

005305

Grum ProcessingLakefield Data

- Processing characteristics of Grum ore vary significantly within the orebody.
- Neither Vangorda nor Grum ore can be successfully processed using Faro plant flowsheet.

Grinding

Three main ore types - G1, G2, and G3.
Grum ore is much harder than either Vangorda or Faro ore.

G1 & G2 K_{60} = 65 - 70 microns.

G3 K_{60} = <60 microns.

At K_{60} 60 microns, 80% of zinc floated in lead rougher concentrate. (ie bulk flotation at coarse grind)

Ore Type	Work Index(kwh/t)
Grum	12.1
Faro	12.0
Vangorda	10.9

Regrinding

Pb Rougher Conc target should be finer than 20 microns. (% not specified)

Increase in pumping capacity in the lead regrind and lead 1st cleaning circuits.

Regrinding both rougher and scavenger (Pb & Zn).

High Speed Conditioner after zinc rgh/scav regrinding -->
Column Flotation Feed.

Reagents - New Reagent

Collector A317/3418A mixture, needs installation of a separate feeding system for lead circuit only.

Recommended Consumption (g/t)

Ore Type	NaCN/ SD-200	A317 3418A	A343	CuSO ₄	MIBC	Dow
G1 Carb-quartzite	325	110.5	70	700	52.5	22.5
G2 Non-carbonac	245	105.5	70	700	40	17.5
G3 Massive Sulphides	305	83	140	1700	25	32.5
Mean	321.6	99.66	99.33	1033.2	39	24.16
Faro Budget 1991	140	130		450	20	10
Difference, g/t **	181.6	62.99		583.3	19	14.16

* 3418A - Price is \$8.0/kg vs \$1.64/kg Xanthate (Nov 19, 91)
 ** Only NaCN/SD-200 will cost \$2,573,000/year more - \$extra.

1991 Testwork at Faro Laboratory

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TABLE #1

GRUN SAMPLING - 1991

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Ore Type	Comments	Feed Grade		Test, Kg Available	Tested	Sample Numbers
		%Pb	%Zn			
Siliceous Phyllite	Very low grade (waste)	0.07	0.23	10	N	01 PG-C-01
Carbonaceous Quartzite	Low Pb grade Available phase 1	1.91	4.30	135	Y	G-46-2
Carbonaceous Phyllite/Schist	Low Pb grade, Grun common ore type	1.20	5.12	5	Y	G-46-30 G-28-30 G-70-30
Siliceous Pyritic Sulphide	30 - 60% pyrite	10.80	14.20	10	Y	G-22-4 G-34-4 G-28-4 G-46-4
Pyritic Quartzite	Low Grade (< 30% pyrite)	2.80	2.88	26	Y	G-46-3 G-22-3 G-64-3 G-28-3 G-70-2
Massive Pyritic Sulphide	60 - 100% pyrite			28	N	G-52-5 G-22-5 G-34-5 G-28-5 G-46-5
Baritic Pyrite Sulphide	> 10% barite			10	N	G-22-7 G-28-7 G-52-7
Non-calcareous - muscovite chlorite - grey phyllite				9	N	G-22-20 G-34-20 G-52-20 G-28-20
Glaucous - silvery grey muscovite - chlorite - phyllite				10	N	G-ALL 40's

Feed grades calculated from flotation concentrates.

Test Kg Available represents the weights obtained from available drill core.

Initial flotation tests conducted on several ore types.

Note the variation in head grades.

