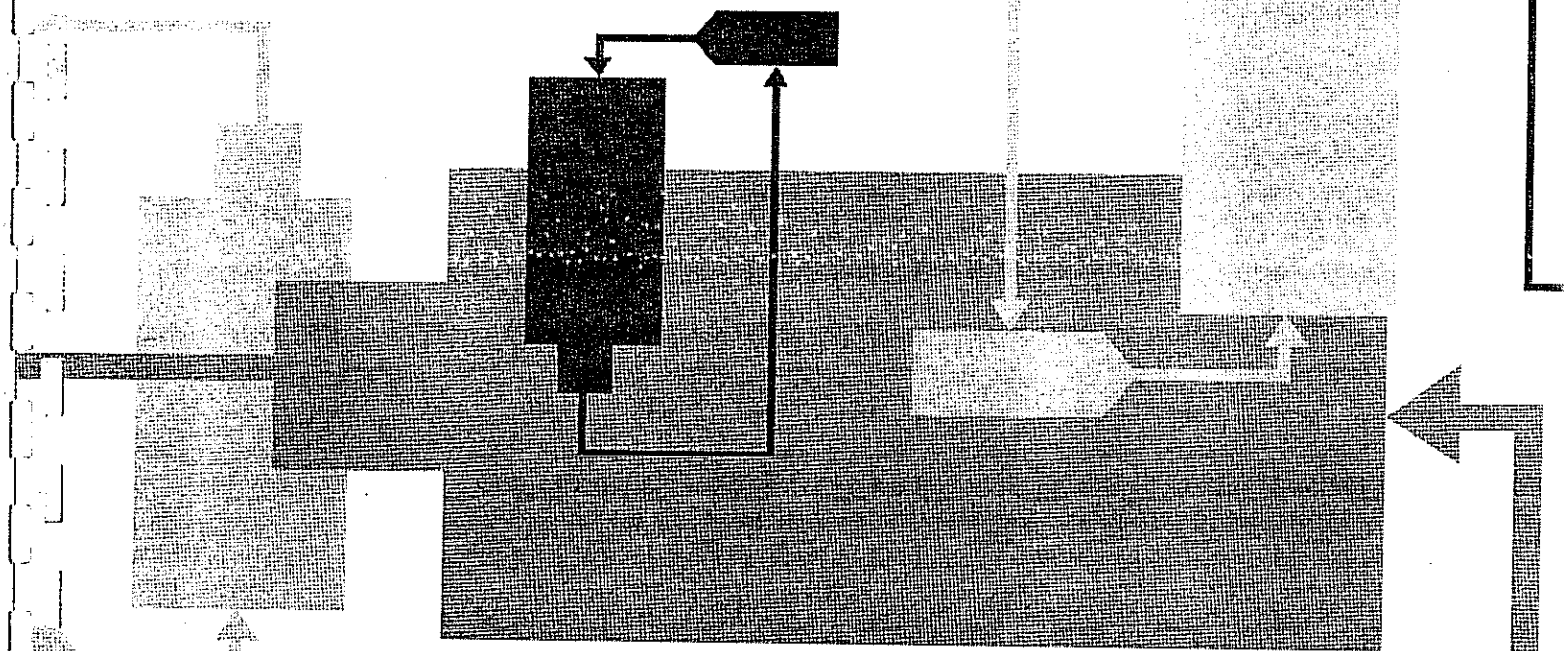
FLOTATION TESTWORK

FARO TAILINGS
YUKON, CANADA

FINAL REPORT



NORMET

NORMET

FLOTATION TESTWORK

FARO TAILINGS
YUKON, CANADA

FINAL REPORT

CLIENT: Curragh Inc. / Denehurst Ltd

JOB No.: 23/583

DATE: 7 May 1993

per Phil Hearse

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1 SUMMARY

Results from the flotation testwork indicate that zinc concentrate at an acceptable grade and recovery is achievable from Faro tailings.

Comparison between the Faro 6 result (Test 6 from testwork conducted by RMS Waterford and Associates, May 1992) and those from Normet indicates that higher overall zinc rougher recoveries are possible, and improvements to this are likely.

	FARO 6	TEST 10
Zn Recovery	65	67
Zn Grade	11	18

Final cleaner concentrate grade/recovery relationship is still not as high as that outlined on the Faro 6 test. However, recoveries achieved by Normet are superior, and recovery to the final cleaner stage is close to that previously achieved.

The reagent costs based on Test 8 are significantly lower than that of the $3.00/t quoted by RMS Waterford at an estimated $1.70/t.

Continuation onto Stage 2 of the testwork program is recommended to optimise conditioning.

2 INTRODUCTION

Denehurst Ltd, in conjunction with Curragh Inc of Canada, are investigating the feasibility of a project to recover zinc from the Faro Mine tailings dams. Normet was requested to conduct flotation testing on tailings samples from the Faro Mine in Yucon, Canada, aimed at zinc recovery with particular emphasis on application of the Denehurst flotation technology.

A program of testwork had been proposed by Normet (ref: "Metallurgical Testwork Program For Curragh Tailings Re-treatment Project" 25 November 1993). The proposed program was broken down into three stages, with a stagewise approach to the testwork. This report is based on the first stage of the testwork, which was aimed at emulating testwork conducted earlier on a separate sample of Faro tailings by RMS Waterford.

The aim of this preliminary stage of the program were to repeat the results previously achieved.

3 SAMPLES / SAMPLE PREPARATION

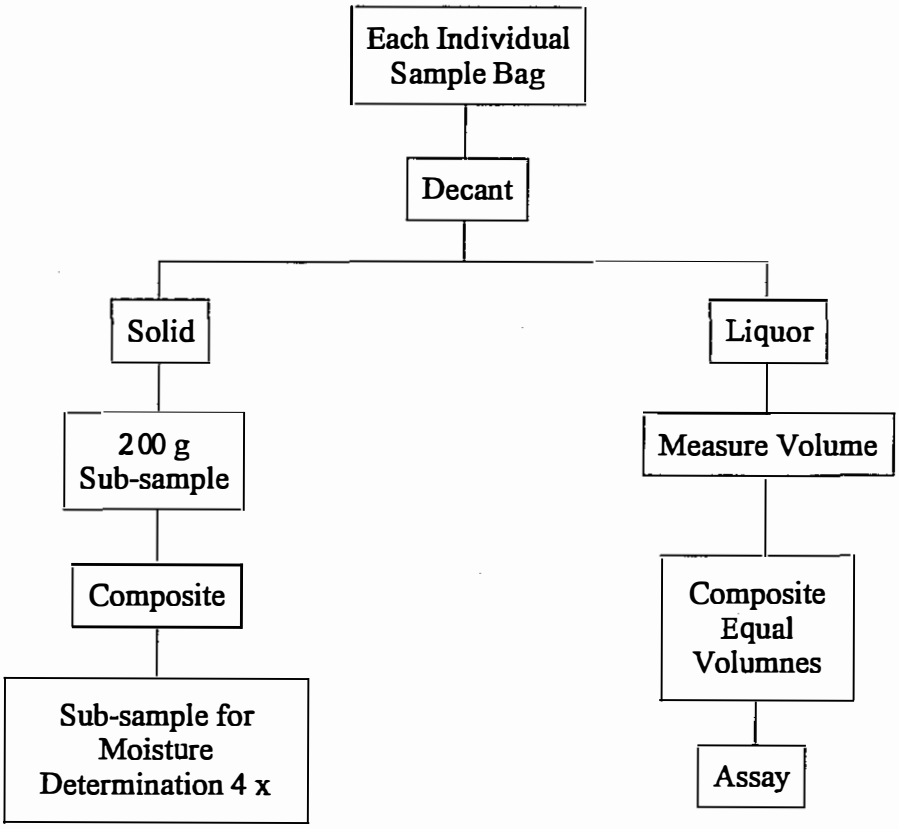
3.1 CURRAGH TAILINGS

A total of seven 20 litre buckets arrived in good condition and were stored in Normet's quarantine facility. The buckets contained in total 144 individual sealed sample bags. The samples ranged from damp to wet.

