polished sections of cleaner lead concentrates from Tests 3, 4, 6, and 7 showed that the galena and sphalerite were intergrown to a large degree. The finer grind of the cleaned lead concentrate of Test 5 liberates more of the ore minerals but the concentrate still contained many intergrown grains of galena and sphalerite.

OUTLINE OF INVESTIGATION

This investigation was carried out in an attempt to produce a lead concentrate containing the minimum amount of zinc and a zinc concentrate

containing the minimum amount of silver. Various combinations of reagents, flotation conditions and degrees of fineness of grind were investigated.

Full details of all tests are shown in the Mines Branch Flotation Test Reports in Appendix A.

DISCUSSION OF RESULTS

Test 1 was carried out with normal lead flotation reagents as shown in Flotation Test Report No. 1 in Appendix A. The rougher lead concentrate, consisting of 19.3 per cent of the weight of ore, assayed 19.58 ounces silver per ton, 5.00 per cent lead and 45.34 per cent zinc. The concentrate contained 86.6 per cent of the silver, 84.4 per cent of the lead and 77.3 per cent of the zinc in the feed. The final tailing assayed 0.11 ounces silver per ton, 0.08 per cent lead and 0.11 per cent zinc and contained 1.6 per cent of the silver, 4.4 per cent of the lead and 0.6 per cent of the zinc in the feed. Though there was no separation of the lead from the zinc, this test indicated that there was no problem in floating the silver, lead, and zinc from the gangue minerals.

In Test 2, selective flotation of lead and zinc, at a coarser grind, produced a rougher lead concentrate assaying 32.57 ounces silver per ton, 10.45 per cent lead, and 20.19 per cent zinc and contained 68.6 per cent of the silver, 83.4 per cent of the lead, and 16.5 per cent of the zinc. With four stages of cleaning, the lead concentrate was increased to 38.20 per cent lead but the zinc was only decreased to 16.85 per cent. The lead recovery decreased from 83.4 per cent to 47.4 per cent. The rougher zinc concentrate assayed 5.42 ounces silver per ton, 0.45 per cent lead, and 46.06 per cent zinc. The zinc content of the lead concentrate is much higher than normal.

Test 3 was carried out at the same grind as Test 2 but with different flotation reagents. The rougher lead concentrate assayed 20.29 per cent lead and 19.04 per cent zinc but contained only 8.0% of the zinc in the feed compared to 16.5 per cent in Test 2.

Test 5 was similar to Test 2 with two additional reagents, zinc hydro sulphite for zinc depression and MIBC for a frother. The rougher lead concentrate was similar to that obtained in Test 2. Re grinding the lead concentrate before two stages of cleaning produced a clean lead concentrate with assays similar to those obtained for the clean lead concentrate in Test 2. There was a significant increase in recovery of the silver and the lead. The zinc cleaner concentrate assayed 4.90 ounces silver per ton, 0.37 per cent lead, and 40.38 per cent zinc and contained 22.8 per cent of the silver, 6.8 per cent of the lead, and 75.8 per cent of the zinc in the feed.

Test 8 was a repeat of Test 5 at a considerably finer grind. The rougher lead concentrate assays and recoveries were very similar to those obtained in Test 5. Finer re grinding of the rougher lead concentrate, before two stages of cleaning, resulted in a lower lead assay and higher zinc assay and lower lead recovery and higher zinc recovery.

The zinc cleaner concentrate in Test 8 assayed 6.61 ounces silver per ton, 0.37 per cent lead, and 38.19 per cent zinc. This concentrate contained 34.0 per cent of the silver, 6.9 per cent of the lead, and 81.3 per cent of the zinc in the feed.

Tests 10 to 13 were carried out at various grinds, pH's and reagent combinations. In each case, the quantity of the promoter, sodium Aerofloat, was kept to a minimum. Regardless of the lead assays of the rougher lead concentrate (range 1.8 to 8.4 per cent) the minimum zinc assay was 12.2 per cent.

In the remainder of the tests, various combinations of grind, flotation conditions, and reagents were used but all the lead concentrates produced contained more than normal amounts of zinc. No difficulty was experienced in producing a low-grade rougher lead concentrate with a satisfactory silver-lead recovery but the lowest zinc assay reported was 13.5 per cent (Test 19). Cleaning and re-cleaning the lead concentrate did not lower the zinc content to any significant degree. In these tests, no difficulty was experienced in recovering the zinc in a zinc concentrate with satisfactory assays of silver, lead, and zinc and with a satisfactory recovery of the zinc. Test 14 illustrates the results that can be expected from the zinc flotation. The rougher zinc concentrate assayed 7.95 ounces silver per ton, 0.45 per cent lead, and 51.19 per cent zinc with recoveries of 33.2 per cent silver, 7.6 per cent lead, and 86.7 per cent zinc. One stage of cleaning increased the grade to 61.6 per cent zinc.

CONCLUSIONS

The main objectives of this investigation were to decrease the amount of zinc floating with the lead and thereby increase the grade of the lead concentrate and at the same time increase the silver recovery in the lead concentrate thereby decreasing the silver that is presently being recovered in the zinc concentrate.

Microscopic examination of the ore and of various samples of the lead concentrate showed that the galena in the lead concentrate was evenly distributed between free grains of galena and numerous fine inclusions of galena in otherwise free grains of sphalerite. It appears that these inclusions of galena cause the sphalerite to float in the lead concentrate.

These observations were confirmed by investigative tests in which regrinding the refloatation of the lead concentrate failed to reduce the zinc content. An example of this is seen from the results of Test 8 in which the rougher lead concentrate grade was increased from 12.2 per cent to 24.2 per cent lead, but the zinc decreased only from 16.3 to 16.2 per cent zinc. Also the chemical analysis of the sized fractions of the sample of lead concentrate shows that while the lead assay of each size fraction increases and zinc assay decreases as the size decreases, the decrease of the zinc assay is not significant except in the finest size fraction of 11.9 microns.

The silver that is recovered in the zinc concentrate was found to be due to extremely fine inclusions of the silver mineral argyrodite in grains of sphalerite. This silver occurrence accounts for the high silver content in the zinc concentrate and precludes its recovery with the lead concentrate. A silver content of about 8 oz per ton of zinc concentrate can be expected and this will represent about 25 per cent of the silver in the ore.

