

017074

NORANDA MINES LIMITED

Noranda, Quebec

Vangorda Project

Report No. 2

FLOTATION TESTWORK ON VANGORDA COMPOSITE SAMPLE

Noranda Ore Dressing Laboratory

July 6, 1970.

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INTRODUCTION

Nine samples of drill core were received from Vangorda property on March 17, 1970. These assayed as follows:

<u>Core No.</u>	<u>Au OPT</u>	<u>Ag OPT</u>	<u>Cu %</u>	<u>Pb %</u>	<u>Zn %</u>
1-A	0.010	1.51	0.27	3.24	3.92
10-A	0.033	2.10	0.27	4.58	4.16
15-A	0.013	1.98	0.30	4.10	4.42
26-A	0.016	2.08	0.20	2.82	3.56
47-A	0.017	2.02	0.14	3.70	4.22
50-A	0.015	1.63	0.41	3.20	3.38
52-A	0.017	0.132	0.20	2.84	3.12
75-A	0.031	2.21	0.16	5.54	6.94
81-A	0.010	0.116	0.15	2.56	3.40

These nine samples were blended into one composite for testwork purposes. A calculated head value was made. Assays were:

(Per cent or ounces per ton)

	<u>Au</u>	<u>Ag</u>	<u>Cu</u>	<u>Pb</u>	<u>Zn</u>	<u>PbO</u>	<u>ZnO</u>	<u>S</u>	<u>Fe</u>	<u>Insol.</u>
Actual	0.017	<u>1.76</u>	0.156	<u>3.71</u>	<u>4.54</u>	0.64	0.17	23.9	23.2	32.8
Calculated	0.018	1.81	0.250	3.56	4.11	-	-	-	-	-

Flotation testwork was conducted along the lines described in the previous Vangorda report dated April 2, 1970.

LYLLE ANES

## SUMMARY

Flotation testwork to date has not been entirely satisfactory due to (a) considerable fine-grained locking of the ore constituents (b) pre-activation of sphalerite and (c) the fair degree of oxidation of the ore. These factors have produced the following metallurgical effects.

a) Locking - The sphalerite in the ore appears to have a much finer degree of dissemination than the other minerals. Galena-sphalerite locking at 270 mesh requires very fine grinding of the lead concentrate to eliminate sphalerite and the consequent loss of slimed galena is considerable. When regrinding of lead concentrate was not practised the displaced zinc in this concentrate amounted to some 30 per cent of the total zinc.

Locking of zinc with quartz, pyrite and pyrrhotite made regrinding of zinc concentrates to 99 per cent minus 325 mesh essential if good zinc concentrates (plus 56 per cent zinc) were to be made.

b) Pre-activation of sphalerite presumably by the copper present in the ore was quite severe and free sphalerite was found to float consistently with the lead concentrate despite high additions of sphalerite depressants. De-zincing of lead concentrate with dichromate was tried but was unsuccessful due to froth problems with slimed galena.

*Microscopic proof?*

*DEZINCING  
K2Cr2O7*

c) Oxidation - Some 17 per cent of all lead and 4 per cent of all zinc was present in the oxide form. Despite fairly high additions of sulphidizing agent, oxide lead tended not to float.

Copper recovery was poor especially when quite large amounts of cyanide were used in attempts to depress the pre-activated sphalerite. The production of a copper concentrate from a cleaned lead concentrate using the Brunswick starch - SO<sub>2</sub> method was not too successful because of the afore-mentioned froth problem.

Fraction	Wt. %	Assay %				Distribution %			
		Cu	Pb	Zn	Ag	Cu	Pb	Zn	Ag
Cu Conc.	5.3	14.20	31.36	7.24	49.2	71.3	3.5	3.2	16.2
Pb Conc.	94.7	0.32	48.00	12.36	14.2	28.7	96.5	96.8	83.8
O'ALL Conc.	100.0	1.06	47.12	12.09	16.06	100.0	100.0	100.0	100.0

Extra cleaning stages and shorter flotation times are indicated.

The basic outcome of the tests showed that 90 per cent lead recovery could be achieved at the expense of some 30 per cent displaced zinc, while very vigorous lead regrinding and recleaning could cut this loss to 10 per cent while at the same time lead recovery would drop to 70 per cent.