The samples received were as follows:

	HOLE	METRE INTERVALS	COMMENTS
1	D1	1 - 7	
2	D2	8 - 18	(No. 8 missing)
3	D3	1 - 4	
4	D4	1 - 10	
5	E5	1 - 9	
6	E6	2 - 11	
7	E7	1 - 17	(No. 5 missing)
8	F13	1 - 5	
9	F14	1 - 21	(No. 6 missing)
10	G18	1 - 6	
11	G19	1 - 24	
12	G20	1 - 21	(No. 8 missing)
Total of 144 samples			
1 unlabelled 1 doubled up (E5 No. 2)			

The samples were treated separately and individually and each sample resealed after sub-sampling. The procedure is outlined in the following flowsheet:



Of the samples only seven had sufficient free water to yield solution for sampling. A composite was made from the solution.

The solid samples were thoroughly mixed and the moisture content determined. From this, samples containing 1,500 g of dry solids were split out for flotation testing.

4 TESTWORK PROCEDURES AND RESULTS

4.1 WATER ANALYSIS

The decanted water collected during the sample preparation was composited by equal volume. Analysis of the solution sample is shown below.

A sample was collected from the wash filtrate solution. Samples were despatched for analysis for float tests 1 and 2. Subsequent test wash solutions were not tested due to assumed similarity.

The results are presented below:

ANALYTE		COMPOSITE SOLUTION	WASH FILTRATE	
			TEST 1	TEST 2
Cu	mg/L	0.40	0.30	0.31
Zn	mg/L	12.70	60.00	59.30
Fe	mg/L	<0.1	<0.1	<0.1
Na	mg/L	384	57	83
Mg	mg/L	348	114	100
Ca	mg/L	1041	490	597
Al	mg/L	4.6	-	-
SO_4	mg/L	3477	1311	1249
Cl^-	mg/L	2615	95	127
pH		7.62	6.7	6.7

4.2 MOISTURE DETERMINATION

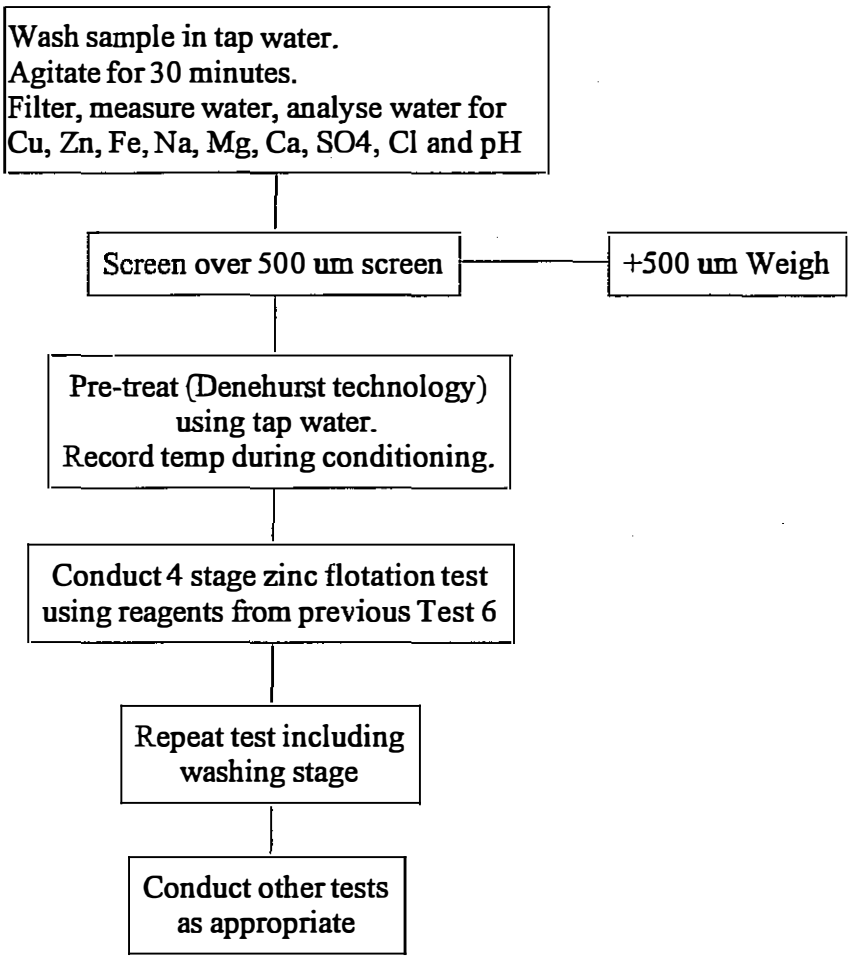
From the composited samples, 4 representative sub-samples were split out and moisture determined on the samples. The results are presented below:

MOISTURE (%)				AVERAGE
13.51	13.63	13.58	13.43	13.54

4.3 FLOTATION TESTING

A series of 12 flotation tests was conducted on the Curragh tailings samples. The detailed results are presented in Section 5.

The testwork procedure was conducted as follows:



The tests were conducted under the following general conditions:

- Tests 1 to 8 and 10 utilised Denehurst pretreatment technology.
- Tests 6, 7 and 10 utilised oxygenation during the pretreatment.
- Tests 9, 11 and 12 did not utilise pretreatment technology, Test 12 did not have the washing/filtration stage prior to flotation as did all the other tests.

The first seven flotation tests concentrated on producing a concentrate from the roughing stage comparable to the work done by RMS Waterford. The results gained from their Test 6 (Table 1, Section 5) resulted in the following:

FARO TEST 6	
Zn Recovery	65%
Zn Grade	11%

The results gained by Normet achieved this result with good repeatability.

TEST	7	8	9	10	11
Zn Recovery	65%	65%	60%	67%	62%
Zn Grade	13%	17%	18%	18%	20.5%

5 DISCUSSION OF RESULTS

5.1 ZINC

The general conclusions gained from the roughing testwork suggests that Denehurst technology and also oxygenation may be beneficial to the recovery of a zinc concentrate. It is however not clear how the technologies can be best utilised to improve on this recovery by optimisation of the two.

Recovery of a final concentrate from the rougher concentrate grade gave very encouraging results. The results that indicate the high recoveries and grade are possible from the rougher concentrate. For Test 9, the recovery from the initial rougher concentrate was 70% in comparison to the 75% gained by the Faro 6 test. However, the lower initial concentrate grade resulted in the poorer recovery. On a pro rata basis it could be expected to achieve grades and recoveries similar to those of Faro 6.

The upgrade ratio for the work indicates that the major difference in the work is that of the upgrading of the No. 1 Cleaner stage, however improvements to this have been made and the emulation of the overall Faro work is expected to be achievable with work progressing into Stages 2 and 3 of the testwork program.

5.2 OTHER MINERALS

Iron

Iron was sufficiently depressed to give a concentrate grade in the region of 10% to 12%. The use of UNIMAX, an iron depressant, had some effect, however this reagent requires further investigation to optimise it.

Iron appears to be readily suppressed during flotation by close pH control, in particular, during the rougher stage.

Copper

Copper grades in the concentrate were similar to that of the Faro 6 testwork remaining well below 5%, however recoveries were well up on that of the Faro 6 testwork.

Lead

The recovery of lead into the concentrate was influenced by the conditioning and the oxygenation. As a general rule, conditioning reduces the percentage lead in the concentrate, conversely, no conditioning increases lead in the concentrate eg Test 9.

The inclusion of oxygenation during conditioning increases the recovery and grade of lead, however this increase is far less than the increase of lead in the concentrate should there be no conditioning step.

Further work would be required to see the effect of a greatly reduced conditioning time and oxygenation.

5.3 COMPARISON WITH PREVIOUS SAMPLES

Normet does not know how similar the set of samples supplied for this testwork program were to the sample for the previous work. However, the work conducted to date indicates that results similar to the previous work are achievable, and are yet to be optimised in terms of grade/recovery and reagents.

Based on the reagent additions for Test 8, reagent costs would be approximately $1.70/t (reagent cost estimates are presented in Table 13). Lime consumption of 4 kg/t is some 20% less than the Faro Test 6 consumption. These reagents costs are significantly lower than that of the Faro 6 work where $3.00/t was estimated.

5.4 FURTHER TESTWORK

From the results presented it is clear that it is possible to achieve the desired grade and recovery for this material. It is recommended that further testwork be conducted to improve on the foundations laid down.

It is recommended that further testing be carried out to optimise the technologies and reagents for the conditioning stage.

Detailed flotation results are tabulated in Section 6.