From the results of this investigation, it does not appear that any major improvement can be made in the grades of concentrates or in the metallurgical recoveries in processing this ore.

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APPENDIX

APPENDIX A

Mines Branch Flotation Test Reports

Abbreviations used in Test Data Reports

CaO	Lime
NaCN	Sodium Cyanide
ZnSO ₄	Zinc Sulphate
A15	Aerofloat Reagent 15
DF250	Dowfroth 250
Z-11	Sodium Isopropyl Xanthate
CuSO ₄	Copper Sulphate
T130	Thiocarbanilide 130
R242	Aerofloat 242
SO ₂	Sulphur Dioxide
610	Depressant 610
633	Depressant 633
MIBC	Methyl Isobutyl Carbinol Frother
Z-3	Potassium Ethyl Xanthate
RM	Rod Mill
Na ₂ S ₂ O ₄	Sodium Hydro Sulphite
Na ₂ CO ₃	Sodium Carbonate
ZnS ₂ O ₄	Zinc Hydro Sulphite
Z-200	Isopropyl Ethyl thiono Carbonate
Na ₂ SO ₃	Sodium Sulphite
Sod A	Sodium Aerofloat
AF71	Frother AF71
3477	Aero Promoter 3477
A31	Aerofloat Reagent 31
H ₂ SO ₄	Sulphuric Acid
404	Promoter 404
Na ₂ CR ₂ O ₇	Sodium Dichromate
301	Sodium Secondary Butyl Xanthate
211	Sodium Diisopropyl Dithiophosphate

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 1	SAMPLE: Reeves MacDonald Mines Limited	DATE: Oct. 30, 1970
OBJECT OF TEST: Preliminary Flotation		CHARGE: 2000-g
		TESTED BY: WAW

OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton									
					CaO	NaCN	ZnSO ₄	A 15	DF250	Z-11	CuSO ₄			
Grind (1)	30	67		7 x 14 RM	1.5	0.25	1.00							
Condition	5	50	8.2	2000-g cell				0.04	0.03					
Lead Float	3	25	8.2								0.05			
Scavenger Float	3	25									0.05			
Zinc Condition	10	25										1.50		
Zinc Float	5	25	8.0						0.03	0.10				

PRODUCT	WT %	ANALYSIS (2)				DISTRIBUTION		
		Ag oz/ton	Pb%	Zn %	Ag	Pb	Zn	
Rougher Pb conc.	19.3	19.58	5.00	45.34	86.6	84.4	77.3	
Scavenger conc.	9.1	3.32	0.76	18.85	6.9	6.0	16.6	
Rougher Zn conc.	9.1	2.34	0.65	6.85	4.9	5.2	5.5	
Rougher tail	62.5	0.11	0.08	0.11	1.6	4.4	0.6	
Feed(calcd)	100.0	4.36	1.14	11.33	100.0	100.0	100.0	

REMARKS: (1) Flotation tailing 98.3 per cent minus 200 mesh.
 (2) From Internal Reports MS-AC-70-1127 and 1129.

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 2		SAMPLE: Reeves MacDonald Mines Limited							DATE: Nov. 5, 1970.								
OBJECT OF TEST: Preliminary at coarser grind											CHARGE: 2000-g						
											TESTED BY: WAW						
OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton												
					T 130	R 242	ZnSO ₄	NaCN	SO ₂	610	633	MIBC	CuSO ₄	CaO			
Grind (1)	15	67	8.2	7x14 RM	0.10	0.10	0.70	0.10									
Condition	5	50	6.5	2000-g cell					15.0								
Condition	5									0.02	0.02						
Condition	5					0.04	0.30										
Pb Float	4	25	7.6														
Zn Condition	5	25	8.9			0.15						0.02	1.0	1.0			
Zn Float	3	25				0.02											
Zn Scavenging	2	25	8.9			0.02											
Pb Clean No. 1	2			500-g cell			0.16	0.05									
Pb Clean Nos. 2, 3 & 4	1			250-g cell			0.16	0.05									
Zn Clean No. 1	2		11.9	500-g cell				0.30									0.30
Zn Clean No. 2	1			250-g cell													

PRODUCT	WT %	ANALYSIS (2)					DISTRIBUTION				
		Ag oz/ton	Pb%	Zn%			Ag	Pb	Zn		
Clean Pb conc.	1.4	97.26	38.20	16.85			31.9	47.4	2.1		
No. 1 clean Pb tail	2.8	12.19	2.92	13.25			8.0	7.3	3.4		
" 2 " " "	1.8	16.40	3.70	15.85			6.9	5.9	2.6		
" 3 " " "	1.8	23.93	6.49	37.60			10.1	10.4	6.2		
" 4 " " "	1.2	41.73	11.65	20.70			11.7	12.4	2.2		
Ro. Pb conc. (calcd)	9.0	32.57	10.45	20.19			68.6	83.4	16.5		
Clean Zn conc.	11.9	6.13	0.33	60.00			17.1	3.5	65.0		
No. 1 clean Zn tail	3.9	3.28	0.68	14.00			3.0	2.3	5.0		
No. 2 " " "	2.8	5.39	0.63	31.50			3.5	1.6	8.0		
Ro Zn conc (calcd)	18.6	5.42	0.45	46.06			23.6	7.4	78.0		
Zn Scav. conc.	8.2	2.12	0.49	5.03			4.1	3.5	3.7		
Ro tail	64.2	0.245	0.10	0.30			3.7	5.7	1.8		
Feed (calcd)	100.0	4.27	1.13	10.99			100.0	100.0	100.0		

REMARKS: (1) Flotation tailing, 85.0 per cent minus 200 mesh.
(2) From Internal Reports MS-AC-70-1138 and 1147.

