PRELIMINARY MINERAL PROCESSING TESTWORK ON THE BENTINCK GRAPHITE PROPERTY

prepared for:

RESOLUTE RESOURCES LTD.

attention:

Dr. M.J.V. Beattie, P.Eng.

prepared by:

PROCESS RESEARCH ASSOCIATES LTD.
9145 Shaughnessy Street
Vancouver, B.C. V6P 6R9

Bernhard Klein

BERNHARD KLEIN, Ph.D.
Senior Metallurgist

December 9, 1992

1 SUMMARY AND RECOMMENDATIONS

Grab samples of graphite ore from the Bentinck property were subjected to preliminary flotation and gravity concentration testwork. The main objective of the testwork was to produce high grade saleable graphite products. Specifically, tests were performed to produce high grade +48 mesh, -48 mesh +100 mesh, and -100 mesh products. The tests involved processing the ore using various stages of grinding, flotation and gravity concentration. From the preliminary tests the following results were achieved.

Table 1. Summary of results from processing testwork on graphite ore.

Product	Grade (% C)	Yield (Wt. %)	Carbon Recovery (%)
+48 mesh	92.5	2.08	10.5
-48 +100 mesh	78.3	8.18	35.0
-100 mesh	64.9	11.3	40.0
Total		21.6	85.6

Although the combined recovery of graphitic carbon was only 85.6%, at the rougher flotation stage of the test the recovery was 99.8%. Since the graphitic carbon was recoverable at this stage, there is a real possibility of increasing the final recovery.

The results from the third test were significantly better than those from the first two tests. This improvement is attributed to the increased grind used for the third test. It was found that the particles were more resistant to breakdown from grinding than was expected and therefore grinding times had to be increased substantially to significantly improve particle liberation. It is expected that further improvements will be made by optimizing the grinding conditions. Specifically, tests to evaluate the effects of different grinds at various stages of the process should be investigated. In addition, changes in the flotation procedures and reagent dosages and gravity concentration procedures could also lead to improved results.

The conclusions and recommendations presented in this report are based on results produced using grab ore samples. Further development work should be conducted on a proper bulk sample obtained by trenching and drilling.

2 INTRODUCTION

Grab samples from the Bentinck graphite property near Bella Coola, British Columbia were subjected to preliminary processing tests. The objectives of the tests were:

a. To produce high grade graphite products, and
b. To maximize the yield of these graphite products.

Various grinding, flotation and gravity concentration procedures were used to produce three products including:

a. +48 mesh concentrate,
b. -48 mesh +100 mesh concentrate, and
c. -100 mesh concentrate.

Of these products, the +48 mesh concentrate is potentially the most valuable and therefore processing was focused on optimizing the production of this product.

3 PROCEDURES & RESULTS

The samples that were received were prepared for head assays and subsequently subjected to processing testwork. The following describes the samples that were received, the processing test procedures and the associated metallurgical results.

3.1 Sample Description

Three samples were received including:

a. a composite sample
b. sample 102010, and
c. sample 102013.

The composite sample consisted of one rock plus several bags of rock chips. Samples 102010 and 102013 consisted of rock chips. All samples had a dark grey colour and contained significant amounts of visual coarse graphite grains. Each sample was jaw and cone crushed to -6 mesh. The composite sample was riffled into eleven 2 kg charges, three of which were used for process testwork. Representative cuts of samples 102010 and 102013 were obtained by riffling and were then analyzed in duplicate for graphitic carbon. Three analytical methods were compared:

a. Leco

b. loss on ignition (L.O.I.)

c. double loss on ignition (D.L.O.I.)

The results of the analyses are as follows.

Table 2. Results of graphitic carbon analyses on Bentinck samples.

Sample	LECO (% C)	L.O.I. (% C)	D.L.O.I. (% C)
#102010	7.23	9.87	8.06
	7.20	9.89	8.09
#102013	15.10	16.8	16.0
	15.20	16.8	16.0

The results presented in the table indicate that each method produces a different result. The D.L.O.I. procedure includes a step to burn off volatiles making it more accurate than the L.O.I. procedure. Since the D.L.O.I. graphitic carbon assay is determined from a weight difference, it is not very accurate for low level determinations. The Leco analysis is performed on a small sample making it less accurate for samples with high graphitic carbon contents. For these reasons, graphite analyses were performed using the Leco procedure for low level determinations and the D.L.O.I. procedure for high level determinations.

Head grades for the composite samples were determined from metallurgical balances. The grades ranged from 17.5% graphitic carbon (test 1) to 18.4% graphitic carbon (test 2).

3.2 Processing of Bentinck Ore

Three different procedures were used to produce the three graphite products. The procedures are shown schematically in Figures 1, 2 and 3 and are described in detail in the Appendix. The procedures involved crushing the ore sample to - 6 mesh and splitting the sample into 2 kg charges for subsequent tests involving grinding, flotation and gravity concentration.

3.2.1 Graphite Float Test 1

The graphite float test 1 procedure is presented in Figure 1 and described in more detail in the Appendix. The process involved grinding the 2 kg sample to approximately 95% -20 mesh and floating the ore to produce a cleaned graphite flotation concentrate. The actual grind was 91.8% -20 mesh and 37.1% -100 mesh. This concentrate was then screened at 48 mesh from which the +48 mesh fraction was upgraded using gravity processes to produce the +48 mesh concentrate. The -48 mesh fraction was reground to improve liberation and then refloated. This flotation concentrate was screened at 100 mesh producing the +100 mesh and -100 mesh concentrates. The balances for the entire procedure are presented in the Appendix. The following table summarizes the main results.

Table 3. Product yields and grades produced from graphite float test 1.

PRODUCT	GRADE (% C)	YIELD (%)	RECOVERY (%)
+48 Mesh Gravity Concentrate 1	83.7	0.60	2.89
+48 Mesh Gravity Concentrate 2	73.0	1.00	4.18
+48 Mesh Gravity Concentrate 3	68.2	1.23	4.78
+48 Mesh Gravity Concentrate 4	58.8	0.89	3.01
+48 Mesh Gravity Concentrate 5	71.6	3.24	13.27
+48 Mesh Gravity Concentrate 6	25.2	1.92	2.76
Total +48 Mesh Gravity Conc.	**60.8**	**8.88**	**30.89**
+100 Mesh Concentrate	**51.7**	**7.79**	**23.01**
-100 Mesh Concentrate	**62.1**	**9.38**	**33.28**

For the purpose of this report, yield refers to the weight percent of the total feed and recovery refers to weight percent total graphitic carbon in the feed.

As is indicated in the table, it was possible to produce a +48 mesh product with a carbon grade as high as 83.7% although the yield was only 0.60%. The yield could be increased at the expense of the grade as is indicated by the total gravity concentrate yield of 8.88% and the corresponding grade of only 60.8%. The yield of the +100 mesh and -100 mesh products were good at 7.79% and 9.38%, respectively. However, the grades for these two products were low at only 51.7% and 62.1%, respectively. These results exemplify the trade off between product yield and grade and the need for greater liberation.

