METALLURGICAL INVESTIGATION OF A SILVER ORE FROM THE FALCON PROSPECT ELKO COUNTY, NEVADA

19 MAY 1965 E. P. JUCEVIC

METALLURGICAL INVESTIGATION
OF A
SILVER ORE
FROM
THE FALCON PROSPECT
ELKO COUNTY, NEVADA

Edward P. Jucevic

May 19, 1965

TABLE OF CONTENTS

INTRODUCTION

The purpose of this investigation was to determine the amenability to flotation of a silver ore from the Falcon prospect, Elko County, Nevada. The results of this examination will be used to do preliminary design work on a 50 ton per day mill and to evaluate expected production costs, and possible profits. This report, however, will only be concerned with the results of the laboratory work.

The Falcon prospect is located in Sections 12 and 14, T. 40 N., R. 50 E., Elko County, Nevada. There is a stream running through the property that is reported to have sufficient water for a medium size mill.

DESCRIPTION OF THE ORE

About 14 kilograms (30 lb.) of ore were obtained from the owner of the Falcon claims for laboratory investigation. Head analysis showed the following:

Au - 0.01 oz/T

Ag - 47.45 oz/T

Hand specimens showed the ore to consist of white quartz, banded chalcedony, and a blue quartz that seemed to contain most of the sulfides. Abundant pieces of highly silicified wall rock, an andesite(?), and black shale are found included in the vein quartz. Specks of ruby silver and pyrite are evident in hand specimens.

Four polished sections and four thin sections were obtained from the ore and the following minerals were identified microscopically.

Silver Minerals:

Pyrargyrite	- - -	$3Ag_2S \cdot Sb_2S_3$
Miargyrite	- - -	$Ag_2S \cdot Sb_2S_3$
Proustite	- - -	$3Ag_2S \cdot As_2S_3$

Tetrahedrite (probably Freibergite - Cu_3SbS_3 silver variable

Copper Minerals:

Chalcopyrite	- - -	$CuFeS_2$
Covellite	- - -	CuS

Gangue Sulfides:

Pyrite	- - -	FeS_2
Marcasite	- - -	FeS_2
Arsenopyrite	- - -	FeAsS

One of the polished sections showed no silver minerals. The silver minerals in the three remaining polished sections were classified as to their size and the number of particles in each size range counted. The average volume of the particles in each of the size ranges was multiplied by the number of particles in that respective size range. The results were expressed as a percentage of the total volume of silver minerals in each speciman. The results were as follows:

Sample No.	Size Range Microns	Average Size Microns	No. of Particles	% of Total Volume	Cumulative % Volume Greater than Mesh	%
1	<13	13	22	-	-	-
	13- 65	39	55	0.2	250	0.2
	65-130	98	45	3.5	115	3.7
	130-260	195	30	18.4	60	22.1
	260-520	390	16	77.9	32	100.0
	>520	520	0	0.0	-	-
4	< 13	13	15	-	-	-
	13- 65	39	53	3.3	250	3.3
	65-130	98	12	19.6	115	22.9
	130-260	195	6	77.1	60	100.0
	260-520	390	0	0	32	-
	>520	520	0	0	-	-
5	< 13	13	85	-	-	0.0
	13- 65	39	73	0.1	250	0.1
	65-130	98	55	2,2	115	2.3
	130-260	195	41	13.2	60	15.5
	260-520	390	21	53.9	32	69.4
	>520	520	5	30.5	-	-

This tabulation of results shows that economic liberation is probably somewhere between 60 and 115 mesh. For the first laboratory tests a grind of 80 mesh will be used.

It was noted that the arsenopyrite crystals in the ore were much finer than the ore minerals and would probably not be liberated at a grind that would liberate the ore minerals.

FLOTATION TESTS

Appendix A lists all flotation tests conducted on this ore.

Due to the very high grade concentrates obtained in these flotation tests the recoveries were calculated from the average head analysis, 47.45oz Ag/T, and the tailings analysis. Concentrate grades were also calculated rather than assayed. This method was considered valid and its validity was confirmed by combining all of the concentrates and assaying the combination very carefully and in quadruplicate. The assay grade agreed closely with the grade predicted by using a weighted average of the combined calculated concentrates.

All flotation tests were conducted with Reno, Nevada, water.

Effect of Reagents

The first series of 14 tests were conducted on 500 gram samples, using an 80 mesh grind, a 10 minute float time, and a natural pH in order to determine the effects of different collecters and activators. A Fagergren flotation machine was used for these tests. The results were as follows:

Test No.	Collector	Collector Amount lb/T	Activator	Concentrate Grade oz/T	Recovery
1	Aerofloat 25	0.08	-	1215	91.5
2	"	0.12	-	1028	90.9
15	"	0.20	-	880	91.9
5	Aerofloat 31	0.08	-	919	85.7
6	"	0.12	-	735	89.9
3	Aerofloat 33	0.08	-	716	88.3
4	"	0.12	-	828	90.7
9	Aero Xanthate 301	0.04	-	1222	86.9
7	"	0.06	-	869	87.1
8	"	0.10	-	1245	89.9
11	Aerofloat 25	0.12	1 lb/T $CuSO_4 \cdot 5H_2O$	1385	84.3
12	"	0.12	1 lb/T $Pb(NO_3)_2$	1445	91.4
13	"	0.12	0.1 lb/T Na_2S	857	89.1
14	"	0.12	1 lb/T $NaSiO_3 \cdot 9H_2O$	1320	89.2

Most of the results shown on the previous page are fiarly similar, however, a few definite trends are obvious. Certain conclusions may be drawn from these trends. Aerofloat 25 seemed to be the best collector and in other than the first test an increase in the amount of collector resulted in an increase in the recovery and a lowering of the concentrate grade. Copper Sulfate, Sodium Sulfide, and Sodium Silicate all seemed to have slightly adverse affects on recovery. The lead nitrate, on the other hand, appeared to have a good affect, raising the recovery about 1/2 of one percent.

Due to the very high grade concentrates obtained in these tests it was felt that an attempt to extract more silver with a lower grade concentrate should be made. Aero Xanthate 350 was selected as the collector for these tests. The conditions were similar to the previous tests; 80 mesh grind, 10 minute float and a natural pH were used. However, since the xanthates have no frothing characteristics, pine oil frothers had to be used. The results of these two tests were as follows:

Test No.	Collector	Amount of Collector lb/T	Concentrate Grade	% Recovery
18	Aero Xanthate 350	0.12	1900 oz/T	93.1
19	"	0.40	1190 oz/T	94.3

Aero Xanthate 350 proved to be a better collector than the Aerofloats. It should also be noted that the concentrate grades were higher.

The higher grade concentrates appear to be due to pine oil frothers. The Cresylic Acid frother seemed to activate the quartz somewhat. Yarmer F gave a slightly better froth than GNS No. 5.

Two 2000 gm flotation tests, No. 16 and No. 17, were conducted with the usual 0.12 lb/T Aerofloat 25 and an additional 0.05 lb/T Aerofloat 208. The Aerofloat 208 was intended to help the recovery of gold. Gold recovery was very difficult to document due to the very small amount of gold in the heads, about 0.01 oz. However, on the basis of test No. 16 and No. 17 it was felt that the Aerofloat 208 was of little value in increasing the gold recovery.

