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Date: January 27, 1984.

006948

Subject: Conditioning Testing on ZEF Ore.

Conclusions:

1. Increased conditioning time improved grades, but decreased recoveries. if flotation time was constant
2. Increased conditioning time, as well as, flotation time improved both grades and recoveries. *(see graphs, Appendix A.)

Best Test	Pb circuit		Zn circuit	
	% Pb	% Recovery	% Zn	% Recovery
6			10.47	87.06
11	33.00	91.23		

Recommendations:

1. Further testwork should be performed to investigate the optimum conditioning and flotation times necessary to produce the best possible metallurgy.
2. Reagent scheme should be optimized. Frothers should be investigated, as well as, secondary or more selective collectors

Discussion and Analysis

The procedure used in this testwork was based on the best cleaner test #4 (from reagent/regrind optimization repeat tests, January 1984). The K.R.A.L. method was employed with an increase (50%) in Z-11 collector. In tests 1-7, both the conditioning and flotation times were varied, but the combined time ~~was~~ remained constant. In tests 8-14, the conditioning times were varied while the flotation time remained constant. The actual reagent and time schemes are detailed in Appendix B.

Pb circuit

In the Pb circuit, it was found that as the conditioning time was increased and the flotation time remained constant, the rougher/scavenger grades improved, while the recoveries decreased. Increasing the flotation time while decreasing the conditioning times improved grades, but lowered recoveries. (see Table 1.)

TABLE 1. Pb ROUGHER TESTS

TEST No.	COND. TIME	FLOAT TIME	% Cum. GRADE	% Cum. RECVY
1	1	9	27.79	92.53
2	2	8	29.45	91.15
3	3	7	30.49	90.83
8	1	10	30.00	91.02
9	2	10	31.24	91.42
10	3	10	29.84	92.24
11	4	10	33.00	91.23

Zn circuit

In the zinc circuit, it was noted that, as the conditioning time increased and the flotation time remained constant, the rougher/scavenger grades decreased, but recoveries improved. In the case of increased flotation times and decreased conditioning times, the grades dropped while recoveries increased (see Table 2).

TABLE #2 Zn Rougher Tests

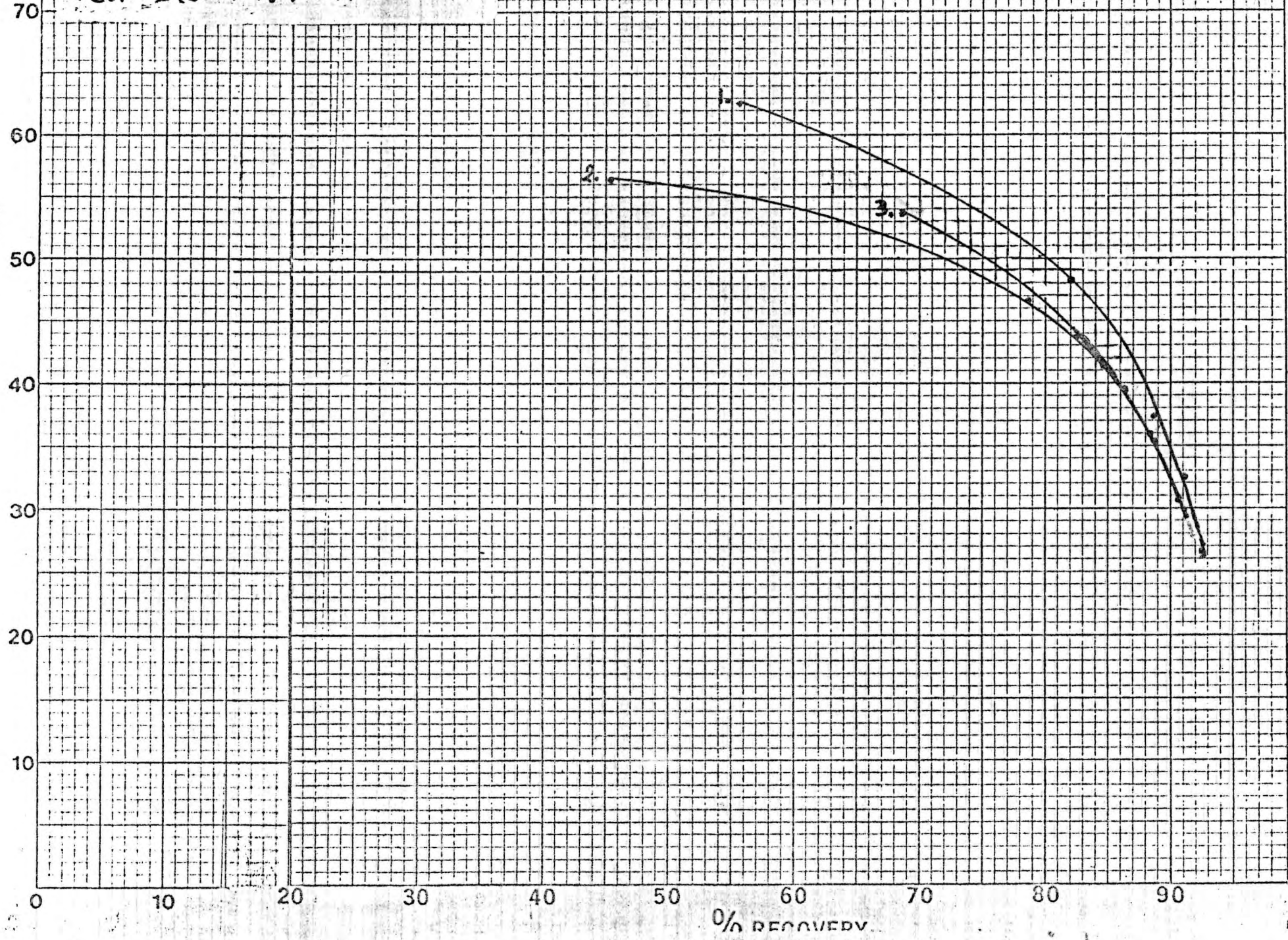
Test No.	Cond. Time	Float Time	% Cum Grade	% Recovery
4	10	10	15.14	85.40
5	8	12	10.39	86.63
6	6	14	10.47	87.06
7	4	16	8.36	87.36
12	4	10	14.85	83.73
13	6	10	12.52	85.47
14	8	10	12.96	86.41