90% lead extracted but 30% zinc with it also.

Test No. V-24 illustrates the first case where no lead concentrate regrinding took place.

Fraction	Wt. %	Assay OPT or %			Distribution %		
		Ag	Pb	Zn	Ag	Pb	Zn
Pb Cleaner Conc.	7.9	14.6	37.6	9.24	66.0	83.4	16.5
O'All Pb Conc.	12.8	10.19	25.18	9.17	74.7	90.5	26.5
Zn Cleaner Conc.	5.1	1.86	1.56	<u>48.08</u>	5.4	2.2	<u>55.5</u>
O'All Zn Conc.	13.0	1.40	1.24	22.45	10.4	4.5	66.1
Tailing	74.0	0.35	0.24	0.44	14.9	5.0	7.4
Heads	100.0	1.75	3.56	4.42	100.0	100.0	100.0

45%

Note that cleaning without regrinding only cuts down pyrite and insolubles in the lead concentrate, without reducing the zinc content appreciably.

In test V-32 (a sextuple locked test) each lead concentrate was re-ground and cleaned twice. Zinc concentrate was also re-ground.

Results were:

Fraction	Wt. %	Assay OPT. on %				Distribution %			
		Ag	Cu	Pb	Zn	Ag	Cu	Pb	Zn
Pb Cleaner Conc.	4.4	<u>18.0</u>	0.42	<u>54.1</u>	<u>9.56</u>	<u>38.4</u>	10.6	<u>63.3</u>	<u>8.6</u>
O'All Pb Conc.	4.9	17.1	0.47	50.6	9.35	40.7	13.5	66.3	9.4
Zn Cleaner Conc.	6.2	2.92	0.20	2.56	<u>56.20</u>	8.8	7.1	4.2	<u>71.4</u>
O'All Zn Conc.	10.1	4.27	0.36	6.64	39.40	20.9	21.2	17.9	81.6
Tailings	85.0	0.93	0.13	0.69	0.52	38.4	65.3	15.8	9.0
Heads	100.0	2.06	0.17	3.76	4.88	100.0	100.0	100.0	100.0

Large amounts of lead reported in the zinc concentrate and tailings due to the severe lead cleaning schedule. However, as the zinc assay was not significantly reduced it may be possible to achieve the same lead concentrate with higher recovery of lead using more stages of flotation cleaning rather than excessive regrinding. It was noted that the lead as lead oxide in the tailings amounted to 0.56 per cent while the zinc as zinc oxide was 0.15 per cent.

Microscopic examination of the zinc concentrate showed a number of fine (5 - 10 micron) inclusions of pyrrhotite and pyrite in sphalerite particles above 40 micron size. Regrinding was seen to be necessary and infrasizing of reground concentrate showed that an optimum size for zinc concentrate would be around 20 microns. Such a fine sizing would possibly introduce filtering problems in practice. *yes!*

Size Microns	% Wt.	% Zn	% Pb	Dist. Zn %	Dist. Fe %
56	17.7	53.5	8.2	17.1	22.4
40	18.5	55.4	7.0	18.5	19.8
28	18.0	56.7	6.0	18.4	16.6
20	15.5	56.7	5.7	15.9	13.5
14	14.3	57.4	5.6	14.8	12.2
10	4.0	54.4	5.8	3.9	3.5
-10	12.0	52.4	6.5	11.4	12.0
Head	100.0	55.4	6.5	100.0	100.0

Silver metallurgy was erratic and excessive recleaning of lead concentrates had a detrimental effect. Usually some 70 per cent recovery in the lead concentrate was experienced.

Testwork details are appended.

SAMPLE

Point of Addition	CONDITIONS						REAGENTS POUNDS PER TON						
	Time Min.	% Solids	pH	NaCN	Na <sub>2</sub> CO <sub>3</sub>	Na <sub>2</sub> SO <sub>4</sub>	Na <sub>2</sub> S	R-343	AF-401	AF-242	CuSO <sub>4</sub>	CaO	MIBC
Grind	22	68		0.25	1.5	1.0	0.4						
Bulk Cond.	5		9.8					0.02	0.03				
Bulk Ro.	6									0.01			
Bulk Scav.	12		9.5					0.03			1.0	0.25	
Zn Cond.	10		10.2								0.75		
Zn Ro.	6							0.07					0.02
Zn Scav.	7		9.4					0.06					0.03
Bulk Cl.				0.10						0.01		0.125	
Zn Cl.												1.0	

REMARKS Grind 79.5 per cent minus 325 mesh.