6 DETAILED TEST DATA

Table 1	**Faro 6**
Tables 2 and 3	**Tests 1 and 2**
Table 4	**Tests 3 to 6**
Tables 5 to 11	**Tests 7 to 12**
Table 12	**Flotation Conditions**
Table 13	**Reagent Costs**

Table 1

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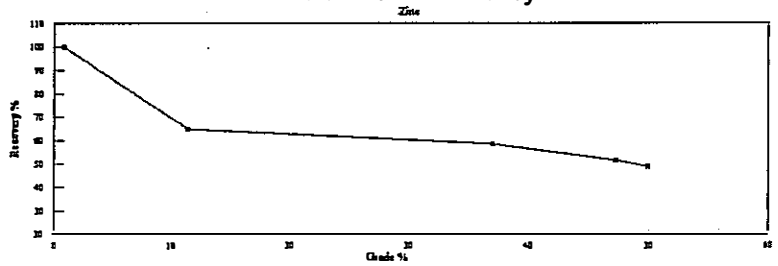
FLOTATION TEST

Client Name	Curragh Resources
Sample Reference	Test 0
Sample Description	FARO 6
Job Number	23/583
Date	1992

PRODUCT	Weight		Copper		Zinc		Lead		Iron	
	g	%	%	Distribution	%	Distribution	%	Distribution	%	Distribution
3rd Cleaner Conc	10.7	0.79	1.0	7.17	49.9	48.71	0.9	1.25	11.7	0.35
3rd Cleaner Tail	1.3	0.10	3.0	2.61	24.9	2.95	3.1	0.52	18.6	0.07
2rd Cleaner Conc	12.0	0.89	1.2	9.78	47.2	51.66	1.1	1.78	12.4	0.41
2rd Cleaner Tail	5.4	0.40	2.6	9.40	14.3	7.04	2.4	1.69	27.1	0.41
1rd Cleaner Conc	17.4	1.29	1.6	19.18	37.0	58.71	1.5	3.46	17.0	0.82
1rd C eaner Tail	44.9	3.33	0.4	12.03	1.5	6.14	0.8	4.67	36.0	4.48
Rougher Conc	62.3	4.63	0.7	31.20	11.4	64.85	1.0	8.13	30.7	5.30
Rougher Tail	1284.2	95.37	0.08	68.80	0.30	35.15	0.6	91.87	26.6	94.70
Calculated Head	1346.5	100.00	0.1	100.00	0.81	100.00	0.57	100.00	26.8	100.0

Grade Vs Recovery



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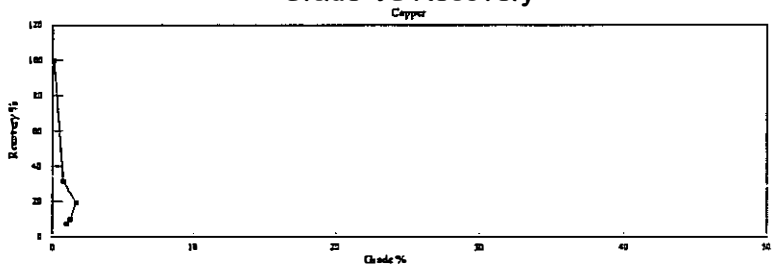

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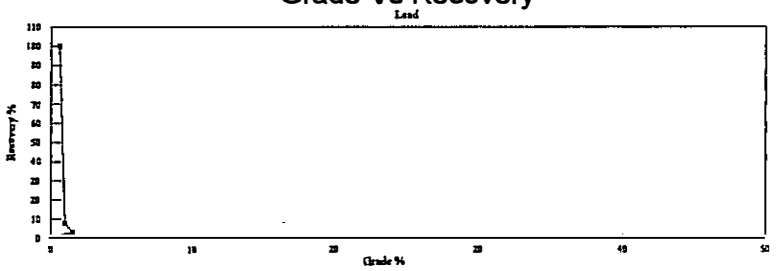

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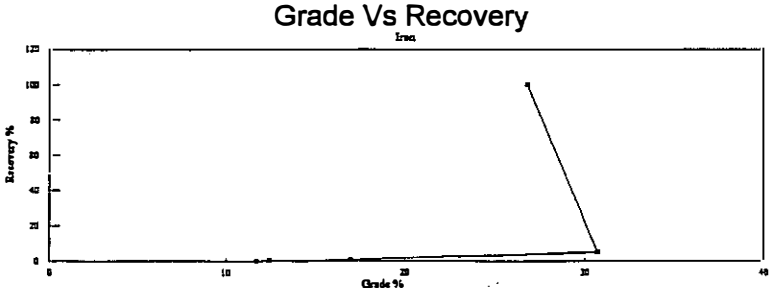


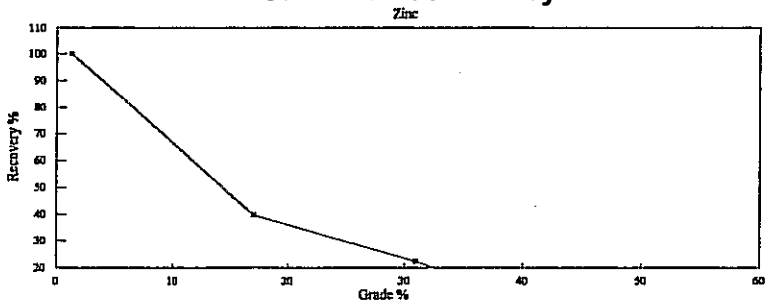
Table 2

FLOTATION TEST

Client	Curragh Resourses
Test Number	Test 1
Sample Description	Curragh Flot 1
Job Number	23/583
Date	25/3/93

PRODUCT	Weight		Copper		Zinc		Iron	
	g	%	%	Distribution	%	Distribution	%	Distribution
3rd Cleaner Conc	4.4	0.31	1.8	4.53	39.7	9.81	14.2	0.2
3rd Cleaner Tail	2.5	0.18	2.9	4.19	30.5	4.34	17.4	0.1
2rd Cleaner Conc	6.9	0.48	2.2	8.72	36.3	14.16	15.4	0.3
2rd Cleaner Tail	6.0	0.42	2.5	8.56	24.7	8.33	18.1	0.3
1rd Cleaner Conc	12.9	0.90	2.3	17.28	30.9	22.48	16.6	0.5
1rd Cleaner Tail	28.7	2.00	1.2	19.25	10.7	17.22	25.0	1.8
Rougher Conc	41.6	2.91	1.5	36.53	16.9	39.71	22.4	2.3
Rougher Tail	1390.8	97.09	0.1	63.47	0.77	60.29	28.1	97.7
Calculated Head	1432.4	100.00	0.1	100.00	1.24	100.00	27.9	100.0

Grade Vs Recovery



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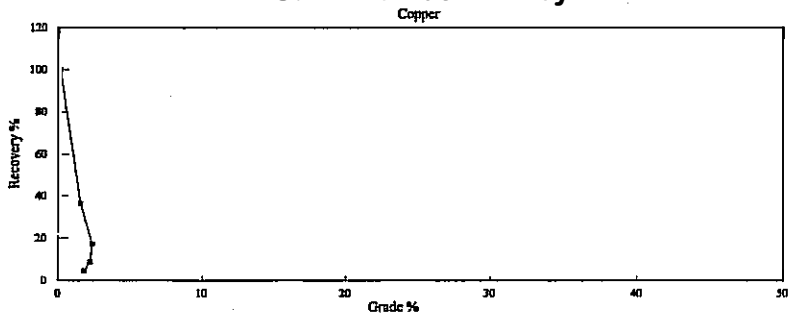

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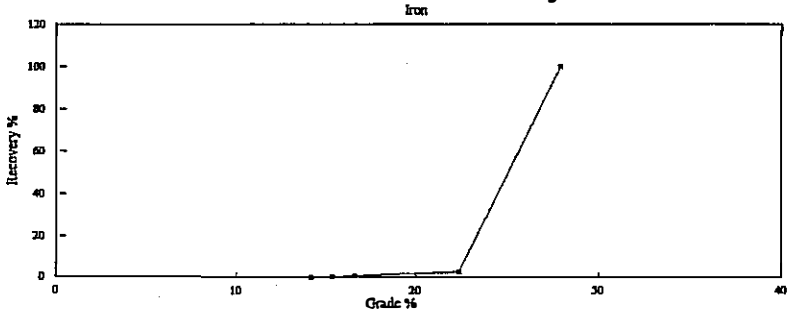