Although this series of tests showed definite trends, the overall metallurgy indicated no improvement when compared to previous testwork. This lack of improvement in metallurgy can be attributed to a number of factors. In both the Pb and Zn circuits, froth conditions were poor throughout flotation which can only inhibit grades and recoveries.

APPENDIX A

CONDITION VS FLOAT TIME ROUGER TESTS

Pb CIRCUIT ONLY
TEST #1 (1 MIN VS 9 MIN)
TEST #2 (2 MIN VS 8 MIN)
TEST #3 (3 MIN VS 7 MIN)



CONDITION VS FLOAT TIME ROUGH TESTS

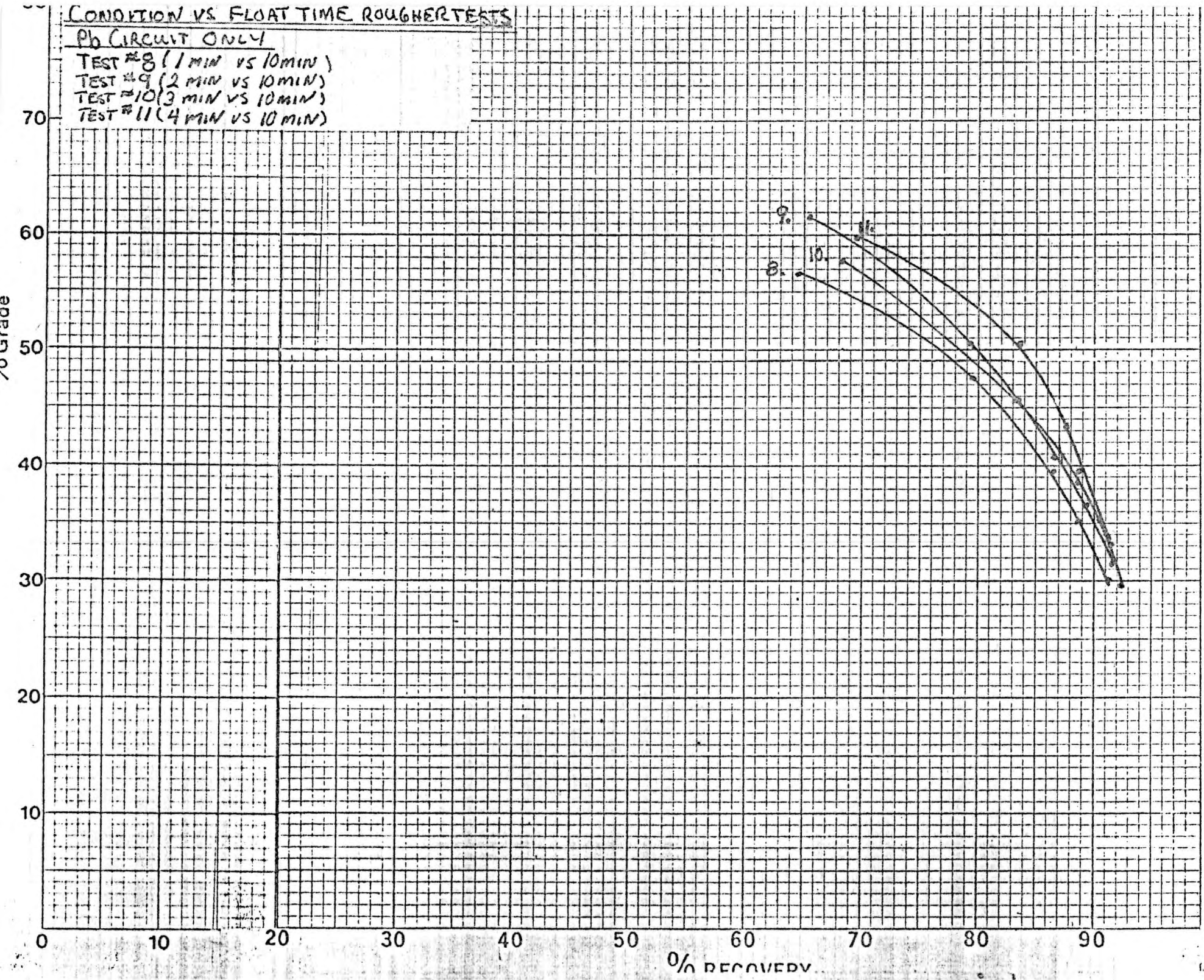
Pb CIRCUIT ONLY

TEST #8 (1 MIN VS 10 MIN)

TEST #9 (2 MIN VS 10 MIN)

TEST #10 (3 MIN VS 10 MIN)

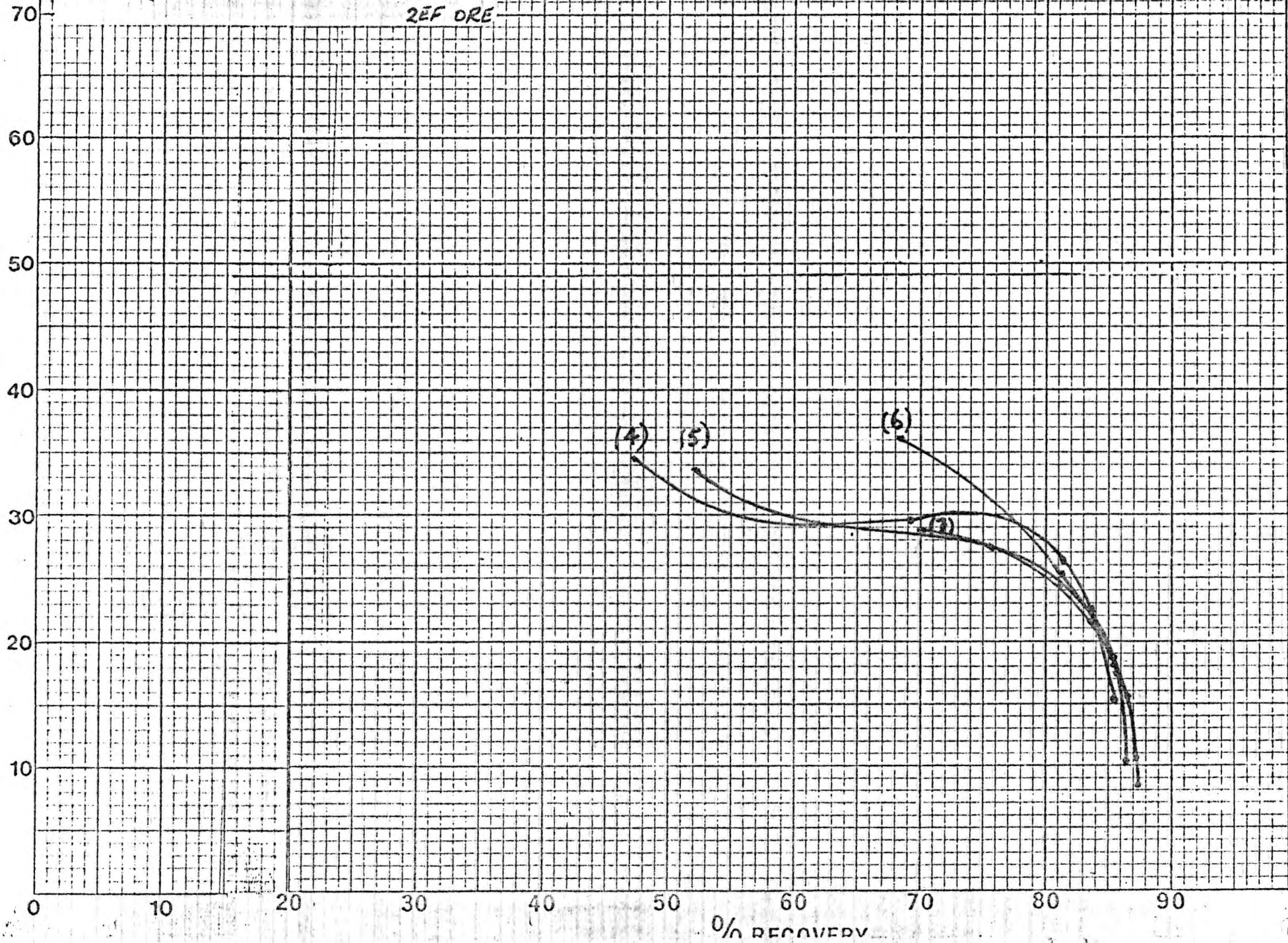
TEST #11 (4 MIN VS 10 MIN)



