Bergvesenet

Postboks 3021, N-7441 Trondheim

Rapportarkivet

Bergvesenet rapport nr	Intern Journal nr	Internt arkiv nr	Rapport lokalisering	Gradering
7047				

Kommer fra ..arkiv	Ekstern rapport nr	Oversendt fra	Fortrolig pga	Fortrolig fra dato:
Kautokeino kobberfelter		Bidjovagge Gruber a.s.		

Tittel

Laboratory Report No. 2 on the testing of Your Graphitic Copper ore Sample, our Lot No. 1636-1

Forfatter	Dato	År	Bedrift (Oppdragsgiver og/eller oppdragstaker)
.Xanthos, John	04.01	1967	Kautokeino kobberfelter A/S, USB

Kommune	Fylke	Bergdistrikt	1: 50 000 kartblad	1: 250 000 kartblad
Kautokeino	Finnmark		18334	Nordreisa

Fagområde	Dokument type	Forekomster (forekomst, gruvefelt, undersøkelsesfelt)
Oppredning		Bidjovagge

Råstoffgruppe	Råstofftype
Malm/metall	Cu, C

Sammendrag, innholdsfortegnelse eller innholdsbeskrivelse

Undersøkelser utført av The Galiagher Company, Salt Lake City, Utah. Vedlagt flytskjema og oversikt over alle utførte tester. Videreføring av tester rapportert i BV 7014 med spesiell vekt på den grafittiske malmtypen.
Hensikten med undersøkelsen var å bestemme den best mulig oppnåelige gehalt og utvinning som kunne forventes ut fra den oversendte prøve av grafittmalm
Flere trinn i flotasjonsprosessen innebar rensing av grafitt-koncene.
Det ble oppnådd et cU-konc med 24,33% Cu og en utvinning på 84,6%. Kopperinnhold i avgang forventes ligge rundt 0,4% Cu.
Tilsammen ble gjort 28 forsøk og en rekke samlere ble utprøvd i flotasjonen.

GALIGHER

NORGES GEOLOGISKE UNDERSOKELSE
TRONDHEIM, NORWAY

LABORATORY REPORT NO. 2 ON THE TESTING OF
YOUR GRAPHITIC COPPER ORE SAMPLE
OUR LOT NO. 1636-1

January 4, 1967

THE GALIGHER COMPANY

HOME OFFICE – 545-585 West 8th South – P. O. Box 209 – Salt Lake City, Utah 84110
EASTERN OFFICE: 921 Bergen Ave. (Room 922), Jersey City, N.J. 07306
U.S.A.

TABLE OF CONTENTS

APPENDIX

FLOWSHEET
TEST DATA SHEETS

THE GALIGHER COMPANY

ESTABLISHED 1901

CABLE ADDRESS
GALSAL
TELEX 038-536

545-585 WEST EIGHTH SOUTH STREET
P. O. BOX 209
SALT LAKE CITY, UTAH 84110
U.S.A.

TELEPHONE
359-8731
AREA CODE 801

January 4, 1967

Norges Geologiske Undersokelse
Leiv Eirickssons Vei 39
Postboks 3006
Trondheim, Norway

Attention: Mr. Karl Ingvaldsen
Administrative Director

LABORATORY REPORT NO. 2 ON THE TESTING OF
YOUR GRAPHITIC COPPER ORE SAMPLE
OUR LOT NO. 1636-1

Gentlemen:

Pursuant to our detailed laboratory report of January 27, 1966 and our letter of November 17, 1966, we are pleased to submit this report covering the latest test results of work performed on your graphitic copper ore sample, our Lot No. 1636-1.

I. OBJECTIVE

The objective of this investigation was to determine the maximum obtainable grade and recovery of copper minerals that could be expected from ore as represented by your sample of graphitic copper ore.

II. FLOWSHEET RECOMMENDATION

As a result of the tests which were conducted during this phase of the investigation, it was determined that the most satisfactory method of treating ore as represented by sample 1636-1 involved carbon flotation followed with selective copper flotation. The results of Test No. 57, following this procedure, were given to you in our letter of November 17, 1966. Because these results were rather encouraging, a closed-circuit test (Test No. 58) was conducted, the detailed procedure and results of which are presented as follows:

1. A representative 1000 gram charge of ore was ground in a laboratory ball mill at 50% solids (using softened, Salt Lake City water). Reagent to the ball mill was 0.20 pound of kerosene per ton of ore. The screen analysis of the ball mill discharge was as follows:

Mesh	+65	+100	+150	+200	+325	-325
Wt.%	0.6	4.6	13.5	13.4	21.6	46.3

2. The ball mill discharge was diluted to 25% solids, the pH being 7.3. 0.05 pound of MIBC (methyl isobutyl carbinol) was added to the float cell and a carbon rougher concentrate was floated for three minutes. 0.05 pound of MIBC was added and the float was continued for another three minutes. 0.05 pound of MIBC was staged two more times with float intervals of two minutes after each stage addition, total rougher flotation time being ten minutes. This was a somewhat rigorous float procedure but it was found to be necessary to insure a complete removal of the carbon. The carbon that is not floated in the carbon float would report as a diluent in the copper circuit. We observed that during the carbon float, the fine carbon floats first and the course carbon floats toward the end of the float.

3. The carbon rougher concentrate was thickened and reground, the ball mill discharge being 89.3% minus 325 mesh.

4. To the reground concentrate, 0.03 pound of MIBC was added and the carbon was cleaned for three minutes. 0.03 pound of MIBC was staged at the end of three, six and eight minutes of the cleaner float, the total float time being nine minutes for the No. 1 cleaner.

5. The carbon cleaner concentrate was recleaned for seven minutes with 0.05 pound of MIBC being added at the beginning of the cleaner and at the end of four and six minutes of the No. 2 cleaner.

6. The carbon recleaner concentrate was cleaned again, the float time being 7.5 minutes with 0.03 pound additions of MIBC at the beginning and at the end of four and six minutes of the float.

7. The combined carbon cleaner tails were thickened and added to the thickened carbon rougher tail. This combined product was conditioned with 4.0 pounds of lime (to a pH of 11.0), 0.02 pound of SAX and 0.08 pound of Dow Z-200 for ten minutes, after which a copper rougher was floated for five minutes. 0.04 pound of Z-200 was conditioned in for one minute and the copper rougher float was continued for another five minutes. 0.04 pound of Z-200 was conditioned in for another minute and the rougher was continued for four more minutes, total copper rougher flotation time being 14 minutes.

8. The copper rougher concentrate was thickened and reground with 4.0 pounds of lime and 0.08 pound of Z-200.

9. The reground copper concentrate was cleaned for 12 minutes, the pH being 11.0.

10. The copper cleaner concentrate was conditioned for one minute with 1.0 pounds of lime (pH of 11.3) and was recleaned for five minutes.

11. The reclosner concentrate was conditioned for one minute with 1.0 pound of lime and 0.03 pound of MIBC and was cleaned a third time for five minutes.

12. The copper cleaner tails were combined, thickened and added to the carbon rougher tail of the following test along with the carbon cleaner tails of that test thus closing the circuit.

Total reagent requirements for Test No. 56 were: 0.20 pound of kerosene, 0.7[illegible] pound of MIBC, 0.02 pound of NaCN, 10.2 pounds of lime and 0.24 pound of Z-200.

The flowsheet used and results obtained in Test No. 56 are depicted as follows:

TEST NO. 56 - CLOSED CIRCUIT

Product	Wt.	%	%Cu	Distribution %Cu
Series #1				
Carbon Cleaner Concentrate #3	420	42.0	0.207	---
Copper Cleaner Concentrate #3	62	6.2	24.61	---
Copper Rougher Tail	429	42.9	0.166	---
Head (Less Circulating Load)	911	91.1	1.68	---
Series #2				
Carbon Cleaner Concentrate #3	423	42.3	0.239	5.7
Copper Cleaner Concentrate #3	60	6.0	26.54	89.0
Copper Rougher Tail	518	51.7	0.182	5.3
Head	1001	100.0	1.79	100.0
Series #3				
Carbon Cleaner Concentrate #3	433	43.3	0.220	4.8
Copper Cleaner Concentrate #3	70	7.2	24.71	90.6
Copper Rougher Tail	478	49.5	0.182	4.6
Head	967	100.0	1.96	100.0
Series #4				
Carbon Cleaner Concentrate #3	426.0	42.4	0.252	5.8
Copper Cleaner Concentrate #3	65.3	6.5	25.27	89.4
Copper Rougher Tail	517.0	51.2	0.173	4.8
Head	1010.3	100.0	1.84	100.0
Copper Cleaner Tail #3	19.0		3.49	
Copper Cleaner Tail #2	45.0		1.650	
Copper Cleaner Tail #1	97.0		0.396	

The results of the above test allow for the following observations:

1. A copper recovery of 84.6% was obtained in a concentrate assaying 24.33% Cu in open circuit testing (Test No. 57), 6.4% of the copper being contained in the combined copper cleaner tailings. The above results show that the majority of the copper contained in this circulating load eventually appeared in the final copper concentrate in that a recovery of about 90% was obtained. It is to be noted that there was very little difference in the copper assays of the copper rougher tailings in Series 1 through 4.

2. A final copper concentrate grade of about 25% can be expected when concentrating ores as represented by the tested sample.

3. The circulating load of Series 1 was seen to be 8.9% by weight of the original ore. That of the final series was about 16%, this representing a substantial increase. However, this was not detrimental regarding final copper concentrate grade and recovery.

III. VARIABLES INVESTIGATED

Twenty-eight tests have been conducted on the graphitic copper ore sample in this latest investigation, the complete details of which may be found on the appended data sheets (Test Nos. 31-58). The major variables which were investigated are discussed as follows:

1. The effect of carbon collector concentration at various grinds for carbon rougher flotation, relating to copper losses in the carbon concentrate and carbon recovery (Test Nos. 34 through 42). These tests indicated that, by increasing the amount of carbon collector (kerosene), copper losses increased in the carbon rougher concentrate. This was primarily due to the increased weight of carbon floating. It was more difficult to float the carbon at the coarser grinds and higher collector concentrations were required at the coarser grinds for a reasonable carbon removal. Inasmuch as complete carbon removal is required prior to copper flotation, it is our belief that a relatively fine grind (about 65% minus 325 mesh) should be used to facilitate carbon removal. It was also determined that by regrinding the carbon rougher concentrate to 90% minus 325 mesh prior to cleaning, copper losses in the final carbon concentrate would be minimized while still ensuring a high carbon recovery.