Z-11

0.10

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3
1

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 3		SAMPLE: Reeves MacDonald Mines Limited						DATE: Nov. 24, 1970.					
OBJECT OF TEST: Different Reagents								CHARGE: 2000-g		TESTED BY: WAW			
OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton								
					Z-3	DF 250	Na ₂ S ₂ O ₄	ZnSO ₄	NaCN	SO ₂	CuSO ₄		
Grind (1)	15	67		7 x 14 RM									
Condition	5	45	6.5	2000-g	0.05	0.02	2.0	1.0	0.5	15			
Pb Float	3	25	7.7		0.05	0.02							
Zn condition	5	25	7.7		0.10						2.0		
Zn Float	5	25	8.2		0.05	0.02							
Zn Scav.	2	25	8.2		0.10	0.02							
Clean Pb	1.5			250-g cell									
PRODUCT	WT %	ANALYSIS (2)					DISTRIBUTION %						
		Ag oz/ton	Pb%	Zn%			Ag	Pb	Zn				
Clean Pb conc.	3.4	46.99	25.00	19.53			36.9	71.5	6.2				
Clean Pb tail	1.1	23.23	5.77	17.53			5.9	5.3	1.8				
Ro. Pb conc (calcd)	4.5	41.20	20.29	19.04			42.8	76.8	8.0				
Ro. Zn conc.	20.6	9.13	0.59	41.80			43.4	10.3	80.7				
Scav. Zn Conc.	7.0	4.99	0.73	11.37			8.1	4.3	7.5				
Ro tail	67.9	0.365	0.15	0.59			5.7	8.6	3.8				
Feed (calcd)	100.0	4.33	1.19	10.67			100.0	100.0	100.0				

REMARKS: (1) Flotation tailing 85.0 per cent minus 200 mesh.
 (2) From Internal Reports MS-AC-70-1164 and 1180.

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 4	SAMPLE: Reeves MacDonald Mines Limited										DATE: Nov. 26, 1970.			
OBJECT OF TEST: Reagent Zinc Hydro sulphite.													CHARGE: 2000-g	
													TESTED BY: WAW	
OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton									
					Na ₂ CO ₃	R242	ZnS ₂ O ₃	ZnSO ₄	NaCN	DF250	CuSO ₄	Z-200		
Grind (1)	15	67		7 x 14 RM	1.0		1.0	1.0	0.5					
Condition	5	45	8.3	2000-g cell		0.05					0.02			
Pb float	4	25	8.3											
Condition	5		8.0									2.0		
Zn float	4		7.0			0.05							0.05	
Pb clean	2			500-g cell			1.0							
Zn clean	2			1000-g cell										
PRODUCT	WT %	ANALYSIS (2)					DISTRIBUTION							
		Ag oz/ton	Pb%	Zn%			Ag	Pb	Zn					
Cl. Pb conc	6.1	26.41	14.04	15.82			39.2	73.6	9.1					
Cl. Pb tail	3.2	6.37	2.26	13.41			5.0	6.2	4.1					
Ro. Pb conc (calcd)	9.3	19.52	9.98	14.99			44.2	79.8	13.2					
Cl. Zn conc	20.5	10.04	0.48	41.09			50.0	8.4	79.4					
Cl. Zn tail	7.0	1.92	0.60	6.78			3.3	3.6	4.5					
Ro. Zn conc (calcd)	27.5	7.80	0.51	32.36			53.3	12.0	83.9					
Ro. tail	63.2	0.165	0.15	0.49			2.5	8.2	2.9					
Feed (calcd)	100.0	4.11	1.16	10.60			100.0	100.0	100.0					
REMARKS: (1) Flotation tailing 85.0 per cent minus 200 mesh. (2) From Internal Report MS-AC-70-1177 and 1180.														

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 5	SAMPLE: Reeves MacDonald Mines Limited	DATE: Nov. 27, 1970.
OBJECT OF TEST: Variation of Reagent Combination plus regrind of concentrate.		CHARGE: 2000-g
TESTED BY: WAW		

OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton										
					T 130	R242	ZnSO ₄	NaCN	SO ₂	610	633	ZnS ₂ O ₄	MIBC	DF250	
Grind (1)	15	67		7 x 14 RM	0.10	0.10	1.0	0.2					1.0		
Condition	5	35	6.6	2000-g cell					25						
Condition	2	35									0.10	0.10			
Lead flotation	4	25	6.7			0.05								0.04	
Zinc condition (2)	10	25	8.0												
Zinc flotation	4	25	8.0												0.02
Zinc clean	2			1000-g cell											
Pb conc grind	30			Pebble Mill											
No. 1. Pb clean	1.5			250-g cell			0.25	0.10							
No. 2. Pb clean	1.5						0.25	0.10							

PRODUCT	WT %	ANALYSIS (3)					DISTRIBUTION %			
		Ag oz/ton	Pb%	Zn%			Ag	Pb	Zn	
Clean Pb conc	2.8	93.40	30.00	14.33			59.5	75.7	3.7	
Clean Pb tail No. 1.	7.3	4.28	0.87	16.15			7.1	5.8	10.8	
Clean Pb tail No. 2.	1.2	12.07	3.00	17.95			3.3	3.2	2.0	
Ro Pb conc (calcd)	11.3	27.19	8.32	15.88			69.9	84.7	16.5	
Clean Zn conc	20.4	4.91	0.37	40.38			22.8	6.8	75.8	
Clean Zn tail	6.1	2.18	0.45	8.50			3.0	2.4	4.6	
Ro Zn conc (calcd)	26.5	4.28	0.38	33.05			25.8	9.2	80.6	
Ro tail	62.2	0.30	0.11	0.50			4.3	6.1	2.9	
Feed (calcd)	100.0	4.39	1.11	10.86			100.0	100.0	100.0	

REMARKS: (1) Flotation tailing 85 percent minus 200 mesh.
 (2) Reagents CuSO₄-2.0 lb/ton, CaO-1.0 lb/ton; Z-11,-0.10 lb/ton
 (3) From Internal Reports MS-AC-70-1177 and 1182.