CONDITION VS FLOT TIME KOLUBER TESTS

- TEST # 4. (10 min. VS 10 min.)
- 5. (8 min. VS 12 min.)
- 6. (6 min. VS 14 min.)
- 7. (4 min. VS 16 min.)

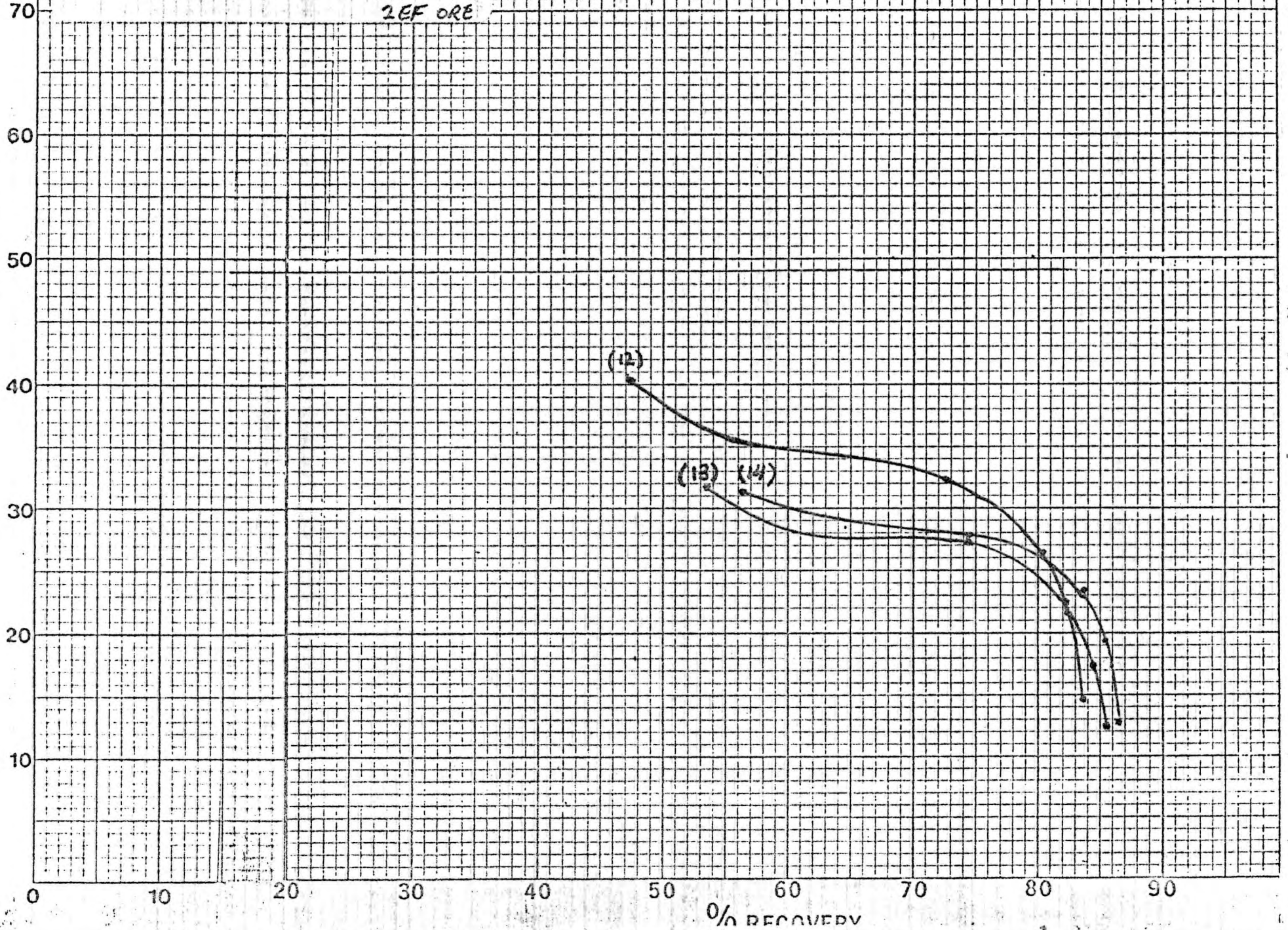
ZINC
CIRCUIT
ONLY
2EF ORE



CONDITION VS FLOT TIME ROUGHER TESTS

TEST # 12. (4 min. VS 10 min.) ZINC
13. (6 min. VS 10 min.) CIRCUIT
14. (8 min. VS 10 min.) ONLY

2EF ORE



APPENDIX B

TEST NO.: 4.

PURPOSE: CONDITIONING VS FLOTATION TIME - Zn circuit only

PROCEDURE: K.R.A.L METHOD - 8 minutes conditioning vs 10 minutes flotation time

FEED: 2 EF ORE

GRIND: 14 minutes primary grind

STAGE	REAGENTS ADDED (g/t)								TIME (MIN)			SCAV TL P ₃₀ ⁴	PH	
	Na ₂ CO ₃	Na ₂ SO ₃	NaCN	Z-11	CuSO ₄	CaO	MIBC drops	DOW drops	GRIND	COND	FROTH		START	FINI
PRIMARY GRIND	3000		200	70					12 2					
PbRo ₁	6710						1			2	3	8.23	10.0	
PbRo ₂														
PbSc ₁				30			1				2			
PbSc ₂														
PbSc ₃				30			1				3			
Zn COND.				70	1000	2200				8 2		9.89 9.72	11.56	
ZnRo ₁								1			1			
ZnRo ₂								2			2			
ZnSc ₁				30				1			2			
ZnSc ₂								2			2			
ZnSc ₃				30				2			3			

TEST NO.: 5.

PURPOSE: CONDITIONING VS FLOTATION TIME - Zn circuit only

PROCEDURE: K.R.A.L METHOD - 6 minutes conditioning vs 12 minutes flotation time

FEED: 2 EF ORE

GRIND: 14 minutes primary grind