2. Various collectors for copper flotation. Three different collectors were tested in the copper flotation circuit, these being Z-3, Z-6 and Z-200. Z-3 was observed to have insufficient collecting power in the environment tested in that a poor copper recovery resulted after rougher concentrate cleaning (see Test No. 44). Z-6 appeared to be too strong a collector in that the iron sulfides floated more readily than was the case with Z-200. Z-200 was the most favorable collector regarding flotation selectivity and copper recovery.

3. The effect of regrinding the copper rougher concentrate prior to cleaning. As can be seen in the tabulation of results presented below, the final copper concentrate grade and recovery are substantially increased when employing a regrind on the copper rougher concentrate prior to cleaning.

Test No.	Minus 325	Product	Wt.%	%Cu	% Dist.
53	64.8	Cu Cl Concentrate #2	3.2	23.42	66.4
		Cu Cl Concentrate #1	6.4	16.3	83.7
56	97.4	Cu Cl Concentrate #4	6.8	22.23	82.2
57	100.0	Cu Cl Concentrate #3	6.3	24.33	84.6
		Cu Cl Concentrate #2	7.7	20.6	87.5
		Cu Cl Concentrate #1	9.8	16.5	89.3

Cursory studies were conducted involving attempts to float the copper and iron minerals together in a bulk float, followed with selective separations of the copper and the iron (Test Nos. 31, 32 and 43) but visual observations indicated inferior results. Also, two stage grinding tests were conducted (Test Nos. 45 and 46) and nothing worthy of further pursuit was developed as a result of these tests. The relatively uncomplicated flowsheet as used in Test No. 53 would seem to be the most desirable approach for treating ores as represented by Lot No. 1536-1.

We've appreciated the opportunity to conduct this investigation for you and, if you have any questions concerning the project or desire further studies, please contact us.

Sincerely yours,

THE GALIGHER COMPANY

John Kanthos

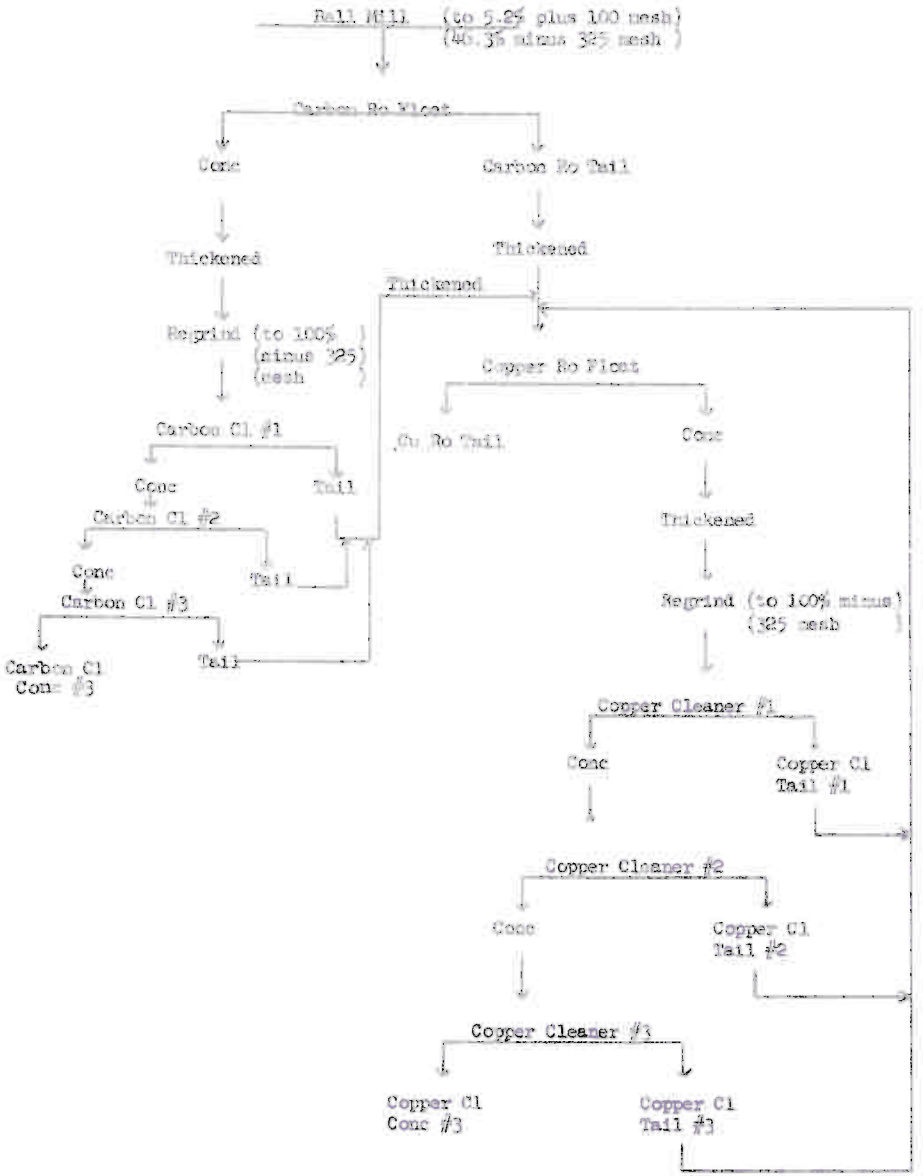
John Kanthos
Metallurgist

JK/do

cc Gus

THE GALIGHER COMPANY

FLOWSHEET, LOT NO. 1036-1, TEST NO. 50



METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 543-585 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8751

OUR LOT NO. 1636-1
DATE
BY

TEST NO. 31 NAME Norges Geologiske

Same C-Ro as test 14 except coarser grind.

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				
					Products not saved										
										Bulk conc					
OPERATION		RM	C-Ro	Ro	Ro	Ro	Ro	Ro	Ro	Regr			GRINDING PRODUCT		
TIME		5	3	2	3	5	2	1	10						
REAGENTS — LBS. PER TON													Head		
												MESH	%	%	
												+10			
HIRC			0.06	0.03	0.03	0.06	0.03					+14			
Z-ima										6.0		+20			
Z-6						0.10	0.05	0.05				+28			
NaCN										0.05		+35			
Frother 65								0.05				+48	9.2		
												+65	13.6		
												+100	17.2		
												+150	16.5		
MACHINE			1000									+200	7.6		
R.P.M.			1000									-200	10.4		
pH			6.8									-325	27.3		
% SOLIDS		50	25												
TEMPERATURE															

REMARKS

Bulk ro conc high in coarse carbon.

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 205 — 845-850 WEST 5TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8781

OUR LOT NO. 1636-1
DATE 7-27-66
BY JX

TEST NO. 32-1 NAME Norges Geologiske

Same as test 14 except Cu conc cleaned further using SO2 caustic starch.

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				
C ro conc		31.8													
Sep cl conc #2		6.9													
Sep cl tail #2		2.1	Products not assayed												
Sep cl tail #1		1.5													
Sep ro tail		29.5													
Bulk cl tail		6.3													
Bulk ro tail		21.9													
Head		100.0													

OPERATION	RM	C-Ro	Ro	Ro	Bulk Ro	Ro	Ro	Bulk Cl	Sep Cond	Sep Ro	Cond	GRINDING PRODUCT	
TIME	20	3	2	3	5	2	1	10	5	8	1		
REAGENTS — LBS. PER TON												Head	
												MESH	%
NOBO		0.06	0.03	0.03	0.06	0.03		0.03				+10	
Lime												+14	
Z-6					0.1	0.05	0.05					+20	
NaCN												+28	
Aerofroth 65										0.05		+35	
SO2									9.0			+48	
Caustic Starch											0.025	+65	
												+100	5.2
												+150	
MACHINE		1000						1000	500		500	+200	
R.P.M.		1100						1100	1000		1000	+325	
pH		7.0						7.3	2.7-3.1			−325	46.3
% SOLIDS	50	25											
TEMPERATURE													

REMARKS

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 548-586 WEST 6th SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 7-27-66
BY JX

TEST NO. 32-2 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				

OPERATION	Sep Cl #1	Sep Cl #1	Cond	Cond	Sep Cl #2							GRINDING PRODUCT	
TIME	4	3	1	1	5								
REAGENTS — LBS. PER TON												MESH	%
												+10	
Frother 65	0.15											+14	
SO2		4.5		4.5								+20	
Caustic Starch			0.1									+28	
												+35	
												+48	
												+65	
												+100	
												+150	
MACHINE			500									+200	
R.P.M.			1000									+325	
pH		2.5		2.5								−325	
% SOLIDS													
TEMPERATURE													
REMARKS													

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 908 — 249-265 WEST 5TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8791

OUR LOT NO. 1636-1
DATE 8-8-66
BY JX

TEST NO. 33 NAME Norges Geologiske

Carbon float on -20 mesh material

PRODUCT	Weight	Percent Weight	ASSAY									DISTRIBUTION				
					Products not assayed											

OPERATION		Cond	C-Re	C-Re	Cond	C-Re						GRINDING PRODUCT	
TIME		3	5	2	2	3							
REAGENTS — LBS. PER TON												MESH	%	%
												-1.10		
												-1.12		
Kerosene		0.4			0.2							+20		
Pine Oil			0.06	0.08		0.08						+28		
												+35		
												+48		
												+65		
												+100		
												+150		
MACHINE		1000										+200		
R.P.M.		1300										+270		
pH												−325		
% SOLIDS		25												
TEMPERATURE														

REMARKS:

Impeller raised ¼".

METALLURGICAL RESEARCH DEPT.