TABLE #2

GRUH - 1991 - INITIAL FLOTATION - KEY RESULTS

Test No.	Ore Type	Head Assays			Flotation Performed	Lead		Zinc		Comments
		%Pb	%Zn	%Fe		Grade	Recov	Grade	Recov	
G0	siliceous phyllite very low grade	0.07	0.23	2.81	No flotation test					No Grade -WASTE-
G1	carbonaceous quartzite G-46-2	1.92	4.31	3.64	Pb Rgh/Scav only Zn Rgh/Scav + 2 Cln stages	60.10	59.41	55.80	67.30	Low pb grade feed. Good and selective flotation. Phase I ore type.
G2	siliceous pyritic sulphides G-46-4	10.85	14.25	19.78	Pb Rgh/Scav + 3 Cln stages Zn Rgh/Scav only	64.74	46.17	53.00	61.66	Pb Rgh c = 36% Pb R = 89.9% Zn Rgh/Scav c = 44.74% Zn R = 68.89% Flotation time low.
G3	carbonaceous phyllite/shist G-46-30	1.20	5.12	24.72	Pb Rgh/Scav flot Zn Rgh/Scav flot	30.00	58.30	20.40	70.51	Low Pb grade feed. Common ore type.
G4	pyritic quartzite & talc G-46-3	2.80	2.88	5.07	Pb Rgh/Scav + 3 Cln stages Zn Rgh/Scav + 3 Cln stages	60.50	75.80	52.40	69.50	Medium Grade.

Phase I ore represented by test G1.

Test G2 would have produced better results if flotation time was extended.

Planned Flotation Tests

So far tests have used Faro reagents and grinding, without lock cycle tests.

This has been undertaken to show the response of the different ore types.

Tests so far have shown separation was not a problem.

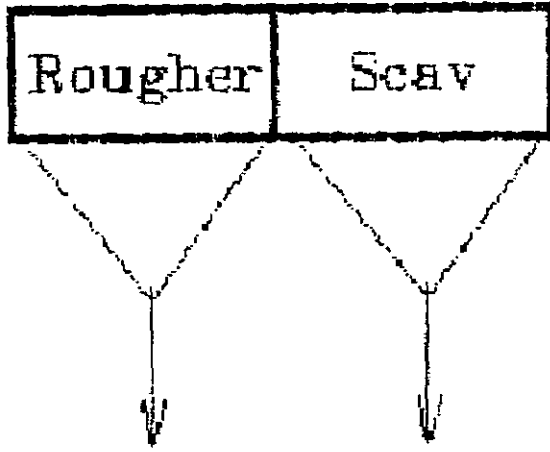
In general the remaining tests should cover:

- a. Flotation of remaining ore types.
- b. Flotation of expected mixtures (starting with phase No. 1). Include some dilution of waste.
- c. Complete flotation to all stages of cleaning (which includes standard regrinding)
- d. Possible extra regrinding. This is recommended by Lakefield, although Faro tests will confirm.
- e. Emphasise balance of grade, recovery and reagents.

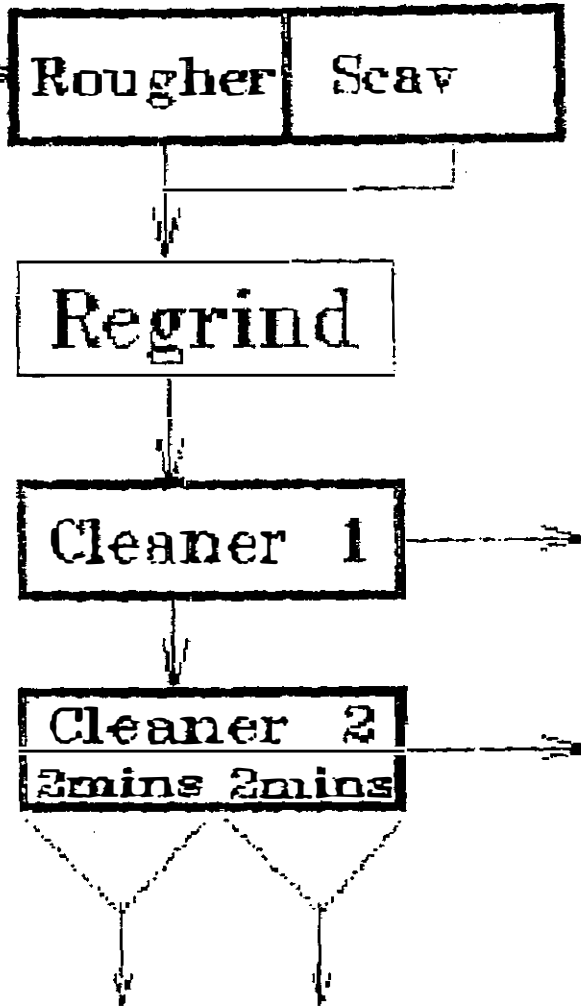
Table #3

Sample	Objective
G-46-2	-Simulate phase 1 mixture = carbonaceous quartzite and carbonaceous phyllite (15%)
G-46-30	-All stages of cleaning
Various	-Flotation of remaining ore types (6)
G-46-2 G-46-30	-Extra regrinding
G-46-4	-Extended flotation time (information only)
G-28-3	