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 6	SAMPLE: Reeves MacDonald Mines Limited							DATE: Nov. 30, 1970					
OBJECT OF TEST: Different Reagents							CHARGE: 2000-g						
							TESTED BY: WAW						
OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton								
					Na ₂ SO ₃	ZnSO ₄	SO ₂	R242	DF250	Na ₂ CO ₃	CuSO ₄	Z-200	
Grind ⁽¹⁾	15	67		7 x 14 RM	2.0	1.0							
Condition	5	45	6.9	2000-g cell			10	0.05					
Lead flotation	4	25	7.0						0.05				
Zinc condition	15	25	7.7							1.0	2.0		
Zinc flotation	5	25	7.7					0.05	0.03			0.05	
No. 1 Pb clean	2			500-g cell	0.25								
No. 2 Pb clean	1			250-g cell									
Zinc clean	2			1000-g cell									
PRODUCT	WT %	ANALYSIS (2)					DISTRIBUTION %						
		Ag oz/t	Pb%	Zn%			Ag	Pb	Zn				
Clean Pb conc	2.8	78.26	22.44	17.62			50.1	53.5	4.6				
No. 1 clean Pb tail	2.1	20.01	6.24	14.48			9.6	11.2	2.8				
No. 2 clean Pb tail	0.4	26.00	6.73	13.67			2.4	2.3	0.5				
Ro Pb conc (calcd)	5.3	51.23	14.83	16.08			62.1	67.0	7.9				
Clean Zn conc	21.5	5.81	0.95	43.20			28.6	17.4	85.7				
Clean Zn tail	6.9	2.67	1.13	6.36			4.2	6.6	4.0				
Ro Zn conc (calcd)	28.4	5.04	0.99	34.25			32.8	24.0	89.7				
Ro tail	66.3	0.335	0.16	0.40			5.1	9.0	2.4				
Feed (calcd)	100.0	4.37	1.17	10.84			100.0	100.0	100.0				
REMARKS: (1) Flotation tailing 85.0 per cent minus 200 mesh (2) From Internal Reports MS-AC-70-1205 and 1210.													

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 7		SAMPLE: Reeves MacDonald Mines Limited								DATE: Dec. 1, 1970					
OBJECT OF TEST:		Repeat of Test 6 at coarser grind.								CHARGE: 2000-g					
										TESTED BY: WAW					
OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton										
					Na ₂ SO ₃	ZnSO ₄	SO ₂	R242	DF 250	Na ₂ CO ₃	CuSO ₄	Z-11			
Grind (1)	10	67		7x14 RM	2.0	1.0									
Condition	5	45	6.7	2000-g cell			2.0								
Condition	2	45	6.7					0.05	0.05						
Lead flotation	5	25	7.5												
Zinc condition	15	25	8.0								1.0	2.0			
Zinc condition	2	25	8.0										0.10		
Zinc flotation	4	25	8.0												
No. 1 Pb clean	1		7.7	500-g cell							1.0				
No. 2 Pb clean	1		9.7	250-g cell							1.0				
Zn clean	2			1000-g cell											
PRODUCT	WT %	ANALYSIS (2)					DISTRIBUTION %								
		Ag oz/t	Pb %	Zn %			Ag	Pb	Zn						
Clean Pb conc	4.5	52.28	16.58	20.38			53.9	62.1	8.6						
Clean Pb tail No. 1	1.5	14.93	2.97	15.00			5.1	3.7	2.1						
Clean Pb tail No. 2	1.2	21.72	6.09	15.65			6.0	6.1	1.8						
Ro Pb conc (calcd)	7.2	39.42	12.00	18.47			65.0	71.9	12.5						
Clean Zn conc	22.0	5.37	0.63	38.16			27.1	11.6	79.2						
Clean Zn tail	3.9	3.04	1.13	13.47			2.7	3.7	5.0						
Ro Zn conc (calcd)	25.9	5.02	0.71	34.44			29.8	15.3	84.2						
Ro tail	66.9	0.34	0.23	0.53			5.2	12.8	3.3						
Feed (calcd)	100.0	4.36	1.20	10.61			100.0	100.0	100.0						

REMARKS: (1) Flotation tailing 63.5 per cent minus 200 mesh.
(2) From Internal Reports MS-AC-70-1192 and 1194.

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 8	SAMPLE: Reeves MacDonald Mines Limited							DATE: Dec. 8, 1970						
OBJECT OF TEST: Regrind Lead Concentrate							CHARGE: 2000-g		TESTED BY: WAW					
OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton									
					T 130	R 242	ZnSO ₄	NaCN	ZnS ₂ O ₄	SO ₂	610	633	MIBC	Z-11
Grind (1)	30	67		7 x 14 RM	0.10	0.10	1.0	0.2	2.0					
Condition	10	50	6.5	2000-g cell						15				
Condition	5	50									0.10	0.10		
Pb float	4	25	7.3										0.05	
Zinc condition (2)	10	25	8.0			0.05								
Zinc float	6	25	8.0											0.10
Pb conc grind	60			Pebble Mill										
No. 1 Pb clean	1			500-g cell			0.25	0.1						
No. 2 Pb clean	1			250-g cell			0.25	0.1						
Zn clean	2			1000-g cell										
PRODUCT	WT %	ANALYSIS(3)					DISTRIBUTION %							
		Ag oz/t	Pb%	Zn%			Ag	Pb	Zn					
Clean Pb conc	2.8			24.23	16.20				58.6	4.5				
Clean Pb tail No. 1	3.8			4.53	16.20				14.3	5.8				
Clean Pb tail No. 2	1.7			8.73	16.81				12.3	2.7				
Ro Pb conc (calcd)	8.3			12.18	16.33				85.2	13.0				
Clean Zn conc	22.5	6.61		0.37	38.19			34.0	6.9	81.3				
Clean Zn tail	6.4			0.51	6.30				2.7	3.7				
Ro Zn conc (calcd)	28.9			0.40	31.21				9.6	85.0				
Ro tail	62.8	0.205		0.10	0.34			3.0	5.2	2.0				
Feed (calcd)	100.0	4.37 (4)		1.20	10.57				100.0	100.0				
REMARKS: (1) Flotation tailing 98.3 per cent minus 200 mesh.														
(2) Reagents CaO - 1.5, CuSO ₄ - 2.0, R 404 - 0.05 lb/ton.														
(3) From Internal Reports MS-AC-70-1211 and 1217.														
(4) Assay Ag head.														