Effect of Flotation Agitation

The affect of strong agitation during flotation was also demonstrated in tests No. 16 and No. 17. The ore in these two tests was floated in a Denver Sub-A flotation machine having the usual quiet zone. Rougher concentrates were much higher grade, 2193 oz/T and 2989 oz/T, but recoveries were lower, 88% and 89%. It was felt that this was due to the less violent agitation of the Sub-A flotation cell as compared to the Fagergren cells which produced concentrates of 1215 oz/T, 1028 oz/T, and 880 oz/T, and recoveries of 91% and 92%.

Effect of Cleaning Tests

Cleaning tests were also conducted in tests No. 16 and No. 17. These tests showed that with a single cleaning a concentrate of between 4400 oz/T and 5400 oz/T might be expected. The cleanings were conducted in a Fagergren flotation cell and both yielded about 87% of the silver contained in the heads.

Effect of Scavenger Tests

Tests No. 17, No. 18, and No. 19 included scavenger floates of 10 minutes, at a natural pH. All three tests increased recoveries by about the same amount, 1.1%. The grades of scavenger concentrates, however, varied between 28 oz/T and 159 oz/T.

Effect of Grind

Most of the tests were conducted with a grind of 62% minus 200 mesh or a 10 minute grind. Test No. 10 was conducted with a 15 minute grind or 88% minus 200 mesh. Screen analysis of 8, 10, and 15 minute grinds are shown in Figure I. The effect of the finer grind can be best seen by comparing test No. 2 and test No. 10

Test No.	Grind, % pass 200 mesh	Concentrate Grade	% Recovery
2	62%	1028 oz/T	90.89
10	88%	850 oz/T	90.65

The comparison shows little difference in recoveries but about a 15% decrease in concentrate grade for the finer grind. This is probably due to more slimes being produced by the fine grind.

The results of a decrease in the grind was demonstrated in experiments No. 19 and No. 20. Conditions were the same in both tests.

Test No.	Grind, % Passing 200 Mesh	Concentrate Grade	% Recovery
19	62%	1190 oz/T	94.3
20	48%	1102 oz/T	95.0

The grade of concentrate was only slightly effected by the decrease in grind time; however the percent recovery increased with a coarser grind. This is probably due to the production of less fines.

Assays of the various screen fractions in the tailings of flotation test No. 20 showed the following:

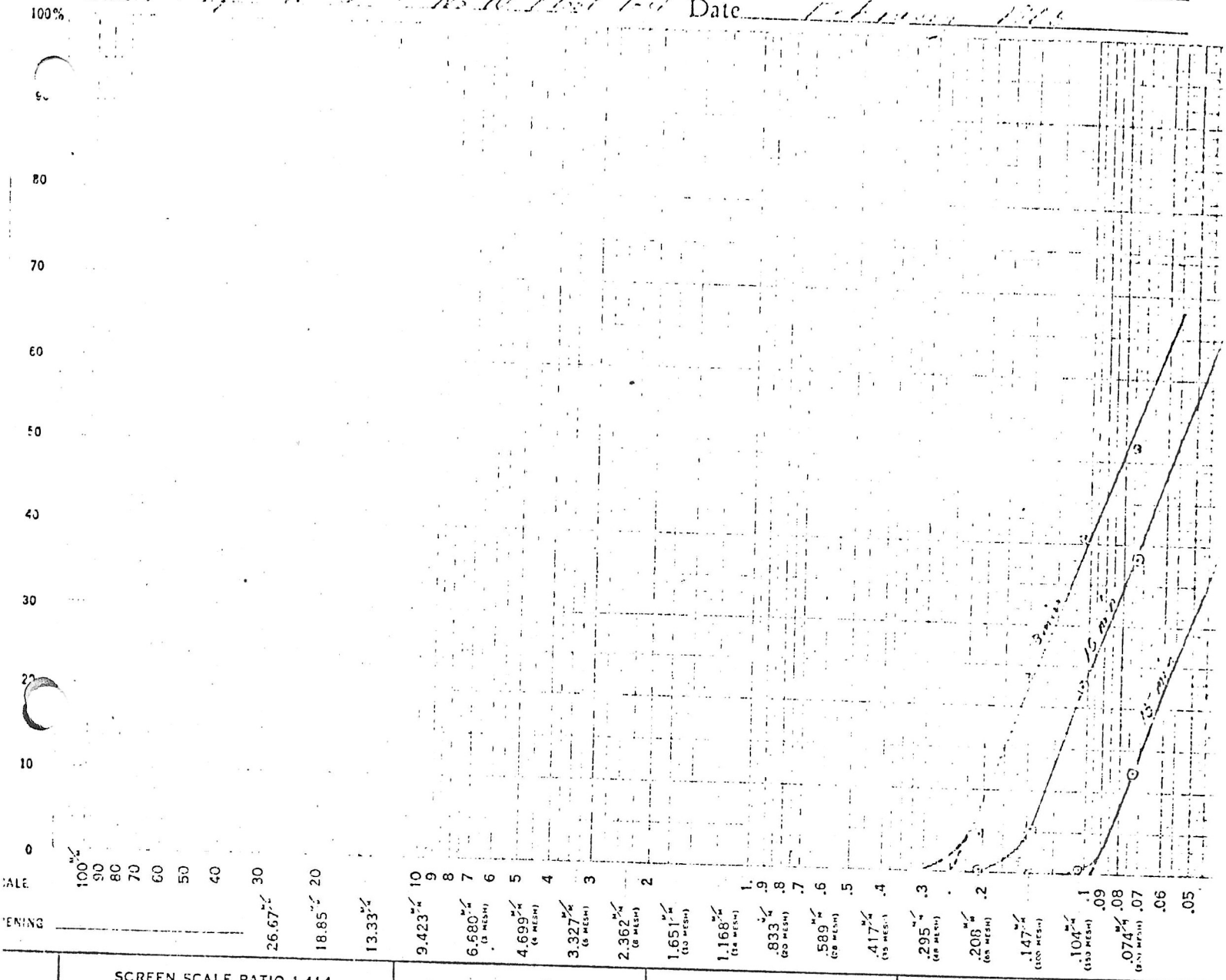
Mesh Size	Analysis oz Ag/T
+48	5.98
48 - 65	2.87
65 -100	2.48
100 -150	Unreliable Analysis
150 -200	2.53
-200	2.84

The Tyler Standard Screen Scale

Form No. 1-C
Please mention above when ordering

Cumulative Logarithmic Diagram of Screen Analysis on Sample of [illegible]

Name [illegible] Date [illegible]



SCREEN SCALE RATIO 1.414				[illegible]			[illegible]			[illegible]		
Openings		Tyler Mesh	U. S. No.	Sample Weights	Per Cent	Per Cent Cumulative Weights	Sample Weights	Per Cent	Per Cent Cumulative Weights	Sample Weights	Per Cent	Per Cent Cumulative Weights
Millimeters	Inches											
26.67	1.050											
18.85	.742											
13.33	.525											
9.423	.371											
6.680	.263	3										
4.699	.185	4	4									
3.327	.131	6	6									
2.362	.093	8	8									
1.651	.065	10	12									
1.168	.046	14	16									
.833	.0328	20	20									
.589	.0232	28	30									
.417	.0164	35	40									
.295	.0116	48	50									
.208	.0082	65	70									
.147	.0058	100	100									
.104	.0041	150	140									
.074	.0029	200	200									
.074	.0029	200	200									
			Totals,									

Apparently there was insufficient liberation in the plus -48 mesh material. This analysis also demonstrates that recoveries are lower in the finer sizes.

