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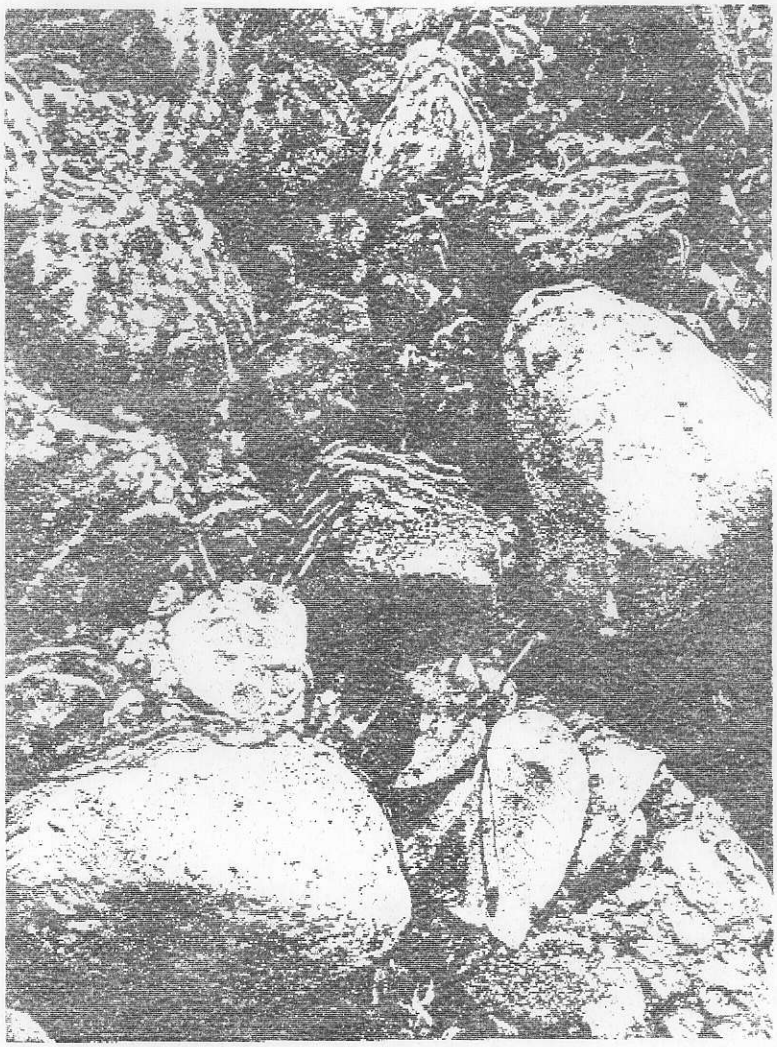
KAMLOOPS
RESEARCH & ASSAY
LABORATORY LTD.
&
MET *ENGINEERS* LTD.

PRELIMINARY FLOTATION STUDY

PACIFIC CASSIAR LTD.

BRITISH COLUMBIA



SUMMARY

Ore represented by the sample tested is amenable to treatment using standard flotation techniques. More work is required to improve silver recovery: It is recommended that finer grinding and sulphurdization be studied in future work.

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KM074

January 19, 1982

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INTRODUCTION

On December 11, 1981, we were requested to perform a preliminary laboratory test program on samples of ore supplied by Pacific Cassiar Limited. Acting on instructions from Mr. John Greig, we prepared a well mixed composite to pass six mesh and divided the sample into 1 kg. lots in preparation for laboratory test-work. A head sample was removed from the composite and assayed for elements of interest.

TABLE 1

Chemical Composition of Sample

Assays %					
Au*	Ag*	Pb	Zn	Cu	Cd
L.001	16.4	2.09	0.66	0.04	L.01

L means "Less than" * troy ozs/S.D.T.

Under the microscope some galena and sphalerite were visible, often dispersed with a gouge material. Oxides of iron were common with some pyrite granules. Mineralization appeared to be generally quite coarse - most crystals of galena and sphalerite noted were in the 50 - 150 um range. As requested by Mr. Greig, a sample has been dispatched to Vancouver Petrographics for a more detailed mineralogical appraisal. (This data will be forwarded when available.)