CABLE "GALRAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 540-565 WEST 5TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-4751

OUR LOT NO. 1636-1
DATE 8-5-66
BY JX

TEST NO. 34 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY Cu	DISTRIBUTION Cu
C cl conc.		19.7	0.340	3.6
C cl tail		7.6	0.825	3.4
C ro tail		72.7	2.360*	93.0
Head - Assay		100.0	1.843	100.0
C ro conc		27.3	0.459	7.0

OPERATION	MN	C-Ro	C-Ro	C Cl	C Cl
TIME	5	3	4	2	3
REAGENTS — LBS. PER TON					
Kerosene	0.20				
MIBC		0.06	0.06		0.03
MACHINE		1000		1000	
R.P.M.		1300		1000	
pH		7.2		7.5	
% SOLIDS	50	25			
TEMPERATURE					

REMARKS

GRADING

MESH	PRODUCT Head %	
+10		
+14		
+20		
+28		
+35		
+48	9.2	
+65		
+100		
+150		
+200		
+325		
-325	27.3	

* Calculated by difference

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY
P. O. BOX 203 — 525-533 WEST 5TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8731

LOT NO. 1636-1
DATE 8-5-66
BY JX

TEST NO. 35 NAME Norges Geologiske

Same as test 34 except more collector in BM (0.4 ppt).

PRODUCT	Weight	Percent Weight	Cu	DISTRIBUTION Cu
C cl conc		30.8	0.343	5.8
C cl tail		8.9	0.756	3.6
C ro tail		60.3	2.770*	90.6
Head - Assay		100.0	1.843	100.0
C ro conc		39.7	0.434	9.4

OPERATION	BM	C-Ro	C-Ro	C Cl	C Cl
TIME	5	3	4	2	3
REAGENTS — LBS. PER TON					
Kerosene	0.4				
MIBC		0.06	0.06		0.06
MACHINE		1000		1000	
R.P.M.		1300		1000	
pH		7.2		7.5	
% SOLIDS	50	25			
TEMPERATURE					

GRINDING PRODUCT

Head

MESH	%	%
+10		
+14		
+20		
+28		
+35		
+48	9.2	
+65		
+100		
+150		
+200		
+325		
−325	27.3	

REMARKS:

* Calculated by difference

METALLURGICAL RESEARCH DEPT.

CABLE "GALGAL"

THE GALIGHER COMPANY

P. O. BOX 205 — 548-556 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-3791

OUR LOT NO. 1636-1
DATE 8-5-66
BY JX

TEST NO. 36 NAME Norges Geologiske

Same as test 34 except more collector in BM (0.6 ppt).

PRODUCT	Weight	Percent Weight	ASSAY Cu	DISTRIBUTION Cu
C cl conc		40.9	0.365	8.1
C cl tail		5.7	1.064	3.3
C ro tail		53.4	3.060*	88.6
Head (Assay)		100.0	1.843	100.0
C ro conc		46.6	0.451	11.4

OPERATION	BM	C-Ro	C-Ro	C Cl	C Cl
TIME	5	3	4	2	3
REAGENTS - LBS. PER TON					
Kerosene	0.6				
MIBC		0.06	0.06		0.06
MACHINE		1000		1000	
R.P.M.		1000		1000	
pH		7.2		2.5	
% SOLIDS	50	25			
TEMPERATURE					
REMARKS:					

GRINDING PRODUCT

MESH	Head %	%
+10		
-10+14		
+20		
-20+28		
+35		
-35+48	9.2	
+65		
-100		
-150		
+200		
-325		
-325	27.3	

* Calculated by difference

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 543-563 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8751

OUR LOT NO. 1636-1
DATE 8-5-66
BY W

TEST NO. 37 NAME Norge Geologiska

Same as test 34 except finer grind (10')

PRODUCT	Weight	Percent Weight	ASSAY Cu	DISTRIBUTION Cu
C.cl conc		33.1	0.336	6.0
C.cl tail		7.3	1.083	4.3
C.ro tail		59.6	2.770*	89.7
Head (Assay)		100.0	1.843	100.0
C.ro conc		40.4	0.470	10.3

OPERATION	RM	C-Ro	C-Ro	C.Cl	C.Cl
TIME	10	3	4	2	3
REAGENTS — LBS. PER TON					
Kerosene	0.2				
MIBC		0.06	0.06		0.06
MACHINE		1000		1000	
R.P.M.		1000		1000	
pH		7.2		7.5	
% SOLIDS	50	25			
TEMPERATURE					
REMARKS					

GRINDING PRODUCT

MESH	Head %	%
+10		
+14		
+20		
+28		
+35		
+48	0.9	
+65		
+100		
+150		
+200		
+325		
−325	33.4	

* Calculated by difference

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 545-565 WEST 5TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8791

OUR LOT NO. 1636-1
DATE 8-8-66
BY JX

TEST NO. 38 NAME Norges Geologiske

Same as test 37 except more collector in BM (0.4 ppt)

PRODUCT	Weight	Percent Weight	ASSAY Cu								DISTRIBUTION Cu				
C cl conc		37.5		0.336							6.8				
C cl tail		5.8		1.518							4.8				
C ro tail		56.7		2.870*							88.4				
Head (Assay)		100.0		1.843							100.0				
C ro conc		43.3		0.494							11.6				

OPERATION	BM	C-Ro	C-Ro	C Cl	C Cl							GRINDING PRODUCT	
TIME	10	3	4	2	3								
REAGENTS — LBS. PER TON												Head	
											MESH	%	%
											+10		
											+14		
Kerosene	0.4										+20		
MIBC		0.06	0.06		0.06						+28		
											+35		
											+48	0.9	
											+65		
											+100		
											+150		
MACHINE		1000		1000							+200		
R.P.M.		1000		1000							+325		
pH		7.2		7.5							−325	33.4	
% SOLIDS	50	25											
TEMPERATURE													
REMARKS													

* Calculated by difference

METALLURGICAL RESEARCH DEPT.

THE GALIGHER COMPANY

CABLE "GALGAL"

P. O. BOX 209 — 545-555 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 8-8-66
BY JX

TEST NO. 39 NAME Norges Geologiske

Same as test 37 except more collector in BM (0.6 ppt)

PRODUCT	Weight	Percent Weight	ASSAY Cu	DISTRIBUTION Cu
C cl conc		44.1	0.387	9.3
C cl tail		4.9	1.675	4.4
C ro tail		51.0	3.120*	86.3
Head (Assay)		100.0	1.843	100.0
C ro conc		49.0	0.516	13.7

OPERATION	BM	C-Ro	C-Ro	C Cl	C Cl
TIME	10	3	4	2	3
REAGENTS — LBS. PER TON					
Kerosene	0.6				
MIBC		0.06	0.06		0.06
MACHINE		1000		1000	
R.P.M.		1000		1000	
pH		7.2		7.5	
% SOLIDS	50	25			
TEMPERATURE					

GRINDING

MESH	PRODUCT Head %	%
+10		
+14		
+20		
+28		
+35		
+48	0.9	
+65		
+100		
+150		
+200		
+325		
−325	33.4	

REMARKS:

* Calculated by difference

METALLURGICAL RESEARCH DEPT.

CABLE "GALBAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 545-565 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 399-5781

OUR LOT NO. 1636-1
DATE 8-8-66
BY TX

TEST NO. 40 NAME Norges Geologiske

Same as test 34 except finer gind (20')

PRODUCT	Weight	Percent Weight	ASSAY Cu	DISTRIBUTION Cu
C cl conc		40.3	0.330	7.2
C cl tail		9.1	1.170	5.8
C ro tail		50.6	3.170*	87.0
Head (assay)		100.0	1.843	100.0
C ro conc		49.4	0.483	13.0

						GRINDING PRODUCT
CONDITION	BM	C-Ro	C-Ro	C Cl	C Cl	
TIME	20	3	4	2	3	
REAGENTS — LBS. PER TON						Head
						MESH % %
						+10
Kerosene	0.2					+14
MIBC		0.06	0.06		0.06	+20
						+28
						+35
						+48
						+65
						+100 5.2
						+150
MACHINE		1000		1000		+200
R.P.M.		1000		1000		+325
pH		7.2		7.5		−325 46.3
% SOLIDS	50	25				
TEMPERATURE						

REMARKS:

* Calculated by difference

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 545-565 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 328-0791

OUR LOT NO. 1636-1
DATE 8-9-66
BY JK

TEST NO. 41 NAME Norges Geologiske

Same as test 40 except less collector in RM (0.08 ppt).

PRODUCT	Weight	Percent Weight	ASSAY Cu	DISTRIBUTION Cu
Cal conc		30.8	0.280	4.7
Cal tail		10.0	0.869	4.7
Cro tail		59.2	2.820*	90.6
Head (assay)		100.0	1.843	100.0
Cro conc		40.8	0.424	0.4

OPERATION	RM	C-Ro	C-Ro	C-Cal	C-Cal
TIME	20	3	4	2	3
REAGENTS — LBS. PER TON					
Kerosene	0.08				
MIBC		0.06	0.06		0.06
LIME		1000		1000	
CaSH		1000		1000	
pH		7.2		7.5	
% SOLIDS	50	25			
TEMPERATURE					

MESH	PRODUCT Head
+10	
+14	
+20	
+28	
+35	
+48	
+65	
+100	5.2
+150	
+200	
-200	46.3

REMARKS:

Carbon cleaner sluggish.

* Calculated by difference

METALLURGICAL RESEARCH DEPT.

CABLE "GALCAL"

THE GALIGHER COMPANY

P. O. BOX 208 — 340-368 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 328-9731

OUR LOT NO. 1636-1
DATE 8-9-66
BY JX

TEST NO. 42 NAME Norges Geologiske

Same as test 40 except less collector in 2M (0.04 ppt).

PRODUCT	Weight	Percent Weight	ASSAY							DISTRIBUTION				
			Cu							Cu				
C cl conc		46.4	0.355							9.0				
C cl tail		6.1	1.997							6.6				
C ro tail		47.5	3.280*							84.4				
Head (Assay)		100.0	1.843							100.0				
C ro conc		52.5	0.547							15.6				

OPERATION		Bk	C-Ro	C-Ro	C-Cl	C-Cl								
TIME		20	3	4	2	3								
REAGENTS — LBS. PER TON														
Kerosene		0.06												
MIBC			0.06	0.06		0.06								
MACHINE			1000		1000									
R.P.M.			1000		1000									
pH			7.2		7.5									
% SOLIDS		50	25											
TEMPERATURE														
REMARKS														

SCREENS

PRODUCT		
	Head	
MESH	%	%
+10		
+14		
+20		
+28		
+35		
+48		
+65		
+100	5.2	
+150		
+200		
+325		
−325	46.3	

* Calculated by difference

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 545-585 WEST 5TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 9-23-66
BY TY

TEST NO. 43-1 NAME Norges Geologiske

Same as test 41 except C cleaned 4 times and Cu float this test.