Comparing the flotation results at different grinds to the required grind predicted by microscope investigation shows the microscopic estimate to be somewhat conservative. Instead of an 80 mesh grind being required, a 65 mesh grind seems to be all that is necessary.

Miscellaneous Effects

In all tests a very high grade concentrate was obtained during the first few minutes of flotation. It appeared that about 90% of all material that would eventually be floated was extracted in the first three minutes.

THICKENING TESTS

The exact amount of water available on the property is not known. Geologists report that there is sufficient for a medium size mill. However, in order to have an idea of thickener requirements, should one become necessary for water reclaimation, a series of settling tests were run. The tests were run on the tailings from flotation test No. 19.

Six settling tests were conducted on the tailings using pulps of from 14% to 51% solids. Figure II shows the height of pulp vs. time for the six tests. The 39% solids pulp was allowed to stand 12 hours to give a final discharge of 62.4% solids. Settling rates were determined from Figure II and were plotted against percent solids in Figure III. Unit areas were then calculated for various pulp dilutions between 30% solids and 14% solids using the data in Figure III. The discharge dilution was taken at 50% solids even though a 12 hour settling test showed a possible 62% solids discharge. Unit areas calculated out as follows:

% Solids Feed	30	25	20	17.5	15	14
Feed Dilution	2.33	3.00	4.00	4.70	5.67	6.14
Discharge Dilution	1.00	1.00	1.00	1.00	1.00	1.00
Rate ft/hr	0.38	0.60	0.95	1.27	1.81	2.15
Unit Area sq ft/T/24 hr	4.67	4.44	4.21	3.89	3.45	3.19

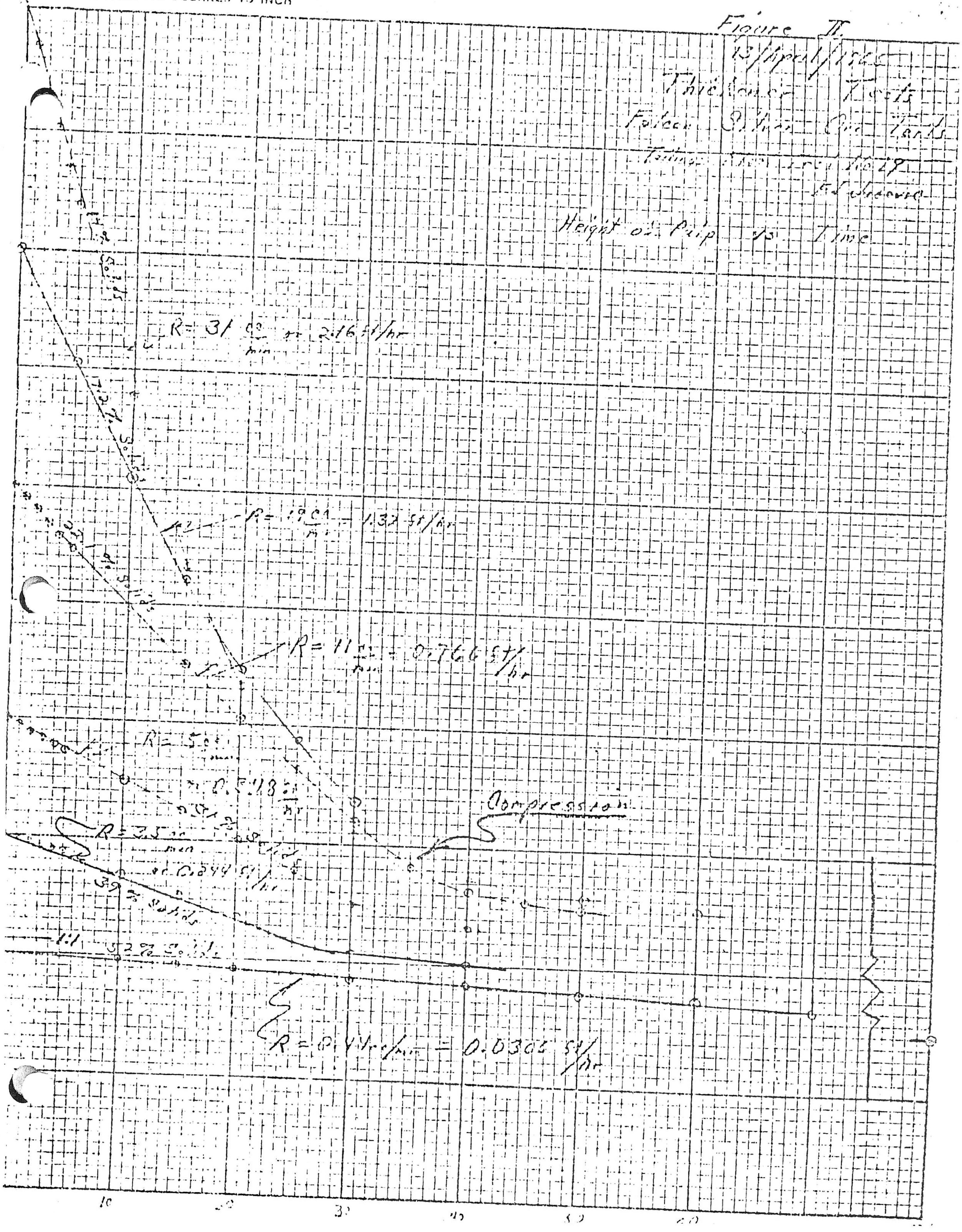
Calculated Unit Areas vs. percent solids in the feed are plotted in Figure IV. The maximum unit area from this plot is 4.65 ft^2/T 24 hr. The recommended size thickener is calculated in the following manner:

$$\frac{4.65 \text{ sq. ft } 24 \text{ hr}}{\text{ton}} \times 50 \frac{\text{ton}}{\text{50 tons per day mill } 24 \text{ hr}} = 232 \text{ sq. ft.}$$