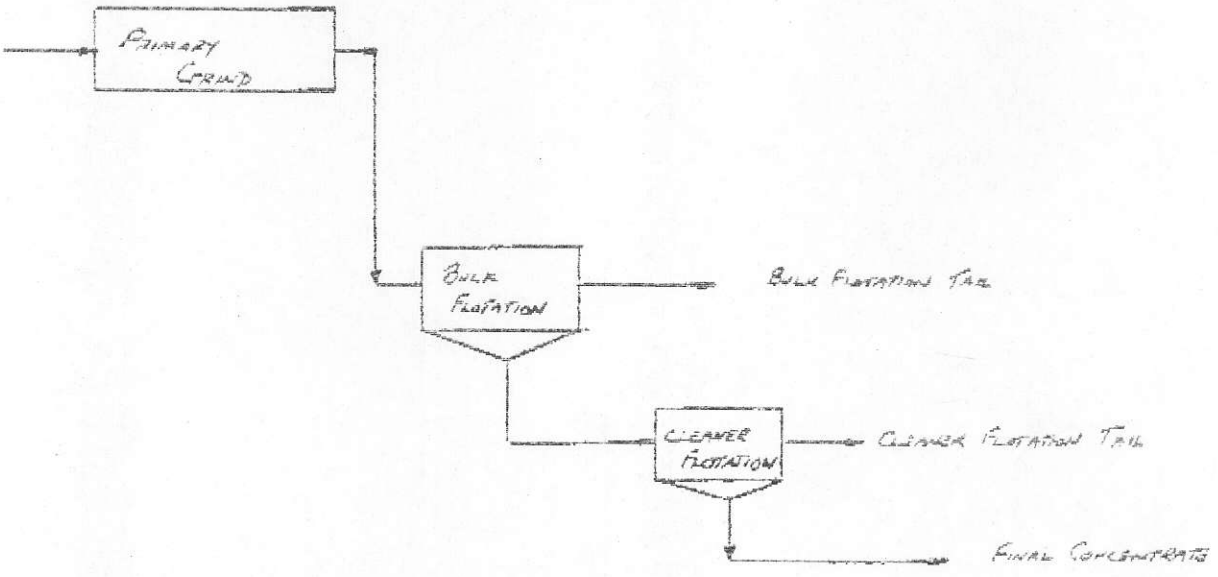
The preliminary program was discussed with Mr. Kenyon on December 30, 1981, and authority to proceed was given at this time. Test-work commenced on January 6th and the preliminary phase was completed January 8th, 1982.

TEST PROGRAM

Because of the very low lead and zinc content of the ore, a bulk flotation method was selected as the most likely route to pursue. In this technique, copper sulphate is used to activate normally non-flotable sulphides and sphalerite. Collectors used were isopropyl xanthate (a strong sulphide collector) and T.M. 3, (a metallics collector). Flotation circuit pH was controlled with lime at about pH 10 - 10.5.

The effects of cleaning the rougher concentrates without regrinding were studied in tests 2 and 3. A flowsheet, indicating test procedure, is shown in the flowsheet below.