PRODUCT	Weight	Percent Weight	ASSAY Cu							DISTRIBUTION Cu			
C cl conc #6-slime		16.6	0.270							2.1			
C cl conc #4-regr.		14.3	0.151	0.213						1.2	3.3		
C cl rail #4-slime		2.3	0.504							0.7			
C cl rail #4-regr		6.0	0.636							2.1			
C cl rail #3		1.5	0.568							0.4			
C cl rail #2		1.2	1.230							0.8			
C cl tail #1		2.4	2.270							2.9			
Sep cl conc		10.2											
Sep cl tail		1.0											
Sep ro tail		30.9	2.860							89.8			
Bulk Cl tail		4.3											
Bulk ro tail		21.4											
Head (assay)		100.0	1.843							100.0			

REAGENT	EM	C Ro	C Ro	Bulk Ro	Ro	Ro	Ro	Cl #1	Cl #1	Cl #1	Cl #1	MESH	PRODUCT Head %	%
Gm	20	3	4	2	1	2	2	2	3	2	1			
REAGENTS—LBS. PER TON														
												+10		
												+14		
Kerosene	0.09											+20		
MIBC		0.06	0.06		0.03	0.03	0.03		0.06	0.03	0.03	+28		
Z-6				0.1		0.05	0.05					+35		
												+48		
												+65		
												+100	5.2	
												+150		
MACHINE		1000						1000				+200		
R.P.M.		1000						1000				+325		
pH		7.2						7.2				-325	46.3	
% SOLIDS	50	25												
TEMPERATURE														

REMARKS:

Slime Cu film showing though entire Cu Ro float. C cl tail #4 deslimed, the sands being reground and floated (C cl #5) for additional C recovery, products from the cleaner being C cl conc #4 - regrind & C cl rail #4 - regrind

* Calculated by difference

METALLURGICAL RESEARCH DEPT.

CABLE "GALGAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 545-555 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 – U.S.A.

TELEPHONE 355-8731

OUR LOT NO. 1636-1
DATE 8-23-66
BY JX

TEST NO. 43-2 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				
				Cu							Cu				
C cl tail #4 - sand		20.3		0.295							3.3				
C cl tail #4		22.6		0.318							4.0				
C cl conc #3		37.0		0.300							6.1				
C cl conc #2		35.5		0.309							6.5				
C cl conc #1		39.7		0.338							7.3				
C ro conc		42.1		0.447							10.2				

OPERATION	C Cl #2	Cl #2	Cl #2	C Cl #3	Cl #3	Cl #3	C Cl #4	Bulk Cl	Sep Conc	Sep Ro	Aerate
TIME	4	3	1	5	3	1	3	9	5	4	7
REAGENTS — LBS. PER TON											
[illegible]EC		0.06	0.03		0.03	0.03					
Frother 65								0.01		0.05	
SO2									9.0		
MACHINE	1000			1000				1000	500		500
R.P.M.	1000			1000				1000	1000		1000
pH	7.2							7.3	2.5		5.3
% SOLIDS											
TEMPERATURE											

GRINDING PRODUCT

MESH	%	%
+10		
+14		
+20		
+28		
+35		
+48		
+65		
+100		
+150		
+200		
+325		
−325		

REMARKS:

All of the slime C floated in 3 minutes of the C cl #4 float. The coarse C remained in the tail which appears to be high in Cu value. The bulk cleaner float should be eliminated.

METALLURGICAL RESEARCH DEPT.

CABLE "GALGAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 545-585 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 – U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 8-23-66
BY JX

TEST NO. 43-3 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY							DISTRIBUTION				

OPERATION	Cond	Sep Cl	C cl tail #4 Sands Desl.	Regr*	Cl #5
TIME	5	6		10	4
REAGENTS — LBS. PER TON					
SO2	4.5				
Frother 65		0.05			
Kerosene					0.08
MACHINE	500				1000
R.P.M.	1000				1000
pH	2.2				
% SOLIDS					
TEMPERATURE					

GRINDING PRODUCT MESH	%	%
+10		
+14		
+20		
+28		
+35		
+48		
+65		
+100		
+150		
+200		
+325		
-325		

REMARKS:

Aeration conditioning provided no visual improvement as to pyrite depression in the sep cl float.

* with small balls

METALLURGICAL RESEARCH DEPT. CABLE "GALGAL"

THE GALIGHER COMPANY
P. O. BOX 209 — 545-585 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8781

OUR LOT NO. 1636-1
DATE 8-23-66
BY JX

TEST NO. 44-1 NAME Norges Geologiske

Same as test 42 except C cleaned 3 times. Also, Cu float this test.

PRODUCT	Weight	Percent Weight	ASSAY Cu			DISTRIBUTION Cu		
C cl conc #3		26.0	0.242			3.4		
C cl tail #3		8.5	0.308	0.258	0.298	1.4	4.8	5.8
C cl tail #2		1.7	1.140			1.0		
C cl tail #1		5.8	1.590			5.0		
Cu cl conc #2		2.2						
Cu cl tail #2		1.1	2.830*			89.2		
Cu cl tail #1		15.6						
Cu ro tail		39.1						
Head (assay)		100.0	1.863			100.0		
C ro conc		42.0	0.476			10.8		

OPERATION	RM	C-Ro	C-Ro	Cond	Cu Ro	Cu Ro	Cu Cl #1	Cu Cl #2	C Cl #1	C Cl #1	C Cl #2	GRINDING PRODUCT
TIME	20	3	4	10	4	3	2-4	2-3	2	3	3	
REAGENTS — LBS. PER TON												Head
											MESH	%
Lime				2.6			1.0	1.0			+10	
Kerosene	0.04										+14	
NITRC		0.06	0.06		0.05	0.03	0.03	0.03		0.06	+20	
NaCN				0.02			0.005	0.005			+28	
Z-3					0.2	0.05					+48	
											+65	
											+100	5.2
											+150	
MACHINE		1000					500	500	1000		+200	
R.P.M.		1000					1000	1000	1000		+325	
pH				11.0			11.1	10.9			-325	46.3
% SOLIDS	50	25										
TEMPERATURE												

REMARKS

C cleaners not pulled to the same end point as in test 43. 1st C Cl pulled exactly like C Cl of test 42. Compare Cu test with test 11.

* calculated by difference

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 548-585 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 8-23-66
BY JX

TEST NO. 44-2 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				

OPERATION	C	C	C	C							GRINDING PRODUCT	
	G1 #2	G1 #2	G1 #3	G1 #3								
TIME												
REAGENTS — LBS. PER TON												
											MESH	%
											+6	
											+10	
HERC	0.03	0.03		0.03							+20	
											+28	
											+35	
											+48	
											+65	
											+100	
											+150	
MACHINE			1000								+200	
R.P.M.			1000								+325	
pH											−325	
% SOLIDS												
TEMPERATURE												

REMARKS:

METALLURGICAL RESEARCH DEPT.

THE GALIGHER COMPANY

CABLE "GALGRE"

P. O. BOX 209 — 545-585 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 355-6751

OUR LOT NO. 1636-1
DATE 8-30-66
BY JK

TEST NO. 45-1 NAME Norges Geologiske

C-Ro float same as test 36, Cu Ro same as test 11

PRODUCT	Weight	Percent Weight	ASSAY							DISTRIBUTION				
C cl conc #2		23.5												
C cl tail #2		4.5												
C scav cl conc #1		11.2			Products not assayed									
C scav cl tail #1		7.8												
Cu cl conc #3		5.5												
Cu cl tail #3		7.2												
Cu cl tail #2		3.4												
Cu cl tail #1		2.2												
Cu scav conc		7.9												
Cu scav tail		26.8												
Head		100.0												

OPERATION	RM	C-Ro	C-Ro	Cond	Cu Ro	Cu Ro	Cu Ro Tail Desl.	Sand Regr.	Cond	Cu Scav ro	C Cl
TIME	5	3	4	10	6	2.5		5	10	3	3
REAGENTS — LBS. PER TON											
Kerosene	0.6										
MIBC		0.06	0.06		0.03	0.03				0.03	
Lime				2.2					2.0		
NaCN				0.02							
Z-6					0.1	0.05				0.05	
MACHINE		1000									
R.P.M.		1000									
pH		7.0		11.0					1000		1000
% SOLIDS	50	25							1000		1000
TEMPERATURE									10.9		7.4

SCREEN PRODUCT		
MESH	Head %	%
+10		
+14		
+20		
+28		
+35		
+48	9.2	
+65		
+100		
+150		
+200		
+325		
−325	27.3	

REMARKS: Cu ro tail - sand reground with 7,000 grams of large balls. Cu scav conc high in carbon and pyrite; however, a heavy streak of pyrite still visible in the Cu scav tail. The total C-Ro conc should be cleaned.

METALLURGICAL RESEARCH DEPT.

CABLE "GALBAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 545-580 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 539-8791

OUR LOT NO. 1636-J
DATE 8-30-66
BY JX

TEST NO. 45-2 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY										DISTRIBUTION				
C cl conc #1		28.0															
C cl tail #1		19.0															
C ro conc		47.0															
Comb C conc		34.7															
Cu cl conc #2		12.7															
Cu cl conc #1		16.1															
Cu ro conc		18.3															
Cu ro tail		34.7															
		C cl				C Cl											
		tail	+325			conc	+325	C	C	Cu						GRINDING	
OPERATION		Desl	Regr	C Scav	C Scav	Desl	Regr	Cl #2	Cl #2	Cl #1	Cl #2	Conc				PRODUCT	
TIME			5	3	1		10	4	3	2-5	2-5	10					
REAGENTS — LBS. PER TON																	
Lime										1.0	1.0		MESH	%	%		
MIBC				0.03	0.03			0.03	0.03	0.03	0.03		+10				
NaCN											0.01		+14				
SO2												3.5	+20				
													+28				
													+35				
													+48				
													+65				
													+100				
													+150				
MACHINE				1000				1000		500	500		+200				
R.P.M.				1000				1000		1000	1000		+325				
pH				11.0						11.2	11.1	2.9-4.0	-325				
% SOLIDS																	
TEMPERATURE																	

REMARKS:

Cu Ro tail--sand reground with small balls. Sulfides floating at end of C scav float--regrind not fine enough.

METALLURGICAL RESEARCH DEPT.