Despite using various stages of cleaning flotation throughout the procedure, the flotation concentrate grades were low. The results reveal that the flotation concentrate grades increased as the product particle size decreased. These results can be explained by the improvement in liberation with decreasing particle size. Microscopic examination of the products revealed that the coarse particles are made up of foliated graphite lamellae with silicate grains trapped between the lamellae. Grinding would break apart these foliated particles to produce separable liberated graphite flakes and silicate particles.

Although the graphitic carbon recovery from rougher flotation was 95.6%, the combined recovery from the three products was only 87.2%. Since a higher rougher flotation recovery was achievable, it is likely that the product recovery can be improved. Specifically, 6.5% of the graphitic carbon was lost to the gravity concentration tailings. By re-grinding and refloating this product, additional graphite could be recovered in the -48 mesh +100 mesh and -100 mesh products.

3.2.2 Graphite Float Test 2

Based on the results of float test 1, a second test was planned and carried out. The objective of test 2 was to increase the graphite concentrate grade by increasing the primary grind to improve particle liberation. The grind time was extended to 3.5 minutes producing a slightly finer feed (93.1% -20 mesh and 46.1% -100 mesh). The procedure for float test 2 is presented in Figure 2 and is described in detail in the Appendix. The balances for float test 2 are also presented in the Appendix. The following table summarizes the main results.

Table 4. Product yields and grades produced from graphite float test 2.

PRODUCT	GRADE (% C)	YIELD (%)	RECOVERY (%)
+48 Mesh Gravity Concentrate 1	77.7	1.37	5.77
+48 Mesh Gravity Concentrate 2	60.8	2.11	6.99
+48 Mesh Gravity Concentrate 3	41.0	3.86	8.60
+48 Mesh Gravity Concentrate 4	33.5	2.44	4.44
Total +48 Mesh Gravity Conc.	**48.6**	**9.77**	**25.8**
+100 Mesh Concentrate	**50.6**	**9.30**	**25.6**
-100 Mesh Concentrate	**57.1**	**7.61**	**23.6**

Comparing these results to those obtained from float test 1 reveals that the total gravity concentrate from test 2 has a very similar grade although it has a higher yield. No improvements were made with respect to the +100 mesh and -100 mesh products.

As in the first test, almost all (98.8%) of the graphitic carbon was recovered during the rougher flotation stage of the test. The combined product graphitic carbon recovery was, however, 75.0% which is worse than the recovery achieved in float test 1. The main graphite losses occurred in the rougher cleaner flotation tailings (9.3%) and in the gravity concentration tailings (14.7%). The higher losses from the rougher cleaner flotation are likely the results of lower dosages of Varsol collector. As stated above, the gravity concentration tails could be reground and refloated to increase the recovery in the -48 mesh +100 mesh and -100 mesh products.

As a result of test 2, it seems that extending the primary grind time by 0.5 minutes did not greatly improve liberation. As stated above, the increased grinding time did not greatly change the size of the feed particles and therefore it is not surprising that the liberation was not improved significantly.

At the end of the test, products were processed further to attempt to improve their grades. This involved regrinding the combined gravity concentration products and panning the +48 mesh fraction. The -48 mesh fraction of the reground material was then combined with the +100 mesh concentrate for further grinding and subsequent flotation. The flotation concentrate produced from this test was then screened at 100 mesh to produce the respective products. As a result of this further upgrading, a +48 mesh pan concentrate with a grade of 82.5% carbon was produced. No significant improvements were made to the grades of other products.

3.2.3 Graphite Float Test 3

A third test was planned incorporating some of the ideas tested at the end of test 2. The resulting process flowsheet is presented in Figure 3 and is described in detail in the Appendix. For this test, the primary grind time was doubled to 7 minutes producing feed that was 47.5% -100 mesh. Despite doubling the grinding time, the particle size was not substantially finer than the feed size for test 2 (46.1% -100 mesh). It is, therefore, apparent that the Bentinck ore particles are more resistant to breakdown by grinding than expected. In test 3, the +48 mesh flotation concentrate was processed through two stages of regrinding and screening prior to gravity concentration. The -48 mesh products were combined, reground and then refloated. Following flotation, the cleaned -48 mesh concentrate was reground one more time and refloated prior to screening to produce the -100 mesh and +100 mesh concentrates. The balances for test 3 are presented in the Appendix. The main results are presented in the following table.

Table 5. Product yields and grades produced from graphite float test 3.

PRODUCT	GRADE (% C)	YIELD (%)	RECOVERY (%)
+48 Mesh Gravity Concentrate 1	93.3	0.40	2.05
+48 Mesh Gravity Concentrate 2	92.8	1.02	5.15
+48 Mesh Gravity Concentrate 3	91.7	0.67	3.34
Total +48 Mesh Gravity Conc.	**92.5**	**2.08**	**10.54**
+100 Mesh Concentrate	**78.3**	**8.18**	**35.02**
-100 Mesh Concentrate	**64.9**	**11.3**	**40.04**

The results show that much higher product grades were achieved using the float test 3 procedure. The combined +48 mesh gravity concentration product grade was greater than 90%. The +100 mesh and -100 mesh concentrates also had significantly higher grades than the respective products from the first two tests. It is therefore evident that product grades can be improved by increasing the grind at various stages of the process.

The combined product graphitic carbon recovery was 85.6% which similar to the recovery from test 1 and is a significantly greater than the recovery from test 2. As with the first two tests, the rougher flotation recovery was very high at 99.8%. The main loss of graphite occurred in the gravity concentration tailings (9.4%). Regrinding and refloating this product would result in improved recoveries to the -48 mesh +100 mesh and -100 mesh products.

Based on the results of test 3, it is evident that grades, yields and recoveries can be improved by changing the processing procedure. The most important process variable seems to be the amount of grinding. For the present set of tests, process variables such as grinding time, were based on experience. It is expected that results could be improved by using what has been learned from these preliminary tests in some additional carefully planned experiments.

