

INTER-OFFICE MEMORANDUM

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FROM BRUCE WOODLAND TO W.E. HITCHMAN
 DATE 9th May, 1977 COPY TO P.S. CROSS ✓
 SUBJECT GRUM METALLURGICAL TESTWORK COPY TO T. NELSON
 FILE No. COPY TO

I.D.B.
A.H.C.
P.S.C.
W.J.
D.A.L.
S.P.
H.D.B.
J.B.S.
FILE

14H

Please find enclosed the preliminary report from A. Norton and comments by W. Hobba concerning initial metallurgical investigation of the Grum ore sample which was received at Mogul several weeks past.

In perusing the data thus far available, it must be stressed that the initial work that has been conducted was directed toward establishing guidelines based on the standard Mogul float procedures which would hopefully present positive results justifying commencement of recycle locked tests. The standard procedure, as it exists, was modified to incorporate the utilization of Z200 to replace xanthate in zinc flotation. Otherwise, the basic method was adhered to. The salient features of the testwork were :-

- Standard Grind - 62.2% -270 mesh ✓
- Pb Flotation - KCN, SIX, PAX, Lime, MIBC
- Zn Flotation - Z200, CuSo4, Lime, MIBC
- 2 Stages Pb Flotation) No recirculation of cln tailings
- 2 Stages Zn Flotation)

Product	Weight %	Assay		Distribution	
		% Pb	% Zn	% Pb	% Zn
Pb Conc	6.62	33.9	5.04	70.3	5.6
Pb 1st Cl Tail	5.13	3.42	6.01	5.5	5.2
Pb 2nd Cl Tail	2.20	5.00	5.83	3.4	2.1
Zn Conc	5.58	0.58	51.4	1.0	48.2
Zn 1st Cl Tail	7.38	1.57	6.84	3.6	8.5
Zn 2nd Cl Tail	3.78	1.46	21.9	1.7	13.9
Float Tailing	69.31	0.66	1.42	14.3	16.5
Heads		3.19	5.96		

- Absolute maximum performance assuming no influence from recirculated material on final discarded tailing :
 - Pb Recovery - 79.2% - 33.9% Pb Conc.
 - Zn Recovery - 70.6% - 51.4% Zn Conc. ✓
- This is theoretical and subject to eventual change pending locked cycle testing.
- Note that results conform to an additional 23 minutes grind for which size analysis was not completed. The above is given as best achieved result as two stages of cleaning were performed on both products and Z200 was utilized in zinc flotation.

- Insufficient sizing data and effort have thus far been expended in Pb flotation to prejudge performance.

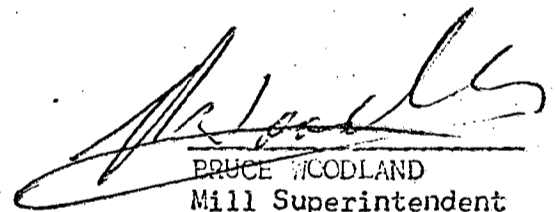
SECOND STAGE OF TESTWORK

The volume of testwork thus far completed has resulted in 50 pounds of remaining sample. It is intended to perform a series of tests as outlined below to establish regrinding procedures prior to commencement of locked cycle testing. The referred testwork will also include accelerated Pb float work to improve performance prior to cycle testing.

Proposed Metallurgical Testing - Stage 2

- (a) Four tests incorporating reduced primary grinding time followed by :-
 1. Regrind of Pb rougher Conc.
 2. Analysis of fractions in Pb Concentrate - two stages of cleaning
 3. Establish influence of coarser grind on Zn losses to Pb flotation.
 4. Regrind of Zn rougher concentrate followed by two stages of cleaning.
 5. Establish new grinding procedure influence on -8 micron in Zn tailing and coarser products in Zn concentrate
- (b) Consideration of increased flotation time and reagent dosage in zinc scavenger flotation.
- (c) Establishing size distribution in primary grinding
- (d) Analysis of Pb products to establish direction in optimizing recovery and grade.

