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Grum 14

A. H. ROSS & ASSOCIATES

CONSULTING CHEMICAL & METALLURGICAL ENGINEERS
1706 - 80 RICHMOND STREET WEST
TORONTO, ONTARIO M5H 2A4
CANADA

A. H. ROSS - PRINCIPAL
K. R. COYNE - PRINCIPAL ASSOCIATE (SENIOR)
N. GIBSON - PRINCIPAL ASSOCIATE

D. H. EBERTS - SENIOR ASSOCIATE
M. J. LAKE - SENIOR ASSOCIATE
D. F. LILLIE - SENIOR ASSOCIATE

W. V. BARKER
A. S. HAYDEN
R. H. RICHARDS
R. C. SWIDER
E. W. S. WARD

CODE 416-366-1653
CABLE "ROSSONTO"
TELEX 06-22325 (ROSSONTO TOR.)

2nd February, 1977

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

Mr. M. D. Rowswell,
Kerr Addison Mines Limited,
P. O. Box 91,
Commerce Court West,
Toronto, Ontario
M5L 1C7.

Dear Sir,

Further Review of Test Reports on Grum Deposit

Introduction

Following review of two test reports, refer our letter dated January 20th, 1977, the further reports listed below were delivered for our comments:

1. Reports by Lakefield Research of Canada

"The Recovery of Lead and Zinc from Grum Deposit Samples submitted by Noranda Mines Limited". Project No. LR 1869.

Progress Report No. 1	dated October 8, 1975
Progress Report No. 2	dated December 30, 1975
Progress Report No. 3	dated April 9, 1976
Progress Report No. 4	dated May 3, 1976
Progress Report No. 5	dated November 22, 1976

"Microscopic Examination of Grum Project pilot plant samples from ore submitted by Noranda Mines Limited". Project No. LR 1868

Progress Report No. 2	dated March 8, 1976

2. Reports by Mattagami Mines Limited

"Vangonda - Grum Sample B"

Progress Report No. 1	dated March 18, 1976

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"Current Status of Beneficiation Testwork on Vangonda Grum Ores"

Inter-office Memorandum dated April 18, 1976

"Grum Flotation"

Inter-office Memorandum dated July 30, 1976

"Flotation Process for Ores from the Grum Deposit"

Inter-office Memorandum dated September 30, 1976

3. Report by Dowa Mining Company Limited

"Flotation Test of Grum Ore for Kerr Addison Mines Limited" dated October, 1976.

The testwork review and other relevant matters were discussed at a meeting held in the offices of Kerr Addison Mines Limited on Thursday, January 27, 1977, attended by:

M. D. Rowswell	Kerr Addison Mines
J. K. Carrington	Kerr Addison Mines
N. Gibson	A. H. Ross & Associates

Review of Test Reports

The reading of these reports, all of which were published before the two reviewed in our letter of January 20, 1977, adds little to our interpretation of the metallurgical problems.

1. Lakefield Reports

The Lakefield test program was initiated with investigations into fineness of grind, effects of recirculation of lead cleaner tailings, and ball mill versus rod mill regrinding.

The Lakefield reagent schedule was found to give higher yields than the Noranda procedure; a primary grind of 77 percent minus 400 mesh resulted in a 97.2 percent lead recovery to rougher concentrates as compared to 95.4 percent lead recovery at a grind of 54.7 percent.

In Progress Report No. 3, the work on sample PPA was required initially to provide information on reagent levels and grinding requirements for the pilot plant test. After an unsatisfactory pilot plant program, further bench scale work was done to investigate the reasons for the difference between the bench and pilot plant results.

In the pilot plant tests, there were high lead losses in the first cleaner stage. The bench scale work suggested that a combination of high oxygen levels in pulp and incomplete mineral liberation were responsible for the indifferent flotation.

Subsequent bench tests with samples of PPB ore left after the pilot plant tests (the ore was mined in November 1975 and bench tested in May 1976) showed a marked deterioration from earlier test results. Some improvement in zinc rejection from lead concentrates was effected by grinding to 88 percent minus 400 mesh but the zinc grade was not reduced below 6 percent; it was concluded that fine mineralization was primarily responsible for the phenomenon.

In a later test series, the results from tests with fresh ore samples PPC were less satisfactory than those attained with PPB fresh ore samples. Finer grinds again resulted in marginal improvements.

2. Mattagami Reports

The Mattagami reports numbered 1 and 2 do not specifically identify the ore samples other than belonging to the B type; results were indifferent.

Report No. 3 summarizes tests with B3 and B4 ores. Locked cycle tests, 6 and 7 stages, with B3 ore showed little or no improvement on earlier work. The tests confirmed that the lead concentrates were extremely low grade at acceptable levels of recovery and that high grade zinc concentrates could be produced but recovery was necessarily low. The salient features of the testwork were:

grind - 70 percent minus 325 mesh

NaCN not used in most tests

1 or 2 zinc cleaning stages

up to 4 regrinds

1st lead cleaner tails were recirculated to either the lead or zinc circuits.

The B4 ore sample (head assay 8 percent lead, 15.9 percent zinc) behaved much as had previously been experienced and test Van 91 results were probably the best.

Product	Weight	Assay		Distribution	
	%	% Pb	% Zn	% Pb	% Zn
Lead concentrate	19.3	36.5	20.0	88.3	24.4
Zinc concentrate	19.3	1.4	54.0	3.4	65.9
Flotation tails	61.4	1.1	2.5	8.3	9.7
Heads		8.0	15.9		

3. Dowa Mining Report

The single Dowa Mining report dated October 1976, reported the work on a B4 sample; although mined at the same time as the Mattagami B4 sample, the assay head was 3.21 percent lead and 5.22 percent zinc.