BENTINCK PROPERTY -- GRAPHITE FLOAT TEST 1

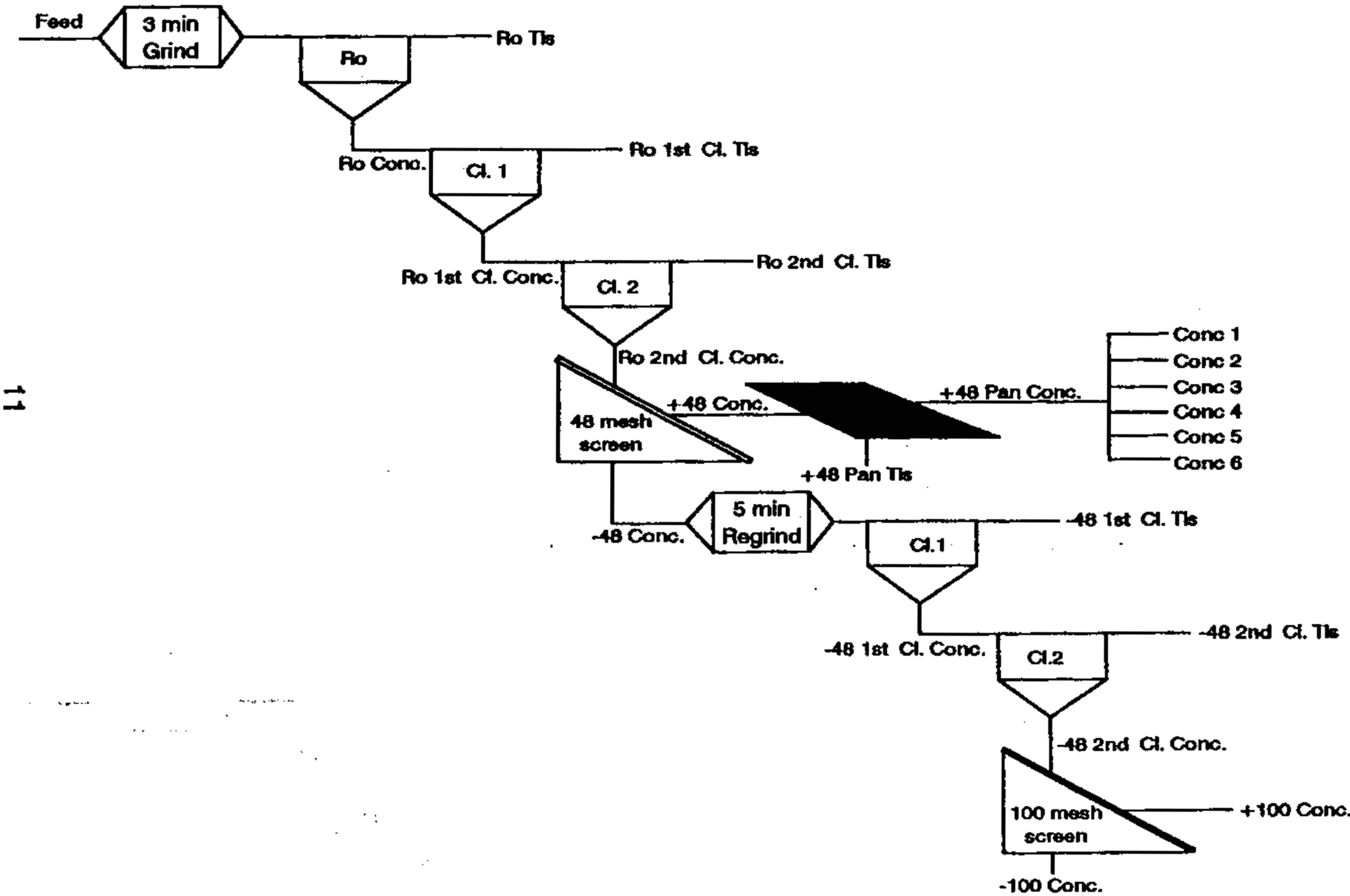

Figure 1. Process flowsheet for float test 1 on Bentinck graphite ore

BENTINCK PROPERTY -- GRAPHITE FLOAT TEST 2

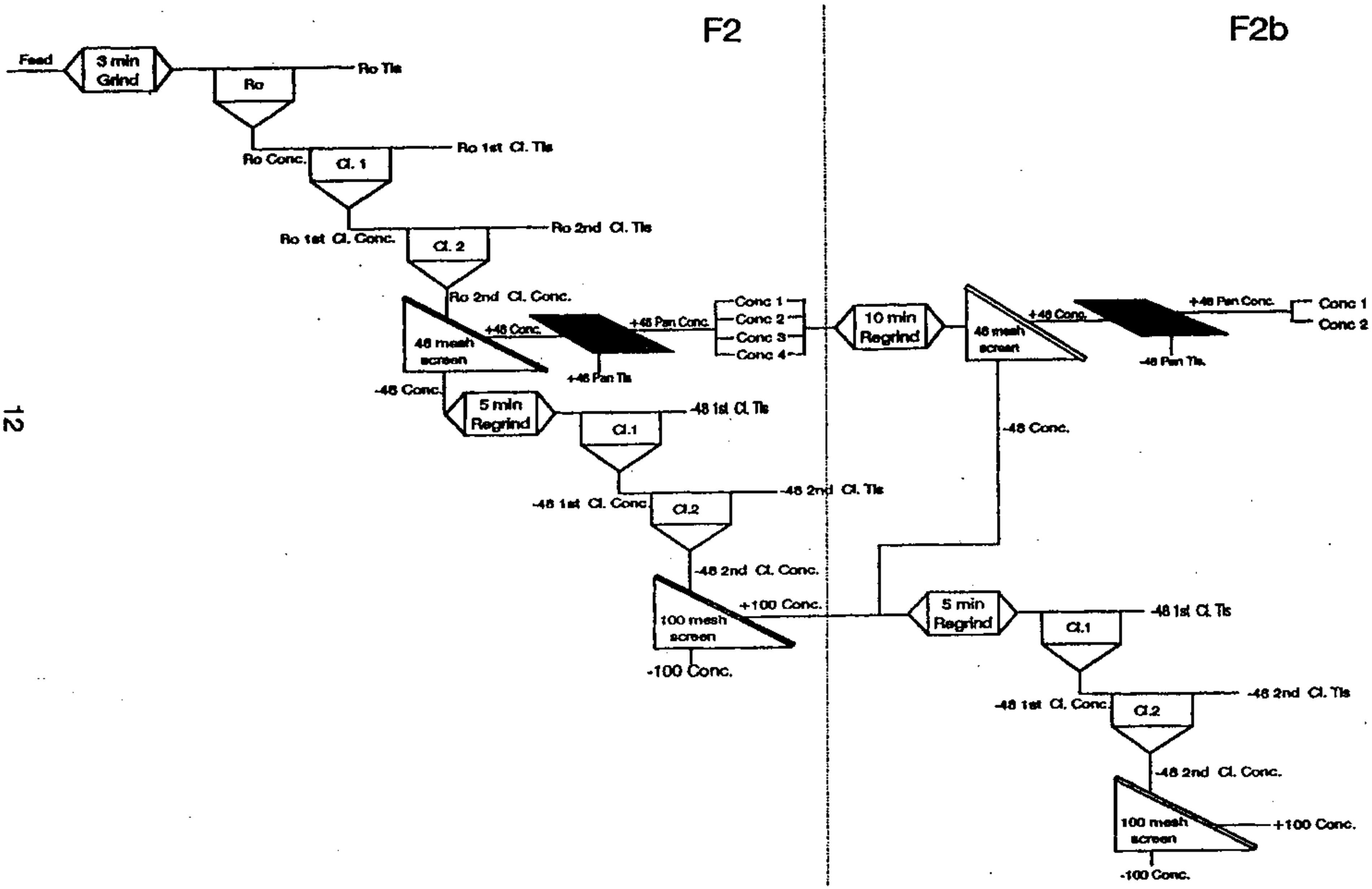

Figure 2 . Process flowsheet for float test 2 on Bentinck graphite ore

BENTINK PROPERTY -- GRAPHITE FLOAT TEST 3

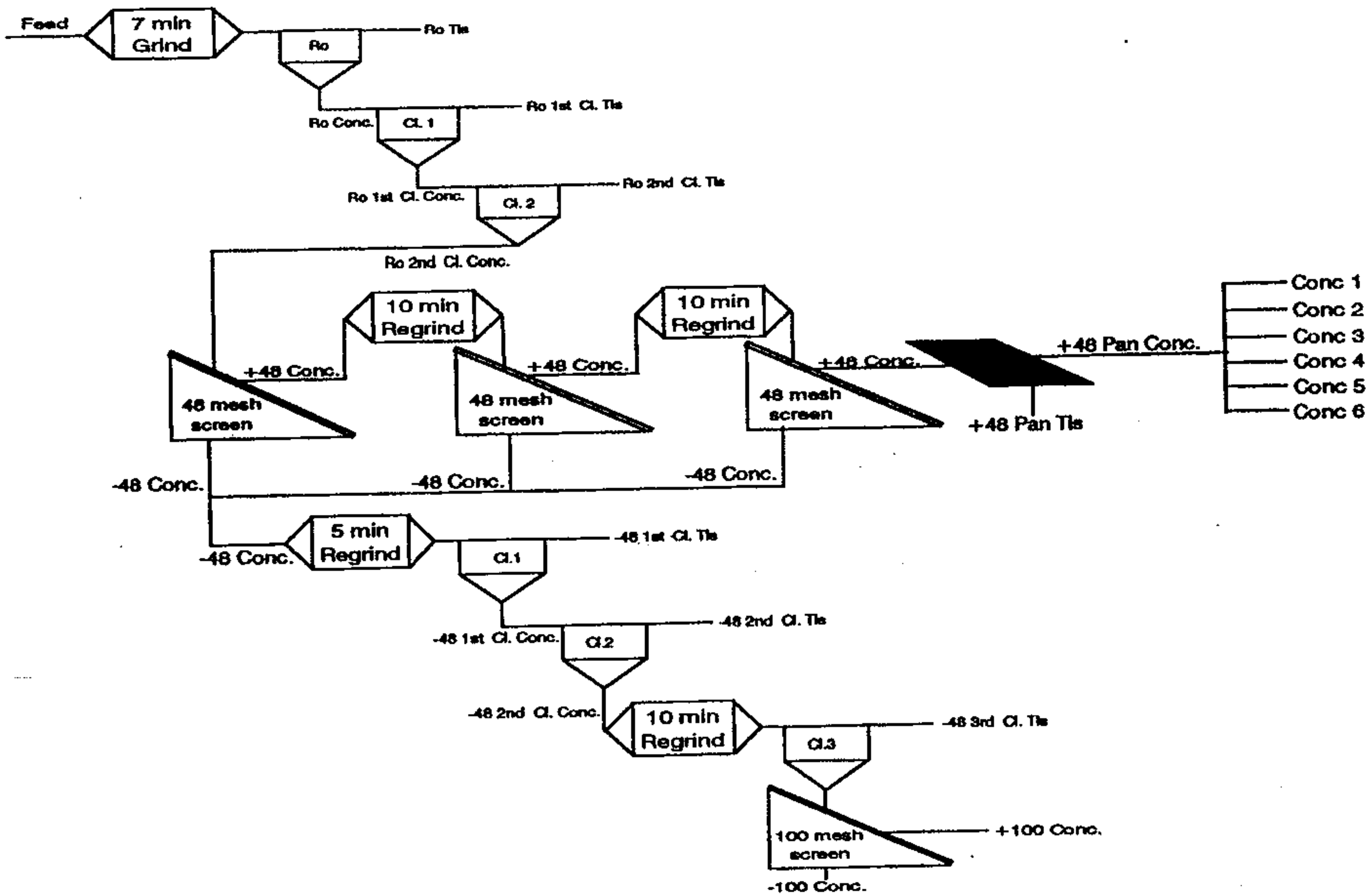

Figure 3. Process flowsheet for float test 3 on Bentinck graphite ore

TESTWORK PROCEDURE

Test No: 92-025 F1 Date: 10-Sep-92

Purpose: Initial bench flotation scoping test

STAGE	TIME (Minutes)	ADDITIONS g/tonne	REAGENT
Grind (55% solids with 1/2 regular rod charge)	3		
Rougher Flotation Rougher float	35	371 67	Varsol MIBC
Cleaner flotation (Rougher concentrates) 1st cleaner float	10	15	Varsol
2nd cleaner float	8	15	Varsol
Screening at 48 mesh (Ro 2nd cleaner conc)			
Gravity separation (panning +48 mesh conc)			
Regrind (-48 mesh conc)	5		
Cleaner flotation (regrind conc)			
1st cleaner float	8	15 13	Varsol MIBC
2nd cleaner float	6	15 13	Varsol MIBC
Screening at 100 mesh (regrind 2nd cleaner concentrates)			

SIZE DISTRIBUTION

SAMPLE NO: 92-025 F1 head