Copper floated from Pb concentrate using 1.0 pounds per ton JCD-73 and SO<sub>2</sub> to pH 4.5.

Product	% Weight	Assay oz./ton or %				% Distribution			
		Ag	Pb	Zn	Cu	Ag	Pb	Zn	Cu
Cu Conc.	0.3	42.2	31.36	7.24	14.20	8.7	2.5	0.5	22.3
Pb Conc.	5.4	14.2	48.00	12.36	0.32	44.8	70.3	15.1	11.2
Bulk Midd.	1.0	7.74	13.40	2.98	1.87	4.5	3.6	2.3	12.8
Bulk Conc.	6.7	14.8	42.10	11.75	1.17	58.0	76.4	17.9	54.0
Zn Conc.	5.1	2.68	3.28	51.56	0.16	8.0	4.5	60.0	5.6
Zn Midd.	2.4	3.15	5.34	21.60	0.30	4.4	3.8	11.8	4.2
Zn Ro.	7.5	2.83	4.09	42.00	0.21	12.4	8.3	71.8	10.5
Scav. Tail	85.8	0.58	0.66	0.58	0.06	22.6	15.3	10.3	35.5
Heads	100.0	1.70	3.69	4.43	0.14	100.0	100.0	100.0	100.0

SAMPLE Vangorda Composite

Point of Addition	CONDITIONS						REAGENTS POUNDS PER TON						
	Time Min.	% Solids	pH	NaCN	Na <sub>2</sub> CO <sub>3</sub>	Na <sub>2</sub> SO <sub>4</sub>	Na <sub>2</sub> S	AF-401	CuSO <sub>4</sub>	CaO	R-343	MIEC	BHA
Grind	20	68		0.5	1.5	1.75	0.4						
Ro Cond.	5		9.8					0.06					
Ro Float	5												
Ro Scav.	12							0.03					
Ro Cl	5			0.25									
Zn Cond.	10		10.0						1.0	1.0			
Zn Ro.	10										0.05	0.02	
Zn Scav.	10										0.03		0.01
Zn Cl	5		10.9							1.0			

REMARKS Good lead concentrate but lead middlings not responding to flotation.

Product	% Weight	Assay oz./ton or %			% Distribution		
		Ag	Pb	Zn	Ag	Pb	Zn
Pb Cl Conc.	2.1	23.2	52.08	5.44	27.0	31.7	2.7
Pb Midd.	6.8	10.15	27.12	10.2	38.3	53.4	16.2
O'All Pb	8.9	13.26	33.01	9.08	65.3	85.1	18.9
Zn Cl Conc.	5.6	1.86	1.40	48.52	6.0	2.3	60.9
Zn Cl Tail	3.4	1.51	1.48	7.24	2.8	1.4	5.7
Zn Scav.	5.0	2.22	1.60	4.70	6.2	2.3	5.5
O'All Zn	14.0	1.94	1.49	22.04	15.0	6.0	72.1
Tails	77.1	0.46	0.40	0.50	13.7	8.9	3.0
Heads	100.0	1.80	3.45	4.23	100.0	100.0	100.0

SAMPLE Vangoraa Composite

Point of Addition	CONDITIONS				REAGENTS POUNDS PER TON								
	Time Min.	% Solids	pH	NaCl	Na <sub>2</sub> CO <sub>3</sub>	Na <sub>2</sub> SO <sub>4</sub>	Na <sub>2</sub> S	AF-40	CuSO <sub>4</sub>	CaO	R-34	MIBC	BHB
Grind	20	68		0.5	1.5	1.75	0.4						
Ro Cond.	5		9.6					0.06					
Ro Float	5												
Ro Scav.	12							0.03					
Ro Cl.	5			0.25									
Zn Cond.	10		9.9						1.0	1.0			
Zn Ro.	10										0.05	0.02	
Zn Scav.	10										0.03		0.01
Zn Cl.	5		11.2							1.0			

REMARKS Triple locked test, grind 82 per cent minus 325 mesh.