We would point out that the data presented is not conclusive nor as comprehensive as the follow up report should be. However, the current testwork which has already commenced will certainly result in a positive step toward establishing a base for locked cycle testing. The results of the aforementioned work will be available within two weeks.


BRUCE WOODLAND
Mill Superintendent

INTER-OFFICE MEMORANDUM

FROM A. NORTON TO W.J. HOBBA
 DATE 26th April, 1977 COPY TO B. WOODLAND
 SUBJECT GRUM ORE SAMPLE - PRELIMINARY COPY TO
 FILE No. REPORT COPY TO

1. Introduction

A considerable amount of work on the Grum ore sample has been performed including microscopic examination, sizing, assaying and testwork. This report contains all the information accumulated to date.

2. Sample Details

The sample was reported as banded massive sulphide from the Grum ore deposit in the Yukon, Canada.

2.1. General Comments about the Sample

Weight - 81 lb
 Size - Predominantly coarse -8+2"
 Condition - As received the sample was wet with a sticky coating and evidence of surface oxidation. Fresh surfaces, however, were obtained on breakage.
 Accuracy - The relatively small weight and coarse size of the sample suggested that it may not have been very representative.

2.2. Sample Preparation

After brief examination the sample was crushed to -4 mesh. A sample of about 2 kg was then cut by coning and quartering. This sample was further reduced to provide assay and sizing samples.

2.3. Assay Data

Assay information on the sample is given in Table 1

It was noted that the lead and zinc values were considerably lower than those of other samples obtained from the orebody.

2.4. Sizing

A sample of the crushed ore was sized to provide size fractions for microscopic examination.

3. Mineralogy and Liberation

The sample was reported as containing 20% combined lead and zinc with large amounts of pyrite and quartz/sericite gangue.

Sphalerite and galena were observed as being the principle zinc and lead bearing minerals.

The size fractions were each examined using a binocular microscope in an attempt to determine the liberation size(s) of galena and sphalerite. A large proportion of the sphalerite was found to be essentially liberated at sizes below about 74 micron. Galena liberation was difficult to interpret visually but significant quantities were thought to be liberated at sizes below 53 micron.

Facilities to quantify liberation are not available at Mogul.

4. Testwork

In order to ensure large proportions of both galena and sphalerite were essentially liberated, it was thought a grind of about 90% -270 mesh (53 micron) was necessary. This is approximately the grind used for standard Mogul flotation tests. It was for this reason that the Mogul standard procedure was applied to a sample of Grum ore.

Test G/1A - Appendix 1 - (Standard Mogul Procedure on Grum Ore)

Lead and zinc recoveries were a surprisingly good start. The poor lead 1st cleaner recovery was thought to be due to high pH. It was thought high collector and/or copper sulphate dosage were responsible for the very low rougher/scavenger grade and very poor upgrading in cleaning. A very high iron recovery was also encountered.

The Grum ore was thought to be considerably harder than Mogul ore as application of the standard grinding procedure gave only 62.2% -270 mesh (c.f. approx. 90%).

Test G/1B - Appendix 2

The lead rougher/scavenger conditions were kept much the same in this test except that flotation time was reduced and conditioning pH lowered to 9.5. Lowering 1st cleaner pH to 10.0 increased lead 1st cleaner recovery considerably.

Z200 was used in place of the SIPX/PAX collector system in the previous test. The CuSo₄ dosage was also reduced. The rougher/scavenger grade and recovery were satisfactory, but recovery in zinc cleaning was poor. It was thought that some collector and CuSo₄ should have been used.

The zinc flotation products from this test were sized and the fraction assayed and the results shown in Table 2.

It can be seen that of the total zinc loss to scavenger tail about 40% is lost in the -8 micron fraction. Losses in this fraction also explained why, in part at least, the zinc cleaner recovery was poor.

Test G/1C - Appendix 3

Lead flotation was the same as in the previous test but no cleaning was performed.