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 9	SAMPLE: Reeves MacDonald Mines Limited	DATE: Dec. 14, 1970												
OBJECT OF TEST: Flotation of Middling Product from Lead Concentrate		CHARGE: 2000-g												
		TESTED BY: WAW												
OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton									
					T130	R242	ZnSO ₄	NaCN	ZnS ₂ O ₄	R404	CaO	CuSO ₄	Z-11	MIBC
Grind (1)	20	67		7x14 RM	0.10	0.10	1.0	0.2	2.0					
Condition	5	50	7.0	2000-g cell						0.10				
Lead float	6	25	7.0											
Zinc condition	10	25	8.1								2.0	2.0		
Zinc float	6	25	8.1										0.10	0.04
No. 1 Pb clean	2			1000-g cell										
No. 2 Pb clean	1			500-g cell										
Condition clean Pb conc ⁽²⁾	5			250-g cell										
Float middling	1.5													
Zinc clean	2			1000-g cell										
PRODUCT	WT %	ANALYSIS % (3)						DISTRIBUTION %						
		Ag oz/ton	Pb %	Zn %	Fe %		Ag	Pb	Zn					
Pb conc	2.8		25.95	22.11	15.69			61.6	5.7					
Pb-Zn middling	0.9		5.39	14.52	13.42			4.2	1.2					
Cl Pb conc (calcd)	3.7		20.97	20.27				65.8	6.9					
No. 1 Cl Pb tail	8.6		1.58	13.15	12.49			11.5	10.4					
No. 2 Cl Pb tail	4.3		2.91	15.88	16.72			10.6	6.3					
Ro Pb conc (calcd)	16.6		6.25	15.44				87.9	23.6					
Cl Zn conc	18.8	4.84	0.37	41.60			20.8	5.9	71.9					
Cl Zn tail	6.9	1.50	0.48	4.62			2.4	2.8	2.9					
Ro Zn conc (calcd)	25.7	3.95	0.40	31.67			23.2	8.7	74.8					
Ro tail	57.7	0.14	0.07	0.31			1.8	3.4	1.6					
Feed (calcd)	100.0	4.37	1.18	10.88			100.0	100.0	100.0					

REMARKS: (1) Flotation tails 90.9 per cent minus 200 mesh. (2) Reagent Sodium Dichromate 3.0 lb/ton.
 (3) From Internal Report MS-AC-71-7 and 11.

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 10		SAMPLE: Reeves MacDonald Mines Limited								DATE: Dec. 16, 1970				
OBJECT OF TEST: Lead flotation with starvation quantity of reagents										CHARGE: 2000-g				
										TESTED BY: WAW				
OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton									
					T130	ZnSO ₄	NaCN	ZnS ₂ O ₄	AF71	SodA	CuSO ₄	CaO	Z-200	
Grind (1)	15	67		7x14 RM	0.10	1.0	0.2	1.0						
Lead flotation	5	25	7.5	2000-g cell					0.02					
Lead scavenger	3	25								0.05				
Zinc condition	10		9.0								2.0	2.0		
Zinc flotation	6												0.10	
No. 1 Pb clean	1			500-g cell										
No. 2 Pb clean	1			250-g cell										
Zinc clean	1			1000-g cell										

PRODUCT	WT %	ANALYSIS % (2)						DISTRIBUTION %				
		Ag oz/ton	Pb %	Zn %	Fe %	Insol%	Cu %	Ag	Pb	Zn	Fe	
Clean Pb conc	1.5		20.00	11.54	7.05	4.52	0.02			25.6	1.6	2.1
No. 1 Cl Pb tail	4.8		6.90	15.30	6.84					28.2	6.7	6.4
No. 2 Cl Pb tail	1.6		11.63	13.55	7.15					15.8	2.0	2.2
No Pb conc (calcd)	7.9		10.34	14.23	6.94					69.6	10.3	10.7
Scavenger Pb conc	2.9		3.05	15.30	6.64					7.5	4.1	3.8
Total Pb conc (calcd)	10.8		8.38	14.52	6.86					77.1	14.4	14.5
Clean Zn conc	14.8	10.09	0.74	54.05	6.21			34.2	9.4	73.6	18.1	
Clean Zn tail	12.0	3.36	0.69	8.90	23.38			9.2	7.1	9.8	55.1	
Ro Zn conc (calcd)	26.8	7.07	0.72	33.83	13.90			43.4	16.5	83.4	73.2	
Ro tail	62.4	0.20	0.12	0.39	1.00			2.9	6.4	2.2	12.3	
Feed (calcd)	100.0	4.37	1.17	10.88	5.09				100.0	100.0	100.0	

REMARKS: (1) Flotation tailing 85.0 per cent minus 200 mesh. (2) From Internal Reports MS-AC-71-9 and 11.

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 11		SAMPLE: Reeves MacDonald Mines Limited							DATE: Dec. 17, 1970					
OBJECT OF TEST: Change of Reagents									CHARGE: 2000-g					
									TESTED BY: WAW					
OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton									
					ZnSO ₄	NaCN	ZnS ₂ O ₄	Sod. A	AF71	CuSO ₄	CaO	3477		
Grind (1)	20	67		7x14 RM	1.0	0.25	1.0							
Condition	5	50	7.3	2000-g cell				0.02	0.02					
Pb float	3.5													
Pb scavenge	3.5							0.03	0.02					
Zn condition	15		8.5							2.0	2.0			
Zn float	55											0.10		
No. 1 Clean Pb	1			500-g cell			1.0							
No. 2 Clean Pb	1			250-g cell										
Zn Clean	2			1000-g cell										

PRODUCT	WT %	ANALYSIS % (2)					DISTRIBUTION %				
		Ag	oz/ton	Pb	Zn		Ag		Pb	Zn	
Clean Pb conc	1.0			2.0	13.95					1.7	1.3
No. 1 Clean Pb tail	4.9			3.06	12.42					12.8	5.4
No. 2 Clean Pb tail	0.8			2.43	12.42					1.6	0.9
Ro Pb conc (calcd)	6.7			2.82	12.66					16.1	7.6
Pb scavenger conc	3.5			5.65	11.94					16.9	3.7
Total Pb conc (calcd)	10.2			3.79	12.41					33.0	11.3
Clean Zn conc	18.6		14.80	3.23	48.71			63.0		51.3	81.1
Clean Zn tail	11.3		2.36	0.82	5.00			6.1		8.0	5.1
Ro Zn conc (calcd)	29.9			2.32	32.19					59.3	86.2
Ro tail	59.9		0.305	0.15	0.46			4.2		7.7	2.5
Feed (calcd)	100.0			1.17	11.17			100.0		100.0	100.0

REMARKS: (1) Flotation tail 90.9 per cent minus 200 mesh. (2) From Internal Reports MS-AC-71-4 and 23.