Product	% Weight	Assay oz./ton or %			% Distribution		
		Ag	Pb	Zn	Ag	Pb	Zn
Bulk Cl Conc	4.4	20.3	56.0	8.1	46.4	65.7	7.5
Bulk Cl Tail	2.3	9.10	18.6	12.1	10.8	11.4	5.8
Bulk Scav Co	1.0	7.22	17.2	10.2	4.2	4.6	2.3
O'All Bulk	7.7	15.3	39.8	9.6	61.3	81.7	15.6
Zn Cl Conc.	5.4	2.33	2.1	53.8	6.5	3.0	61.5
Zn Cl Tail	3.4	1.92	2.10	10.7	3.4	1.9	7.7
Zn Scav Conc	3.5	2.68	3.3	6.7	4.7	3.1	5.0
O'All Zn	12.3	2.29	2.4	28.5	14.6	8.0	74.2
Tails	80.0	0.58	0.4	0.60	24.1	10.3	10.2
Heads	100.0	1.93	3.7	4.7	100.0	100.0	100.0

SAMPLE Vangorua Composite

Point of Addition	CONDITIONS					REAGENTS POUNDS PER TON				
	Time Min.	% Solids	pH	NaCl	Na <sub>2</sub> CO <sub>3</sub>	CaO	ZnO	Al <sub>2</sub> O <sub>3</sub>	Dow-Frost 250	CaSO <sub>4</sub>
Grind	18	68	9.6	0.20	2.3					
Pb Cond.	8		9.6				0.04	0.07		
Pb Ro.	7		9.6				0.04	0.07		
Pb Scav.	6		9.3				0.03	0.07		
Pb Cl	10		9.8				0.04	0.002		
Regrind	3					1.0				
Zn Cond.	5		10.7				0.01			0.50
Zn Ro.	5		10.7				0.04	0.002		
Zn Cond.	5		10.7				0.01			0.20
Zn Scav.	6		10.7				0.06	0.002		
Zn Cl	11		10.8				0.04	0.002		

REMARKS Triple locked - Basic Brunswick procedure. . Insufficient zinc depression.

Product	% Weight	Assay oz./ton or %			% Distribution		
		Ag	Pb	Zn	Ag	Pb	Zn
#2 Pb Cl Conc	8.3	13.35	35.60	10.72	58.6	79.1	19.8
#2 Pb Cl Tail	0.7	4.76	8.20	7.88	1.7	1.5	1.2
#1 Pb Cl Conc	9.0	12.67	33.46	10.48	60.3	80.6	21.0
#1 Pb Cl Tail	1.0	3.25	5.04	8.00	1.7	1.3	1.8
Pb Ro Conc.	10.0	11.73	30.62	10.24	62.0	81.2	22.9
Pb Scav. Conc	0.9	4.88	7.96	10.52	2.3	1.9	2.1
0'All Pb Conc	10.9	11.16	28.75	10.26	64.3	83.8	24.0
#2 Zn Cl Conc	5.1	2.21	1.76	51.20	5.2	2.4	52.1
#2 Zn Cl Tail	0.3	3.25	4.04	18.60	0.6	0.4	1.2
#1 Zn Cl Conc	5.4	2.30	1.92	49.38	6.5	2.8	50.3
#1 Zn Cl Tail	1.3	2.03	2.76	6.84	1.4	1.0	1.9
Zn Ro Conc.	6.7	2.26	2.08	41.13	7.2	3.8	6.22
Zn Scav. Conc	4.2	1.62	2.04	5.90	3.6	2.3	5.4

Vangorda Composite V-22

Product	% Weight	Assay oz./ton or %				% Distribution			
		Ag	Pb	Zn		Ag	Pb	Zn	
O'All Zn Conc	10.9	2.02	2.06	27.52		11.5	6.1	66.6	
Zn Scav.Tails	78.2	0.58	0.48	0.48		24.2	10.1	8.5	
Heads	100.0	1.89	3.73	4.49		100.0	100.0	100.0	