Ground 3 min. at 55% solids

Size Fraction (mesh)		Individual Percentage Retained	Cumulative Percentage Passing
	+20	8.2	91.8
-20	+48	32.1	59.7
-48	+65	11.9	47.8
-65	+100	10.7	37.1
-100	+150	9.2	27.9
-150	+200	7.0	20.9
-200	+325	7.8	13.1
-325	+400	1.8	11.4
-400		11.4	

MATERIAL BALANCE

Project no : 92-025
Test no : F1

Date : 10/27/92

Sample description : Ore (composite 1)

Products	Weight		Assays	% Distribution
	(g)	(%)	Graphite (%)	Graphite
Total +48 conc	342.41	17.81	36,70	37.4
Total -48 conc	383.62	19.95	49.61	56.6
Total Ro 2nd cl conc	726.03	37.76	43.52	94.0
Ro 2nd cl tails	36.90	1.92	8.46	0.9
Total Ro 1st cl conc	762.93	39.68	41.83	94.9
Ro 1st cl tails	66.15	3.44	3.70	0.7
Total Ro conc	829.08	43.12	38.78	95.6
Final Ro tails	1093.60	56.88	1.34	4.4
Calculated head	1922.68	100.00	17.49	100.00
Assay head				

Products	Weight (g)	(%)	Units Graphite
Total +48 conc	342.41	17.81	653.59
Total -48 conc	383.62	19.95	989.84
Total Ro 2nd cl conc	726.03	37.76	1643.43
Ro 2nd cl tails	36.90	1.92	16.24
Total Ro 1st cl conc	762.93	39.68	1659.66
Ro 1st cl tails	66.15	3.44	12.73
Total Ro conc	829.08	43.12	1672.39
Final Ro tails	1093.60	56.88	76.22
	1922.68	100.00	1748.61