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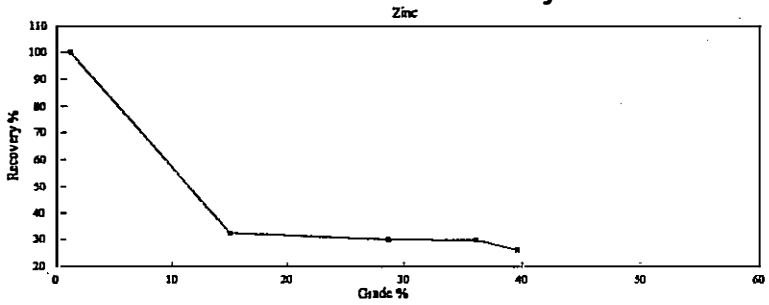
Table 3

FLOTATION TEST

Client	Curragh Resourses
Test Number	Test 2
Sample Description	Curragh Flot 2
Job Number	23/583
Date	26/3/93

PRODUCT	Weight		Copper		Zinc		Iron	
	g	%	%	Distribution	%	Distribution	%	Distribution
3rd Cleaner Conc	10.7	0.74	2.3	11.35	39.5	26.27	14.9	0.4
3rd Cleaner Tail	2.6	0.18	2.0	2.40	21.9	3.61	17.7	0.1
2rd Cleaner Conc	13.3	0.93	2.3	13.75	36.0	29.88	15.4	0.5
2rd Cleaner Tail	3.5	0.25	10.6	17.05	0.9	0.20	21.2	0.2
1rd Cleaner Conc	16.8	1.17	4.0	30.80	28.7	30.08	16.6	0.7
1rd Cleaner Tail	17.9	1.24	0.2	2.00	2.0	2.27	24.9	1.2
Rougher Conc	34.7	2.42	2.1	32.80	15.0	32.35	20.9	1.9
Rougher Tail	1400.1	97.58	0.1	67.20	0.78	67.65	26.6	98.1
Calculated Head	1434.8	100.00	0.2	100.00	1.12	100.00	26.5	100.0

Grade Vs Recovery



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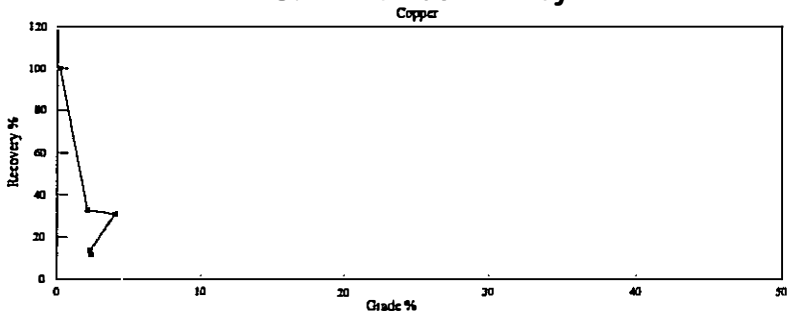

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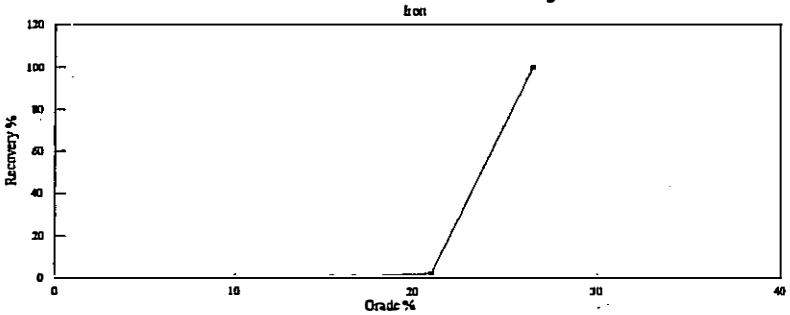


Table 4

Flotation Test Results Tests CTF3 to CTF5

Date	31/3/93
Sample	Curragh Comp 5/2/93
Test Number	Test 3
Objective	Single Rougher (NaAF 3418A)

Stage	Wt	Wt %	Assay % Copper	Dist'n % Copper	Cum % Copper	Assay % Zinc	Dist'n % Zinc	Cum % Zinc	Assay % Iron	Dist'n % Iron	Cum % Iron
Zinc Rougher 1	1430	96.17	0.10	64.11	64.11	0.64	54.04	54.04	28.68	95.77	95.77
Zinc Con	57	3.83	1.40	35.89	100.00	13.55	45.96	100.00	31.81	4.23	100.00
Total	1487	100.00	0.15	100.00		1.13	100.00		28.80	100.00	

Date	31/3/93
Sample	Curragh Comp 5/2/93
Test Number	Test 4
Objective	Single Rougher (NaAF 3418A) Additional NaAF

Stage	Wt	Wt %	Assay % Copper	Dist'n % Copper	Cum % Copper	Assay % Zinc	Dist'n % Zinc	Cum % Zinc	Assay % Iron	Dist'n % Iron	Cum % Iron
Zinc Rougher 1	1374	95.95	0.08	51.17	51.17	0.63	53.49	53.49	28.43	92.38	92.38
Zinc Con	58	4.05	1.81	48.83	100.00	12.97	46.51	100.00	55.59	7.62	100.00
Total	1432	100.00	0.15	100.00		1.13	100.00		29.53	100.00	

Date	1/4/93
Sample	Curragh Comp 5/2/93
Test Number	Test 5
Objective	Two Stage Rougher (SIPX 3418A)

Stage	Wt	Wt %	Assay % Copper	Dist'n % Copper	Cum % Copper	Assay % Zinc	Dist'n % Zinc	Cum % Zinc	Assay % Iron	Dist'n % Iron	Cum % Iron
Zinc Rougher 1	1355.93	90.40	0.06	36.16	36.16	0.54	42.80	42.80	27.71	92.09	92.09
Zinc Con	144.07	9.60	0.10	63.84	100.00	6.73	57.20	100.00	22.40	7.91	100.00
Total	1500	100.00	0.15	100.00		1.13	100.00		27.20	100.00	

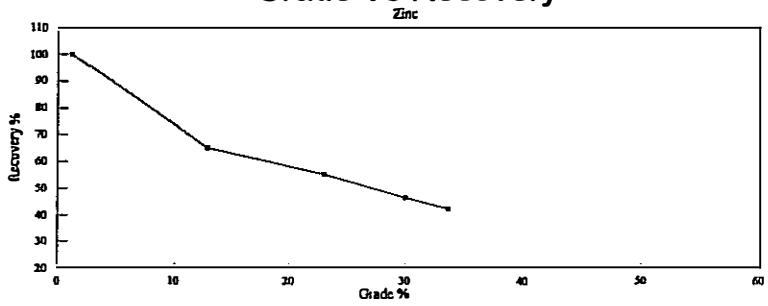
Table 5

FLOTATION TEST

Client	Curragh Resourses
Test Number	Test 6
Sample Description	Curragh Flot 3
Job Number	23/583
Date	1/4/93

PRODUCT	Weight g	Weight %	Copper %	Copper Distribution	Zinc %	Zinc Distribution	Iron %	Iron Distribution
3rd Cleaner Conc	20.9	1.43	1.5	19.52	33.6	42.19	15.8	0.8
3rd Cleaner Tail	4.9	0.34	1.5	4.58	14.3	4.20	23.4	0.3
2rd Cleaner Conc	25.8	1.77	1.5	24.10	30.0	46.39	17.2	1.1
2rd Cleaner Tail	14.0	0.96	0.9	8.01	10.1	8.53	25.7	0.9
1rd Cleaner Conc	39.7	2.73	1.3	32.11	23.0	54.92	20.2	2.1
1rd Cleaner Tail	44.5	3.06	0.4	9.71	3.7	10.01	28.2	3.2
Rougher Conc	84.3	5.79	0.8	41.82	12.8	64.94	24.4	5.3
Rougher Tail	1372.3	94.21	0.1	58.18	0.43	35.06	27.0	94.7
Calculated Head	1456.6	100.00	0.1	100.00	1.14	100.00	26.9	100.0