Screen + assay of tailings

Fraction	Wt. %	Assay			Distribution		
		OPT Ag	% Pb	% Zn	Ag	Pb	Zn
+270	3.7	0.81	0.50	0.60	5.0	3.8	5.4
+325	6.4	0.70	0.48	0.48	7.5	6.4	7.4
-325	89.9	0.58	0.48	0.40	87.5	89.8	87.2
Total	100.0	0.60	0.48	0.41	100.0	100.0	100.0

FLOTATION REPORT

SAMPLE Vangorda Composite

Point of Addition	CONDITIONS						REAGENTS POUNDS PER TON					
	Time Min.	% Solids	pH	NaCN	ZnSO <sub>4</sub>	NaCO <sub>3</sub>	Na <sub>2</sub> S	ZnO	CuO	CuSO <sub>4</sub>	Dow froth 250	
Grind	18	68		0.30	0.80	2.5	0.20					
Pb Cond.	2		3.6					0.04	0.05			
Pb Ro.	7											
Pb Scav.	10							0.04	0.05			
Pb Cl.	10			0.10	0.40				0.04			
Regrind	3									1.0		
Zn Cond.	10		10.7								0.50	
Zn Ro.	5							0.04			0.002	
Zn Cond.	5										0.30	
Zn Scav.	8							0.06			0.002	

REMARKS Triple locked. High initial zinc depressant charge does not seem to alter zinc displacement. High lead recovery at expense of high displaced zinc. Zn Cl Conc. assayed Po 11.6 per cent Py 5.6 per cent.

Product	% Weight	Assay oz./ton or %			% Distribution		
		Ag	Pb	Zn	Ag	Pb	Zn
2 Bulk Conc.	7.9	14.6	37.6	9.24	66.0	83.4	16.5
2 Bulk Tail	1.0	4.32	8.16	11.00	2.5	2.3	2.5
1 Bulk Conc.	8.9	13.44	34.29	9.44	68.5	85.7	19.0
1 Bulk Tail	2.0	2.22	3.60	8.36	2.5	2.0	3.8
Bulk Ro Conc.	10.9	11.38	28.66	9.24	71.0	87.7	22.8
Bulk Scav. Co.	1.9	3.39	5.20	8.80	3.7	2.8	3.8
O'All Bulk Co	12.8	10.19	25.18	9.17	74.7	90.5	26.5
#2 Zn Conc.	5.1	1.86	1.56	48.08	5.4	2.2	55.5
#2 Zn Tail	0.7	1.40	1.44	10.03	0.6	0.3	1.6
#1 Zn Conc.	5.8	1.81	1.55	43.50	6.0	2.5	57.1
#1 Zn Tail	4.5	0.93	0.84	4.40	2.4	1.1	4.5
Zn Ro Conc.	10.3	1.43	1.24	26.42	8.4	3.6	61.6
					2.0	0.9	4.5



SAMPLE Vangorda Composite

Point of Addition	CONDITIONS						REAGENTS POUNDS PER TON						
	Time Min.	% Solids	pH	Na <sub>2</sub> S	NaCN	Na <sub>2</sub> CO <sub>3</sub>	AMP130	Zn	AMP104	MIBC	CaO	ZnSO <sub>4</sub>	CuSO <sub>4</sub>
Grind	18	68	9.4	0.25	0.20	2.3	0.03						
Pb Cond.	2		9.4					0.04	0.05	0.01			
Pb Ro	7												
Pb Scav.	11							0.02	0.02				
Pb Cl Cond.	5		9.9		0.05						0.20	0.20	
Pb Cleaner	4								0.02				
Pb Cl Re grind	2				0.10						0.50	0.20	
Reclean	5												
Regrind	3										R-343		
Dezinc Cond.	15										0.01		0.10

REMARKS In the dezinc step the pulp is heated to a temperature of 40°C and 3.0 pounds per ton dichromate was added.