MATERIAL BALANCE

Project no : 92-025 Da 10/09/92
Test no : F1

Sample description : Ore (composite 1)

Products	Weight		Assays	% Distribution
			carbon	carbon
	(g)	(%)	(%)	
+48 gravity conc 1	11.60	0.60	83.75	2.9
+48 gravity conc 2	19.23	1.00	73.00	4.2
+48 gravity conc 3	23.60	1.23	68.15	4.8
+48 gravity conc 4	17.20	0.89	58.90	3.0
+48 gravity conc 5	62.30	3.24	71.62	13.3
+48 gravity conc 6	36.90	1.92	25.15	2.8
Total +48 gravity conc	170.83	8.88	60.80	30.9
+48 gravity tails	171.58	8.92	12.70	6.5
Total +48 conc	342.41	17.81	36.70	37.4
Assay head				

Products	Weight (g)	Weight (%)	Units carbon
+48 gravity conc 1	11.60	0.60	50.53
+48 gravity conc 2	19.23	1.00	73.01
+48 gravity conc 3	23.60	1.23	83.65
+48 gravity conc 4	17.20	0.89	52.69
+48 gravity conc 5	62.30	3.24	232.06
+48 gravity conc 6	36.90	1.92	48.27
Total +48 gravity conc	170.83	8.88	540.21
+48 gravity tails	171.58	8.92	113.33
Total +48 conc	342.41	17.81	653.54
	1922.68	100.00	

MATERIAL BALANCE

Project no : 92-025

Test no : F1

Date: 10/09/92

Sample description : Ore (composite 1)

Products	Weight (g)	Weight (%)	Assays carbon (%)	% Distribution carbon
+100 conc	149.8	7.79	51.65	23.0
-100 conc	180.26	9.38	62.05	33.3
-48 2nd cl conc	330.06	17.17	49.33	56.3
-48 2nd cl tails	5.71	0.30	7.40	0.1
-48 1st cl conc	335.77	17.46	49.44	56.4
-48 1st cl tails	47.85	2.49	1.36	0.2
Total -48 conc	383.62	19.95	[illegible]	56.6
Assay head				

Products	Weight (g)	Weight (%)	Units carbon
+100 conc	149.80	7.79	402.42
-100 conc	180.26	9.38	581.75
-48 2nd cl conc	330.06	17.17	984.16
-48 2nd cl tails	5.71	0.30	2.20
-48 1st cl conc	335.77	17.46	986.36
-48 1st cl tails	47.85	2.49	3.38
-48 conc	383.62	19.95	989.75
	1922.68	100.00	

TESTWORK PROCEDURE

Test No: 92-025 F2 **Date:** 29/10/1992

Purpose: To increase graphite concentrate grade by increase primary grinding time

STAGE	TIME (Minutes)	ADDITIONS g/tonne	REAGENT
Grind (55% solids with 1/2 regular rod charge)	3.5		
Rougher Flotation Rougher float	35	282 50	Varsol MIBC
Cleaner flotation (Rougher concentrates) 1st cleaner float	10	15 8	Varsol MIBC
2nd cleaner float	8	15 24	Varsol MIBC
Screening at 48 mesh (Ro 2nd cleaner conc)			
Gravity separation (panning +48 mesh conc)			
Regrind (-48 mesh conc)	5		
Cleaner flotation (regrind conc)			
1st cleaner float	7	15 13	Varsol MIBC
2nd cleaner float	6	15 13	Varsol MIBC
Screening at 100 mesh (regrind 2nd cleaner concentrates)			

TESTWORK PROCEDURE

Test No: 92-025 F2b

Date: 8-Oct-92

Purpose: To increase F2 concentrate products grade by regrinding and refloating

STAGE	TIME (Minutes)	ADDITIONS g/tonne	ADDITIONS REAGENT
Regrind (Combine all F2 +48 mesh gravity concentrates)	10		
Screening at 48 mesh (regrind concentrates)			
Gravity separation (+48 mesh concentrates)			
Regrind (-48 mesh and F2 +100 mesh concentrates)	5		
Cleaner flotation (Regrind concentrates)			
1st cleaner float	5	58 44	Varsol MIBC
2nd cleaner float	8	104 79	Varsol MIBC
Screening at 100 mesh (Regrind concentrates)			

SIZE DISTRIBUTION

SAMPLE NO: 92-025 F2 Head

Ground 3.5 min. at 65% solids

Size Fraction (mesh)		Individual Percentage Retained	Cumulative Percentage Passing
	+20	6.9	93.1
-20	+48	24.6	68.5
-48	+65	12.2	56.3
-65	+100	10.2	46.1
-100	+150	8.7	37.4
-150	+200	6.2	31.2
-200		31.2	

MATERIAL BALANCE

Date : 10/09/92

Project no : 92-025
Test no : F2

Sample description : Ore (composite 1)

Products	Weight		Assays	% Distribution
			Graphite	Graphite
	(g)	(%)	(%)	
Total +48 conc	445.50	23.03	32.39	40.6
Total -48 conc	383.62	19.83	45.33	48.9
Total Ro 2nd cl conc	829.12	42.86	38.38	89.5
Ro 2nd cl tails	57.60	2.98	15.50	2.5
Total Ro 1st cl conc	886.72	45.84	36.89	92.0
Ro 1st cl tails	223.80	11.57	10.80	6.8
Total Ro conc	1110.52	57.41	31.63	98.8
Final Ro tails	823.80	42.59	0.53	1.2
Calculated head	1934.32	100.00	18.39	100.0
Assay head				

Products	Weight		Units
	(g)	(%)	Graphite
Total +48 conc	445.50	23.03	745.99
Total -48 conc	383.62	19.83	899.00
Total Ro 2nd cl conc	829.12	42.86	1644.98
Ro 2nd cl tails	57.60	2.98	46.16
Total Ro 1st cl conc	886.72	45.84	1691.14
Ro 1st cl tails	223.80	11.57	124.96
Total Ro conc	1110.52	57.41	1816.09
Final Ro tails	823.80	42.59	22.57
	1934.32	100.00	1838.67
	1948.25	100.00	

MATERIAL BALANCE

Project no : 92-025
Test no : F2

Date : 10/09/92

Sample description : Ore (composite 1)

Products	Weight		Assays	% Distribution
			Graphite	Graphite
	(g)	(%)	(%)	
+48 gravity conc 1	26.50	1.37	77.65	5.8
+48 gravity conc 2	41.00	2.11	60.80	7.0
+48 gravity conc 3	74.80	3.86	41.00	8.6
+48 gravity conc 4	47.30	2.44	33.50	4.4
Total +48 gravity conc	189.60	9.77	48.56	25.8
+48 gravity tails	256.20	13.21	20.45	14.7
Total +48 conc	445.80	22.98	32.39	40.5
Assay head				