Grade Vs Recovery



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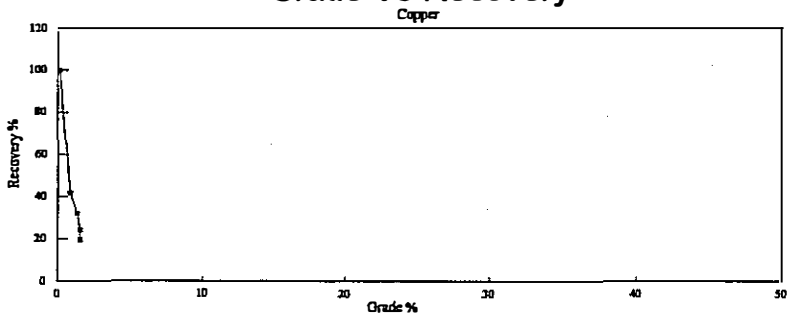

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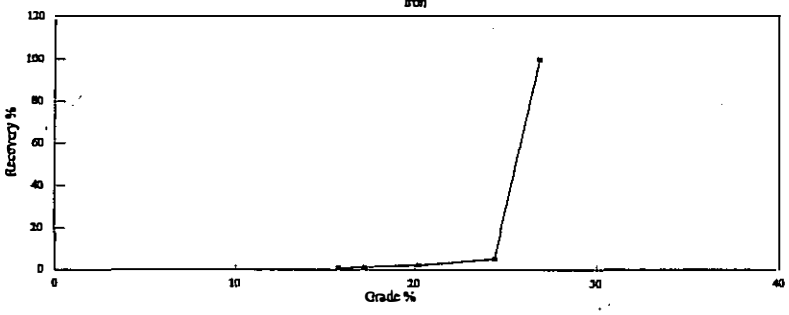

Table 6

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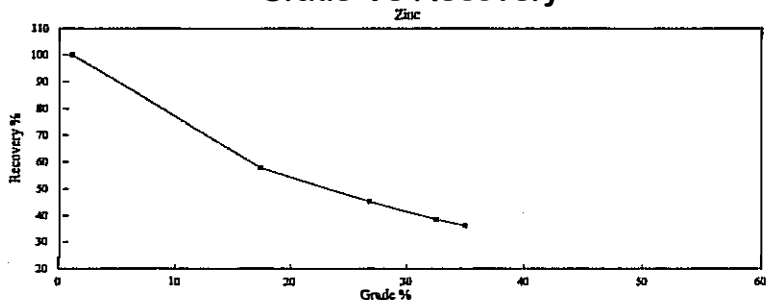
FLOTATION TEST

Client	Curragh Resourses
Test Number	Test 7
Sample Description	Curragh Flot 4
Job Number	23/583
Date	1/4/93

PRODUCT	Weight g	Weight %	Copper %	Copper Distribution	Zinc %	Zinc Distribution	Iron %	Iron Distribution
3rd Cleaner Conc	16.5	1.15	1.9	20.10	34.9	35.95	14.9	0.6
3rd Cleaner Tail	2.5	0.17	1.7	2.64	16.3	2.53	23.9	0.1
2rd Cleaner Conc	19.0	1.32	1.9	22.74	32.5	38.48	16.0	0.7
2rd Cleaner Tail	8.0	0.55	1.3	6.79	13.3	6.59	25.3	0.5
1rd Cleaner Conc	26.9	1.87	1.7	29.53	26.8	45.07	18.8	1.2
1rd Cleaner Tail	26.6	1.85	0.7	11.16	7.7	12.88	27.9	1.8
Rougher Conc	53.6	3.73	1.2	40.69	17.3	57.95	23.3	3.0
Rougher Tail	1383.5	96.27	0.1	59.31	0.49	42.05	28.8	97.0
Calculated Head	1437.1	100.00	0.1	100.00	1.11	100.00	28.6	100.0

Grade Vs Recovery



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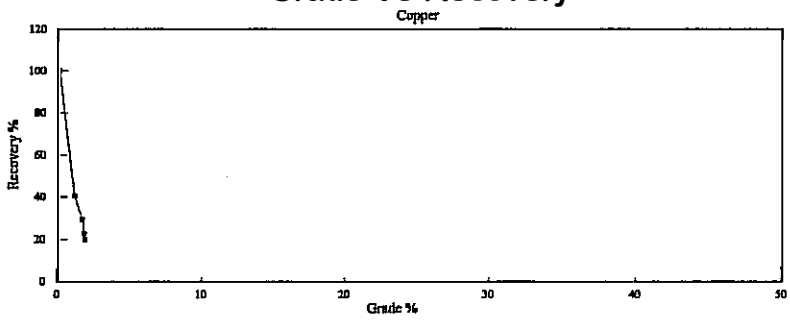


Grade Vs Recovery

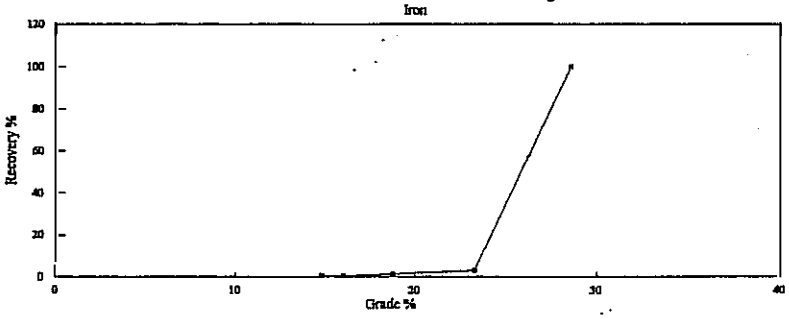


Table 7

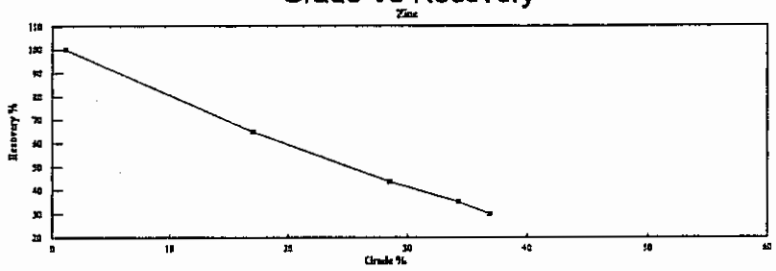
NORMET

FLOTATION TEST

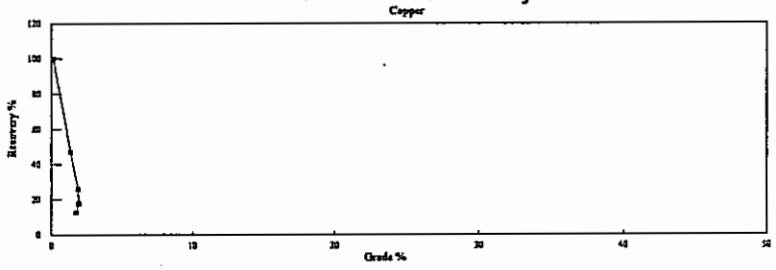
Client Name	Curragh Resources
Sample Reference	Test 8
Sample Description	Curragh Flot 8
Job Number	23/583
Date	5/4/93

PRODUCT	Weight		Copper		Zinc		Lead		Iron	
	g	%	%	Distribution	%	Distribution	%	Distribution	%	Distribution
3rd Cleaner Conc	13.4	0.92	1.7	12.67	36.9	29.98	2.0	2.72	15.8	0.51
3rd Cleaner Tail	3.6	0.25	2.6	5.14	24.6	5.35	3.9	1.42	22.1	0.19
2rd Cleaner Conc	17.0	1.17	1.9	17.81	34.3	35.33	2.4	4.14	17.1	0.71
2rd Cleaner Tail	8.2	0.56	1.8	8.21	16.7	8.30	3.1	2.62	23.8	0.48
1rd Cleaner Conc	25.2	1.73	1.9	26.02	28.6	43.62	2.6	6.76	19.3	1.18
1rd Cleaner Tail	37.7	2.59	1.0	20.85	9.3	21.33	2.1	8.14	28.5	2.61
Rougher Conc	62.9	4.32	1.4	46.87	17.0	64.96	2.3	14.89	24.8	3.79
Rougher Tail	1392.6	95.68	0.07	53.13	0.42	35.04	0.6	85.11	28.4	96.21
Calculated Head	1455.5	100.00	0.1	100.00	1.13	100.00	0.67	100.00	28.3	100.0