$$+ 20\% \qquad \underline{47}$$

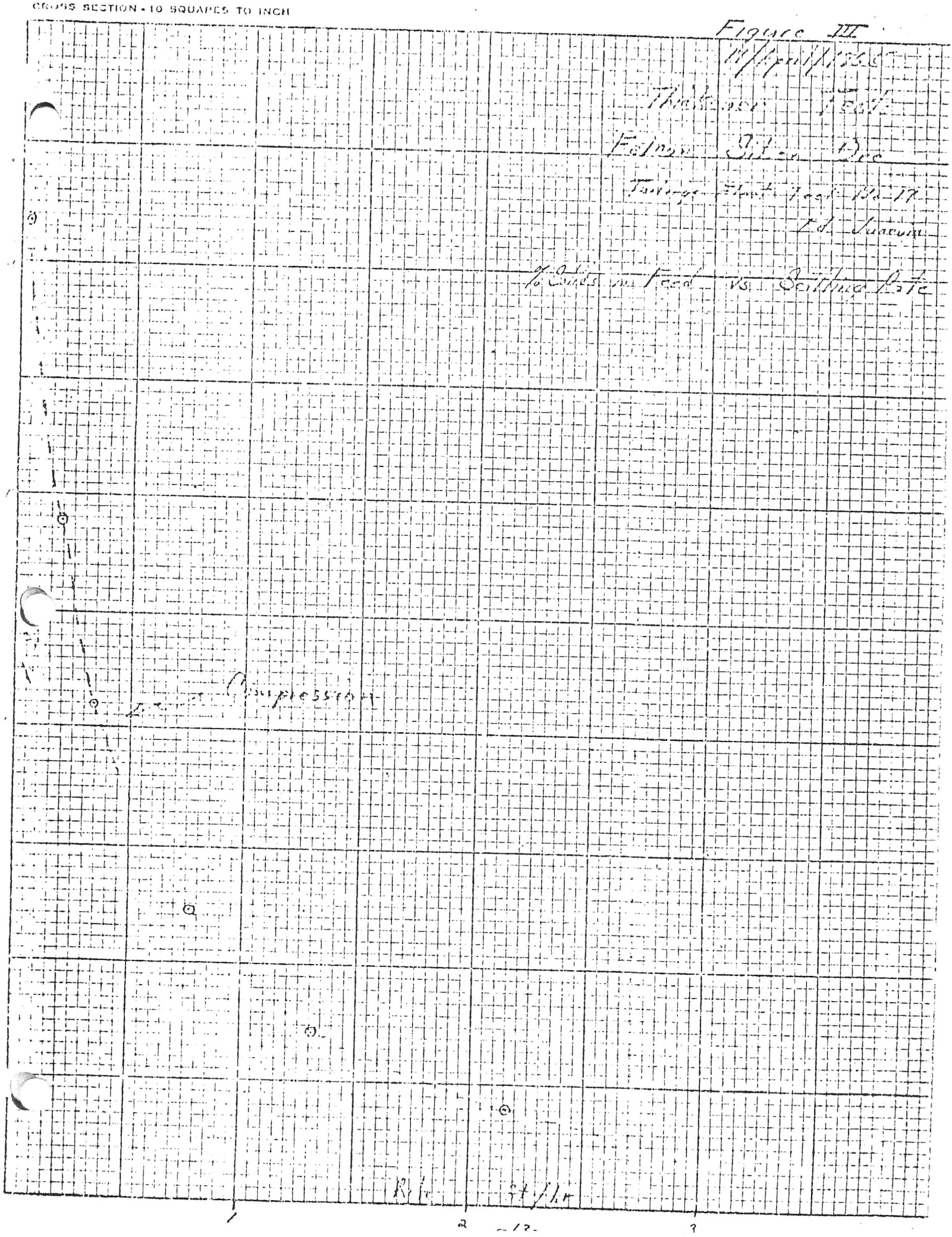
$$279 \text{ sq. ft.}$$

CROSS SECTION - 10 SQUARES TO INCH



CROSS SECTION - 10 SQUARES TO INCH

Figure III



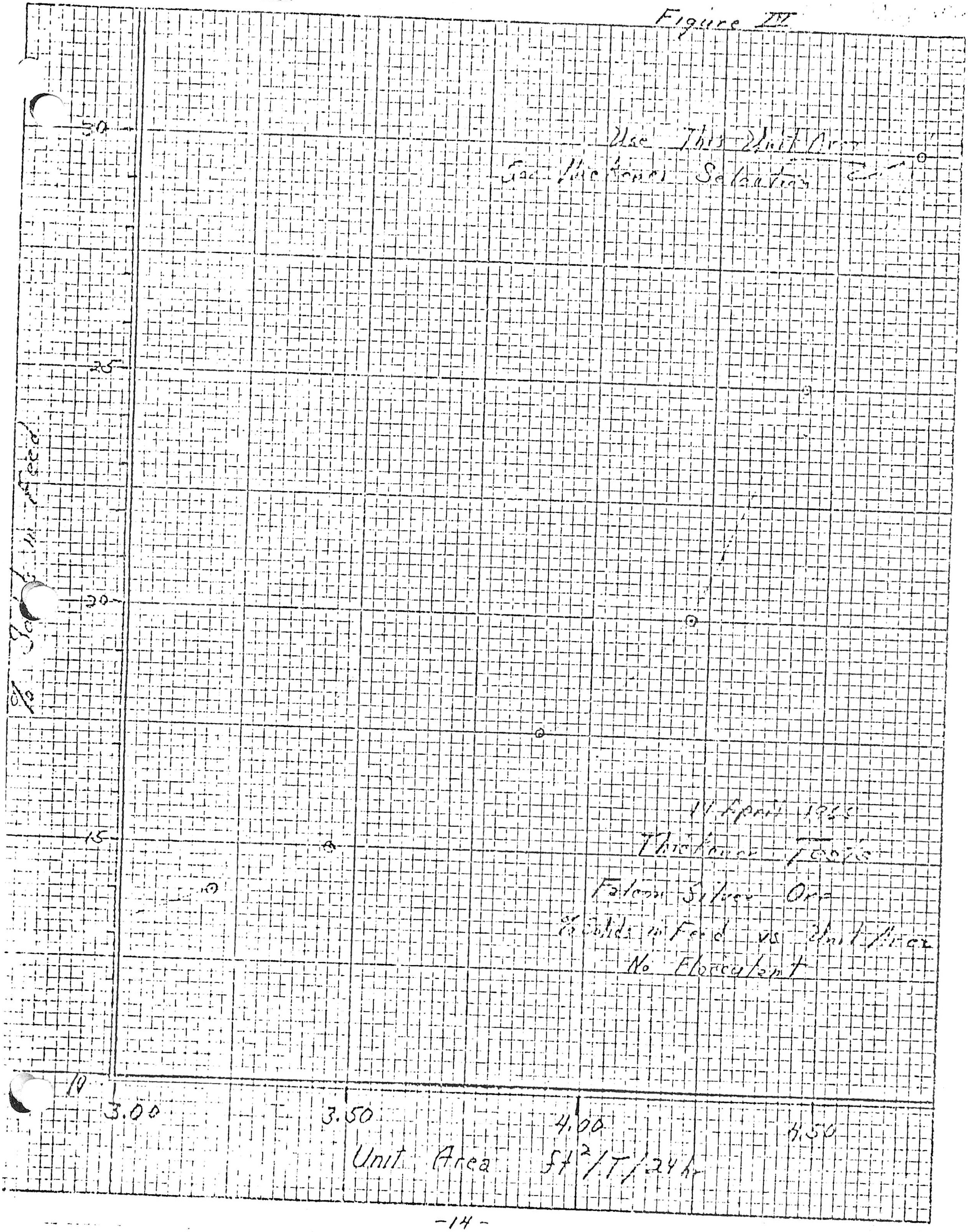


Figure IV
Use This Unit Area
for Thickener Selection
Thickener Tests
Falcon Silver Ore
% Solids in Feed vs Unit Area
No Flocculant
30
25
20
15
10
% Solids in Feed
3.00
3.50
4.00
4.50
Unit Area ft²/T/24 hr