CABLE "GALGAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 545-555 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 8-30-66
BY JX

TEST NO. 45-3 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				

	Gr
OPERATION	Gl. #3
TIME	5
REAGENTS — LBS. PER TON	
MIBC	
SO2	
MACHINE	500
R.P.M.	1000
pH	
% SOLIDS	
TEMPERATURE	

GRINDING PRODUCT

MESH	%	%
+[illegible]		
+[illegible]		
+[illegible]		
+[illegible]		
+[illegible]		
+[illegible]		
+[illegible]		
+100		
+[illegible]		
+[illegible]		
+325		
-[illegible]		

REMARKS:

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 345-333 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-3731

OUR LOT NO. 1636-1
DATE 8-31-66
BY JX

TEST NO. 46-1 NAME Norges Geologiske

Similar to test 45 except simplified C procedure and different Cu Cl procedure

PRODUCT	Weight	Percent Weight	ASSAY Cu	DISTRIBUTION Cu
Cu cl conc #2		35.9	0.207	4.2
Cu cl tail #2		2.0	1.000	1.1
Cu cl tail #1		9.2	1.270	6.6
Cu cl conc #2		9.0	14.640	74.7
Cu cl tail #2		3.0	1.470	2.5
Cu cl tail #1		3.3	0.415	0.8
Cu scav conc		8.6	1.520	7.4
Cu scav tail		29.0	0.166	2.7
Head (Calc)		100.0	1.766	100.0

OPERATION	Mill	C-Ro	C-Ro	Cond	Cu Ro	Cu Ro	Cu Ro Tail Desl.	+325 Regr.	Cond	Cu Scav Ro	Grinding Product		
TIME	5	3	3	10	4.0	2.5	0-325	5	3	3		Head	
REAGENTS — LBS. PER TON											MESH	%	%
											+10		
											+14		
Kerosene	0.5										+20		
MIBC		0.06	0.06		0.03	0.03				0.03	+28		
[illegible]				2.2					2.0		+35		
NaCN				0.02							+48		
Z-6					0.1	0.05				0.01	+65	9.2	
Powell's acc'l										0.05	+87		
											+100		
											+150		
MACHINE		1000							1000		+200		
R.P.M.		1000							1000		+325		
pH		6.7		11.1					11.0		−325	27.3	
% SOLIDS	50	25											
TEMPERATURE													

REMARKS: C-Ro conc screened over 200 mesh +200 reground for 15' with small balls. Cu rougher tail desliimed, sands reground and combined with slimes for scavenger.

METALLURGICAL RESEARCH DEPT.

CABLE "GALGAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 545-555 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 8-31-66
BY JX

TEST NO. 46-2 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				
				Cu							Cu				
C cl conc #1		37.9		0.248							5.3				
C ro conc		47.1		0.448							11.9				
Cu cl conc #1		12.0		11.350							77.2				
Cu ro conc		15.3		8.990							78.0				
Comb Cu ro & assay conc		23.9		6.300							85.4				
Cu ro tail		37.6		0.476							10.1				

	C-Ro Con Anal	+200	C						Cu		
OPERATION	0-200	Regr	Cl #1	Cl #1	Cl #1	Cl #2	Cl #2	Cl #2	Cl #1	Cl #1	
TIME		15	3	1	1.5	4	2.5	1	3-1.5	4	
REAGENTS — LBS. PER TON											
HTBC			0.03	0.03	0.03		0.03	0.03			
SO2									3.5		
Powell's Accel										0.05	
MACHINE			1000			1000			500		
R.P.M.			1000			1000			1000		
pH			8.1						2.8		
% SOLIDS											
TEMPERATURE											

GRINDING PRODUCT		
MESH	%	%
+10		
+14		
+20		
+28		
+35		
+48		
+65		
+100		
+150		
+200		
+325		
−325		

REMARKS:

METALLURGICAL RESEARCH DEPT.

CABLE "GALBAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 645-655 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 355-5731

OUR LOT NO. 1636-1
DATE 8-31-66
BY JK

TEST NO. 46-3 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				

OPERATION	Cond	Cu cl #2										CUMULATIVE PRODUCT	
TIME	%	%											
REAGENTS—LBS. PER TON													
												TEST	%
												+10	
												+14	
NaCN		0.03										+20	
SO2	3.3											+28	
												+35	
												+48	
												+65	
												+100	
												+150	
MACHINE	500											+200	
R.P.M.	1000											+325	
pH	2.5	2.8										−325	
% SOLIDS													
DISCHARGE													

REMARKS:

The Cu cl #2 float did not come to an end point, may be a middling problem.

METALLURGICAL RESEARCH DEPT.

CABLE "GALGAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 645-655 WEST 2nd SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-5731

OUR LOT NO. 1636-1
DATE 9-1-66
BY JX

TEST NO. 47-1 NAME Norges Geologiske

Same as test 46 except finer grind, less kerosene in BM, no C or Cu scav floats.

PRODUCT	Weight	Percent Weight	ASSAY Cu	DISTRIBUTION Cu
C cl conc #2		34.6	0.217	4.1
C cl tail #2		8.8	0.896	1.4
C cl tail #1		9.2	1.240	6.3
Cu cl conc #2		6.3	22.670	78.6
Cu cl tail #2		9.0	1.050	5.2
Cu cl tail #1		9.1	0.233	1.2
Cu co tail		28.9	0.204	3.2
Head (Calc)		100.0	1.820	100.0

OPERATION	BM	C-Ro	C-Ro	Cond	Cu Ro	Cu Ro	C-Ro conc Desl. 0-200	C-Ro conc Desl. +200 reg *	Cu Cl #1	Cu Cl #2
TIME	20	3	3	10	4	2.5		15	3-5	3-7
REAGENTS — LBS. PER TON										
Kerosene	0.08									
MIBC		0.06	0.05		0.03	0.03			0.03	0.03
Lime				2.6						
NaCN				0.02						
Z-6					0.1	0.05				
302									3.5	3.5
MACHINE		1000							500	500
R.P.M.		1000							1000	1000
pH		7.2		11.0					3.0	2.5
% SOLIDS	50	25								
TEMPERATURE										

SIEVE	PRODUCT Head %	%
+10		
+14		
+20		
+35		
+48		
+65		
+100		5.2
+150		
+200		
+325		
−325		46.3

The coarse C comes at the end of the C-Ro. C-Ro pulled hard towards the end of float this test.

* with small balls

METALLURGICAL RESEARCH DEPT.

CABLE "GALIGHER"

THE GALIGHER COMPANY

P. O. BOX 300 — 349-353 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8721

OUR LOT NO. 1636-1
DATE 9-1-66
BY IX

TEST NO. 47-2 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY						DISTRIBUTION				
			Cu						Cu				
C cl. conc #3		37.5	0.269						5.5				
C re-conc		46.7	0.460						11.8				
Cu cl. conc #1		15.3	9.950						83.8				
Cu re-conc		26.4	6.330						85.0				

OPERATION	C	C	C	C	C	C	GRINDING PRODUCT		
	Cl #1	Cl #1	Cl #1	Cl #2	Cl #2	Cl #2			
TIME	4	2	2	4	2	2			
REAGENTS — LBS. PER TON							MESH	%	%
							+10		
MIBC	0.03	0.03	0.03		0.03	0.03	+14		
							+20		
							+28		
							+35		
							+48		
							+65		
							+100		
							+150		
MACHINE	1000			1000			+200		
R.P.M.	1000			1000			+325		
pH							-325		
% SOLIDS									
TEMPERATURE									

REMARKS

METALLURGICAL RESEARCH DEPT.

CABLE "GALREAL"

THE GALIGHER COMPANY

P. O. BOX 205 — 540-568 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8791

OUR LOT NO. 1636-1
DATE 9-7-66
BY JX

TEST NO. 48-1 NAME Norges Geologiske

Same as test 47 except Z-200 in place of Z-6, kerosene in the C cleaners.

PRODUCT	Weight	Percent Weight	ASSAY Cu	DISTRIBUTION Cu
C cl conc #2		30.7	0.229	3.8
C cl tail #2		1.8		
C cl tail #1		8.5		
Cu cl conc #2		5.9	23.330	74.6
Cu cl tail #2		1.6		
Cu cl tail #1		12.7		
Cu ro tail		38.8	0.296	6.2
Head - Assay		100.0	1.843	
Cu ro conc		20.2		

OPERATION	RM	C-Ro	C-Ro	Cond	Cu Ro	Cu Ro	Cu Cl #1	Cu Cl #1	Cu Cl #2	C-Ro conc Reslimed	+200 Regrind
TIME	20	3	3	10	4.0	2.5	3-5	1	1-4	0-200	15
REAGENTS—LBS. PER TON											
Kerosene	0.08										
MIBC		0.06	0.06								
Lime				2.6							
NaCN				0.02							
Z-200					0.08	0.04		0.002	0.04		
SO2							3.5		3.5		
MACHINE		1000					500		500		
CFSM		1000					1000		1000		
pH		7.2		10.9			3.1		2.8		
% SOLIDS	50	25									
TEMPERATURE											

GRINDING

PRODUCT	Head		
MESH	%	%	
+10			
+14			
+20			
+28			
+35			
+48			
+65			
+100	5.2		
+150			
+200			
+325			
-325	46.3		

REMARKS:

Coarse C dropped out in the Cu Cl #1, maybe locked copper--try regrind on this product.

* with small balls

METALLURGICAL RESEARCH DEPT.

CABLE "GALGAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 345-355 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 355-6791

OUR LOT NO. 1636-1
DATE 9-7-66
BY JX

TEST NO. 48-2 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				

OPERATION	C	C	C	C	C	C						DISTRIBUTION	
	Cond	Cl #1	Cl #1	Cond	Cl #2	Cl #2						PRODUCT	
TIME	2	3	2	2	5	1							
REAGENTS — LBS. PER TON													
												MESH	%	%
												+10		
												+14		
												+20		
Kerosene	0.08			0.04								+28		
MIBC		0.03	0.03		0.03	0.03						+35		
												+48		
												+65		
												+100		
												+150		
MACHINE	1000			1000								+200		
R.P.M.	1000			1000								+325		
pH	7.5											-325		
% SOLIDS														
TEMPERATURE														

REMARKS

Leave the kerosene out of the C Cl #2.

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 308 — 545-565 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 363-8781

OUR LOT NO. 1636-1
DATE 9-13-66
BY JX

TEST NO. 49-1 NAME Norges Geologiske

Same as test 20 except Cu Ro cleaned, C-Ro deslimed, coarse C reground & cleaned.