STAGE	REAGENTS ADDED (g/t)								TIME (MIN)			SCAV TL P ₃₀ ¹	PH	
	Na ₂ CO ₃	Na ₂ SO ₃	NaCN	Zn	CuSO ₄	CaO	MIBC drops	DOW drops	GRIND	COND	FROTH		START	FINI
PRIMARY GRIND	3000		200	70					12 2					
PbPo ₁	7460						1			2	3	8.24	10.00	
PbPo ₂														
PbSc ₁				30			1				2			
PbSc ₂														
PbSc ₃				30			2				3			
Zn COND.				70	1000	2200				6 2		9.95 9.78	11.35	
ZnPo ₁								2			2			
ZnPo ₂								1			2			
ZnSc ₁				30				1			2			
ZnSc ₂								2			3			
ZnSc ₃				30				2			3			

TEST NO.: 7.

PURPOSE: CONDITIONING VS FLOTATION TIME - Zn circuit only

PROCEDURE: K.R.A.L METHOD - 2 minutes conditioning vs 16 minutes flotation time

FEED: 2 EF ORE

GRIND: 14 minutes primary grind

STAGE	REAGENTS ADDED (g/t)								TIME (MIN)			SCAV TL P ₈₀ ^H	PH	
	Na ₂ CO ₃	Na ₂ SO ₃	NaCN	Z-11	CuSO ₄	CaO	MIBC drops	DOW drops	GRIND	COND	FROTH		START	FINIS
PRIMARY GRIND	3000		200	70					12	2				
PbRo ₁	5440						1				3	8.33	10.0	
PbRo ₂														
PbSc ₁				30			2				2			
PbSc ₂														
PbSc ₃				30			1				3			
Zn COND.				70	1000	2200						9.90		
												9.72		
													11.32	
													11.46	
ZnRo ₁								2			3			
ZnRo ₂								1			3			
ZnSc ₁				30				2			3			
ZnSc ₂								2			3			
ZnSc ₃				30				2			4			

TEST NO.: 6.