Products	Weight		Units
	(g)	(%)	Graphite
+48 gravity conc 1	26.50	1.37	106.08
+48 gravity conc 2	41.00	2.11	128.51
+48 gravity conc 3	74.80	3.86	158.11
+48 gravity conc 4	47.30	2.44	81.69
Total +48 gravity conc	189.60	9.77	474.40
+48 gravity tails	256.20	13.21	270.11
Total +48 conc	445.80	22.98	744.51
	1939.70	100.00	

MATERIAL BALANCE

Project no : 92-025
Test no : F2

Date : 10-Oct-92

Sample description : Ore (composite 1)

Products	Weight		Assay	% Distribution
			Graphite	Graphite
	(g)	(%)	(%)	
+100 conc	180.3	9.30	50.60	25.6
-100 conc	147.6	7.61	57.05	23.6
-48 2nd cl conc	327.9	16.90	45.13	49.2
-48 2nd cl tails	7.5	0.39	5.37	0.1
-48 1st cl conc	335.4	17.29	45.24	49.3
-48 1st cl tails	53.3	2.75	0.69	0.1
Total -48 conc	388.70	20.04	45.28	49.4
Assay head				

MATERIAL BALANCE

Project no : 92-025
Test no : F2

Date : 10-Oct-92

Sample description : Ore (composite 1)

Products	Weight		Assay	% Distribution
	(g)	(%)	Graphite (%)	Graphite
+100 conc	180.3	9.30	50.60	25.6
-100 conc	147.6	7.61	57.05	23.6
-48 2nd cl conc	327.9	16.90	45.13	49.2
-48 2nd cl tails	7.5	0.39	5.37	0.1
-48 1st cl conc	335.4	17.29	45.24	49.3
-48 1st cl tails	53.3	2.75	0.69	0.1
Total -48 conc	388.70	20.04	45.23	49.4
Assay head				

TESTWORK PROCEDURE

Test No: 92-025 F3 Date: 27-Oct-92

Purpose: To increase +48 mesh gravity concentrates grade to >90% by finer grind in the primary grinding mill

STAGE	TIME (Minutes)	ADDITIONS g/tonne	ADDITIONS REAGENT
Grind	7		
(55% solids with 1/2 regular rod charge)			
Rougher Flotation			
Rougher float	25	281.9	Varsol
		33.3	MIBC
Cleaner flotation			
(Rougher concentrates)			
1st cleaner float	12	43.7	Varsol
		10.0	MIBC
2nd cleaner float	12	43.7	Varsol
		15.0	MIBC
Screening at 48 mesh			
(2nd Ro cleaner conc)			
Regrind	10		
(+48 mesh conc)			
Screen at 48 mesh			
(Reground +48 mesh conc)			
Regrind	10		
(+48 mesh conc)			
Screen at 48 mesh			
(Reground +48 mesh conc)			
Gravity separation			
(reground +48 mesh conc)			

TESTWORK PROCEDURE

Test No: 92-025 F3 **Date:** 27-Oct-92

Purpose: To increase +48 mesh gravity concentrates grade to >90% by finer grind in the primary grinding mill

STAGE	TIME (Minutes)	ADDITIONS g/tonne	ADDITIONS REAGENT
Regrind (-48 mesh conc)	20		
Cleaner flotation (regrind conc)			
1st cleaner float	10	6.6 20.0	Varsol MIBC
2nd cleaner float	12	6.6 20.0	Varsol MIBC
Regrind (2nd cleaner conc)	10		
3rd cleaner float	12	21.85 16.65	Varsol MIBC
Screen at 100 mesh (regrind 3nd cleaner conc)			

SIZE DISTRIBUTION

SAMPLE NO: 92-025 F3 Head

Ground 7.0 min. at 65% solids

Size Fraction (mesh)		Individual Percentage Retained	Cumulative Percentage Passing
	+48	19.1	80.9
-48	+65	18.1	62.8
-65	+100	15.3	47.5
-100	+150	12.5	35.0
-150	+200	9.2	25.8
-200	+325	9.6	16.2
-325		16.2	

MATERIAL BALANCE

Project no : 92-025
Test no : F3

Date : 10/27/92

Sample description : Ore (composite 1)

Products	Weight		Assays	% Distribution
			Graphite	Graphite
	(g)	(%)	(%)	
Total +48 conc	80.80	4.21	86.60	19.9
Total -48 conc	787.04	40.98	34.38	77.1
Total Ro 2nd cl conc	867.84	45.19	39.24	97.0
Ro 2nd cl tails	45.49	2.37	8.83	1.1
Total Ro 1st cl conc	913.33	47.56	37.73	98.2
Ro 1st cl tails	146.07	7.61	3.90	1.6
Total Ro conc	1059.40	55.17	33.06	99.8
Final Ro tails	860.97	44.83	0.08	0.2
Calculated head	1920.37	100.00	18.28	100.0
Assay head				

Products	Weight		Units
	(g)	(%)	Graphite
Total +48 conc	80.80	4.21	364.37
Total -48 conc	787.04	40.98	1409.02
Total Ro 2nd cl conc	867.84	45.19	1773.39
Ro 2nd cl tails	45.49	2.37	20.92
Total Ro 1st cl conc	913.33	47.56	1794.31
Ro 1st cl tails	146.07	7.61	29.66
Total Ro conc	1059.40	55.17	1823.97
Final Ro tails	860.97	44.83	3.59
	1920.37	100.00	1827.56

MATERIAL BALANCE

Project no : 92-025
Test no : F3

Date : 10/27/92

Sample description : Ore (composite 1)

Products	Weight		Assays	% Distribution
			carbon	carbon
	(g)	(%)	(%)	
+48 gravity conc 1	7.70	0.40	93.25	2.0
+48 gravity conc 2	19.50	1.02	92.75	5.2
+48 gravity conc 3	12.80	0.67	91.70	3.3
Total +48 gravity conc	40.00	2.08	92.51	10.5
+48 gravity tails	40.80	2.12	80.80	9.4
Total +48 conc	80.80	4.21	86.60	19.9
Assay head				

Products	Weight		Units
	(g)	(%)	carbon
+48 gravity conc 1	7.70	0.40	37.38
+48 gravity conc 2	19.50	1.02	94.14
+48 gravity conc 3	12.80	0.67	61.10
Total +48 gravity conc	40.00	2.08	192.62
+48 gravity tails	40.80	2.12	171.60
Total +48 conc	80.80	4.21	364.22
	1921.12	100.00	

MATERIAL BALANCE

Project no : 92-025

Test no : F3

Date: 10/27/92

Sample description : Ore (composite 1)