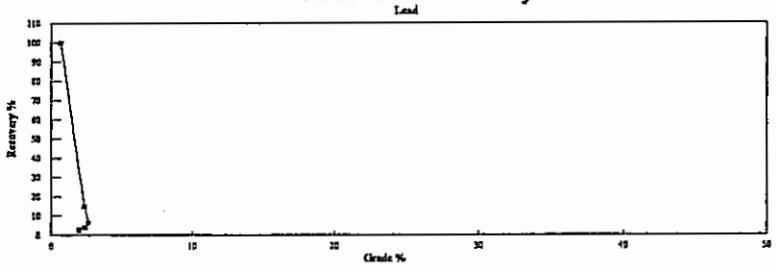
Grade Vs Recovery



Grade Vs Recovery



Grade Vs Recovery



Grade Vs Recovery

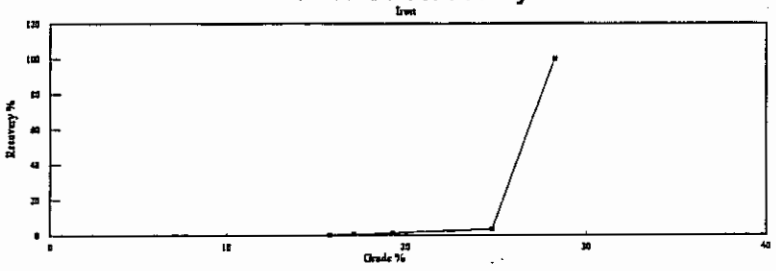


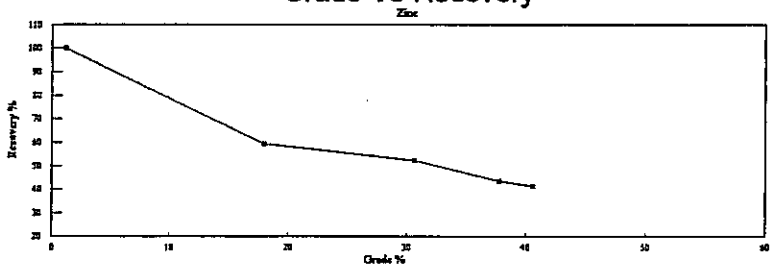
Table 8

FLOTATION TEST

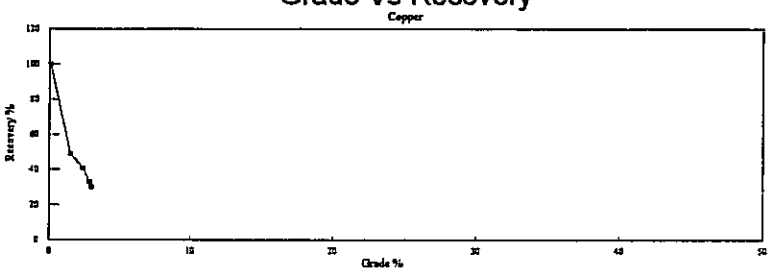
Client Name	Curragh Resources
Sample Reference	Test 9
Sample Description	Curragh Flot 9
Job Number	23/583
Date	6/4/93

PRODUCT	Weight		Copper		Zinc		Lead		Iron	
	g	%	%	Distribution	%	Distribution	%	Distribution	%	Distribution
3rd Cleaner Conc	16.9	1.16	3.0	30.28	40.6	41.33	4.4	7.47	10.6	0.53
3rd Cleaner Tail	2.3	0.16	1.9	2.65	17.3	2.40	7.8	1.79	20.3	0.14
2rd Cleaner Conc	19.2	1.32	2.8	32.94	37.8	43.72	4.8	9.27	11.7	0.67
2rd Cleaner Tail	9.1	0.63	1.4	7.92	15.7	8.65	5.6	5.07	22.2	0.60
1rd Cleaner Conc	28.3	1.95	2.4	40.85	30.7	52.37	5.1	14.33	15.1	1.28
1rd Cleaner Tail	26.5	1.83	0.5	8.30	4.5	7.20	2.9	7.70	28.5	2.25
Rougher Conc	54.8	3.78	1.5	49.15	18.0	59.58	4.0	22.03	21.6	3.53
Rougher Tail	1394.3	96.22	0.06	50.85	0.48	40.42	0.6	77.97	23.2	96.47
Calculated Head	1449.0	100.00	0.1	100.00	1.14	100.00	0.69	100.00	23.1	100.0

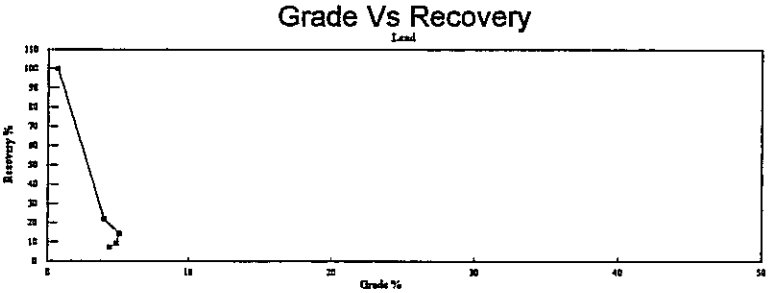
Grade Vs Recovery



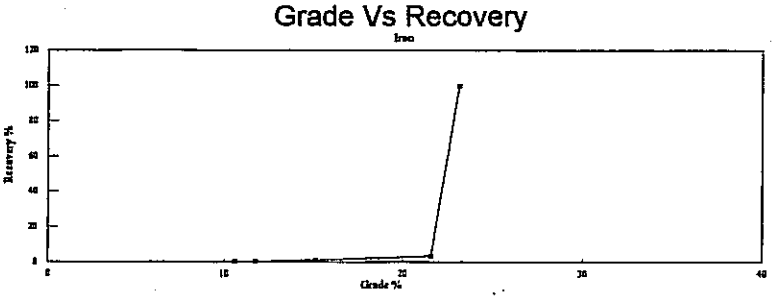
Grade Vs Recovery



Grade Vs Recovery



Grade Vs Recovery

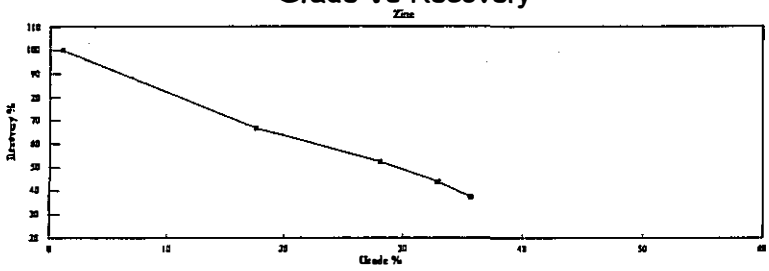


FLOTATION TEST

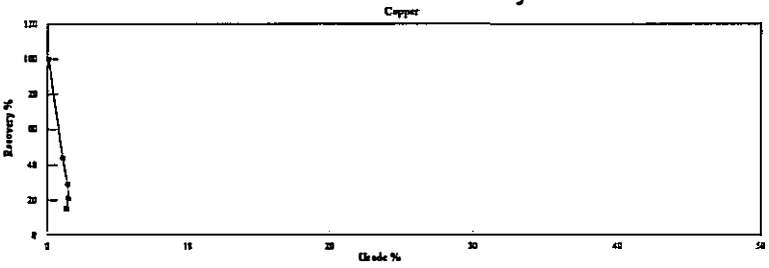
Client Name	Curragh Resources
Sample Reference	Test 10
Sample Description	Curragh Flot 10
Job Number	23/583
Date	7/4/93