PURPOSE: CONDITIONING VS FLOTATION TIME - 2n Circuit only

PROCEDURE: K.R.A.L. METHOD - 4 minutes conditioning vs 14 minutes flotation time

FEED: 2 EF ORE

GRIND: 14 minutes primary grind

STAGE	REAGENTS ADDED (g/t)								TIME (MIN)			SCAV TL P ₃₀ ^H	PH	
	Na ₂ CO ₃	Na ₂ SO ₃	NaCN	Z-11	CuSO ₄	CaO	MIBC drops	DOW drops	GRIND	COND	FROTH		START	FINISH
PRIMARY GRIND	3000		200	70					12 2					
PbFo ₁	6190						1				3	8.24	10.0	
PbFo ₂														
PbSc ₁				30			1				2			
PbSc ₂														
PbSc ₃				30			2				3			
Zn COND.				70	1000	2200						9.95 9.75	11.52	
ZnFo ₁								2			2			
ZnFo ₂								1			3			
ZnSc ₁				30				2			3			
ZnSc ₂								2			3			
ZnSc ₃				30				2			3			

TEST NO.: 12.

PURPOSE: CONDITIONING VS FLOTATION TIME - 2n circuit only

PROCEDURE: K.R.A.L METHOD - 2 minutes conditioning vs 10 minutes flotation time

FEED: 2 EF ORE

GRIND: 14 minutes primary grind

STAGE	REAGENTS ADDED (g/t)								TIME (MIN)			SCAV TL p ₈₀ ^u	PH	
	Na ₂ CO ₃	Na ₂ SO ₃	NaCN	Z-11	CuSO ₄	CaO	MIBC drops	DOW drops	GRIND	COND	FROTH		START	FINI
PRIMARY GRIND	3000		200	70					12 2					
PbFo ₁	5830						1			2	3	8.17	10.00	
PbFo ₂														
PbSc ₁				30			2				2			
PbSc ₂														
PbSc ₃				30			0				3			
Zn COND.				70	1000	2200				2 2		9.92 9.74	11.53 11.63	
ZnFo ₁								2			1			
ZnFo ₂								2			2			
ZnSc ₁				30				2			2			
ZnSc ₂								2			2			
ZnSc ₃				30				2			3			

TEST NO.: 13.

PURPOSE: CONDITIONING VS FLOTATION TIME - Zn circuit only

PROCEDURE: K.R.A.L METHOD - 2 minutes conditioning vs 10 minutes flotation time

FEED: 2EF

GRIND: 14 minutes primary grind

STAGE	REAGENTS ADDED (g/t)								TIME (MIN)			SCAV TL P ₃₀ ⁴	PH	
	Na ₂ CO ₃	Na ₂ SO ₃	NaCN	Z-11	CuSO ₄	CaO	MIBC drops	DOW drops	GRIND	COND	FROTH		START	FIN
PRIMARY GRIND	3000		200	70					12 2					
PbRo ₁	5840						2			2	3	8.54	10.00	
PbRo ₂														
PbSc ₁				30			1				2			
PbSc ₂														
PbSc ₃				30			1				3			
Zn COND.				70	1000	2200				4 2		9.91 9.72	11.52 11.60	
ZnRo ₁								2			1			
ZnRo ₂								2			2			
ZnSc ₁				30				2			2			
ZnSc ₂								2			2			
ZnSc ₃				30				2			3			

TEST NO.: 14.

PURPOSE: CONDITIONING VS FLOTATION TIME - Zn circuit only

PROCEDURE: K.R.A.L METHOD - 6 minutes conditioning vs 10 minutes flotation time

FEED: 2 EF

GRIND: 14 minutes primary grind

STAGE	REAGENTS ADDED (g/t)								TIME (MIN)			SCAV TL 230 ^u	PH	
	Na ₂ CO ₃	Na ₂ SO ₃	NaCN	Z-11	CuSO ₄	CaO	MIBC drops	DCW drops	GRIND	COND	FROTH		START	FINISH
PRIMARY GRIND	3000		200	70					12 2					
PbRo ₁	7250						1			2	3	8.26	10.0	
PbRo ₂														
PbSc ₁				30			1				2			
PbSc ₂														
PbSc ₃				30			1				3			
Zn COND.				70	1000	2200				6 2		9.92 9.81	11.58 11.51	
ZnFo ₁								2			1			
ZnFo ₂								2			2			
ZnSc ₁								2			2			
ZnSc ₂								2			2			
ZnSc ₃								2			3			

Appendix C

TEST1, CONDITION VS FLOT TIME, REF ORE, (1 min vs 9 min)