Product	% Weight	Assay oz./ton or %				% Distribution		
		Ag	Pb	Zn	Ag	Pb	Zn	
Dezincd	2.3	2.05	34.36	19.60	3.2	24.2	9.9	
Pb Cl Conc.	5.3	11.30	31.84	6.60	40.8	51.7	7.7	
Pb Cl Tails	3.0	5.60	6.48	11.48	11.5	6.0	7.6	
Ro Conc.	10.6	7.68	25.21	10.80	55.5	81.9	25.2	
Scav. Conc.	2.2	3.15	4.64	11.36	4.7	3.1	5.5	
O'All Pb Conc	12.8	6.90	21.67	10.70	60.2	85.0	30.7	
Zn Cl Conc.	5.2	2.10	1.56	50.64	7.4	2.5	58.0	
Zn Retreatment Tail	0.7	5.60	6.80	25.00	2.7	1.4	3.9	
Zn Retreatment	3.6	1.98	2.24	3.34	4.8	2.5	2.6	
O'All Zn Conc	2.5	2.31	2.21	3.08	14.9	6.4	64.5	
Tails	77.7	0.47	0.36	0.28	24.9	8.6	4.8	
Heads	100.0	1.47	3.26	4.54	60.9	100.0	100.0	

Date:

EXPERIMENTAL LABORATORY  
FLOTATION REPORT

TEST NO. V-25

Sample: Vangorda Composite

Point of Addition	CONDITIONS				REAGENTS POUNDS PER TON								
	Time Min.	% Solids	pH	CaO	CuSO <sub>4</sub>	R-343	MIBC						
RE Grind	5		11.5	1.0									
Zn Cond.	10				0.50								
Zn Ro.	5					0.04	0.01						
Zn Cond.	5				0.30								
Zn Scav.	8					0.06	0.01						
Zn Cl. Conc.	11					0.04	0.01						
Zn Cl. Tails + Scav. Conc. Recleaned	5		11.0										
Zn Recleaned	5												
Zn Recleaned Rescav. Conc. (Retreatment)	6		11.5			0.04	0.01						

FLOTATION REPORT

SAMPLE Vanagorda Composite

Point of Addition	CONDITIONS					REAGENTS POUNDS PER TON							
	Time Min.	% Solid	pH	NaOH	ZnSO <sub>4</sub>	H <sub>2</sub> CO <sub>3</sub>	Na <sub>2</sub> S	ZnO	Al <sub>2</sub> O <sub>3</sub>				
Grind	18	68		0.30	0.60	2.5	0.20						
Bulk Cond.	2		9.6					0.04	0.05				
#1 Bulk Float	5												
#2 Bulk Float	12							0.04	0.05				

REMARKS

To determine the relative flotation rates of PbS and ZnS using a combination of zinc depressants.

Product	% Weight	Assay oz./ton or %		% Distribution	
		Pb	Zn	Pb	Zn
#1 Bulk Conc.					
0 - 1	6.3	36.64	8.60	62.2	12.1
1 - 3	4.1	18.56	10.32	20.5	9.4
3 - 5	1.7	10.96	9.20	5.0	3.7
#2 Bulk Conc.					
5 - 7	3.2	3.56	7.20	3.1	5.6
7 - 9	1.5	2.48	6.63	1.0	2.2
9 - 11	1.5	2.20	6.56	0.9	2.2
11 - 13	1.2	1.76	6.12	0.6	1.6
13 - 15	0.2	1.72	6.20	0.4	1.2
15 - 17	0.2	1.52	5.96	0.4	1.2
O'All Bulk Co	21.3	16.38	8.28	21.1	27.2
Tailings	72.7	0.28	3.42	5.2	60.8
Head	100.0	3.71	4.50	100.0	100.0

SAMPLE Vangorda Composite

Point of Addition	CONDITIONS						REAGENTS POUNDS PER TON						
	Time Min.	% Solids	pH	NaCN	ZnSO <sub>4</sub>	Na <sub>2</sub> CO <sub>3</sub>	Na <sub>2</sub> S	ZnO	MF-H <sub>2</sub> O <sub>4</sub>				
Grind	18	68		0.40	0.50	2.5	0.20						
Bulk Cond.	2		9.6					0.04	0.05				
#1 Bulk Float	5												
#2 Bulk Float	12							0.04	0.05				

REMARKS To determine the relative flotation rates of PbS and ZnS using a combination of zinc depressants.