PRODUCT	Weight	Percent Weight	ASSAY									DISTRIBUTION				
C cl conc #2		35.4														
C cl tail #2		2.3			Products not assayed											
C cl tail #1		9.2														
Cu cl conc #2		8.1														
Cu cl tail #2		1.3														
Cu cl tail #1		4.9														
Cu ro tail		38.8														
Head		100.0														
												C-Ro				

OPERATION	Rd	C-Ro	C-Ro	Cond	Cu Ro	Cu Ro	Cu Cl #1	Cu Cl #2	Cu Cl #2	conc 0-200
TIME	20	3	4	10	5	1 - 4	1 - 7	1 - 6	1	
REAGENTS — LBS. PER TON										
Kerosene	0.20									
MIBC		0.04	0.06							
Lime				3.4			1.0	1.0		
Z-200				0.04		0.04			0.001	
NaCN				0.02						
MACHINE		1000					500	500		
R.P.M.		1000					1000	1000		
pH		7.0		11.0			11.1	11.0		
% SOLIDS	50	25								
TEMPERATURE										

GRIND: C PRODUCT

MESH	Head %	%
+10		
+14		
+20		
+28		
+35		
+48		
+65		
+100	5.2	
+150		
+200		
+325		
−325	46.3	

REMARKS:

Sulfides dropped out in the Cu cl tail #1 but not much C dropped out. C & Cu floating in the last minute of the Cu cl #2 float.

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 345-355 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH, 84110 — U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 9-13-66
BY JX

TEST NO. 49-2 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY									DISTRIBUTION				
OPERATION		Sands	C	C	C	C	C							GRIND TO PRODUCT		
USE		Reg	C1 #1	C1 #1	C1 #2	C1 #2	C1 #2									
REAGENTS — LBS. PER TON		15	2-3	3	2	2	1									
														MESH	%	%
														+10		
														+14		
Kerosene			0.08											+20		
MIBC			0.03	0.03		0.03	0.03							+28		
														+35		
														+48		
														+65		
														+100		
														+150		
MACHINE			1000		1000									+200		
R.P.M.			1000		1000									+325		
pH														−325		
% SOLIDS																
TEMPERATURE																

REMARKS:

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 545-535 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 328-8731

OUR LOT NO. 1636-1
DATE 9-14-66
BY JX

TEST NO. 50-1 NAME Norges Geologiske

Same as test 49 except longer C-Ro float.

PRODUCT	Weight	Percent Weight	ASSAY Cu	DISTRIBUTION Cu
C-cl conc #2		39.5	0.255	5.4
C-cl tail #2		2.7	1.300	1.9
C-cl tail #1		10.8	1.820	10.6
Cu cl conc #2		4.8	25.400	65.7
Cu cl tail #2		0.9	1.630	.8
Cu cl tail #1		1.4	1.940	1.5
Cu ro tail		39.9	0.655	14.1
Head (Calc)		100.0	1.860	100.0
Cu ro conc		7.1	17.800	68.0

OPERATION	RM	C-Ro	C-Ro	C-Ro	C-Ro	Cond	Cu Ro	Cu Ro	Cu Cl #1	Cu Cl #2	Cu Cl #2	GRINDING PRODUCT
TIME	20	3	4	2	1	10	5	1 - 4	1 - 5	1 - 5	1	
REAGENTS — LBS. PER TON												Head
												MESH % %
												-+10
Kerosene	0.20											-+14
MIBC		0.06	0.06	0.06	0.03							-+20
Lime						4.0			1.0	1.2		-+28
NaCN						0.02						-+35
Z-200						0.04		0.04				-+48
Z-6											0.001	-+65
												-+100 5.2
												-+150
MACHINE		1000							500	500		-+200
R.P.M.		1000							1000	1000		-+325
pH		6.9				11.0			11.0	10.9		--325 46.3
% SOLIDS	50	25										
TEMPERATURE												

REMARKS:

The addition of Z-6 at the end of the Cu Cl #2 float floated Cu but not G

METALLURGICAL RESEARCH DEPT. *

CABLE "GALMAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 345-365 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8781

OUR LOT NO. 1636-1
DATE 9-14-66
BY IT

TEST NO. 50-2 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				
		C-Ro													
		Code	Bands	C	C	C	C	C	C					GRINDING	
ORIENTATION		0-200	Reg	Cl #1	Cl #1	Cl #1	Cl #2	Cl #2	Cl #2					PRODUCT	
TIME			15	3	2	1	4	1.5	1						
REAGENTS — LBS. PER TON														MESH	%
														+10	
														+14	
														+20	
MIBC				0.03	0.03	0.03	0.03	0.03	0.03					+28	
														+35	
														+48	
														+65	
														+100	
														+150	
MACHINE				1000										+200	
R.P.M.				1000										+325	
pH														-325	
% SOLIDS															
TEMPERATURE															

REMARKS:

METALLURGICAL RESEARCH DEPT.

CABLE "GALGAL"

THE GALIGHER COMPANY
P. O. BOX 209 — 540-585 WEST 5TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-6751

OUR LOT NO. 1636-1
DATE 10-3-66
BY JX

TEST NO. 51-1 NAME Norges Geologiske

Repeat on Test 50-1

PRODUCT	Weight	Percent Weight	ASSAY Per Cent Cu	OxCu						DISTRIBUTION Per Cent Cu				
C cl conc #2		39.9												
C cl tail #2		2.6												
C cl tail #1		12.4												
Cu cl conc #2		5.7	22.87							71.4				
Cu cl tail #2		0.3												
Cu cl tail #1		1.3												
Scav conc		2.9	2.29							3.7				
Ro tail - Slimes		7.3	0.538	0.075						2.1				
Scav tail - Sands		27.6	0.226	0.044						3.4				
Heads - Assay		100.0	1.846											
Ro tails		37.8	0.444							10.2				
Slimes & sands comb.		34.2	0.289							6.5				

OPERATION	Carbon Float					Copper			Sand	GRINDING PRODUCT
	RM	Ro	Ro	Ro	Ro	Cond	Ro	Ro	Deslime scav	
TIME	20	3	4	2	1	10	5	4	2	Heads
REAGENTS — LBS. PER TON										
Kerosene	0.20									
NIBC		0.06	0.06	0.06	0.03					
Lime						4.0				
NaCN						0.02				
Z-200						0.04	0.04	0.04		
Reco										
									0.05	
MACHINE		1000							500	
R.P.M.		1000							1000	
pH		6.9				11.1				
% SOLIDS		25								
TEMPERATURE										

MESH	%	%
+10		
+14		
+20		
+28		
+35		
+48		
+65		
+100	5.2	
+150		
+200		
+325		
-325	46.3	

REMARKS:

Some carbon in copper float. Copper float tails decanted over 325 mesh screen. Sands floated for copper scavenger.

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 645-685 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 – U.S.A.

TELEPHONE 359-8791

OUR LOT NO. 1636-1
DATE 10-3-66
BY WJB

TEST NO. 31-2 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				

OPERATION	Carbon conc Deslime	BM	Cl #1	Cl #1	Cl #2	Cl #2			Copper cleaners Cl #1	Cl #2	GRINDING PRODUCT		
TIME		15	5	3 2	5	2			1 4	1 4			
REAGENTS – LBS. PER TON											MESH	%	%
Lime									1.0	1.0	+10		
Z-6									0.01		+14		
MIBC				.03-.03		.03-.03					+20		
NaCN			0.1		0.1						+28		
											+35		
											+48		
											+65		
											+100		
Balls - small		7000									+150		
MACHINE			1000						500	500	+200		
G.P.M.			1000						1000	1000	+325		
pH									11.1	11.0	−325		
% SOLIDS													
TEMPERATURE													

REMARKS:

Carbon conc deslimed on 325 mesh - sand reground

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 508 — 645-655 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 355-0781

OUR LOT NO. 1636-1
DATE 10-19-66
BY JX

TEST NO. 52-1 NAME Norges Geologiske

Same as test 50 except more collector in Cu Ro float and C-Cl tails 1 & 2 circulated back to head of Cu Ro float.

PRODUCT	Weight	Percent Weight	ASSAY									DISTRIBUTION				
C-Cl conc #2		40.5														
Cu cl conc #2		9.3	Products not assayed													
Cu cl tail #2		0.7														
Cu cl tail #1		4.9														
Cu scav conc		3.9														
Cu scav tail		40.7														
Head		100.0														

OPERATION		FM	C-Ro	C-Ro	C-Ro	C-Ro	C-Ro conc	Sands Reg	C Cl #1	Cl #1	Cl #1		GRINDING PRODUCT	
TIME		20	3	4	2	1	0-200	15	3	2	1			
REAGENTS — LBS. PER TON													Head	
												MESH	%	%
												+10		
Kerosene		0.20										+14		
MIBC			0.06	0.06	0.06	0.03			0.03	0.03	0.03	+28		
												+28		
												+35		
												+48		
												+65		
												+100	5.2	
MACHINE			1000						1000			+150		
R.P.M.			1000						1000			+200		
pH			7.0						7.9			+325		
% SOLIDS		50	25									−325	46.3	
TEMPERATURE														

REMARKS:

C conc sand reground with 7,000 gms small balls. Too much weight in the Cu Cl conc #2.

METALLURGICAL RESEARCH DEPT.

CABLE "CALGAL"

THE CALIGHER COMPANY

P. O. BOX 809 — 545-565 WEST 5TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 10-19-66
BY JX

TEST NO. 52-2 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				

OPERATION	C Cl #2	C Cl #2	C Cl #2	Cu Cond	Cu Ro	Cu Ro	Cu Scav	Cu Cl #1	Cu Cl #2	Cu Cl #2		GRINDING PRODUCT	
TIME	4	1.5	1	10	5	1 - 4	1 - 5	1 - 5	1 - 5	5			
REAGENTS — LBS. PER TON													
											MESH	%	%
											+10		
MIBC	0.03	0.03	0.03							0.006	+14		
Lime				4.0				1.0	1.2		+20		
NaCN				0.02							+28		
Z-200				0.08		0.04	0.04				+35		
Z-6										0.010	+48		
											+65		
											+100		
											+150		
MACHINE				1000				500	500		+200		
R.P.M.				1000				1000	1000		+325		
pH				11.0				11.2	11.0		-325		
% SOLIDS													
TEMPERATURE													

REMARKS: C Cl tails 1 & 2 filtered and circulated to the head of Cu Ro from this test forward.