RCFTEF01

COND. 1 min FLOT TIME, 9 minutes

	MASS (GM)	ASSAYS(%)					DISTRIBUTION(%)					CUM. GRADE(%)		CUM. RECOVERY(%)	
		Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag	Pb in the Pb Circuit	Zn in the Pb Circuit	Zn in the Zn Circuit	
F5 RD1	32.40	62.68	2.87	8.6	0.16	13.85	55.69	1.92	0.81	2.82	39.35	62.68	55.69	2.87	1.92
F5 RD2	29.70	32.30	6.42	22.7	0.37	7.88	26.31	3.94	1.96	5.98	20.52	48.15	82.00	4.57	5.85
F5 SC1	25.00	10.10	7.63	31.2	0.56	2.82	6.92	3.94	2.27	7.62	6.18	37.23	88.93	5.45	9.79
F5 SC2	14.50	5.28	7.01	33.1	0.62	1.60	2.10	2.10	1.40	4.90	2.03	32.67	91.03	5.67	11.89
F5 SC3	19.80	2.77	7.05	34.3	0.64	1.07	1.50	2.88	1.98	6.90	1.86	27.79	92.53	5.89	14.77
Zn RD1	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zn RD2	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ERR	0.00	ERR	0.00
Zn SC1	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ERR	0.00	ERR	0.00
Zn SC2	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ERR	0.00	ERR	0.00
Zn SC3	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ERR	0.00	ERR	0.00
Zn SC TLS	878.60	0.31	4.70	35.8	0.15	0.39	7.47	85.23	91.58	71.77	30.05	0.31	7.47	4.7	85.23
CALCHEAD	1000.00	3.65	4.85	34.3	0.18	1.14	100.00	100.00	100.00	100.00	100.00				

ROUGHER TEST

TEST 2, CONDITION vs FLOT TIME, ZEF ORE (2 min vs 8 min)

RCFTEF02

	MASS (GM)	ASSAYS(%)					DISTRIBUTION(%)					CUM. GRADE(%)		CUM. RECOVERY(%)	
		Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag	Pb in the Pb Circuit	Zn in the Pb Circuit	Pb in the Zn Circuit	Zn in the Zn Circuit
Pb R01	30.10	56.22	3.25	12.3	0.16	10.96	45.34	1.92	1.05	2.65	29.86	56.22	45.34	3.25	1.92
Pb R02	32.40	38.42	4.96	17.6	0.41	8.38	33.36	3.15	1.62	7.32	24.58	46.99	78.70	4.14	5.07
Pb SC1	14.20	15.98	7.49	28.6	0.53	4.00	6.08	2.09	1.16	4.15	5.14	41.25	84.78	4.76	7.16
Pb SC2	17.60	8.83	7.68	31.0	0.53	2.49	4.16	2.65	1.55	5.14	3.97	35.20	88.94	5.30	9.81
Pb SC3	21.20	3.88	7.13	33.6	0.59	1.31	2.20	2.97	2.03	6.90	2.51	29.45	91.15	5.64	12.77
Zn R01	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zn R02	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ERR	0.00	ERR	0.00
Zn SC1	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ERR	0.00	ERR	0.00
Zn SC2	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ERR	0.00	ERR	0.00
Zn SC3	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ERR	0.00	ERR	0.00
Zn SC TLS	892.90	0.37	4.98	36.4	0.15	0.42	8.85	87.23	92.58	73.84	33.94	Pb in the Final Tails 0.37	8.85	Zn in the Final Tails 4.98	87.23
CALCHEAD	1008.40	3.70	5.06	34.8	0.18	1.10	100.00	100.00	100.00	100.00	100.00				

ROUGHER TEST TEST 10, CONDITION vs FLOT TIME, 2EF ORE (3 min vs 10 min)

RCFTRF10

	MASS (GM)	ASSAYS(%)					DISTRIBUTION(%)					CUM. GRADE(%)		CUM. RECOVERY(%)		CUM. GRADE(%)	CUM.
		Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag	Pb in the Pb Circuit	Zn in the Pb Cir	Zn in the Zn Cir	Zn in the Final		
Pb R01	44.70	57.75	3.62	10.6	0.19	12.64	68.27	3.13	1.37	4.81	48.88	57.75	68.27	3.62			
Pb R02	24.60	23.21	6.98	25.7	0.42	5.75	15.10	3.32	1.82	5.86	12.24	45.49	83.37	4.81			
Pb SC1	17.90	10.83	7.95	30.5	0.57	2.98	5.13	2.75	1.57	5.78	4.62	38.37	88.50	5.45			
Pb SC2	10.00	6.85	8.05	31.9	0.70	2.07	1.81	1.55	0.92	3.97	1.79	35.13	90.31	5.72	1		
Pb SC3	19.70	3.72	7.69	33.5	0.81	1.46	1.94	2.93	1.90	9.05	2.49	29.84	92.24	6.05	1		
												Pb in the Zn Circuit		Zn in the Zn Cir			
Zn R01	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Zn R02	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ERR	0.00	ERR	ERR		
Zn SC1	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ERR	0.00	ERR	ERR		
Zn SC2	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ERR	0.00	ERR	ERR		
Zn SC3	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	ERR	0.00	ERR	ERR		
												Pb in the Final Tails		Zn in the Final			
Zn SC TLS	888.60	0.33	5.03	36.1	0.14	0.39	7.76	86.33	92.42	70.53	29.98	0.33	7.76	5.03			
CALCHEAD	1005.50	3.76	5.15	34.5	0.18	1.15	100.00	100.00	100.00	100.00	100.00						