Lead Flotation



Zinc Flotation



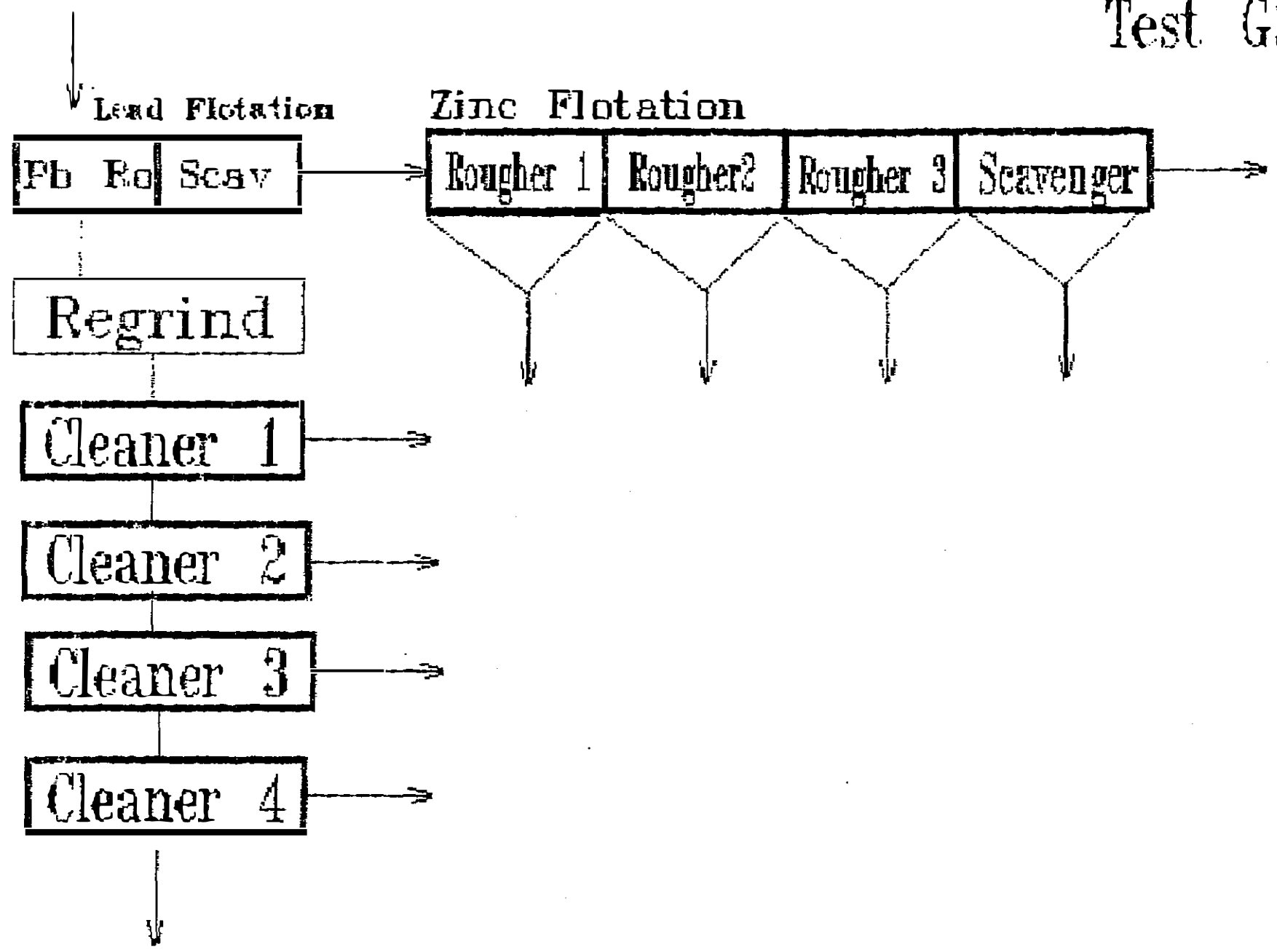
Test No.: "G1" Crum - G46-2

Date: Oct 28, 1991

Ore Type: 2 - Carbonaceous Quartzite ore type with some amounts
of Graphite(carbon)