Preliminary tests with a flotation process specially developed for another similar type ore and which excluded the use of cyanide were totally unsuccessful.

A flotation technique with some features quite different to the Lakefield and Mattagami work was used for 14 stage locked cycle test; the results are given below:

Product	Weight	Assay		Distribution	
	%	% Pb	% Zn	% Pb	% Zn
Lead Concentrate	3.7	64.32	6.22	71.5	4.4
Zinc Concentrate	8.0	3.49	49.68	8.4	76.0
Flotation tails	86.6	0.70	0.99	18.3	16.3
Biotite Concentrate	1.7	3.53	10.22	1.8	3.3
Heads		3.33	5.22		

The first flotation step at natural pH was to remove a biotite concentrate which was 1.7 percent of the feed sample weight. Both lead and zinc rougher flotation was followed by regrind stages; there were four stages of lead and zinc cleaning. CaO was used for pH modification and NaCN additions made in each lead cleaner stage; no other pyrite or sphalerite depressents were employed; $CuSO_4$ was the only sphalerite activator used. The material balance presented in a flowsheet was based on the results from the last five of the 14 test cycles.

The mineralogical investigation revealed that the sulphide minerals were finely disseminated and interlocked; some of the sulphide minerals in the gangue minerals were finer than 10 microns.

Distribution of metals in the feed and products is summarized in the following table. Virtually all the minerals are in the minus 35 micron fraction in all components.

	Fraction minus micron size	Assay %		Distribution %	
		Pb	Zn	Pb	Zn
Ore feed	8.9	6.04	7.30	46.6	39.4
Lead Concentrate	8.8	65.57	5.25	65.9	56.4
Zinc Concentrate	9.5	3.93	52.79	68.1	58.6
Final tailing	9.5	1.02	2.14	72.4	86.0

It is claimed that these figures support the conclusion that the separation difficulty is due to the finely disseminated mineralization and that lead and zinc sulphides are substantially liberated at a 400 mesh (38 micron) grind for this particular sample.

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Comments on Testwork

These further reports give credence to the need for fine grinding to effectively liberate the minerals in the greater majority of the samples tested.

The Lakefield work also highlights the aging problem for which no totally compensatory procedure has as yet been developed.

Plant Results Projected by Lakefield

The validity of the Lakefield projected plant results was queried at our meeting on Thursday, January 27, 1977. At your request, we have examined these figures in some detail and have also consulted with Lakefield staff.

The most successful tests in the Lakefield program, measured by projected plant results, were 126 to 131. These tests were conducted on B2 and C2 ore samples and individual results are reported in Progress Report No. 6. In these six locked cycle tests, each six stages, the projected lead concentrate grade and recovery was respectively 52 to 57 percent and 88 to 91 percent.

The method used to translate the bench scale results into projected plant results is in general use throughout the industry. However, a prior requirement to its application is that sufficient locked cycle tests should be conducted to bring the system to equilibrium.

The first criteria indicating an adequate number of cycles, is that the tailings loss should have reached a reasonably constant value. In the following tables, the zinc rougher tailing values are shown for the successive cycles in tests 126 to 131.

	% Lead Content in Zinc Rougher Tailings					
Cycle	A	B	C	D	E	F
Test 126	0.41	0.41	0.42	0.52	0.57	0.64
127	0.33	0.38	0.35	0.36	0.53	0.43
128	0.38	0.43	0.53	0.53	0.54	0.48
129	0.37	0.46	0.40	0.45	0.50	0.48
130	0.35	0.40	0.41	0.49	0.50	0.48
131	0.35	0.51	0.60	0.62	0.69	0.69

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Cycle	% Zinc Content in Zinc Rougher Tailings					
	A	B	C	D	E	F
Test 126	0.76	0.51	0.54	0.56	0.68	0.69
127	0.55	0.70	0.60	0.65	1.15	0.73
128	0.54	0.63	0.68	0.71	0.74	0.75
129	0.55	0.85	0.62	0.78	0.82	0.80
130	0.53	0.66	0.69	0.85	0.99	1.00
131	0.52	0.68	1.00	0.97	1.24	0.99

The lead content in the tailings shows a greater degree of consistency than the zinc values. Taking into consideration other data such as tailings weight and concentrate grade as indications of flowsheet stability we believe that several cycle results can logically be translated to a plant flowsheet by the accepted methods Lakefield employed. There are others however, 126 and 131 are examples, where a greater number of cycle results would be required before a judgement on flowsheet equilibrium could be made. It should be noted that projected plant results are possibly the ultimate that could be achieved. Depending on flowsheet complexity, homogeneity of ore, ease of operation, 'adjustment factors' may need to be applied to the projected technical results, discussed above, to determine an average or typical plant performance for economic feasibility studies.

Current Mattagami Program

We understand that a comprehensive survey of the ore mineralogy is in progress and as requested, we shall be pleased to appraise the work when the report is issued.

Regarding your query on the effect of pulp temperature on galena-sphalerite flotation, we offered the opinion that all ores do not have an identical response. We endorse the proposal to investigate temperature effects on Grum ore when ore types have been categorized and standard flotation techniques can show reproducable results.

It is encouraging to note that the ore mineralogy is now receiving due emphasis. It should be pursued to the point where formerly observed anomalies can be explained and the downstream projected plant performance supported.

We would be pleased to provide any further information you may require.

With kindest regards.

Yours sincerely,

Norman Gibson

N. Gibson, P.Eng.

NG/va
c.c. Mr. P. S. Cross