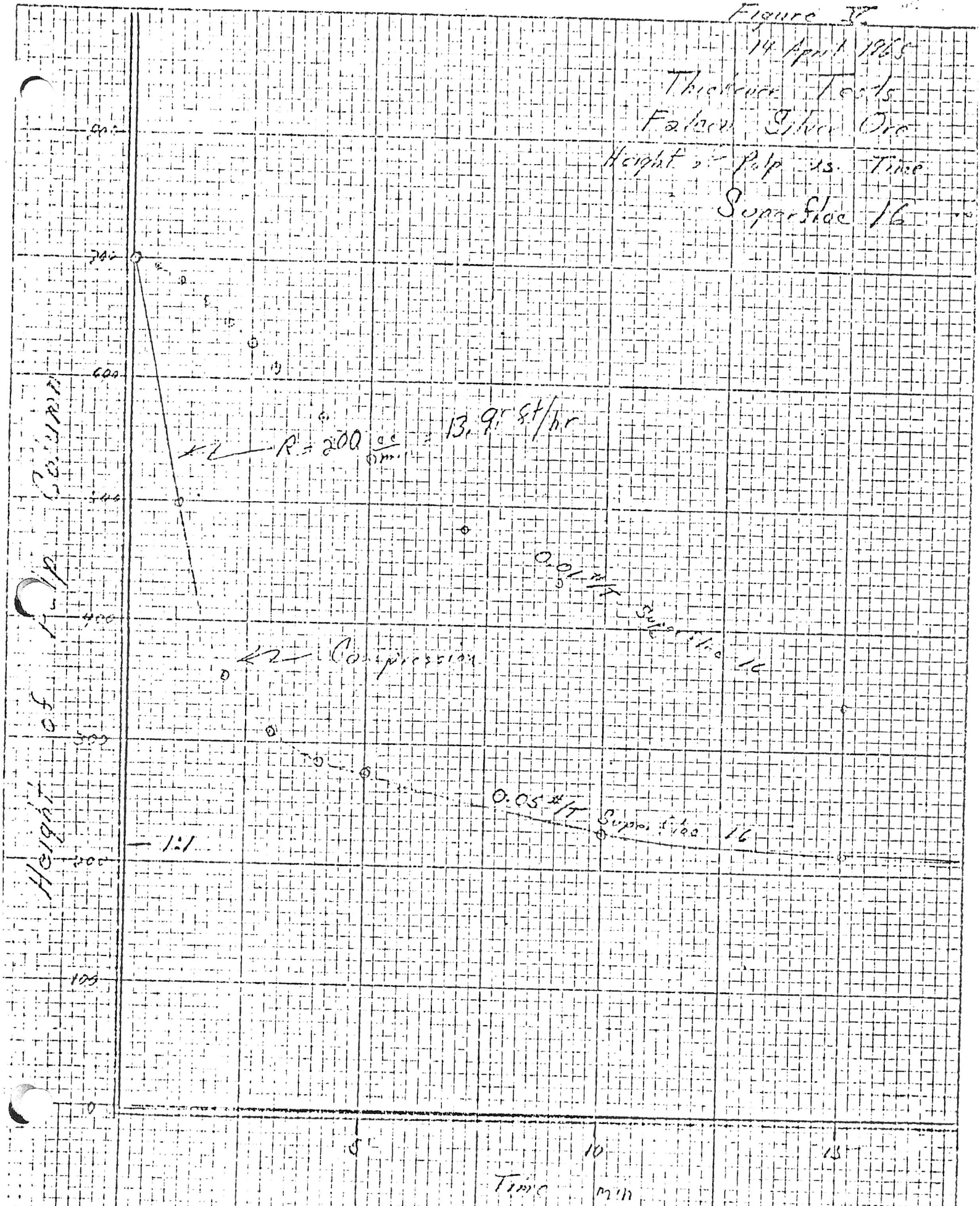
$$D = \sqrt{\frac{4A}{\pi}}$$

$$= \sqrt{\frac{4 \times 279}{\pi}} = 18.9 \text{ ft diameter}$$

Therefore use either a 19 ft diameter or a 20 ft diameter thickener.

The effect of a flocculating agent was investigated in two tests. Superfloc 16 was used in the amounts of 0.01 lb/T and 0.05 lb/T. Both tests were conducted with a feed of about 20% solids. Figure V is a plot of the height of the pulp column vs. the time. The test involving only 0.01 lb/T of Superfloc 16 had a slow settling rate and the solution was not clear; therefore a unit area was not calculated for this test. The 0.05 lb/T Superfloc 16 test gave very good results. The settling rate was 13.9 ft/hr and the unit area calculated out to be 18.3 sq. ft/ton/24 hr. This resulted in only a 60 in. diameter thickener being required.

"THE CHAMPION LINE" NO. 810
CROSS SECTION - 10 SQUARES TO INCH



SUMMARY AND RECOMMENDATIONS

The Falcon silver ore is composed mostly of quartz gangue and antimony and arsenic silver minerals. Polished section investigation indicated an economic liberation of about 80 mesh.

Flotation tests run with Reno water at a natural pH of about 6.2 gave the best results using Aero Xanthate 350 for a collector and Yarmar F for a frother. Aerofloat 208 did not seem to increase gold recovery appreciably. Strong agitation during flotation appears to have a favorable effect on recovery. Recoveries of about 95% and rougher concentrate grades of between 1000 oz/T and 1400 oz/T are indicated. Lead nitrate seemed to be the only activator tried that could increase recovery.

Scavenger floats increased recoveries by about 1.1 percent. A single cleaning doubled concentrate grade and left only about 1 to 2% of the silver in the cleaner tailings. Most of the silver minerals floated very rapidly.

A 65 mesh grind is sufficient; any further grinding tends to slightly reduce recovery.

Thickening tests on the tailings indicated that the raw tailings from a 50 ton per day mill could be thickened to 50% solids in a 19 ft thickener. With the addition of 0.05 lb/Ton Aerofloat 16 a thickener of only 60 in. diameter would be required.

Future tests should include a grindability test for determining grinding mill requirements. If possible, all future flotation tests should be run with the water that is available at the mill. The effect of lead nitrate on Aero Xanthate 350 flotation should also be investigated. The effects of scavenger flotation after optimum rougher flotation should also be investigated.

Based on the data collected in these experiments, the following generalities may be infered.

Using a 65 mesh grind, 10 minute flotation time in a high agitation flotation machine, about 0.4 lb Aero Xanthate and 0.08 lb of Yarmar F per ton of ore a recovery of about 95% and a concentrate grade of between 1000 oz and 1500 oz silver per ton might be expected. The flow sheet suggested for this is shown in Figure VI.