PRODUCT	Weight		Copper		Zinc		Lead		Iron	
	g	%	%	Distribution	%	Distribution	%	Distribution	%	Distribution
3rd Cleaner Conc	16.6	1.15	1.4	15.19	35.7	37.46	2.5	4.55	12.2	0.60
3rd Cleaner Tail	4.6	0.32	1.9	5.84	22.8	6.59	4.7	2.37	16.4	0.22
2rd Cleaner Conc	21.2	1.46	1.5	21.03	32.9	44.04	3.0	6.92	13.1	0.82
2rd Cleaner Tail	8.3	0.58	1.4	7.90	15.7	8.25	4.6	4.25	19.7	0.48
1rd Cleaner Conc	29.5	2.04	1.5	28.93	28.1	52.30	3.4	11.17	14.9	1.30
1rd Cleaner Tail	30.8	2.13	0.7	15.10	7.4	14.44	3.2	10.79	23.7	2.15
Rougher Conc	60.3	4.16	1.1	44.03	17.5	66.74	3.3	21.96	19.4	3.45
Rougher Tail	1386.9	95.84	0.06	55.97	0.38	33.26	0.5	78.04	23.6	96.55
Calculated Head	1447.1	100.00	0.1	100.00	1.09	100.00	0.63	100.00	23.4	100.0

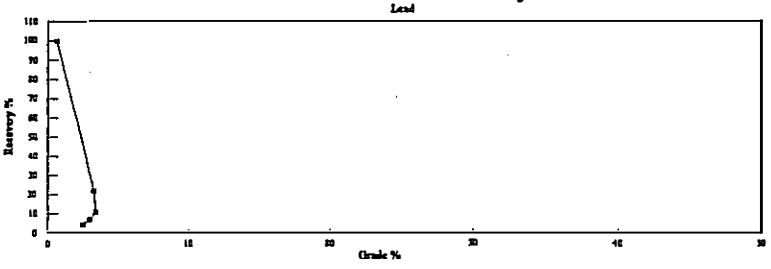
Grade Vs Recovery



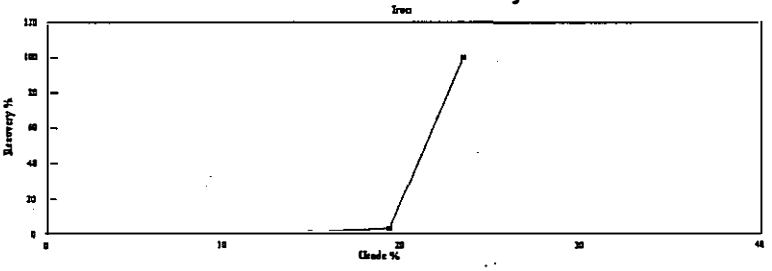
Grade Vs Recovery



Grade Vs Recovery



Grade Vs Recovery

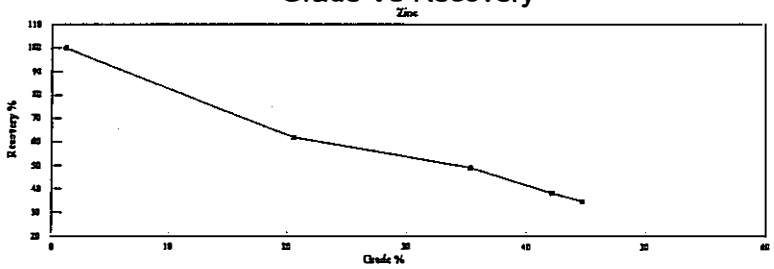


FLOTATION TEST

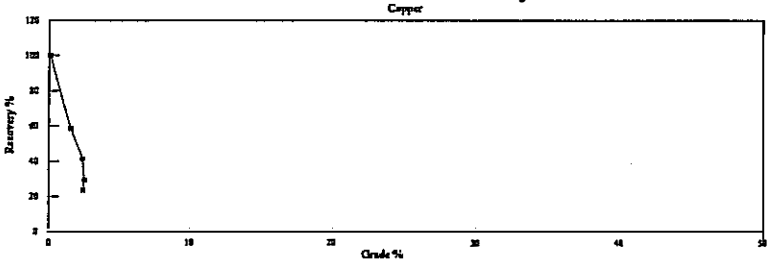
Client Name	Curragh Resources
Sample Reference	Test 11
Sample Description	Curragh Flot 11
Job Number	23/583
Date	8/4/93

PRODUCT	Weight		Copper		Zinc		Lead		Iron	
	g	%	%	Distribution	%	Distribution	%	Distribution	%	Distribution
3rd Cleaner Conc	13.1	0.90	2.5	23.80	44.8	34.52	3.5	4.62	10.5	0.34
3rd Cleaner Tail	2.3	0.16	3.0	5.17	27.8	3.80	7.8	1.84	17.2	0.10
2rd Cleaner Conc	15.4	1.06	2.5	28.97	42.2	38.32	4.1	6.46	11.5	0.44
2rd Cleaner Tail	8.2	0.56	2.1	12.56	22.5	10.85	6.2	5.14	21.4	0.44
1rd Cleaner Conc	23.5	1.62	2.4	41.53	35.4	49.16	4.8	11.60	15.0	0.88
1rd Cleaner Tail	27.6	1.90	0.8	16.84	7.9	12.83	3.5	9.91	29.6	2.05
Rougher Conc	51.2	3.53	1.5	58.37	20.5	61.99	4.1	21.52	22.9	2.93
Rougher Tail	1399.9	96.47	0.04	41.63	0.46	38.01	0.6	78.48	27.7	97.07
Calculated Head	1451.1	100.00	0.1	100.00	1.17	100.00	0.68	100.00	27.6	100.0

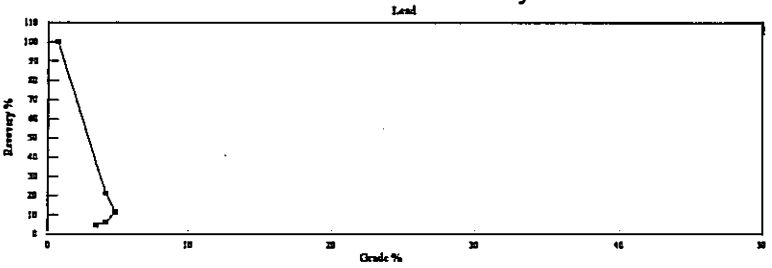
Grade Vs Recovery



Grade Vs Recovery



Grade Vs Recovery



Grade Vs Recovery

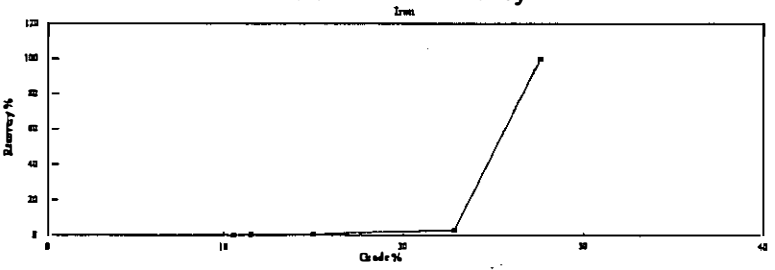


Table 11

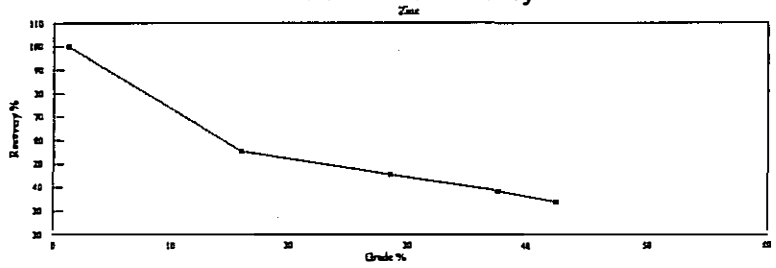
NORMET

FLOTATION TEST

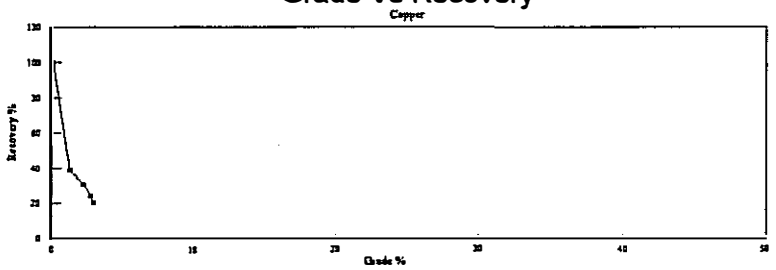
Client Name	Curragh Resources
Sample Reference	Test 12
Sample Description	Curragh Flot 12
Job Number	23/583
Date	19/4/93