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 12	SAMPLE: Reeves MacDonald Mines Limited							DATE: Dec. 17, 1970					
OBJECT OF TEST: Change of Reagents							CHARGE: 2000-g						
							TESTED BY: W.A.W.						
OPERATION	Time min	% Solids	pH	Unit used	Reagents. lb per ton								
					ZnSO ₄	NaCN	ZnS ₂ O ₄	Sod A	AF71	CaO	CuSO ₄	Z-11	
Grind (1)	20	67		7 x 14 RM	1.0	0.25	1.0						
Condition	5	50	7.8	2000-g cell				0.04					
Pb float	3	25							0.03				
Pb scavenger	3	25						0.05					
Zn condition	11	25	8.7							2	2		
Zn float	3.5	25							0.02			0.10	
No. 1 Pb clean	1.5			500-g cell									
No. 2 Pb clean	1.0			250-g cell									
Zn clean	2.5			1000-g cell									
PRODUCT	WT %	ANALYSIS (2)					DISTRIBUTION %						
		Ag. oz/ton	Pb	Zn			Ag	Pb	Zn				
Clean Pb conc	0.8		2.23	14.68				1.6	1.1				
No. 1 Cl Pb tail	4.4		3.66	12.14				13.9	4.8				
No. 2 Cl Pb tail	1.4		2.16	12.93				2.6	1.6				
Ro Pb conc (calcd)	6.6		3.17	12.61				18.1	7.5				
Pb scavenger	4.4		4.64	11.67				17.6	4.7				
Total Pb conc (calcd)	11.0		3.75	12.23				35.7	12.2				
Clean Zn conc	19.4	13.56	2.96	45.04			60.2	49.7	79.2				
Clean Zn tail	4.9	3.59	1.08	9.01			4.0	4.6	4.0				
Ro Zn conc (calcd)	24.3	11.59	2.58	37.77				54.3	83.2				
Ro tail	64.7	0.445	0.18	0.78			6.6	10.0	4.6				
Feed (calcd)	100.0	4.37 ³	1.16	11.03				100.0	100.0				
REMARKS: (1) Flotation tailing 90.9 per cent minus 200 mesh													
(2) From Internal Report MS-AG-71-4 and 31													
(3) Assay value													

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 13	SAMPLE: Reeves MacDonald Mines Limited	DATE: Dec. 30, 1970
OBJECT OF TEST: Repeat of Test No. 12 at finer grind		CHARGE: 2000-g
		TESTED BY: W.A.W.

OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton										
					ZnSO ₄	NaCN	ZnS ₂ O ₄	SO ₂	AF 71	Sod A	CuSO ₄	CaO	Z-11		
Grind (1)	30	67		7 x 14 RM	1.0	0.25	1.0								
Condition	10	50	6.8	2000-g cell				25							
No. 1 Pb Float	2.5	25								0.03					
Clean No. 1 Pb conc	1			250-g cell			1.0								
No. 2 Pb Float	3.0	25	7.4	2000-g cell							0.04				
Zn condition	10	25	8.3									2.0	2.0		
Zn float	4	25								0.03				0.10	
Zn clean	2			1000-g cell											

PRODUCT	WT %	ANALYSIS % (2)					DISTRIBUTION %		
		Ag	Pb	Zn			Ag	Pb	Zn
No. 1 Pb clean conc	2.0	5.83	1.47	13.43			2.8	2.6	2.5
No. 1 Pb clean tail	2.4	6.21	1.47	12.04			3.5	3.1	2.6
No. 1 Pb rough conc(calcd)	4.4	6.05	1.47	12.66			6.3	5.7	5.1
No. 2 rough conc	1.5	13.13	2.00	11.24			4.7	2.6	1.6
Rough Pb conc (calcd)	5.9	7.85	1.59	12.31			11.0	8.3	6.7
Zn clean conc	16.4	17.69	4.27	48.92			69.2	61.8	73.9
Zn clean tail	10.5	6.07	2.01	11.22			15.2	18.6	10.8
Zn rough conc (calcd)	26.9	13.15	3.39	34.20			84.4	80.4	84.7
Rough tail	67.2	0.285	0.19	1.39			4.6	11.3	8.6
Feed (calc)	100.0	4.19	1.13	10.86			100.0	100.0	100.0

REMARKS: (1) Flotation tailing 97.7 per cent minus 200 mesh.
 (2) From Internal Reports MS-AC-71-11 and 31.

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 14	SAMPLE: Reeves MacDonald Mines Limited							DATE: Jan. 5, 1971					
OBJECT OF TEST: Reagents used in mill							CHARGE: 2000-g						
							TESTED BY: WAW						
OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton								
					ZnSO ₄	NaCN	A31	MIBC	633	CuSO ₄	CaO	3477	ZnS ₂ O ₄
Grind (1)	30	67		7x14 RM	0.10	0.07	0.02	0.02					
Condition	5	45	8.0	2000-g cell					0.02				
Pb float	5	25						0.04					
Zn condition	10	25	8.5				0.02			0.80	0.60	0.05	
Zn float	4												
Pb clean No. 1	1			500-g cell								0.05	
Pb clean No. 2	1			250-g cell									
Zn clean	1.5			1000-g cell									
PRODUCT	WT %	ANALYSIS % (3)					DISTRIBUTION %						
		Ag (2)	Pb %	Zn %			Ag	Pb	Zn				
Cl Pb conc	0.8		14.21	13.68				10.4	1.0				
Cl Pb tail No. 1	5.2		12.72	16.00				60.0	7.7				
Cl Pb tail No. 2	1.0		11.58	13.28				10.5	1.2				
Ro Pb conc (calcd)	7.0		12.73	15.33				80.9	9.9				
Cl Zn conc	13.9	9.065	0.43	61.60			28.8	5.5	79.2				
Cl Zn tail	4.4	4.43	0.52	18.30			4.4	2.1	7.5				
Ro Zn conc (calcd)	18.3	7.95	0.45	51.19			33.2	7.6	86.7				
Ro tail	74.7	0.46	0.17	0.49			7.9	11.5	3.4				
Feed (calcd)	100.0	4.37 ⁽⁴⁾	1.10	10.80			100.0	100.0	100.0				
REMARKS: (1) Flotation tailing 97.7 per cent minus 200 mesh. (2) oz per ton													
(3) From Internal Reports MS-AC-71-18 and 40 (4) Assay													