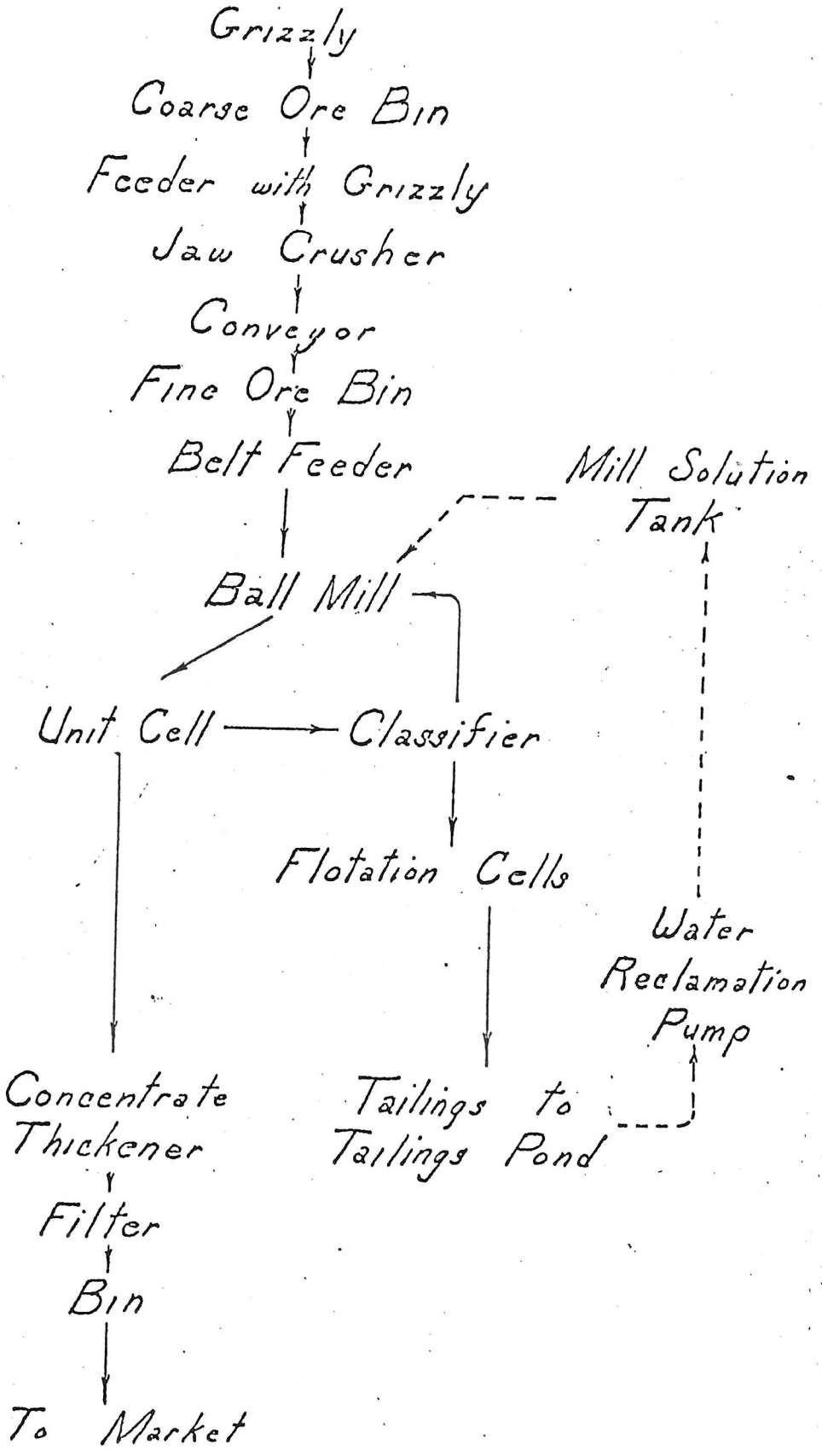


FIGURE VI SUGGESTED FLOW SHEET

APPENDIX A

TEST NO. 1

Sample No. Falcon Silver
Sample weight 500 gm
Grind Rod mill, 10 min, 50% solids
Sizing 95% -100 mesh
Water used Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.3	1 min	10 min	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aerofloat 25	Cresylic A.	
Rougher	0.08	0.04	
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	480.0	T	4.17	
Rougher conc.	17.79	-	1215.2	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	91.52	-
Cleaner conc.		
Scavenger conc.		

TEST NO. 2

Sample No.	Falcon Silver
Sample weight	500 gm
Grind	Rod mill, 10 min., 50% solids
Sizing	95% -100 mesh
Water used	Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.3	1 min.	10 min.	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aerofloat 25	Cresylic A	
Rougher	0.12	0.02	
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	480.5	-	4.51	
Rougher conc.	21.03	-	1028.5	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	90.89	-
Cleaner conc.		
Scavenger conc.		

TEST NO. 3

Sample No. Falcon Silver
Sample weight 500 gm
Grind Rod mill, 10 min., 50% solids
Sizing 95% -100 mesh
Water used Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.3	1 min	10 min	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aerofloat 33	Cresylic A.	
Rougher	0.08	0.02	
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	472.7	T	5.88	
Rougher conc.	29.39	-	716.1	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	88.33	-
Cleaner conc.		
Scavenger conc.		

TEST NO. 4

Sample No. Falcon Silver
Sample weight 500 gm
Grind Rod mill, 10 min., 50% solids
Sizing 95% -100 mesh
Water used Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.3	1 min	10 min	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aerofloat 33	Cresylic A	
Rougher	0.12	0.02	
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	475.0	T	4.65	
Rougher conc.	26.04	-	828.1	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	90.71	-
Cleaner conc.		
Scavenger conc.		

TEST NO. 5

Sample No. Falcon Silver
Sample weight 500 gm
Grind Rod mill, 10 min, 50% solids
Sizing 95% -100 mesh
Water used Reno .

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.3	1 min	10 min	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aerofloat 31	Cresylic A	
Rougher	0.08	0.04	
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	479.6	T	7.08	
Rougher conc.	22.20	-	919.6	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	85.74	-
Cleaner conc.		
Scavenger conc.		

TEST NO. 6

Sample No. Falcon Silver
Sample weight 500 gm
Grind Rod mill, 10 min., 50% solids
Sizing 95 % -100 mesh
Water used Reno .

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.4	1 min	10 min	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aerofloat 31	Cresylic A	
Rougher	0.12	0.04	
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	465.4	T	5.09	
Rougher conc.	28.66	-	735.4	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	89.90	
Cleaner conc.		
Scavenger conc.		

TEST NO. 7

Sample No.	Falcon Silver
Sample weight	500 gm
Grind	Rod mill, 10 min., 50% solids
Sizing	95% -100 mesh
Water used	Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.3	1 min	10 min	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aero Xanthate 301	GNS No. 5	
Rougher	0.06	0.08	
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	480.6	T	6.37	
Rougher conc.	23.98	-	868.8	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	87.19	-
Cleaner conc.		
Scavenger conc.		

TEST NO. 8

Sample No. Falcon Silver
Sample weight 500 gm
Grind Rod mill, 10 min. 50% solids
Sizing 95% -100 mesh
Water used Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.3	.1 min	10 min	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aero Xanthate 301	GNS No. 5	
Rougher	0.10	0.08	
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	486.1	T	4.96	
Rougher conc.	17.25	-	1244.9	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	89.91	
Cleaner conc.		
Scavenger conc.		