In order to increase zinc rougher/scavenger recovery more Z200 and CuSo₄ were added prior to zinc scavenging. Z200 and CuSo₄ were also added to the zinc 1st cleaner stage. Zinc rougher/scavenger recovery was not improved by this step but cleaner recovery was improved considerably.

All products from this test were sized and the fractions assayed. The results are shown in Table 3-7.

Several interesting points were apparent :-

- (a) Of the total zinc loss to scavenger tailing approximately 50% occurred in the -8 microm fraction.
- (b) Of the total zinc in the zinc 1st cleaner tailing about 63% occurred in the -8 micron fraction.
- (c) The recovery of zinc to the lead rougher/scavenger concentrate appears to increase with reducing size.

Test G/2A - Appendix 4

Grinding time was increased by 23% for this test.

Despite increased grinding time and PAX scavenger dosage lead recovery was not improved. However, marginally less zinc was recovered in the lead circuit. Again, despite increased grinding time and Z200 dosage on zinc scavenging, overall zinc recovery was only improved by about 3%. This was only a little more than the extra zinc rejected from the lead circuit.

Both the lead and zinc rougher/scavenger concentrates were cleaned twice. The lead was cleaned to a rather low grade but fairly good recovery and it is clear grade is likely to become an important problem in future work. The zinc was cleaned to a satisfactory grade but poor recovery. The recovery was poor because the cleaner recoveries were not ideal and because some of the zinc was trapped in the lead circuit. Hopefully a lot of zinc would be rejected from the lead circuit in a continuous operation.

5. Discussion of Results to Date

Work so far has revolved around increasing lead and zinc rougher/scavenger recoveries above about 80% and 70% respectively. Increased reagent dosages and grinding times have met with little success.

The presence of oxide minerals suggest that recovery improvements are likely to be difficult, especially with zinc.

With regard to lead cleaning, it has not yet been ascertained if the poor lead grades are due to selectivity or middling problems. If the latter is the problem regrinding of rougher concentrate may be a solution.

With regard to zinc cleaning, it would seem that fairly large collector dosages will be needed so as to reduce cleaner tail losses (or large circulating loads in a continuous process.)

6. Continuation of Testwork

- 6.1. Further oxide assays will be performed before any other work is carried out.
- 6.2. If oxide mineralization is a problem in getting better recoveries, then future work will become extremely complex.

A. Norton

ALAN NORTON
Research Metallurgist

ASSAY DATA

3.02	-	% Pb	9.60
5.98	-	% Zn	
20.50	-	% Fe ✓	
24.60	-	% S ✓	
1.45	-	Oz/Ton Ag ✓	
0.10	-	% MgO	
0.56	-	% Pb Non-Sulphide	
0.49	-	% Zn Non-Sulphide	
43.90	-	% Acid Insol.	

TEST: MOGUL STANDARD FLOTT ON GRUM ORE

TEST NO.: G/1A

DATE: 6/4/77

TEST FEED: 1 kg - 4# GRUM ORE

FEED TREATMENT: STANDARD GRIND

STAGE	KCN ml 1g/Ton	SIPX ml 1g/Ton	PAX ml 1g/Ton	LIME → PH:	MIBC (DROPS)	TIME (MIN.)	CuSO ₄ ml 1g/Ton		REMARKS
CONDITION	4.0 0.4		1.5 0.06	9.7		9			
FLOAT					7	3			Pb Rougher
FLOAT			0.5 0.02			2			Pb Scavenger
CONDITION		0.3 0.012		11.0		1			
FLOAT					4	2			Pb 1st Clean
CONDITION		5.0 0.2		10.0		9	18.0 1.8		
FLOAT						2			Zn Rougher
FLOAT			2.5 0.1			3			Zn Scavenger
CONDITION		0.5 0.02		11.0		1			
FLOAT					4	2			Zn 1st Clean
CONDITION				11.5		1			
FLOAT					3	2			Zn 2nd Clean