METALLURGICAL RESEARCH DEPT.

CABLE "GALSALT"

THE GALIGHER COMPANY

P. O. BOX 209 — 540-565 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 355-5791

OUR LOT NO. 1636-1
DATE 10-21-66
BY JX

TEST NO. 53-1 NAME Norges Geologiske

Same as test 52 except C-Ro and cleaners pulled harder and C cleaned one more time. Shorter Cu cleaner #2 float.

PRODUCT	Weight	Recalc Weight	ASSAY Cu	DISTRIBUTION Cu
C cl conc #3		42.8	0.280	6.5
Cu cl conc #2		5.2	23.420	66.4
Cu cl tail #2		3.2	9.910	17.3
Cu cl tail #1		1.8	3.030	3.0
Cu scav conc		4.0	0.844	1.9
Cu scav tail		43.0	0.207	4.9
Head		100.0	1.830	100.0
Cu cl conc #1		8.4	18.300	83.7
Cu ro conc		10.2	15.600	86.2
Comb ro & scav conc		14.2	11.400	88.7

OPERATION	BM	C-Ro	C-Ro	C-Ro	C-Ro	C-Ro conc 0-200	Sands reg	C Cl #1	Cl #1	Cl #1
TIME	20	3	3	2	2		15	3	2	3
REAGENTS—LBS. PER TON										
Kerosene	0.20									
MIBC		0.06	0.06	0.06	0.06			0.03	0.03	0.03
MACHINE		1000						1000		
R.P.M.		1000						1000		
pH		7.3						7.9		
% SOLIDS	50	25								
TEMPERATURE										

REMARKS:

GRINDING PRODUCT		
	Head	
MESH	%	%
+10		
+14		
+20		
+28		
+35		
+48		
+65		
+100	5.2	
+150		
+200		
+325		
−325	46.3	

METALLURGICAL RESEARCH DEPT.

CABLE "GALREAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 645-655 WEST 5TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 532-0721

OUR LOT NO. 1636-1
DATE 10-21-66
BY JX

TEST NO. 53-2 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY									DISTRIBUTION				

OPERATION	C Cl #2	Cl #2	Cl #2	C Cl #3	Cl #3	Cl #3	Cond	Cu Ro	Cu Ro	Scav		GRINDING PRODUCT	
TIME	4	2	1	4	2	1.5	10	5	1-4	1-5		Cu Ro Conc	
REAGENTS — LBS. PER TON											MESH	%	%
											-1-10		
MIBC	0.03	0.03	0.03	0.03	0.03	0.03					-1-14		
Lime							4.0				-1-20		
Z-6							0.02				-1-28		
Z-200							0.08		0.04	0.04	-1-35		
											-1-48		
											-1-65		
											-1-100		
											-1-150		
MACHINE	1000			1000			1000				-1-200	17.2	
G.P.M.	1000			1000			1000				-1-325	18.0	
pH	7.8			7.9			11.0				-325	64.8	
% SOLIDS													
TEMPERATURE													

REMARKS

METALLURGICAL RESEARCH DEPT.

CABLE "CALSAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 645-685 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 355-8731

OUR LOT NO. 1636-1
DATE 10-21-66
BY JX

TEST NO. 53-3 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				

OPERATION	Cu Cl #1	Cu Cl #2	Cu Cl #2								GRINDING PRODUCT		
TIME													
REAGENTS — LBS. PER TON													
											MESH	%	%
											-10		
											-14		
Lime	1.0	1.2									-20		
Z-11			0.002								-28		
											-35		
											-48		
											-65		
											-100		
											-150		
MACHINE	500	500									-200		
R.P.M.	1000	1000									-325		
pH	11.1	11.0									-325		
% SOLIDS													
TEMPERATURE													

REMARKS:

METALLURGICAL RESEARCH DEPT.

CABLE "GALIGHER"

THE GALIGHER COMPANY

P. O. BOX 209 — 540-105 WEST 6th SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 10-24-66
BY JX

TEST NO. 54-1 NAME Norges Geologiske

Same as test 53 except kerosene staged in the C-Ro. No Cu Scav float this test.

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				
C cl conc #3		43.1													
Cu cl conc #2		4.5													
Cu cl tail #2		4.7	Products not assayed												
Cu cl tail #1		3.0													
Cu ro tail		45.7													
Head		100.0													
Cu cl conc #1		8.7													
Cu ro conc		11.7													

OPERATION	RM	C-Ro	C-Ro	Cond	C-Ro	Cond	C-Ro	C-Ro conc thick	Sands reg	C Cl #1	C Cl #2	GRINDING PRODUCT
TIME	20	3	3	2	2	2	1	0-200	15	4	1	
REAGENTS — LBS. PER TON												Head
												MESH % %
												+10
Kerosene	0.20			0.08		0.08						+14
MIBC		0.06	0.06	0.06		0.06				0.03	0.03	+20
												+28
												+35
												+48
												+65
												+100 5.2
												+150
MACHINE		1000								1000		+200
R.P.M.		1000								1000		+325
pH		7.3								8.1		-325 46.3
% SOLIDS	50	25										
TEMPERATURE												

REMARKS

Kerosene in the C float didn't seem to provide for a faster float of the C in the cleaners.

METALLURGICAL RESEARCH DEPT.

CABLE "GALGAL"

THE GALIGHER COMPANY

P. O. BOX 300 — 340-355 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 355-0791

OUR LOT NO. 1636-1
DATE 10-24-66
BY JY

TEST NO. 54-2 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				

OPERATION	C	C	C	C	C	C	C	C	C	C	C	GRINDING PRODUCT		
TIME	Cl #1	Cl #1	Cl #2	Cl #2	Cl #2	Cl #2	Cl #3	Cl #3	Cl #3	Cl #3	Cl #3			
REAGENTS — LBS. PER TON	2	2	3	2	2	2	4	2	2	2.5	0.5			
												MESH	%	%
MIBC	0.03	0.03		0.03	0.03	0.03		0.03	0.03	0.03	0.03	+10		
												+14		
												+20		
												+28		
												+35		
												+48		
												+65		
												+100		
												+150		
MACHINE			1000				1000					+200		
TOTAL			1000				1000					+325		
pH			7.7									−325		
% SOLIDS														
TEMPERATURE														
REMARKS														

METALLURGICAL RESEARCH DEPT.

CABLE "GALGAL"

THE GALIGHER COMPANY
P. O. BOX 209 — 545-555 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 10-24-66
BY JX

TEST NO. 54-3 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				

OPERATION	Cond	Cu Ro	Cu Ro	Cu Cl #1	Cu Cl #2	Cu Cl #2					
TIME	10	5	1 - 4	1 - 5	1 - 5	1					
REAGENTS — LBS. PER TON											
Lime	4.0			1.0	1.2						
NaCN	0.02										
Z-200	0.08		0.04			0.002					
Z-11											
MACHINE	1000			500	500						
R.P.M.	1000			1000	1000						
pH	11.0			11.0	11.0						
% SOLIDS											
TEMPERATURE											

GRINDING PRODUCT

MESH	%	%
+10		
+14		
+20		
+28		
+35		
+48		
+65		
+100		
+150		
+200		
+325		
-325		

REMARKS:

METALLURGICAL RESEARCH DEPT.

CABLE: "GALIGHER"

THE GALIGHER COMPANY

P. O. BOX 502 — 840-848 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 – U.S.A.

TELEPHONE 328-8731

OUR LOT NO. 1636-1
DATE 10-28-66
BY JX

TEST NO 55 NAME Norges Geologiske

500 gram composite of products from test 54 for a magnetic separation test.

PRODUCT	Weight	Percent Weight	ASSAY							DISTRIBUTION				
				Ni										
Cl conc #3		4.4		0.40										
Comb ro & cl tails		95.6		0.05										
Head		100.0												

OPERATION		Mag So	Mag Cl #1	Mag Cl #2	Mag Cl #3									
RPM														
REAGENTS — LBS. PER TON														
MACHINE		500												
R.P.M.		1000												
pH														
% SOLIDS														
TEMPERATURE														

SCREENING			
		PRODUCT	
MESH		%	%
+10			
+14			
+20			
+28			
+35			
+48			
+65			
+100			
+150			
+200			
+325			
−325			

REMARKS:

METALLURGICAL RESEARCH DEPT. CABLE "GALGAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 545-585 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 – U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 11-1-66
BY JX

TEST NO. 56-1 NAME Norges Geologiske

Similar to test 53 except Cu Ro and Cu scav concentrates combined and reground before cleaning.

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				
				Cu							Cu				
C cl conc #3		39.1													
Cu cl conc #4		6.8		22.23							82.2				
Cu cl tail #4		0.6													
Cu cl tail #3		1.4													
Cu cl tail #2		3.5													
Cu cl tail #1		6.8													
Magnetic conc		0.3													
Cu ro tail		41.5													
Head (assay)		100.0		1.84											

OPERATION	BM	C-Ro	C-Ro	C-Ro	C-Ro	C-Ro conc thick	Ro conc reg	C Cl #1	Cl #1	Cl #1	Cl #1		GRINDING PRODUCT	
TIME	20	3	3	2	2		5	3	2	3	1			
REAGENTS — LBS. PER TON													Head	
												MESH	%	%
												+10		
Kerosene	0.20											+14		
HIBC		0.06	0.06	0.06	0.06			0.03	0.03	0.03	0.03	+20		
Lime												+28		
NaCN												+35		
Z-200												+48		
Z-6												+65		
												+100	5.2	
												+150		
MACHINE		1000						1000				+200		
R.P.M.		1000						1000				+270		
pH		7.2						8.1				−325	86.3	
% SOLIDS	50	25												
TEMPERATURE														

REMARKS:

C regrind with 7000 grams of small balls. Cu regrind with 5000 grams of small balls.

METALLURGICAL RESEARCH DEPT.