TEST NO. 9

Sample No.	Falcon Silver
Sample weight	500 gm
Grind	Rod mill, 10 min., 50% solids
Sizing	95% -100 mesh
Water used	Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.3	.1 min	10 min	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aero Xanthate 301	GNS No. 5	
Rougher	0.04	0.12	
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	482.8	T	6.42	
Rougher conc.	16.87	-	1221.8	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	86.93	-
Cleaner conc.		
Scavenger conc.		

TEST NO. 10

Sample No. Falcon Silver
Sample weight 500 gm
Grind Rod mill, 15 min, 50% solids
Sizing 95% -170 mesh
Water used Reno .

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.3	1 min	10 min	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aerofloat 25	Cresylic A	
Rougher	0.12	0.04	
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	481.9	T	4.60	
Rougher conc.	25.9	0.02	850.0	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	90.65	-
Cleaner conc.		
Scavenger conc.		

TEST NO. 11

Sample, No.	Falcon Silver
Sample weight	500 gm
Grind	Rod mill 10 min, 50% solids
Sizing	95% -100 mesh
Water used	Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.3	10 min	10 min	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aerofloat 25	Cresylic A.	$CuSO_4 \cdot 5H_2O$
Rougher	0.12	0.04	1.0
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	485.7	-	7.69	
Rougher conc.	14.44	-	1384.8	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	84.26	-
Cleaner conc.		
Scavenger conc.		

TEST NO. 12

Sample No.	Falcon Silver
Sample weight	500 gm
Grind	Rod mill, 10 min, 50% solids
Sizing	95% -100 mesh
Water used	Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.3	10 min	10 min	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aerofloat 25	Cresylic A	$Pb(NO_3)_2$
Rougher	0.12	0.02	1.0
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	484.4	-	4.33	
Rougher conc.	14.98	-	1445.0	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	91.35	-
Cleaner conc.		
Scavenger conc.		

TEST NO. 13

Sample No. Falcon Silver
Sample weight 500 gm
Grind Rod mill, 10 min, 50% solids
Sizing 95% -100 mesh
Water used Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.4	6 min	10 min	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aerofloat 25	Cresylic A.	Na_2S
Rougher	0.12	0.02	0.1
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	478.6	-	5.51	
Rougher conc.	24.8	-	857.0	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	89.1	-
Cleaner conc.		
Scavenger conc.		

TEST NO. 14

Sample No.	Falcon Silver
Sample weight	500 gm
Grind	Rod mill, 10 min, 50% solids
Sizing	95% -100 mesh
Water used	Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.3	3 min	10 min	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aerofloat 25	Cresylic A	$NaSiO_2 \cdot 9H_2O$
Rougher	0.12	0.02	1.0
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	487.1	-	5.38	
Rougher conc.	16.1	-	1320.0	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	89.2	-
Cleaner conc.		
Scavenger conc.		

TEST NO. 15

Sample No. Falcon Silver
Sample weight 500 gm
Grind Rod mill, 10 min, 50% solids
Sizing 95% -100 mesh
Water used Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.3	1 min	10 min	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aerofloat 25	Cresylic A	
Rougher	0.20 (stages)	0.02	
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	476.7	-	4.14	
Rougher conc.	24.8	-	880.0	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	91.9	-
Cleaner conc.		
Scavenger conc.		

TEST NO. 16

Sample No. Falcon Silver
Sample weight 2000 gm
Grind Rod mill, 40 min, 50% solids
Sizing Approx. 95% -100 mesh
Water used Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.4	1 min	10 min	Sub-A	Full
Cleaner	-	6.4	-	10 min	Fag	Full
Scavenger						

REAGENTS (lb./ton):

	Collectors		Frother	Activator
	Aerofloat 25	Aerofloat 208	Cresylic A	
Rougher	0.12	0.05	0.04	
Cleaner	-	-	0.04	
Scavenger				

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	1973.3	T	5.87	
Rougher conc.	40.37	0.48	2192.9	
Cleaner tails	20.6	0.07	47.95	
Cleaner conc.	19.77	0.90	4414.9	
Scavenger conc.	-	-	-	

RECOVERY:

	Ag	Au
Rougher conc.	88.43	-
Cleaner conc.	87.20	-
Scavenger conc.	-	-

TEST NO. 17

Sample No. Falcon Silver
Sample weight 2000 gm
Grind Rod mill, 50 min, 50% solids
Sizing Approx. 95% -100 mesh
Water used Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.3	1 min	10 min	Sub-A	Full
Cleaner	-	6.3	-	10 min	Fag	Full
Scavenger	-	6.3	-	10 min	Sub-A	Full

REAGENTS (lb./ton):

	Collectors		Frother	Activator
	Aerofloat 25	Aerofloat 208	Cresylic Acid	
Rougher	0.12	0.05	-	
Cleaner	-	-	0.04	
Scavenger	-	-	-	

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	1982.1	T	4.83	
Rougher conc.	30.04	-	2989.2	
Cleaner tails	13.84	0.12	170.36	
Cleaner conc.	16.30	1.10	5433.7	
Scavenger conc.	6.98	0.07	159.37	

RECOVERY:

	Ag	Au
Rougher conc.	89.48	-
Cleaner conc.	87.16	-
Scavenger conc.	1.10	-

TEST NO. 18

Sample No. Falcon Silver
Sample weight 500 gm
Grind Rod mill, 10 min, 50% solids
Sizing 95% -100 mesh
Water used Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.2	1 min	10 min	Fag	Full
Cleaner	-	-	-	-	-	-
Scavenger	-	6.2	-	10 min	Fag	Full

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aero Xanthate 350	GNS No. 5	
Rougher	0.12	0.12	
Cleaner	-	-	
Scavenger	0.12	-	

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	481.5	-	2.76	
Rougher conc.	11.56	-	1900	
Cleaner tails	-	-	-	
Cleaner conc.	-	-	-	
Scavenger conc.	4.31	-	67.20	

RECOVERY:

	Ag	Au
Rougher conc.	93.1	-
Cleaner conc.	-	-
Scavenger conc.	1.23	-

TEST NO. 19

Sample No. Falcon Silver
Sample weight 500 gm
Grind Rod mill, 10 min, 50% solids
Sizing 95% -100 mesh
Water used Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.2	-	10 min	Fag	Full
Cleaner	-	-	-	-	-	-
Scavenger	-	6.2	-	10 min	Fag	Full

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aero Xanthate 350	GNS No. 5	
Rougher	0.40	0.08	
Cleaner	-	-	
Scavenger	0.40	-	

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	470.0	-	2.37	
Rougher conc.	18.7	-	1190.00	
Cleaner tails	-	-	-	
Cleaner conc.	-	-	-	
Scavenger conc.	9.2	-	28.15	

RECOVERY:

	Ag	Au
Rougher conc.	94.3	-
Cleaner conc.	-	-
Scavenger conc.	1.08	-

TEST NO. 20

Sample No. Falcon Silver
Sample weight 500 gm
Grind Rod mill, 8 min, 50% solids
Sizing 95% -65 mesh
Water used Reno

TEST CONDITIONS:

	Temp.	pH	Cond. Time	Float Time	Machine	Aeration
Rougher	-	6.3	1 min	10 min	Fag	Full
Cleaner						
Scavenger						

REAGENTS (lb./ton):

	Collectors	Frother	Activator
	Aero Xanthate 350	Yarmer F	
Rougher	0.40	0.08	
Cleaner			
Scavenger			

ANALYSIS:

	wt.	oz.Au/ton	oz. Ag/ton	Value/ton
Tailings	478.8	-	2.45	
Rougher conc.	20.4	-	1102.00	
Cleaner tails				
Cleaner conc.				
Scavenger conc.				