PRODUCT	WEIGHT		ASSAY			CONTENT			DISTRIBUTION			RE-ASSAY
	g.	%	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	
Pb Scav Conc	13.0	1.30	4.60	7.08	34.2				1.9	1.6	2.2	
Pb 1st Cl. Tail	162.4	6.23	5.40	3.83	38.9				27.6	10.7	31.4	
Pb Conc.	50.6	5.06	34.0	4.39	23.1				54.2	3.8	5.8	
Zn Scav Conc	72.8	7.28	1.45	6.40	23.0				3.2	7.9	8.3	
Zn 1st Cl. Tail	47.6	4.76	1.29	11.5	28.2				2.0	9.4	6.8	
Zn 2nd Cl Tail	52.5	5.25	0.83	7.3	38.1				1.4	6.6	10.0	
Zn Conc	173.8	17.37	0.67	17.1	34.6				3.6	51.2	29.8	
Zn Scav Tail	427.7	42.75	0.45	1.20	2.70				6.1	8.8	5.7	

TEST: MODIFIED FLOAT ON GRUM ORE

TEST NO.: 6/16

DATE: 8/4/77

TEST FEED: 1 Kg -4# GRUM ORE

FEED TREATMENT: STANDARD GRIND

STAGE	KCN		PAX		Z200		CuSO ₄		LIME → PH:	MIBC (DROPS)	TIME (MIN.)			REMARKS
	ml	lb/Ton	ml	lb/Ton	ml	lb/Ton	ml	lb/Ton						
CONDITION	4.0	0.4	1.5	0.06					9.5		9			
FLOAT										7	2	} COMBINE	Pb Rougher	
FLOAT			0.5	0.02							1		Pb Scavenger	
CONDITION					2.0	0.08	12.0	1.2	10.0		9			
FLOAT											2	} COMBINE	Zn Rougher	
FLOAT					1.0	0.04	3.0	0.3			2		Zn Scavenger	
CONDITION					1.0	0.04	1.0	0.1	11.0		1			
FLOAT											2		Zn 1st Clean	

PRODUCT	WEIGHT		ASSAY			CONTENT			DISTRIBUTION			RE-ASSAY
	g.	%	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	
Pb Ro/Sc Conc	167.5	16.68	16.8	5.63	31.2				81.6	15.5	27.2	
Zn Conc	83.4	8.31	8.31	42.8	15.4				1.9	58.8	6.7	
Zn 1st Cl. Tail	42.4	4.22	1.82	12.5	28.0				2.2	8.7	6.2	
Zn Scav. Tail	710.6	70.79	0.69	1.45	16.2				14.3	17.0	59.9	
Calc. Head.	1003.9	100.00	3.43	6.05	19.1				100.0	100.0	100.0	

EFFECT OF INCREASED GRIND TIME.

LOT NO: G/2A

DATE: 13/6/77

TEST FEED: 1 Kg - 4# GRUM ORE.

FEED TREATMENT: 80 min. Grind

STAGE	KCN ml lb/Ton	SIPX ml lb/Ton	PAX ml lb/Ton	Z200 ml lb/Ton	CuSO ₄ ml lb/Ton	LIME → PH:	MIBC (DROPS)	TIME (MIN.)	REMARKS
CONDITION	4.0 0.4		1.5 0.06			9.5		9	
FLOAT							7	2	Pb Rougher
FLOAT			1.0 0.04					1	Pb Scavenger
CONDITION		0.8 0.032				10.0		1	
FLOAT							4	TO COMPLETION	Pb 1st Clean
CONDITION		0.4 0.016				10.0		1	
FLOAT							3	TO COMPLETION	Pb 2nd Clean
CONDITION				2.0 0.08	12.0 1.2	10.0		9	
FLOAT								2	Zn Rougher
FLOAT				2.0 0.08	3.0 0.3			2	Zn Scavenger
CONDITION				1.0 0.04	1.0 0.1	11.0		1	
FLOAT							2	TO COMPLETION	Zn 1st Clean
CONDITION						11.0		1	
FLOAT							2	TO COMPLETION	Zn 2nd Clean