Sample	Wt %	ASSAYS			DISTRIBUTION		
		%Pb	%Zn	%Fe	%Pb	%Zn	%Fe
Feed (Calc)	100.00	1.92	4.31	3.64	100.00	100.00	100.00
C0 - Scavenger	0.53	2.70	5.44	6.01	0.74	0.67	0.88
C1 - Pb Conc	1.90	60.10	6.24	3.47	59.41	2.75	1.81
C2 - Pb Scav	1.52	18.00	11.00	9.48	14.23	3.88	3.96
C3 - Zn Conc	4.43	0.88	56.80	7.79	2.03	58.36	9.48
C4 - Zn Conc	0.68	1.36	55.00	7.99	0.43	8.67	1.49
T2	0.67	2.26	38.80	11.10	0.79	6.03	2.04
T1	4.75	0.93	7.74	17.60	2.30	8.53	22.98
Final Tails	85.52	0.45	0.56	2.44	20.02	11.11	57.35

- Low Pb head grade (1.92% Pb)
- Flowsheet: Pb Rgh/Scav flotation only.
Zn Rgh/Scav + regrind + 2 cleaner stage.
- good Pb and Zn concentrates, good selectivity.



Test No.: "C2" Grun - G-46-4

Date: Nov 8, 1991

Ore Type: Siliceous pyritic sulphide

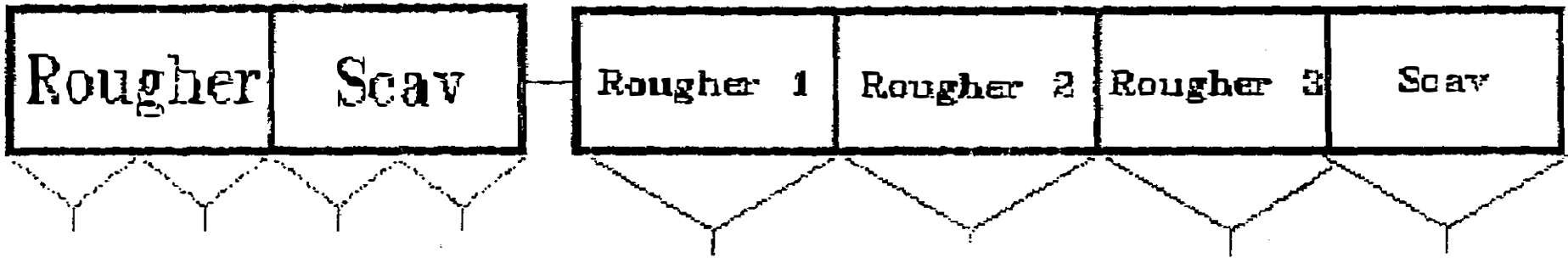
Sample	Wt (grams)	Wt %	ASSAYS			DISTRIBUTION		
			%Pb	%Zn	%Fe	%Pb	%Zn	%Fe
Feed (Calc)	1580.03	100.00	10.85	14.25	19.78	100.00	100.00	100.00
C1 - Pb Conc	64.20	4.06	71.50	6.93	2.14	26.78	1.98	0.44
C2	35.52	2.25	60.20	11.90	4.84	12.43	1.88	0.65
T3	22.50	1.42	52.60	12.70	8.06	6.91	1.27	0.58
T2	71.30	4.51	50.70	12.30	9.71	21.09	3.90	2.22
T1	234.15	14.82	16.60	19.00	22.60	22.68	19.76	16.93
C3 - Zn Conc	90.24	5.71	2.24	54.60	7.01	1.18	21.88	2.02
C4	53.89	3.41	2.58	53.20	6.91	0.81	12.73	1.19
C5	117.80	7.46	2.42	51.70	8.35	1.66	27.05	3.15
C6	84.76	5.36	3.37	19.20	2.71	1.67	7.23	0.73
Final Tails	806.67	50.09	1.01	0.65	28.00	4.75	2.33	72.18
						100.00		