Bulk Flotation Flowsheet



ANALYSIS AND DISCUSSION OF RESULTS

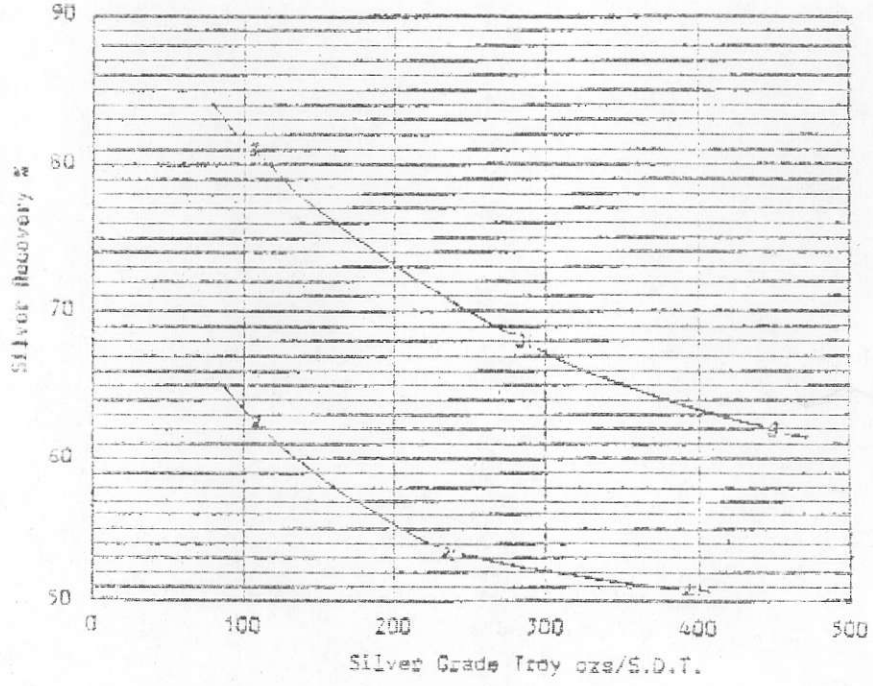
A preliminary test was performed to become familiar with the response of the ore. Then two more tests were executed to determine the influence of grind on metallurgy.

1. Grind Effects

As shown below, there is a very significant increase in silver recovery as the result of increasing the fineness of grind to 90% passing minus 200 mesh. It is assumed that this improvement is the result of liberating locked or coated minerals.

GRAPH 1

Effect of Grind on Silver Recovery



Based on these results it would be reasonable to pursue still finer grinding to determine if additional gains can be achieved. Also, to assist in mill design it may be prudent to conduct a Bond test to determine grinding power needs.

Slight variations in reagent balance, to include a sulphurdization stage, might assist in oxide mineral recovery. In these tests sodium sulphide would be used in the grinding mill, then following conditioning, activator and collector would be added and a bulk concentrate floated.

2. Concentrate Quality

In assessing the results of the tests, it is reasonable to assume that most of the values in the cleaner tailings will, on recycling, report to the final concentrate. Thus, a relatively low grade lead concentrate would be produced and should be fairly easy to market. The approximate chemical composition of the bulk concentrate is shown below in Table 2.

TABLE 2

Estimated Chemical Composition of Concentrate+

Product	Assays %								
	Au*	Ag*	Pb	Zn	Cu	Fe	Sb	As	Hg**
Bulk Flotation Concentrate	.12	449	25	7	.42	12.4	.28	.12	23 ppm

+ Data based on concentrate assays

* troy ozs/S.D.T.
** p.p.m.

CONCLUSIONS

1. The ore represented by the sample tested is amenable to flotation methods at a relatively fine grind. The technique proposed is simple to operate on a plant scale, economic in terms of reagents and would provide an environmentally acceptable effluent.

2. It is recommended that additional tests be performed to attempt to improve silver recovery. Finer grind tests and sulphurdization are recommended.

3. Ancillary tests for preliminary plant design would include a Bond test, dewatering and sizing tests on the concentrates, water recycling tests and regrinding studies.

APPENDIX I

DETAILS OF EQUIPMENT USED IN FLOTATION TESTS

APPENDIX I

Details of Equipment Utilized in Testwork

A. Grinding

Rod Mill	- Steel container 21.5 cm ø x 40.5 cm. Charge 25 kg steel rods approx. 2.0 cm ø.
Ball Mill	- Steel container 21.5 cm ø x 18 cm. Charge 5 kg. steel balls - graded charge 0.5 - 3.0 cm ø.
Drive for Mills	- Twin rolls, one drive, one idle. Both 12.5 ø x 122 cm.

B. Flotation

Denver D2 Flotation Machine	- Used for roughing and scavenger at 1500 RPM with a 5.5 L stainless steel tank.
	- For first cleaner work with a 2.5 L stainless steel tank.
Denver D1 Flotation Machine	- Used for all cleaning stages at 1500 RPM with a 2.5 L stainless steel tank.

C. Instrumentation

Orion Specific Ion Meter 401	- Used for pH control on the rougher and scavenger circuits.
Fisher Digital pH Meter 609	- Used for pH control on the cleaning circuit.
Swift 80 Binocular Microscope	- Used for microscopic examination of various elements and products.