Product	% Weight	Assay oz./ton or %			% Distribution	
		Pb	Zn		Pb	Zn
#1 Bulk Conc.						
0 - 1	5.3	41.52	8.76		67.0	11.2
1 - 2	2.3	22.00	10.20		13.8	5.1
3 - 5	1.1	7.04	8.72		2.1	2.1
#2 Bulk Conc.						
5 - 7	4.0	5.28	8.80		5.8	7.6
7 - 9	2.0	4.40	8.00		2.4	3.5
9 - 11	1.1	3.00	7.44		0.9	1.8
11 - 13	1.2	2.32	6.76		0.8	1.7
13 - 15	1.2	1.84	6.20		0.6	1.6
15 - 17	1.6	1.28	5.60		0.5	2.0
Overall Bulk Co	20.4	16.94	8.37		23.0	26.6
Tailings	79.6	0.28	3.63		6.1	63.4
Hand	100.0	3.66	4.69		100.0	100.0

SAMPLE Vangorda Composite

Point of Addition	CONDITIONS						REAGENTS POUNDS PER TON					
	Time Min.	% Solids	pH	NaCN	Na <sub>2</sub> SO <sub>4</sub>	Na <sub>2</sub> CO <sub>3</sub>	Na <sub>2</sub> S	ZnO	AF-H <sub>2</sub> O			
Grind	18	68		0.50	0.80	2.5	0.20					
Bulk Cond.	2		9.6					0.01	0.05			
#1 Bulk Float	5											
#2 Bulk Float	12							0.01	0.05			

REMARKS

To determine the relative flotation rates of PbS and ZnS using a combination of zinc depressants.

Product	% Weight	Assay oz./ton or %		% Distribution	
		Pb	Zn	Pb	Zn
1 Bulk Conc. 0 - 1	7.1	34.80	8.92	68.3	14.4
1 - 2	4.3	12.88	9.84	15.3	9.7
2 - 5	2.5	5.36	7.92	3.7	4.5
#2 Bulk Conc. 5 - 7	4.3	2.44	6.52	3.2	7.3
7 - 9	2.2	2.44	5.56	1.5	2.8
9 - 11	1.9	1.80	5.40	0.2	2.3
11 - 13	2.1	1.16	4.92	0.7	2.3
13 - 15	1.9	0.96	4.84	0.5	2.1
15 - 17	1.2	0.64	4.44	0.3	1.8
0' All Bulk C.	29.7	11.92	7.92	24.5	17.2
Tailings	71.3	0.28	3.24	5.5	52.8
Head	100.0	3.62	4.36	100.0	100.0

SAMPLE Vangorda Composite

Point of Addition	CONDITIONS				REAGENTS POUNDS PER TON								
	Time Min.	% Solids	pH	NaCN	Na <sub>2</sub> S	AF130	CaO	Z-9	AF104	AF242	CuSO <sub>4</sub>	MIBC	Na <sub>2</sub> SiO <sub>3</sub>
Grind	18	68		0.20	0.25	0.03	1.00						
Bulk Cond.	1		9.5				2.00	0.04	0.05				
Bulk Float	4		9.8							0.03			
Bulk Scav.	10							0.02	0.02	0.03			
Zn Cond.	10		9.8				1.00				1.25		
Zn Float	5							0.06				0.002	
Zn Scav.	8							0.04					
Bulk Cl.	5			0.02	ZnSO <sub>4</sub> 0.10		0.20		0.02				0.2
Zn Cl	10		10.5				2.00			R-343 0.02			

REMARKS Quintuple locked, grind 89.5 per cent minus 325 mesh on tailings.

Lime used as alkalinity regulator, gave poor zinc metallurgy.

Product	% Weight	Assay oz./ton or %			% Distribution		
		Ag	Pb	Zn	Ag	Pb	Zn
Pb Conc.	3.9	16.3	50.64	9.52	31.7	51.1	7.5
Pb Midd.	8.4	8.4	14.80	21.60	35.2	32.2	36.7
ALL Pb	12.3	10.9	26.16	17.76	66.9	83.3	44.2
Zn Conc.	4.4	2.45	2.08	39.84	5.4	2.4	35.5
Zn Midd.	9.3	2.23	2.44	4.72	10.3	5.9	8.9
ALL Zn	13.7	2.30	2.33	16.00	15.7	8.3	44.4
Tails	74.0	0.47	0.44	0.76	17.4	8.4	11.4
Leads	100.0	2.01	3.86	4.94	100.0	100.0	100.0