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 15		SAMPLE: Reeves MacDonald Mines Limited						DATE: Jan. 5, 1971						
OBJECT OF TEST: Reagent change								CHARGE: 2000-g						
								TESTED BY: W.A.W.						
OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton									
					ZnSO ₄	NaCN	Z-3	H ₂ SO ₄	CaO	CuSO ₄	ZnS ₂ O ₄			
Grind (1)	30	67		7x14 RM	1.0	0.2								
Condition	5	45	7.0	2000-g cell			0.01	1.0						
Pb float	5	25	7.0											
Zn condition	15	25	10.6						7.0	2.0				
Zn float	5	25												
Pb conc condition	5		6.7	500-g cell								1.0		
No. 1 Pb clean	1													
No. 2 Pb clean	0.75			250-g cell										
Zn clean	2			1000-g cell										

PRODUCT	WT %	ANALYSIS % (2)					DISTRIBUTION %		
		Ag (3)	Pb %	Zn %			Ag	Pb	Zn
Cl Pb conc	0.6		9.61	12.71				5.0	0.7
No. 1 Cl Pb tail	8.0		10.32	16.00				70.7	12.0
No. 2 Cl Pb tail	1.2		8.65	12.54				8.9	1.4
Ro Pb conc (calcd)	9.8		10.08	15.37				84.6	14.1
Cl Zn conc	11.1	10.38	0.35	62.70			26.4	3.4	65.3
Cl Zn tail	7.2	6.55	0.56	23.87			10.8	3.4	16.1
Ro Zn conc (calcd)	18.3	8.87	0.43	47.43			37.2	6.8	81.4
Ro tail	71.9	0.455	0.14	0.67			7.5	8.6	4.5
Feed (calcd)	100.0	4.37 ⁽⁴⁾	1.17	10.67			100.0	100.0	100.0

REMARKS: (1) Flotation tailing 97.7 per cent minus 200 mesh	(2) From Internal Reports MS-AC-71-18 and 50
(3) ounces per ton	(4) Assay

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 16		SAMPLE: Reeves MacDonald Mines Limited						DATE: Jan. 6, 1971							
OBJECT OF TEST:		Coarse grind with regrind of Lead Concentrate						CHARGE: 4000-g							
								TESTED BY: W.A.W.							
OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton										
					T130	R 242	ZnSO ₄	NaCN	SO ₂	610	633	ZnS ₂ O ₄	MIBC	Z-11	
Grind (1 + 2)	15	67		7x14 RM	0.10	0.10	1.0	0.2					1.0		
Condition	5	35	6.1	2000-g cell					50						
Condition	5	35							25	0.10	0.10				
Pb float	4	25	7.2			0.05								0.04	
Zn condition (3)	10	25	8.7												
Zn float	4	25	8.7												0.10
Zn clean	1.5			1000-g cell										0.01	
Zn reclean	1.0			500-g cell											
Pb conc screen				400-m screen											
+400 m grind	15			pebble mill											
+400 m clean	1.5			250-g cell			1.00	0.25						0.01	
-400 m clean + reclean	1.5			500+250 g cell			1.00	0.25							
PRODUCT	WT %	ANALYSIS % (6)					DISTRIBUTION %								
		Ag (4)	Pb	Zn			Ag	Pb	Zn						
+400 m clean Pb conc	1.0		31.60	18.30				26.6	1.7						
+400 m clean Pb tail	1.2		3.08	23.50				3.1	2.6						
+400 m Ro Pb conc (calcd)	2.2		31.18	21.14				29.7	4.3						
-400 m Recl Pb conc	1.0		40.55	12.38				34.2	1.2						
-400 m Recl Pb tail	2.4		4.00	14.00				8.1	3.1						
-400 m Cl Pb tail	0.9		9.58	16.00				7.3	1.3						
-400 m Ro Pb conc (calcd)	4.3		13.67	14.05				49.6	5.6						
Total Ro Pb conc (calcd)	6.5		19.60	16.45				79.3	9.9						
Clean Zn conc	11.0	6.36	0.48	58.50			16.0	4.5	59.9						
Clean Zn tail	9.7	2.96	0.61	11.25			6.6	5.0	10.1						
Reclean Zn tail	4.7	5.61	0.66	36.75			6.0	2.6	16.1						
Ro Zn conc (calcd)	25.4	4.93	0.56	36.43			28.6	12.1	86.1						
Ro tail	68.1	0.31	0.15	0.63			4.8	8.6	4.0						
Feed (calcd)	100.0	4.37(5)	1.19	10.75			100.0	100.0	100.0						
REMARKS: (1) 2000-g batch ground and floated (2) Flotation tailing 84.0 per cent minus 200 mesh (3) Additional Reagents CaO = 2.0 lb/ton, CuSO ₄ = 3.0 lb/ton (4) ounces per ton (5) Assay (6) From Internal Reports MS-AG-71-32 and 67															