PRODUCT	WEIGHT		ASSAY			CONTENT			DISTRIBUTION			RE-ASSAY
	g.	%	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	
Pb Conc	67.3	6.62	33.9	5.04	24.1				70.3	5.6	7.8	
Pb 1st Cl. Tail	52.2	5.13	3.42	6.01	34.5				5.5	5.2	8.6	
Pb 2nd Cl. Tail	22.4	2.20	5.00	5.83	35.6				3.4	2.1	3.8	
Zn Conc	56.8	5.58	0.58	51.4	9.5				1.0	48.2	2.6	
Zn 1st Cl. Tail	75.1	7.38	1.57	6.84	35.7				3.6	8.5	12.8	
Zn 2nd Cl. Tail	38.5	3.78	1.46	21.9	27.5				1.7	13.9	5.1	
Zn Scav Tail	705.0	69.31	0.66	1.42	17.6				14.3	16.5	59.3	
Calc. Head	1017.3	100.00	3.19	5.96	20.6				100.0	100.0	100.0	

TEST FIELD STANDARD FLOAT ON GRUM ORE

TEST NO. 1 S/1A

DATE 6/4/77

TEST FIELD 1 Kg - 4" GRUM ORE

FIELD TREATMENT STANDARD GRIND

STAGE	KCN ml 10/Ton	SIPA ml 10/Ton	PAX ml 10/Ton	LIME → PH:	MISC. (DROPS)	TIME (MIN.)	CUSO ₄ ml 10/Ton		REMARKS
CONDITION	4.0	0.4		1.5 0.06	9.7	9			
FLOAT						7			Pb Rough
FLOAT				0.5 0.02		2			Pb Scaver
CONDITION		0.3	0.012		11.0	1			
FLOAT						4			Pb 1st Cl
CONDITION		5.0	0.2		10.0	9	18.0 1.8		
FLOAT						2			Zn Rough
FLOAT				2.5 0.1		3			Zn Scave
CONDITION		0.5	0.02		11.0	1			
FLOAT						4			Zn 1st Cl
CONDITION					11.5	1			
FLOAT						3			Zn 2nd Cl

PRODUCT	WEIGHT		ASSAY			CONTENT			DISTRIBUTION			RE-ASSAY
	g.	%	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	
Pb Scav Conc	13.0	1.30	4.65	7.08	34.2				1.9	1.6	2.2	
Pb 1st Cl Tail	162.4	6.23	5.40	3.83	38.9				27.6	10.7	31.4	
Pb Conc	50.6	5.06	34.0	4.34	23.1				56.2	3.8	5.8	
Zn Scav Conc	72.8	7.28	1.45	6.40	23.0				3.2	7.9	3.3	
Zn 1st Cl Tail	47.6	4.76	1.29	11.5	28.2				2.0	9.4	6.8	
Zn 2nd Cl Tail	52.5	5.25	0.83	7.3	36.1				1.4	6.6	10.0	
Zn Conc	173.8	17.38	0.67	17.1	34.6				3.6	51.2	29.3	
Zn Scav Tail	427.7	42.75	0.65	1.20	2.70				6.1	8.8	5.7	
Calc. Head	1000.4	100.00	3.18	5.81	20.1				100.0	100.0	100.0	

TEST : MODIFIED FLOAT ON GRUM ORE

TEST NO. : G/18

DATE : 7/4/77

TEST FELD : 1K₂ - 4" GRUM ORE

FELD THROUGH 1 STANDARD GRIND

STAGE	KCN ml 10/Ton	SIPA ml 10/Ton	PAX ml 10/Ton	ZNO ml 10/Ton	CUSO ₄ ml 10/Ton	LIME Ppt	MIBC (conc)	TIME (min)	REMARKS
CONDITION	6.0 0.4		1.5 0.06			9.5		9	
FLOAT							7	2	} COMBINE Pb Rough
FLOAT			0.5 0.02			10.0		1	
CONDITION		0.3 0.012				10.0		1	
FLOAT							4	2	Pb 1 st CL
CONDITION				2.0 0.08	12.0 1.2	10.0		9	
FLOAT								2	} COMBINE Zn Rough
FLOAT				0.5 0.02				2	
CONDITION						11.0		1	
FLOAT								2	Zn 1 st CL