Products	Weight (g)	Weight (%)	Assays carbon (%)	% Distribution carbon
+100 conc	157.13	8.18	78.25	35.0
-100 conc	216.80	11.29	64.85	40.0
-48 3nd cl conc	373.93	19.46	70.48	75.1
-48 3nd cl tails	80.00	4.16	2.33	0.5
-48 2st cl conc	453.93	23.63	58.47	75.6
-48 2st cl tails	23.87	1.24	10.61	0.7
-48 1st cl conc	477.80	24.87	56.08	76.3
-48 1st cl tails	309.24	16.10	0.86	0.8
Total -48 conc	787.04	40.97	34.38	77.1
Assay head				

Products	Weight (g)	Weight (%)	Units carbon
+100 conc	157.13	8.18	640.01
-100 conc	216.80	11.29	731.84
-48 2nd cl conc	373.93	19.46	1371.85
-48 2nd cl tails	80.00	4.16	9.70
-48 1st cl conc	453.93	23.63	1381.55
-48 1st cl tails	23.87	1.24	13.18
-48 1st cl conc	477.80	24.87	1394.74
-48 1st cl tails	309.24	16.10	13.84
-48 conc	787.04	40.97	1408.58
	1921.12	100.00	

Vancouver Petrographics Ltd.

8080 GLOVER ROAD, LANGLEY, B.C. V3A 4P9
PHONE (604) 888-1323 • FAX (604) 888-3642

Report for: M.J.V. Beattie,
Beattie Consulting Ltd.,
2955 West 38th Ave.,
VANCOUVER, B.C., V6N 2X2

Job 61
September 1992

Samples: BCL-020 Series #1, #2, #3, #4

Summary:

Sample BCL-020 #1 is a fine grained quartz-graphite-plagioclase-biotite-pyrrhotite schist containing minor sphalerite and trace chalcopyrite. Biotite is concentrated in a few patches up to 5 mm across.

Sample BCL-020 #2 is a quartz-graphite-tremolite-(pyrrhotite-biotite-plagioclase) schist. Tremolite forms porphyroblastic grains. Graphite flakes are very fine to fine grained and commonly are warped moderately. Patches of pyrrhotite (altered to pyrite) and minor chalcopyrite are associated with graphite clusters.

Sample BCL-020 #3 is a quartz-plagioclase-graphite-microcline-diopside-tremolite-(pyrrhotite-biotite-tourmaline) schist.

The rock is a fine grained schist dominated by quartz with less plagioclase and much less graphite, microcline, diopside, and tremolite, and minor pyrrhotite/pyrite, biotite, tourmaline, and sphalerite.

Sample BCL-020 #4 is a fine grained quartz-plagioclase-diopside-graphite-(microcline-pyrrhotite-tourmaline) schist. It also contains minor sphalerite and trace chalcopyrite. Graphite occurs mainly in clusters of grains less than 0.5 mm in size, with less abundant free grains averaging 0.2-0.5 mm in size.

Assuming that the preferred quality of graphite is coarse, single, undeformed flakes, the samples were ranked as follows: excellent (Sample 1), good (Sample 3), fair (Sample 4) , poor (Sample 2).

John G. Payne
(604)-986-2928

Sample BCL-020 #1 — Quartz-Graphite-Plagioclase-Biotite-Pyrrhotite Schist

The rock is a fine grained schist dominated by quartz and graphite, with less plagioclase and biotite, minor pyrrhotite and sphalerite, and trace apatite and chalcopyrite. Biotite is concentrated in a few patches up to 5 mm across.

quartz	50-55%
graphite	20-25
plagioclase	12-15
biotite	7- 8
pyrrhotite/pyrite	1- 2
sphalerite	0.5
apatite	0.1
chalcopyrite	trace

Quartz forms anhedral grains averaging 0.2-0.7 mm in size.

Graphite forms well developed, mainly undeformed flakes averaging 0.5-1.2 mm in length, with a few up to 2 mm long. It also occurs in patches up to 2 mm in size of very fine to fine grained aggregates, commonly showing deformation textures. It also forms stubby flakes averaging 0.1-0.2 mm in size, mainly intergrown with biotite and plagioclase, but also occurring in some patches of finer grained quartz.

Plagioclase forms anhedral, equant grains averaging 0.5-1 mm in size, with a few up to 1.5 mm long. Some coarser grains appear to be porphyroblastic. Composition is An40 by the Michel-Levy method using the extinction angle of albite twins (22^o), combined with a comparison of R.I. with quartz (slightly greater than quartz). Grains are fresh. In a few patches of coarse plagioclase, many grains contain abundant, equant inclusions of graphite averaging 0.02-0.07 mm in size.

Biotite forms disseminated flakes averaging 0.3-0.8 mm in size. Pleochroism is from pale straw to bright brownish red. It is concentrated strongly in a few patches up to 5 mm across as aggregates of anhedral grains intergrown with much less quartz and graphite. In these patches, graphite forms abundant, equant flakes averaging 0.05-0.1 mm in size.

In the core of the large patch is an anhedral grain 1.5 mm across of bright red sphalerite. Similar sphalerite grains up to 0.4 mm in size occur elsewhere, mainly associated with pyrrhotite and graphite.

Pyrrhotite (altered to pyrite) forms disseminated patches averaging 0.1-0.2 mm in size and locally up to 0.8 mm long. Many of these have delicate, concentric alteration textures. Chalcopyrite forms a few grains up to 0.07 mm in size associated with pyrrhotite. Lensy patches of pyrrhotite and sphalerite and minor chalcopyrite are intergrown intimately along cleavage planes in a few grains of graphite.

Apatite forms a few anhedral grains up to 0.3 mm in size.

Sample BCL-020 #2   Quartz-Graphite-Tremolite-(Pyrrhotite-Biotite-Plagioclase) Schist

The schist is dominated by quartz with less abundant graphite, porphyroblastic grains of tremolite and much less pyrrhotite, biotite, and plagioclase. Graphite flakes are very fine to fine grained and commonly are warped moderately. Patches of pyrrhotite (altered to pyrite) and minor chalcopyrite are associated with graphite clusters.

quartz	65-70%
graphite	17-20
tremolite	7- 8
biotite	1- 2
pyrrhotite	1- 2
plagioclase	1- 2
apatite	minor
chalcopyrite	trace

Quartz forms aggregates of moderately to strongly interlocking grains averaging 0.05-0.2 mm in size. Textures suggest that original coarser grains (up to 0.5 mm in size) were strained strongly and recrystallized. A few patches up to 2 mm across are dominated by coarser grained quartz (original grains up to 0.8 mm in size) showing similar deformation and recrystallization textures.

Graphite forms flakes averaging 0.1-0.5 mm in length. Most are ragged and warped moderately, and occur in clusters averaging 0.2-0.8 mm in size. A few, commonly coarser and grains from 0.7-1.0 mm long are parallel to foliation.

Tremolite forms anhedral to subhedral, equant to elongate prismatic grains averaging 0.5-1.5 mm in size, with a few over 2 mm long. It is pale green in color and very weakly pleochroic. Some grains contain a few rounded to lensy inclusions of quartz from 0.1-0.2 mm in size; these do not show the strained and recrystallized texture of quartz away from tremolite.