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 17		SAMPLE: Reeves MacDonald Mines Limited					DATE: Jan. 7, 1971							
OBJECT OF TEST: Float plus 325 mesh fraction, Regrind concentrate combine with minus 325 mesh fraction and float						CHARGE: 2000-g								
						TESTED BY: W.A.W.								
OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton									
					301	DF250	CuSO ₄	NaCN	Na ₂ CO ₃	ZnSO ₄	CaO			
Grind	15	67		7x14 RM										
Screen				325 mesh										
Float +325 m fraction (1)	8	25	6.9	1000-g cell	0.10	0.04	2.0							
Regrind conc	30		7.0	Pebble Mill				0.15	0.03					
Pb float (2)	20			1000-g cell		0.15		0.6			1.5			
Pb clean No. 1	7			500-g cell				0.2			0.3			
Pb clean No. 2	7			250-g cell				0.25			0.4			
Pb clean No. 3	7													
Zn condition	10			1000-g cell				1.5						
Zn float	9		11.0									10		
Zn clean	5													
PRODUCT	WT %	ANALYSIS % (4)					DISTRIBUTION %							
		Ag (3)	Pb	Zn			Ag	Pb	Zn					
Reclean Pb conc	3.3	73.28	22.18	17.50			55.8	65.9	5.7					
Cl Pb Tail No. 1	3.1	7.19	1.80	20.00			5.2	5.0	6.2					
Cl Pb Tail No. 2	2.3	18.87	4.98	22.14			10.0	10.4	5.0					
Cl Pb Tail No. 3	0.9	24.68	6.92	20.72			5.1	5.6	1.9					
Ro Pb conc (calcd)	9.6	34.34	10.05	19.70			76.1	86.9	18.8					
Cl Zn conc	11.9	5.27	0.20	55.65			14.5	2.2	65.8					
Cl Zn tail	6.1	2.31	0.36	14.59			3.2	2.0	8.9					
Ro Zn conc (calcd)	18.0	4.27	0.26	41.73			17.7	4.2	74.7					
+325 m tail	30.1	0.195	0.03	0.28			1.4	0.9	0.8					
-325 m tail	42.3	0.49	0.21	1.36			4.8	8.0	5.7					
Ro Tail (calcd)	72.4	0.367	0.14	0.91			6.2	8.9	6.5					
Feed (calcd)	100.0	4.331	1.11	10.06			100.0	100.0	100.0					
REMARKS: (1) Reagents stage added. CuSO ₄ at 4th stage (2) Reagents stage added														
(3) ounces per ton (4) From Internal Report MS-AC-71-32 and 67														

MINES BRANCH FLOTATION TEST REPORT

TEST NO. 18	SAMPLE: Reeves MacDonald Mines Limited										DATE: Jan. 18, 1971						
OBJECT OF TEST: Grind Pb concentrate, depress Lead and float zinc											CHARGE: 2000-g						
											TESTED BY: W.A.W.						
OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton												
					T130	R 242	ZnSO ₄	NaCN	ZnS ₂ O ₄	CaO	CuSO ₄	404	Z-200	Na ₂ Cr ₂ O ₇			
Grind (1)	30	67		7x14 RM	0.10	0.10	1.0	0.2	2.0								
Pb float	6	25	7.7	2000-g cell													
Zn condition	15	25	8.8								2	2					
Zn float	3	25											0.10	0.08			
Pb conc grind	45			Pebble mill													
Condition Pb conc	5															4.0	
Float Middling	10																
Clean Zn conc	2			1000-g cell													
Reclean Zn conc	2																
PRODUCT	WT %	ANALYSIS % (3)						DISTRIBUTION %									
		Ag (2)	Pb	Zn				Ag	Pb	Zn							
Lead conc	6.9	4.91	8.15	14.00			7.6	49.5	9.1								
Middling conc	7.3	41.78	6.08	14.00			68.0	39.2	9.7								
Ro Pb conc (calcd)	14.2	23.86	7.08	14.00			75.6	88.7	18.8								
Zn conc	16.2	5.03	0.27	47.00			18.2	3.9	71.9								
Zn clean tail	3.2	1.70	0.32	7.50			1.2	0.9	2.3								
Zn reclean tail	3.1	2.32	0.36	12.50			1.6	0.9	3.7								
Ro Zn conc (calcd)	22.5	4.18	0.29	36.63			21.0	5.7	77.9								
Ro tail	63.3	0.243	0.10	0.56			3.4	5.6	3.3								
Feed	100.0	4.48	1.13	10.58			100.0	100.0	100.0								
REMARKS: (1) Flotation tailing 97.7 per cent minus 200 mesh (2) ounces per ton																	
(3) From Internal Report MS-AC-71-54 and 67																	

D.F.
250

0.02

0.02

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MINES BRANCH FLOTATION TEST REPORT

TEST NO. 19	SAMPLE: Reeves MacDonald Mines Limited							DATE: Feb. 25, 1971					
OBJECT OF TEST: Zinc float at pH 10.							CHARGE: 2000-g						
							TESTED BY: WAW						
OPERATION	Time min	% Solids	pH	Unit used	Reagents, lb per ton								
					Tl30	R 242	ZnSO ₄	NaCN	ZnS ₂ O ₄	CaO	CuSO ₄	211	DF250
Grind (1)	20	67		7 x 14 RM	0.10	0.10	1.00	0.20	1.0				
Pb float	2	25	7.5	2000-g cell									
Zn condition	10		8.5							2.0	2.0		
Zn float	4	25	10.0									0.10	0.03
Pb grind	30			pebble mill			1.0	0.20					
Pb clean	2			500-g cell			0.5	0.10					
Pb reclean	2			250-g cell			0.5	0.10					
Zn clean	1			500-g cell									
PRODUCT	WT %	ANALYSIS % (2)					DISTRIBUTION %						
		Ag (3)	Pb	Zn			Ag	Pb	Zn				
Reclean Pb conc	2.4	92.22	31.87	11.65			50.5	55.9	2.7				
Reclean Pb tail	1.5	22.53	1.19	13.38			7.7	1.3	1.9				
Clean Pb tail	6.3	5.72	6.18	14.16			8.2	28.4	8.5				
Rougher Pb conc (calcd)	10.2	28.54	11.49	13.46			66.4	85.6	13.1				
Clean Zn conc	16.5	5.63	0.45	48.79			21.2	5.4	76.8				
Clean Zn tail	4.8	2.77	0.29	11.40			3.0	1.0	5.2				
Rougher Zn conc (calcd)	21.3	4.99	0.41	40.36			24.2	6.4	82.0				
Rougher tail	68.5	0.60	0.16	0.75			9.4	8.0	4.9				
Feed (calcd)	100.0	4.38	1.37	10.48			100.0	100.0	100.0				
REMARKS: (1) Flotation tailing 90.9 per cent minus 200 mesh. (2) From Internal Report MS-AC-71-115. (3) Ounces per ton.													