ROUGHER TEST TEST 13, CONDITION vs FLOT TIME, ZEF ORE, (6 min vs 10 min)

R0CFTEF13

	MASS (GM)	ASSAYS (%)					DISTRIBUTION (%)					CUM. GRADE (%)		CUM. RECOVERY (%)	
		Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag	Pb in the Pb Circuit	Zn in the Pb Circuit	Pb in the Zn Circuit	Zn in the Zn Circuit
Pb R01	116.00	28.50	5.92	24.2	0.38	7.46	91.47	13.37	8.08	21.06	69.85	28.50	91.47	5.92	13.37
Pb R02	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.50	91.47	5.92	13.37
Pb SC1	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.50	91.47	5.92	13.37
Pb SC2	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.50	91.47	5.92	13.37
Pb SC3	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28.50	91.47	5.92	13.37
Zn R01	86.40	0.40	31.76	23.2	0.26	0.51	0.96	53.44	5.77	10.73	3.56	0.40	0.96	31.76	53.44
Zn R02	54.00	0.56	19.73	29.4	0.40	0.63	0.84	20.75	4.57	10.32	2.75	0.46	1.79	27.13	74.18
Zn SC1	53.30	0.88	8.56	33.6	0.80	0.77	1.30	8.88	5.16	20.38	3.31	0.58	3.09	22.02	83.07
Zn SC2	56.60	0.70	1.38	37.0	0.44	0.57	1.10	1.52	6.03	11.90	2.60	0.60	4.19	17.35	84.59
Zn SC3	100.20	0.43	0.45	35.6	0.21	0.43	1.19	0.88	10.27	10.05	3.48	0.55	5.38	12.52	85.47
Zn SC TLS	542.40	0.21	0.11	38.5	0.06	0.33	3.15	1.16	60.12	15.55	14.45	0.21	3.15	0.11	1.16
CALCHEAD	1008.90	3.58	5.09	34.4	0.21	1.23	100.00	100.00	100.00	100.00	100.00				

ROUGHER TEST TEST 14, CONDITION vs FLOT TIME, 2EF ORE, (8 min vs 10 min)

RCFTEF14

	MASS (SK)	ASSAYS(%)					DISTRIBUTION(%)					CUM. GRADE(%)		CUM. RECOVERY(%)	
		Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag	Pb in the Pb Circuit	Zn in the Pb Circuit	Pb in the Zn Circuit	Zn in the Zn Circuit
Pb R01	112.40	30.71	5.72	22.4	0.43	8.00	91.08	11.98	7.29	22.76	68.91	30.71	91.08	5.72	11.98
Pb R02	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.71	91.08	5.72	11.98
Pb SC1	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.71	91.08	5.72	11.98
Pb SC2	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.71	91.08	5.72	11.98
Pb SC3	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30.71	91.08	5.72	11.98
Zn R01	97.20	0.45	31.06	23.3	0.26	0.54	1.15	56.27	6.55	11.90	4.02	0.45	1.15	31.06	58.27
Zn R02	46.50	0.68	21.08	27.9	0.46	0.74	0.83	18.27	3.75	10.07	2.64	0.52	1.99	27.83	74.54
Zn SC1	50.00	1.09	9.92	33.2	0.91	0.96	1.44	9.24	4.80	21.43	3.68	0.67	3.43	23.21	83.78
Zn SC2	42.80	0.89	2.02	36.9	0.47	0.80	1.01	1.61	4.57	9.47	2.62	0.71	4.43	19.37	85.39
Zn SC3	121.20	0.38	0.45	37.0	0.16	0.44	1.22	1.02	12.98	9.13	4.09	0.60	5.65	12.96	88.41
Zn SC TLS	539.00	0.23	0.16	38.5	0.06	0.34	3.27	1.61	60.05	15.23	14.04	0.23	3.27	0.16	1.61
CALCHEAD	1009.10	3.76	5.32	34.2	0.21	1.29	100.00	100.00	100.00	100.00	100.00				