PRODUCT	WEIGHT		ASSAY			CONTENT			DISTRIBUTION			RE-ASSAY
	g	%	Pb	Zn	Fe	Pb	Zn	Fe	Pb	Zn	Fe	
Pb Conc	69.7	6.92	33.2	5.23	23.0				69.8	6.6	7.7	
Pb 1 st CL Tail	86.3	8.56	4.16	6.03	37.2				10.8	8.6	15.3	
Zn Conc	39.5	3.92	0.75	51.1	9.50				0.9	33.5	1.8	
Zn 1 st CL Tail	67.3	6.63	1.59	30.5	17.5				3.2	36.1	5.6	
Zn Scave Tail	76.5	7.65	0.68	1.41	19.6				15.3	17.4	69.6	
Calc Head	1007.0	100.00	3.29	5.97	26.8				100.0	100.0	100.0	

TEST: MODIFIED FLOAT ON GRUM ORE

TEST NO.: 6/1C

DATE: 8/4/77

TEST FEED: 1 Kg -4" GRUM ORE

FELD TREATMENT: STANDARD GRIND

STAGE	KCN		PAX		Z 200		Cu SO ₄		LIME → PH:	MIGC (grees)	TIME (min.)		REMARKS
	ml	16/Ton	ml	16/Ton	ml	16/Ton	ml	16/Ton					
CONDITION	4.0	0.4	1.5	0.06					9.5		9		
Float										7	2		COMBINE Pb Rougher
Float			0.5	0.02							1		Pb Scavenger
CONDITION					2.0	0.08	12.0	1.2	10.0		9		
Float											2		COMBINE Zn Rougher
Float					1.0	0.04	3.0	0.3			2		Zn Scavenger
CONDITION					1.0	0.04	1.0	0.1	11.0		1		
Float											2		Zn 1st Clean

PRODUCT	WEIGHT		ASSAY			CONTENT			DISTRIBUTION			RE-ASSAY
	g.	%	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	
Pb Ro/Sc Conc	167.5	16.63	16.8	5.63	31.2				81.6	15.5	27.2	
Zn Conc	83.4	8.31	8.31	42.8	15.4				1.9	53.2	6.7	
Zn 1st Cl. Tail	42.4	4.22	1.32	12.5	23.0				2.2	8.7	6.2	
Zn Scav. Tail	710.8	70.75	0.69	1.45	16.2				14.3	17.0	59.9	
Calc. Head	1003.9	100.00	3.63	6.05	19.1				100.0	100.0	100.0	

TEST 1 EFFECT OF INCREASED GRIND TIME.

TEST NO. 1 G/2A

DATE 13/4/77

TEST FLD 1 1F₃ - 4" GRUM ORE

FLD TREATMENT 180 Min. Grind

STAGE	KCN ml 14/Ton	SIPX ml 14/Ton	PAX ml 14/Ton	Z 200 ml 14/Ton	CaSO ₄ ml 14/Ton	LIME → PH:	MIBC (Drops)	TIME (MIN.)	REMARKS
CONDITION	4.0 0.6		1.5 0.06			9.5		9	
FLOAT							7	2	Pb Rough
FLOAT			1.0 0.04					1	Pb Scaven
CONDITION		0.3 0.032				10.0		1	
FLOAT							4	TO COMPLETION	Pb 1 st Cl
CONDITION		0.4 0.016				10.0		1	
FLOAT							3	TO COMPLETION	Pb 2 nd Cl
CONDITION				2.0 0.08	12.0 1.2	10.0		9	
FLOAT								2	Zn Rough
FLOAT				2.0 0.08	3.0 0.3			2	Zn Scaven.
CONDITION				1.0 0.04	1.0 0.1	11.0		1	
FLOAT							2	TO COMPLETION	Zn 1 st Cl
CONDITION						11.0		1	
FLOAT							2	TO COMPLETION	Zn 2 nd Cl