FLOTATION REPORT

SAMPLE Vangorda Composite

Point of Addition	CONDITIONS					REAGENTS POUNDS PER TON							
	Time Min.	% Solids	pH	NaCN	Na <sub>2</sub> CO <sub>3</sub>	Na <sub>2</sub> S	AP130	Z-9	AP404	AP242	CaO	CuSO <sub>4</sub>	MIBC
Grind	18	68		0.20	2.3	0.25	0.03						
Bulk Cond.	1		8.8					0.04	0.05				0.002
Bulk Float	4									0.03			
Bulk Scav.	10							0.02	0.02	0.03			
Zn Cond.	10		9.6								1.0	1.25	
Zn Float	5							0.06					0.002
Zn Scav.	8												
Regrind Bulk Conc.	5			0.02	0.2	Na <sub>2</sub> SiO <sub>3</sub>	ZnSO <sub>4</sub>	Na <sub>2</sub> SiO <sub>3</sub>			0.20		
Bulk Cl	5		9.6						0.02				
Zn Cl	10		10.8										

REMARKS Quintuple locked. Each bulk concentrate reground gave excessive slimed lead losses to the zinc concentrate. Zinc concentrate reground to 99.2 per cent minus 325 mesh.

Product	% Weight	Assay oz./ton or %			% Distribution		
		Ag	Pb	Zn	Ag	Pb	Zn
Pb Cl Conc.	4.8	17.0	54.40	11.40	46.5	65.7	11.7
Pb Cl Tail	0.5	14.1	37.72	7.12	4.0	4.8	0.8
TAIL Pb	5.3	16.7	52.82	11.00	50.5	70.5	12.5
Zn Cl Conc.	5.7	2.93	2.60	52.40	9.5	3.7	63.9
Zn Cl Tail	8.1	3.96	6.68	2.20	18.3	13.6	16.0
TAIL Zn	13.8	3.54	14.22	27.04	27.8	17.3	79.9
Tails	80.2	0.47	0.60	0.44	21.7	12.2	7.6
Lead	100.0	1.76	3.97	4.67	100.0	100.0	100.0

SAMPLE Vangorda Composite

Point of Addition	CONDITIONS						REAGENTS POUNDS PER TON						
	Time Min.	% Solids	pH	NaCN	Na <sub>2</sub> S	Na <sub>2</sub> CO <sub>3</sub>	AF130	Z-9	AF404	MLBC	AF242	CaO	CuSO <sub>4</sub>
Grind	18	68		0.20	0.25	2.3	0.03						
Bulk Cond.	1		8.6					0.04	0.05	0.02			
Bulk Float	4										0.03		
Bulk Scav.	10							0.02	0.02		0.03		
Zn Cond.	10		9.6									1.0	1.25
Zn Float	5							0.06					
Zn Scav.	8							0.04		0.02			
Bulk Conc. Re	5		Na <sub>2</sub> SO <sub>3</sub> 0.20	ZnO 0.25	Na <sub>2</sub> SiO <sub>3</sub> 0.2	Ca(OH) <sub>2</sub> 0.10						0.20	
Bulk Cl.	5		9.6						0.02				
Zn Cl.	10		10.5									1.0	

REMARKS Quintuple locked similar to V-31 grind 79.4 per cent minus 325 mesh.

High lead losses due to overgrinding of bulk concentrate.

Product	% Weight	Assay oz./ton or %				% Distribution			
		Ag	Cu	Pb	Zn	Ag	Cu	Pb	Zn
Pb Cl. Conc.	4.4	18.0	0.42	54.1	9.56	38.5	10.5	63.3	8.6
Pb Midds.	0.5	9.20	0.98	22.4	7.44	2.2	3.0	3.0	0.8
O'All Pb Conc.	4.9	17.1	0.47	50.6	9.35	40.7	13.5	66.3	9.4
Zn Cl. Conc.	6.2	2.92	0.20	2.56	56.2	8.8	7.1	4.2	71.4
Zn Midds.	3.9	6.42	0.62	13.12	12.72	12.1	14.1	13.7	10.2
O'All Zn Conc.	10.1	4.27	0.36	6.64	39.40	20.9	21.2	17.9	81.6
Tailings	85.0	0.93	0.13	0.69	0.52	38.4	65.3	15.8	9.0
Head	100.0	2.06	0.17	4.12	4.88	100.0	100.0	100.0	100.0