- EXTREMELY HIGH HEAD GRADES.
- good Pb and Zn concentrates, good selectivity.
- flotation time has to be extended (2 more minutes) to achieve low tailings with such a high feed grade (in reality this ore would be mixed)
- Flowsheet: Pb Rgh/Scav + regrind + 4 cleaning stages.
Zn Rgh/Scav flotation only - no cleaner flotation.
- rougher zinc gave 51 to 54% zinc.

Test 03

Lead Flotation

Zinc Flotation



Test No.: "G3" Gram - G46-30

Date: Nov 12, 1991

Ore Type: Carbonaceous phyllite/shist.

Sample	Wt %	ASSAYS			DISTRIBUTION		
		%Pb	%Zn	%Fe	%Pb	%Zn	%Fe
Feed (Calc)	100.00	1.20	6.12	24.72	100.00	100.00	100.00
C1 - Pb Conc	1.78	31.30	9.36	8.80	46.56	3.25	0.63
C2	0.83	11.90	9.06	14.50	9.25	1.47	0.49
SC-1	0.56	7.98	8.03	18.20	3.73	0.88	0.41
SC-2	1.09	4.22	6.85	23.30	3.84	1.46	1.03
C3 - Zn Conc	5.08	0.55	42.70	9.05	2.33	42.34	1.86
C4	2.25	0.74	19.50	22.70	1.39	8.56	2.07
C5	2.89	0.94	13.20	26.10	2.03	7.45	3.05
C6	6.43	0.89	6.54	5.88	4.78	8.21	1.53
Final tails	79.09	0.41	1.71	27.80	27.09	26.40	88.93

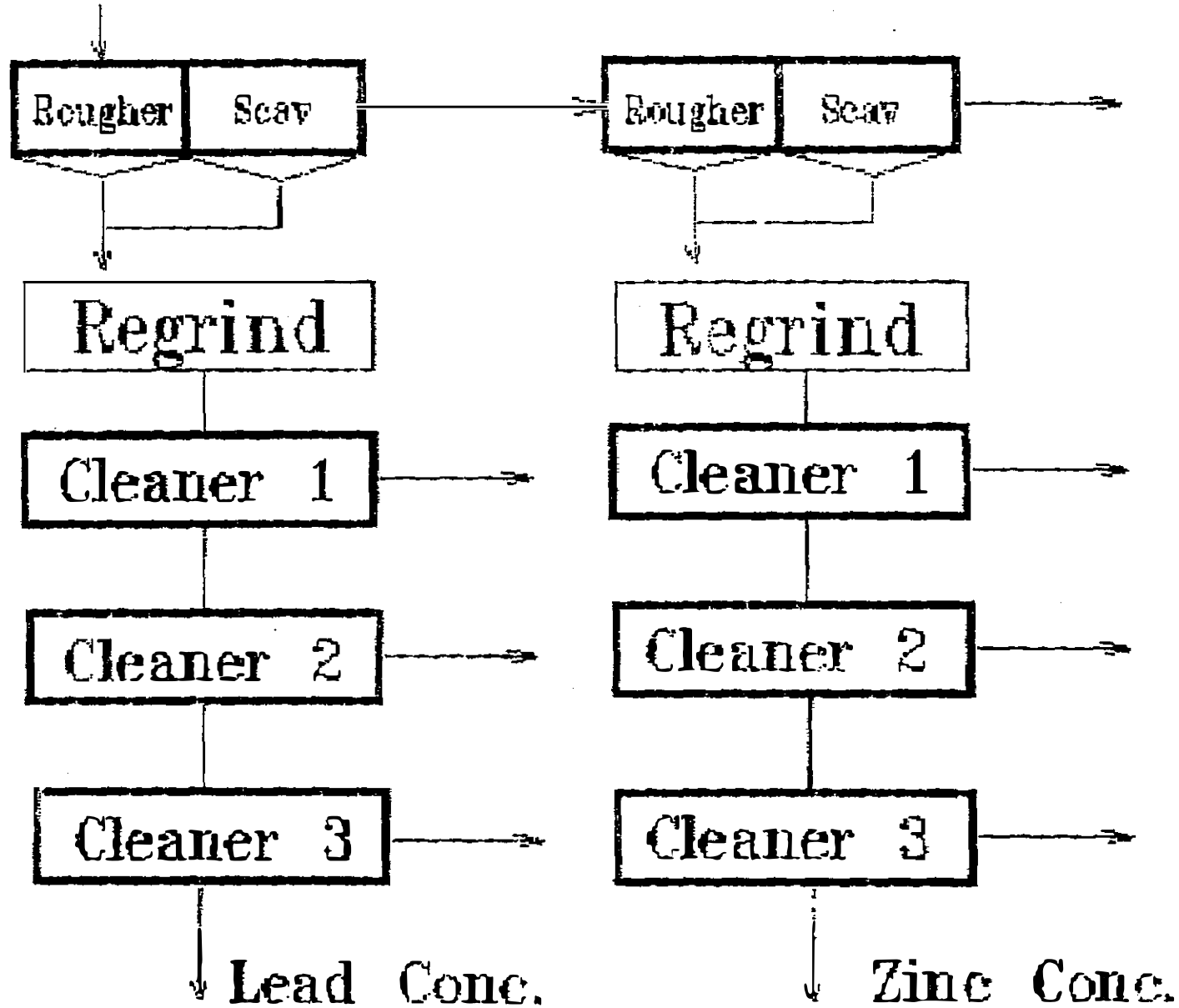
- Low Pb head grade (1.20% Pb)