APPENDIX II

TECHNICAL DETAILS OF FLOTATION TESTS 1 - 3 INCLUSIVE

For each test are shown details of reagents used, and essential test parameters, assays for each test, a metallurgical balance and tailings screen analysis.

Gold and Silver values reported in troy ounces per short dry ton.

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TEST NO. 1

PURPOSE: Preliminary Bulk Flotation

PROCEDURE: Grind - Float a bulk concentrate - clean once

FEED: 1 kg. Pacific Cassiar Ore

GRIND: 5 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne				Time, Minutes			pH	
	Lime	Z-11	$CuSO_4$	TM3	Grind	Cond	Froth	Start	Finish
Primary Grind	5000				5				12.0
Bulk Conditioning		200	500			5			
Bulk Ro/Sc		100					4	12.0	12.0
Bulk 1st Cleaner		50				2	3	11.8	11.6

16:1

Product	Weight	Assays %				Distribution			
	%	Ag	Pb			Ag	Pb		
Bulk Concentrate	4.00	262.00	21.40			65.96	39.33		
Bulk Cleaner Tails 2	2.70	32.60	2.55			5.54	3.16		
Tails	93.31	4.85	1.34			28.51	57.51		
Calculated Head	100.00	15.87	2.17			100.00	100.00		

KM074

TEST NO. 2

PURPOSE: Preliminary Bulk Flotation

PROCEDURE: Reduce Lime Consumption

FEED: 1 kg. Pacific Cassiar Ore

GRIND: 5 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne				Time, Minutes			pH	
	Lime	Z-11	$CuSO_4$	TM3	Grind	Cond	Froth	Start	Finish
Primary Grind	1000				5				10.5
Bulk Conditioning		100	500	26		5		10.0	
Bulk Ro/Sc		100					5		9.4
Bulk 1st Cleaner		50				2	3	10.6	10.0
Bulk 2nd Cleaner		20				2	2	10.9	10.5

30:1

Product	Weight	Assays %				Distribution			
	%	Ag	Pb			Ag	Pb		
Bulk Concentrate	1.60	396.00	28.20			47.74	25.38		
Bulk Cleaner Tails 2	1.43	53.10	2.72			5.72	2.19		
Bulk Cleaner Tails 1	4.64	26.20	2.03			9.18	5.31		
Tails	92.34	5.36	1.29			37.36	67.12		
Calculated Head	100.00	13.25	1.77			100.00	100.00		

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TEST NO. 3

PURPOSE: Fine Grind Effect

PROCEDURE: Same as test 2 and increase primary grind time

FEED: 1 kg. Pacific Cassiar Ore

GRIND: 15 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne				Time, Minutes			pH	
	Lime	Z-11	$CuSO_4$	TM3	Grind	Cond	Froth	Start	Finish
Primary Grind	1000				15				10.0
Bulk Conditioning		100	500	26		5		9.5	
Bulk Ro/Sc		100					5		
Bulk 1st Cleaner		50				2	3	10.5	9.8
Bulk 2nd Cleaner		20				2	2	10.9	10.5

2.5:1

Product	Weight	Assays %				Distribution			
	%	Ag	Pb			Ag	Pb		
Bulk Concentrate	2.46	449.00	25.80			61.66	32.64		
Bulk Cleaner Tails 2	1.82	64.10	2.92			6.53	2.74		
Bulk Cleaner Tails 1	9.21	24.40	1.69			12.57	8.02		
Tails	86.51	3.98	1.27			19.25	56.59		
Calculated Head	100.00	17.89	1.94			100.00	100.00		

SCREEN ANALYSES

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Mesh Size	Aperture	% Retained		% Passing
Tyler	Microns	Individual	Cumulative	Cumulative
100	150	38.98	38.98	61.02
200	74	18.56	57.54	42.46
-200	-74	42.46	100.00	

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Mesh Size	Aperture	% Retained		% Passing
Tyler	Microns	Individual	Cumulative	Cumulative
100	150	.19	.19	99.81
200	74	9.43	9.62	90.38
-200	-74	90.38	100.00	