PRODUCT	Weight		Copper		Zinc		Lead		Iron	
	g	%	%	Distribution	%	Distribution	%	Distribution	%	Distribution
3rd Cleaner Conc	14.2	0.98	3.0	20.46	42.5	33.93	5.0	6.49	13.4	0.48
3rd Cleaner Tail	4.0	0.27	2.1	4.02	20.0	4.45	4.8	1.72	23.9	0.24
2rd Cleaner Conc	18.2	1.25	2.8	24.48	37.6	38.38	4.9	8.20	15.7	0.71
2rd Cleaner Tail	10.1	0.69	1.3	6.57	12.4	7.01	3.6	3.30	28.2	0.71
1rd Cleaner Conc	28.2	1.94	2.3	31.05	28.6	45.39	4.5	11.51	20.1	1.42
1rd Cleaner Tail	33.7	2.32	0.5	7.88	5.3	9.95	2.1	6.49	32.7	2.75
Rougher Conc	61.9	4.26	1.3	38.93	15.9	55.34	3.2	18.00	26.9	4.17
Rougher Tail	1391.9	95.74	0.09	61.07	0.57	44.66	0.6	82.00	27.6	95.83
Calculated Head	1453.8	100.00	0.1	100.00	1.22	100.00	0.75	100.00	27.5	100.0

Grade Vs Recovery



Grade Vs Recovery



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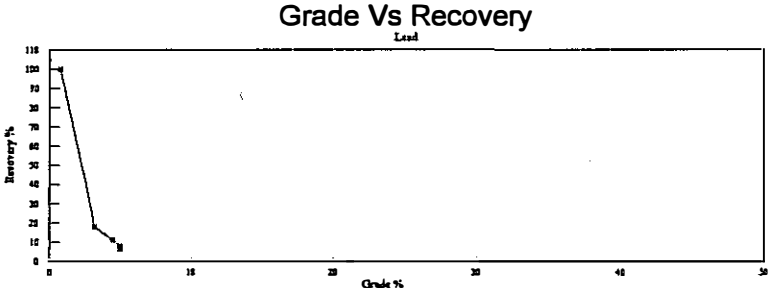

Grade Vs Recovery

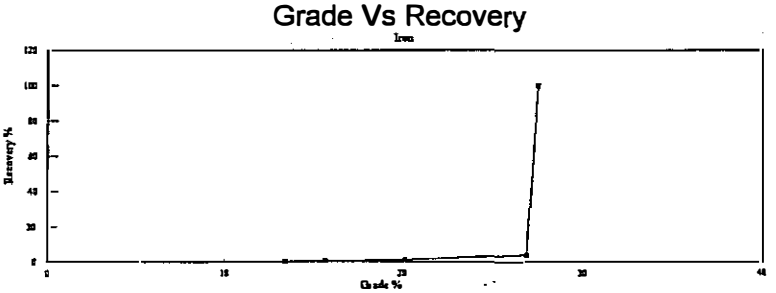

TABLE 12

	TEST NUMBER											
	1	2	3	4	5	6	7	8	9	10	11	12
CONDITIONING												
Washed	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	No
+500 Material (g)	18.35	16.26	15.06	14.76	14.26	13.21	13.65	12.76	12.85	N/A	N/A	12.6
Initial pH	6.23	6.4	6.14	N/A	N/A	5.92	5.09	5.8	6.1	5.97	5.59	5.51
Conditioning time (Denelle	4	4	4	4	4	4	4	4	0	4	0	0
Starting Temp (C)	25	26	26	26		26	31	26		24		28
Finishing Temp (C)	37	35	38			35	36	38		37		27
D.O Initial (ppm)	N/A	N/A	N/A	N/A	N/A	1.3	2	N/A	N/A	6.5	6.5	N/A
D.O final (ppm)	N/A	N/A	N/A	N/A	N/A	29.8	30.5	4.6	N/A	26.1	N/A	N/A
FLOTATION												
Rougher												
Cell volume (ml)	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000
Conditioning time	13	13	13	13	13	13	10	10+5	10+5	10+5	10+5	13
pH initial	6.23	6.18	6.03	5.67	5.13	4.54	4.19	5	4.56	4.56	5.59	5.51
pH final	11	10.73	11.03	11.1	11.02	10.87	11.06	10.96	11	10.98	11.03	10.98
Flot time	6	6	20	10	10	11	15	10+5	10+5	10+5	10+5	6
MIBC g/t	0	0	13	13	13	13	13	13	26	26	26	26
CuSO4 g/t	375	375	375	375	375	375	440	440	440	440	440	440
SMBS g/t	60	60	60	60	80	80	80	80	80	100	100	100
3418A g/t	7.5	7.5	7.5	7.5	20	30	30	30	30	30	30	30
SIPX g/t	20	20	0	0	40	60	60	60	60	60	60	60
NaAF g/t	0	0	40	100	0	0	0	0	0	0	0	0
Unimax g/t	0	0	0	0	0	0	0	0	0	0	0	0
Lime g/t	2000	2400	4130	4330	4330	4500	4000	4500+325	3200+550	5000+700	2800+200	5000
Cleaner 1												
Cell Volume (ml)	500	500	500	500	500	500	500	500	500	500	500	500
Conditioning time	2	2	2	2	2	2	2	2	2	2	2	2
pH initial	11.3	11.77	11.52	11.57	11.3	11.54	11.4	11.5	11.32	11.3	10.66	10.27
pH final	11.06	11.3	11.41	11.72	11.87	11.32	11.2	11.09	10.92	11.23	11.32	11.0
Flot time	6	13	8	8	8	8	8	8	8	8	8	8
MIBC g/t	0	6.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.85	0.7	8
CuSO4 g/t	0	0	0	0	0	0	0	0	0	0	0	0.85
SMBS g/t	0	0	0	0	0	0	0	0	0	0	0	0
3418A g/t	0	0	0	0	0	0	0	0	0	0	0	0
SIPX g/t	0	0	0	0	0	0	0	0	0	0	0	0
NaAF g/t	0	0	0	0	0	0	0	0	0	0	5	0
Unimax g/t	0	0	0	0	0	0	0	0	0	0	10	0
Lime g/t	50	68	200	200	66	133	66	66	66	66	66	66
Cleaner 2												
Conditioning time	2	2	2	2	2	2	2	2	2	2	2	2
pH initial	11.7	11.73	11.63	11.85	11.69	11.6	11.45	11.47	11.5	11.44	11.57	11.6
pH final		11.54	11.43	11.74	11.6	11.34	11.21	11.26	11.32	11.31	11.21	11.49
Flot time	4	7	8	8	8	8	8	8	8	8	8	8
MIBC g/t	0	6.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.85	0.7	0.7
CuSO4 g/t	0	0	0	0	0	0	0	0	0	0	0	0
SMBS g/t	0	0	0	0	0	0	0	0	0	0	0	0
3418A g/t	0	0	0	0	0	0	0	0	0	0	0	0
SIPX g/t	0	0	0	0	0	0	0	0	0	0	0	0
NaAF g/t	0	0	0	0	0	0	0	0	0	0	5	0
Unimax g/t	0	0	0	0	0	0	0	0	0	0	10	0
Lime g/t	60	68	130	130	68	120	68	68	68	68	68	100
Cleaner 3												
Conditioning time	2	2	2	2	2	2	2	2	2	2	2	2
pH initial	11.56	11.74	11.73	11.85	11.43	11.54	11.41	11.52	11.3	11.34	11.53	11.55
pH final	11.56	11.43	11.61	11.74	11.3	11.48	11.39	11.14	11.13	11.01	11.5	11.44
Flot time	3	5	8	8	8	8	8	8	8	8	8	8
MIBC g/t	0	0	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.86	0.7	0.7
CuSO4 g/t	0	0	0	0	0	0	0	0	0	0	0	0
SMBS g/t	0	0	0	0	0	0	0	0	0	0	0	0
3418A g/t	0	0	0	0	0	0	0	0	0	0	0	0
SIPX g/t	0	0	0	0	0	0	0	0	0	0	0	0
NaAF g/t	0	0	0	0	0	0	0	0	0	0	5	0
Unimax g/t	0	0	0	0	0	0	0	0	0	0	10	0
Lime g/t	0	68	130	130	68	120	82	68	68	68	68	66

TABLE 13

REAGENT COSTS

Prices based on estimates from operating mines in Australia:

Reagent	$/t
Lime	150
Frother	2840
Copper Sulphate	1200
SMBS	630
3418A	9200
SIPX	1526