- Flowsheet: Pb Rgh/Scav flotation only.
 Zn Rgh/Scav flotation only.
 No cleaner flotation.

- Acceptable selectivity.

- A complete standard flotation (rgh/scav + cleaner) is scheduled.

Equivalent to Faro Standard Flotation Test G4



Test No.: "Cf" Grun - 664-3

Date: Nov 14, 1991

Ore Type: Pyritic Quartzitic Ore

Sample	Wt (gms)	Wt %	ASSAYS			DISTRIBUTION		
			%Pb	%Zn	%Fe	%Pb	%Zn	%Fe
Feed (Calc)	2010.05	100.00	2.89	2.88	5.07	100.00	100.00	100.00
Lead Concentrate	72.80	3.62	60.50	7.81	6.26	76.82	9.81	4.47
Pb 3rd Cln Tails	15.38	0.77	32.30	12.90	13.20	8.55	3.42	1.99
Pb 2nd Cln Tails	8.97	0.45	17.70	10.40	17.90	2.73	1.61	1.58
Pb 1st Cln Tails	19.88	0.99	8.14	6.69	20.10	2.79	1.92	3.92
Pb Scav Concentrate	10.00	0.50	5.81	9.50	25.60	1.00	1.64	2.51
Zinc Concentrate	76.85	3.82	1.95	52.40	9.61	2.58	69.45	7.25
Zn 3rd Cln Tails	6.89	0.34	1.55	21.30	26.70	0.18	2.53	1.81
Zn 2nd Cln Tails	12.00	0.60	0.90	7.74	32.60	0.19	1.60	3.83
Zn 1st Cln Tails	119.95	5.97	0.34	1.52	31.10	0.70	3.14	36.62
Final Tails	1667.33	82.95	0.19	0.17	2.20	5.45	4.89	36.01

- standard flotation using Pero reagent scheme.
- low head grades (2.89% Pb, 2.88% Zn).
- good/acceptable Pb and Zn concentrates (60% Pb, 52.4% Zn)
- good selective flotation.
- low grade tails (0.19% Pb, 0.17% Zn)
- low metal units loss in tails (5.45% Pb, 4.89% Zn)