PRODUCT	WEIGHT		ASSAY			CONTENT			DISTRIBUTION			RE-ASSAY
	g.	%	Pb	Zn	Fe	Pb	Zn	Fe	Pb	Zn	Fe	
Pb Conc	67.3	6.52	33.9	5.04	24.1				70.3	5.6	7.8	
Pb 1 st Cl. Tail	52.2	5.12	3.42	6.01	34.5				5.5	5.2	8.6	
Pb 2 nd Cl. Tail	22.4	2.22	5.00	5.83	35.6				3.6	2.1	3.8	
Zn Conc	56.8	5.55	0.58	51.4	9.5				1.0	48.2	2.6	
Zn 1 st Cl. Tail	75.1	7.32	1.57	6.84	35.7				3.6	8.5	12.8	
Zn 2 nd Cl. Tail	33.5	3.23	1.46	21.9	27.5				1.7	13.9	5.1	
Zn Scav Tail	705.0	69.31	0.56	1.42	17.6				14.3	16.5	54.3	
Calc. Head	1017.3	100.00	3.19	5.96	20.6				100.0	100.0	100.0	

MOGUL OF IRELAND LIMITED

INTER-OFFICE MEMORANDUM

FROM W.J. HOBBA TO BRUCE WOODLAND

DATE April 29, 1977 COPY TO

SUBJECT IMPLICATIONS OF GRUM TESTWORK COPY TO

FILE No. TO DATE - A. NORTON REPORT 26.4.1977 COPY TO

1. Although satisfactory lead grades have not been reached, the zinc loss to lead concentrate is fairly low, despite using lime instead of soda ash and no zinc sulphate. This could result in large reagent savings on both Lakefield and Mattagami Estimates.
2. The analyses for oxide minerals in the Grum Ore is obviously disturbing. Subsequent oxide confirmation assays are consistent and indicate a significant amount of oxidised mineralisation rather than just superficial weathering of the surface. This could explain recovery difficulties and why tails assays, below 1.4%, were not reached after regrinding. In the silica matrix, calamine is more likely to be present than the carbonate, smithsonite.
 $ZnCO_3$ Zn_5O_4
3. A zinc concentrate of 51.1% was made. Size analysis data in Table 2 indicates that material + 30 micron in size is responsible for not reaching the 52% necessary in our contract. Care would need to be taken in regrinding to prevent over-creation of slime material which could report to the cleaner tail.
4. The most pressing problem at present is for an increase in lead grade. Although the uniformity in assay for the rougher scavenger sizing suggests that liberation is not the entire problem, a regrind giving close to 100% -325 mesh looks likely to improve matters considerably.

In conclusion, it appears that a promising start has been made on the Grum Ore. It would be interesting to get other opinions on the oxide mineral assays since the lead assay, in particular, could have repercussions with regard to our own ore.

The Mogul lead system of lime and no zinc sulphate shows promise in at least satisfactorily rejecting zinc. Further development of the process would eventually have to involve regrinding tests within some form of locked cycle testing. This workload would tend to preclude any other metallurgical testwork for some time. There is plenty of sample left to carry on the work.

5. Due to the success with Z200 so far, we will continue with its use rather than attempt to optimise xanthate results. However, the extra cost of Z200 could be a significant factor in reagent costs.
6. The recovery of oxide lead and zinc minerals is likely to be impossible. Fractionation has shown the bulk of the oxide zinc to be in the -8 micron fraction precluding amine flotation which normally requires careful desliming for success.

The use of sodium sulphide or hydrogen sulphide is a second possibility but is unlikely to succeed unless a separate circuit is designed for it.

7. The Grum zinc concentrates made so far have contained rather more iron than equivalent Mogul concentrates, partly due to the lower lead assays. The concentrates are much darker brown than at Mogul which probably indicates a little more iron in the matrix.



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