Biotite forms ragged flakes averaging 0.2-0.5 mm in size. Pleochroism is from light to medium reddish brown.

Plagioclase forms scattered, anhedral grains averaging 0.1-0.2 mm in size.

Apatite forms a few subhedral, prismatic grains up to 0.3 mm long.

Pyrrhotite (altered to pyrite/oxide?) forms grains averaging 0.03-0.1 mm in size, and locally up to 0.2 mm across. These occur in clusters averaging 0.2-0.5 mm in size, and locally up to 1 mm across. Patches commonly are intergrown coarsely with graphite.

Chalcopyrite forms anhedral grains up to 0.08 mm across, commonly associated with pyrrhotite.

Sample BCL-020 #3 Quartz-Plagioclase-Graphite-Microcline-Diopside Tremolite-Pyrrhotite-Biotite-Tourmaline) Schist

The rock is a fine grained schist dominated by quartz with less plagioclase and much less graphite, microcline, diopside, and tremolite, and minor pyrrhotite/pyrite, biotite, tourmaline, and sphalerite.

quartz	50-55%
plagioclase	17-20
microcline	5- 7
graphite	4- 5
diopside	4- 5
tremolite	3- 4
tourmaline	1
biotite	1
sphalerite	0.3
chalcopyrite	trace

Quartz forms equant grains averaging 0.2-0.5 mm in size. Some patches are recrystallized to much finer subgrain aggregates.

Plagioclase forms equant grains averaging 0.2-0.3 mm in size, and a few grains up to 0.7 mm across. It also occurs in lenses and patches of extremely fine grain size associated with microcline and quartz. These lenses and patches and the recrystallized nature of some quartz patches indicate that the rock was slightly to moderately cataclastically deformed.

Microcline forms equant grains averaging 0.1-0.4 mm in size. Commonly along borders of microcline and plagioclase are grains averaging 0.1 mm in size of myrmekite.

Graphite forms about equal amounts of free grains and clusters of grains averaging 0.2-0.5 mm in size.

Diopside forms equant, anhedral grains averaging 0.2-0.4 mm in size, and a few prismatic grains up to 0.7 mm long.

Tremolite forms anhedral, prismatic grains averaging 0.5-0.7 mm long and a few up to 1 mm long. It is pale greenish yellow in color.

Pyrrhotite forms patches averaging 0.2-0.3 mm in size, and a few from 0.5-1.3 mm across of grains averaging 0.05-0.2 mm in size. Alteration is complete to secondary pyrite and minor non-reflective material showing delicate concentric alteration textures in individual grains.

Sphalerite forms anhedral grains averaging 0.1-0.15 mm in size, mainly associated with graphite and pyrrhotite/pyrite and a few patches up to 0.6 mm in size in quartz-plagioclase.

Tourmaline forms equant grains averaging 0.1-0.2 mm in size and a few prismatic grains up to 0.3 mm long. Pleochroism is from light orange to dark brownish red and locally black.

Biotite forms ragged flakes averaging 0.1-0.2 mm in size. Pleochroism is weak from pale to light brown, suggesting that the mineral is altered partly towards muscovite.

Chalcopyrite forms equant grains averaging 0.02-0.05 mm in size, mainly associated with pyrrhotite/pyrite.

Distribution of Graphite

Graphite grains were classified according to 1) whether they were free grains or occurred in clusters and 2) on grain size. "Free" grains also includes aggregates of parallel flakes, which would be expected to separate readily into free grains on crushing and processing. Two traverses were made across each section; the samples are uniform enough that these give a semi-quantitative estimate of the graphite distribution (Table 1). Results are compiled in Table 2 to show the total amount of graphite flakes in the given size ranges.

Table 1. Distribution of Graphite (%)
(size and texture classification)

Sample	Free Grains					Clusters			
	(sizes in mm)								
	<0.2	0.2-0.5	0.5-0.8	0.8-1.2	>1.2	<0.2	0.2-0.5	0.5-0.8	0.8-1.2
1	7	13	16	7	5	13	29	9	1
2	5	11	2	1	-	70	11	-	-
3	13	29	9	1	-	25	19	1	3
4	5	15	7	-	-	42	26	5	-

Table 2. Distribution of Graphite (%)
(size classification)

Sample	(sizes in mm) <0.2	0.2-0.5	0.5-0.8	0.8-1.2	>1.2
1	20	42	25	8	5
2	75	22	2	1	-
3	38	48	10	4	-
4	47	41	12	-	-

Conclusions:

The samples are ranked as follows in terms of coarseness of grain size and ease of liberation of single graphite flakes:

1. Excellent - Sample 1
2. Good - Sample 3
3. Fair - Sample 4
4. Poor - Sample 2

Although it has the poorest quality of graphite, the high graphite content of Sample 2 may improve its classification, depending on the quality of the product desired.

John G. Payne
John G. Payne,
604-986-2928

BEATTIE CONSULTING LTD.

INVOICE

2955 WEST 38th AVENUE
VANCOUVER, B.C.
V6N 2X2

TEL.(604) 263 0695
FAX.(604) 263 0695

IN ACCOUNT WITH: ~~Resolute Resources Ltd.~~ 403826 BC LTD.

2200 - 666 Burrard Street

Vancouver, B.C. V6C 2X8

ATTENTION: Jim Clucas

INVOICE NO: 92 - 031

PROJECT NO: BCL 020

DATE: October 30, 1992

GST REG. NO. R132383324

RE: Expenses related to mineralogical study of Bentinck samples.

Vancouver Petrographics	$ 469.00
Sample delivery	7.30

CW 10

SUB TOTAL	$ 476.30
GST at 7%	33.34
TOTAL	$ 509.64
LESS ADVANCE	0
BALANCE DUE	$ 509.64

Terms: Payable upon receipt of invoice.

PROCESS RESEARCH ASSOCIATES LTD.
9145 Shaughnessy Street
Vancouver, B.C.
Canada V6P 6R9

Phone:(604) 322-0118
Fax:(604) 322-4907

INVOICE

Invoice No. INV085
File: 92-025
Date: February 2, 1993

TO: 403826 B.C. LTD.
#2200-666 Burrard Street
Vancouver, B.C.
V6C 2X8

Attention: Mr. J. Clucas

RE: Testwork on Bentink Graphite Ore

PROFESSIONAL SERVICES

Report Writing	$750.00
Sample Preparation, Gravity Concentration & Flotation	2,850.00
Analytical	1,304.50
Sub-total	**4,904.50**
G.S.T (7%)	343.32
TOTAL AMOUNT OWING	**$5,247.82**

Bernhard Klein

Bernhard Klein, Ph.D.
Senior Process Metallurgist
PROCESS RESEARCH ASSOCIATES LTD.

ch 09

Terms: Payable upon receipt of invoice.
G.S.T. Number R132440272