CABLE "GALIGHER"

THE GALIGHER COMPANY

P. O. BOX 300 — 340-360 WEST 6th SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8791

OUR LOT NO. 1636-1
DATE 1-11-66
BY JX

TEST NO. 56-2 NAME Norges Geologiske

PRODUCT	Weight	Assay									Distribution				
Cu cl conc #3		7.4													
Cu cl conc #2		8.2													
Cu cl conc #1		11.7													
Cu ro conc		18.5													

OPERATION	C Cl #2	Cl #2	Cl #2	C Cl #3	Cl #3	Cl #3	Cond	Cu Ro	Ro	Ro			Grinding Product	
Mat	4	2	1	4	2	1.5	10	5	1 - 5	1 - 4				
Reagents — Lbs. per ton											Mesh	%	%	
											+48			
											+65			
MIBC	0.03	0.03	0.03	0.03	0.03	0.03					+100			
Lime							4.0				+150			
NaCN							0.02				+200			
Z-200							0.08		0.04	0.04	+270			
											-270			
											+400			
											-400			
Machine	1000			1000			1000							
R.P.M.	1000			1000			1000							
pH	7.8			7.9			11.0							
% Solids														
Temperature														

Remarks:

METALLURGICAL RESEARCH DEPT.

CABLE "GALBALT"

THE GALIGHER COMPANY

P. O. BOX 209 — 545-555 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 11-1-66
BY JX

TEST NO. 56-3 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	Assay								Distribution				

Operation	Cu Ro conc thick	Cu conc reg	cond	Cu Cl #1	Cl #2	Cl #3	Cl #4	Cl #4	Cl conc #4 mag cleaner	
Time		5	2	5	1 - 5	1 - 5	1 - 5	2		
Reagents -- Lbs. per ton										
Lime		2.0	1.5		1.2	1.2	3.0			
Z-200		0.08				0.03	0.03			
MIBC								0.002		
Z-11										
Machine			1000		500	500	500			
R.P.M.			1000		1000	1000	1000			
pH			9.7-11.0		11.0	11.0	12.2			
% Solids										
Temperature										

Grinding

Mesh	Product: Cu Conc Regr. %	%
+10		
+14		
+20		
+28		
+35		
+48		
+65		
+100		
+150		
+200		
+325	2.6	
-325	97.4	

Remarks:

Cu Cl #1 pulled quite hard. Cu Cl tail #1 high in pyrite and pyrrhotite.

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 100 — 345-355 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 11-7-66
BY JX

TEST NO. 57-1 NAME Norges Geologiske

Same as Test 56 except longer C-Ro conc and Cu-Ro conc regrinds.

PRODUCT	Weight	Assay Cu	Distribution Cu
C cl conc#3	42.7	0.201	4.7
Cu cl conc #3	6.3	24.330	84.6
Cu cl tail #3	1.4	3.720	2.9
Cu cl tail #2	2.1	1.549	1.8
Cu cl tail #1	6.0	0.510	1.7
Cu ro tail	41.5	0.185	4.3
Head (Calc)	100.0	1.181	100.0

OPERATION	Mi	C-Ro	C-Ro	C-Ro	C-Ro	C-Ro conc thick	Mo conc reg	Cl #1	Cl #1	Cl #1	Cl #1	GRINDING PRODUCT
Use	20	3	3	2	2		10	3	3	2	1	
REAGENTS — LBS. PER TON												Head
												MESH % %
												+10
												-10
Kerosene	0.20											+20
MIBC		0.06	0.06	0.06	0.06			0.03	0.03	0.03	0.03	-20
												+35
												+48
												+65
												+100 5.2
												+150
MACHINE		1000										+200
R.P.M.		1000										+400
pH		7.0										-325 46.3
% SOLIDS	50	25										
TEMPERATURE												

REMARKS

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 345-355 WEST 3rd SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 11-7-66
BY JX

TEST NO. 57-2 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				
				Cu							Cu				
Cu-cl conc #2		7.7		20.6							87.5				
Cu-cl conc #1		9.8		16.5							89.3				
Cu-ro conc		15.8		10.4							91.0				

OPERATION	C Cl #2	Cl #2	Cl #2	C Cl #3	Cl #3	Cl #3	Cond	Cu Ro	Ro	Ro		GRINDING PRODUCT	
TIME	4	2	1	4	2	1.5	10	5	1-5	1-4			
REAGENTS — LBS. PER TON											MESH	%	%
											+10		
NaSC	0.03	0.03	0.03	0.03	0.03	0.03					+14		
Z-Line							4.0				+20		
NaCN							0.02				+28		
Z-200							0.08		0.04	0.04	+35		
											+48		
											+65		
											+100		
											+150		
MACHINE	1000			1000			1000				+200		
R.P.M.	1000			1000			1000				+325		
pH	7.5			8.0			11.0				-325		
% SOLIDS													
TEMPERATURE													
REMARKS													

METALLURGICAL RESEARCH DEPT.

CABLE "GALGAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 545-585 WEST 8TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 11-7-66
BY JE

TEST NO. 57-3 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY								DISTRIBUTION				
		Cu													

OPERATION	Cu ro conc thick	conc reg.	Cu Cl #1	Cl #2	Cl #3
TIME		15	12	1 - 5	1 - 5
REAGENTS — LBS. PER TON					
Lime		4.0		1.2	1.1
Z-200		0.08			
MIBC					0.03
MACHINE			1000	500	500
R.P.M.			1000	1000	1000
pH			10.7	11.1	10.9
% SOLIDS					
TEMPERATURE					

REMARKS:

SIZING — MESH	Cu Ro Regr. %	%
+10		
+14		
+20		
+28		
+35		
+48		
+65		
+100		
+150		
+200		
+325		
−325	100.0	

METALLURGICAL RESEARCH DEPT. CABLE "GALHAL"

THE GALIGHER COMPANY

P. O. BOX 209 — 545-565 WEST 6th SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-3751

OUR LOT NO. 1636-1
DATE 11/21/66
BY JX

TEST NO. 58-1 NAME Norges Geologiske

Same as Test 57 except closed circuit

PRODUCT	Weight	Percent Weight	ASSAY Cu	DISTRIBUTION Cu
Series #1				
C-Cl Conc #3	420	42.0	0.207	
Cu Cl Conc #3	62	6.2	24.61	
Cu Ro Tail	429	42.9	0.166	
Head (less C.L. *)	911	91.1	1.68	
Series #2				
C-Cl Conc #3	423	42.3	0.239	5.7
Cu Cl Conc #3	60	6.0	26.56	89.0
Cu Ro Tail	518	51.7	0.182	5.3
Head (Calc)	1001	100.0	1.70	100.0
circulating load				

OPERATION		RM	C-Ro	C-Ro	C-Ro	C-Ro	C-Ro conc thick	C-Ro conc reg.	Cl #1	Cl #1	Cl #1	Cl #1	PRODUCT
TIME		20	3	3	2	2		10	3	3	2	1	
REAGENTS — LBS. PER TON													Head
Kerosene		0.20											
MIBC			0.06	0.06	0.06	0.06			0.03	0.03	0.03	0.03	
MACHINE			1000						1000				
R.P.M.			1000						1000				
pH			7.3						8.0-8.5				
% SOLIDS		50	25						8.0-8.5				
TEMPERATURE													
REMARKS													

MESH	%	Σ
+10		
+14		
+20		
+28		
+35		
+48		
+65		
+100	5.2	
+150		
+200		
+325		
-325	46.3	

Voluminous froth in the C.Cl. floats 1, 2, and 3.

METALLURGICAL RESEARCH DEPT. CABLE "GALGAL"

THE GALIGHER COMPANY

P. O. BOX 202 — 545-585 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 — U.S.A.

TELEPHONE 359-8731

OUR LOT NO. 1636-1
DATE 11-21-66
BY JX

TEST NO 58-2 NAME Norges Geologiske

PRODUCT	Weight	Percent Weight	ASSAY									DISTRIBUTION				
Series #3			Cu									Cu				
C-Cl Conc #3	419	43.3	0.220									4.8				
Cu Cl Conc #3	70	7.2	24.71									90.6				
Cu Ro Tail	478	49.5	0.182									4.6				
Head (Calc)	967	100.0	1.96									100.0				
Series #6																
C-Cl Conc #3	428.0	42.4	0.252									5.8				
Cu Cl Conc #3	65.3	6.5	25.27									89.4				
Cu Ro Tail	517.0	51.2	0.173									4.8				
Head (Calc)	1010.3	100.0	1.84									100.0				
Cu Cl Tail #3	19		3.69													
Cu Cl Tail #2	45		1.650													
Cu Cl Tail #1	97		0.396													

OPERATION	C Cl #2	Cl #2	Cl #2	C Cl #3	Cl #3	Cl #3	Cond	Cu Ro	Ro	Ro		GRINDING PRODUCT		
TIME	4	2	1	4	2	1.5	10	5	1-5	1-4				
REAGENTS — LBS. PER TON														
											SIEVE	%	%	
											+10			
MIBC	0.03	0.03	0.03	0.03	0.03	0.03					+14			
Lime							4.0				+20			
NaCN							0.02				+28			
Z-200							0.08		0.04	0.04	+35			
											+48			
											+65			
											+100			
											+150			
MACHINE	1000			1000			1000				+200			
R.P.M.	1000			1000			1000				+325			
pH	8.0						11.0	11.0			-325			
% SOLIDS														
TEMPERATURE														

REMARKS:

The Cu Ro conditioner and Ro float could possible be shortened.

METALLURGICAL RESEARCH DEPT.

CABLE "GALSAL"

THE GALIGHER COMPANY
P. O. BOX 208 — 545-565 WEST 6TH SOUTH STREET
SALT LAKE CITY, UTAH 84110 - U.S.A.

TELEPHONE 532-8731

OUR LOT NO. 1636-1
DATE 11-21-66
BY JX

TEST NO. 58-3 NAME Norges Geologiske

PRODUCT	Weight	% of Weight	ASSAY								DISTRIBUTION				
		Cu %0													
OPERATION		Conc thick	Conc reg	Cu Cl #1	Cl #2	Cl #3									GRINDING PRODUCT
TIME			10	12	1-5	1-5									
REAGENTS — LBS. PER TON															
													WEIGHT	%	%
													+10		
Lime			4.0		1.2	1.0							+14		
Z-200			0.08										+20		
NOBC						0.03							+28		
													+35		
													+48		
													+65		
													+100		
													+150		
MACHINE				1000	500	500							+200		
R.P.M.				1000	1000	1000							+325		
pH													-325		
% SOLIDS				9.0-11.1	11.3-11.1	11.5-11.1									
TEMPERATURE				11.1-11.0	11.0-11.0	11.1-11.1									
REMARKS															