RECOVERY:

	Ag	Au
Rougher conc.	95.04	-
Cleaner conc.		
Scavenger conc.		

CARLIN GOLD MINING COMPANY
P.O. Box 979
CARLIN, NEVADA 89822

August 30, 1977

Mr. F. W. McQuiston, Jr.
230 Kaanapali Drive
Napa, California 94558

Dear Frank:

Enclosed is the information I got from Perry on the Falcon.

I also enclosed a small map so you can get an idea of the physiography, and a sketchy history from the Elko County Mineral Deposit book.

If it titilates your interest and there is anything I can do give a yell.

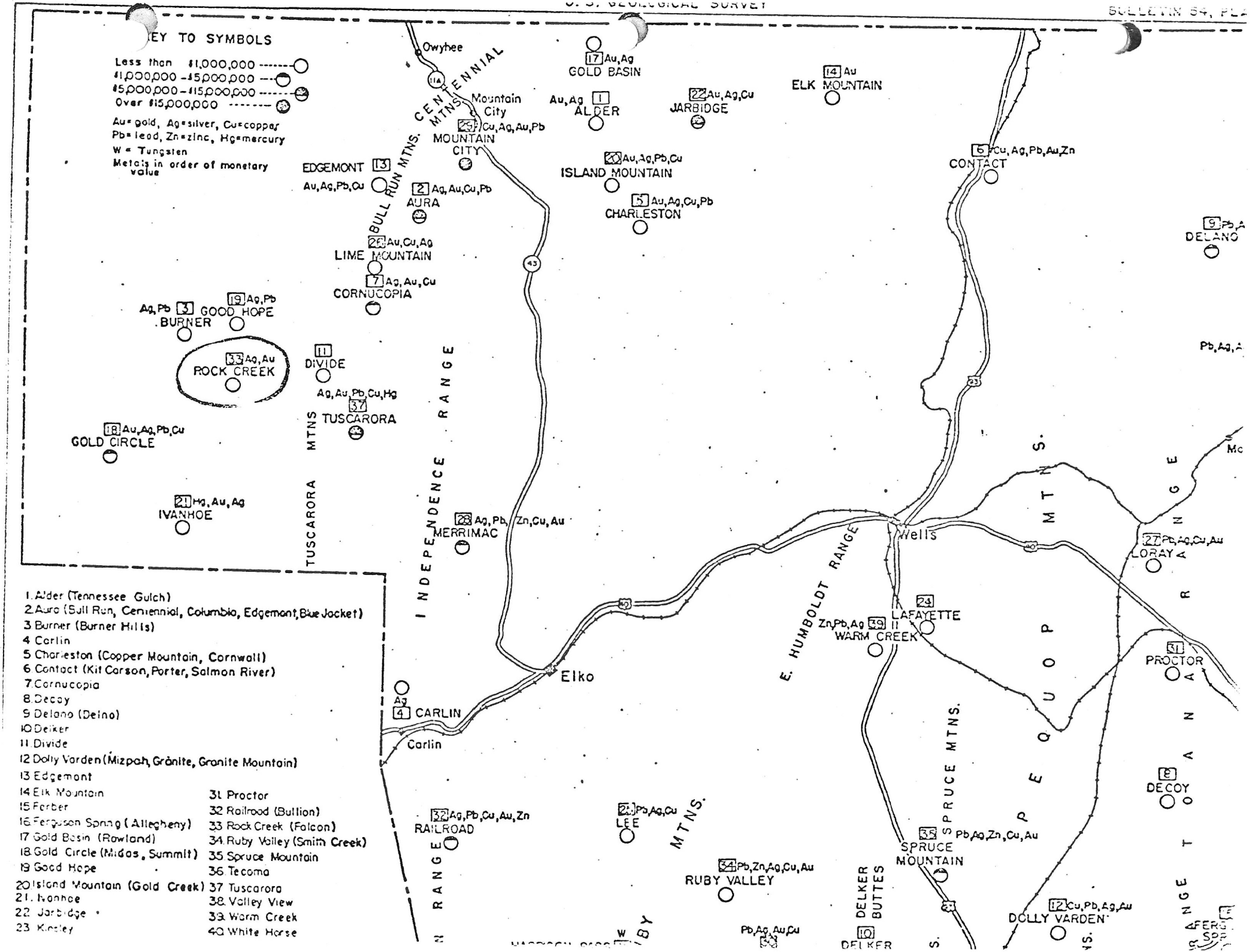
Yours truly,

J. D. McBeth

JDM/lb

Enclosure

The Falcon mine is caved at the collar but seems to be clear below. It probably needs only the collar retimbered.



1. Alder (Tennessee Gulch)
2. Aura (Bull Run, Centennial, Columbia, Edgemont, Blue Jacket)
3. Burner (Burner Hills)
4. Carlin
5. Charleston (Copper Mountain, Cornwall)
6. Contact (Kit Carson, Porter, Salmon River)
7. Cornucopia
8. Decoy
9. Delano (Delno)
10. Delker
11. Divide
12. Dolly Varden (Mizpah, Granite, Granite Mountain)
13. Edgemont
14. Elk Mountain
15. Forber
16. Ferguson Spring (Allegheny)
17. Gold Basin (Rowland)
18. Gold Circle (Midas, Summit)
19. Good Hope
20. Island Mountain (Gold Creek)
21. Ivanhoe
22. Jarbidge
23. Kinsley
31. Proctor
32. Railroad (Bullion)
33. Rock Creek (Falcon)
34. Ruby Valley (Smith Creek)
35. Spruce Mountain
36. Tecoma
37. Tuscarora
38. Valley View
39. Warm Creek
40. White Horse

ROCK CREEK (FALCON) DISTRICT

Silver, quicksilver

Sources of information

Emmons, W. H., 1910, A reconnaissance of some mining camps in Elko, Lander, and Eureka Counties, Nevada: U. S. Geol. Survey Bull. 408, p. 62.

Lincoln, F. C., 1923, Mining districts and mineral resources of Nevada: Nevada Newsletter Pub. Co., Reno, p. 54.

Bailey, E. H., and Phoenix, D. A., 1944, Quicksilver deposits in Nevada: Nevada Univ. Bull., v. 38, No. 5, Geol. and Min. Ser. No. 41, p. 63.

Location

The Rock Creek district lies about 10 miles west of Tuscarora and adjoins the Good Hope district on the south. The area includes parts of T. 40 N., Rs. 48 and 49. E.

History and production

During the period 1879–1881 the Falcon mine, the only mine in the district at that time, produced silver ore which was hauled to Tuscarora. There is no record of the amount or value of ore mined. In 1884 a four-pan silver mill was built but not operated. The Ruby King claim is reported to have produced a little silver and gold in 1922 from ore mined by lessees, and the property was reported to have had two vertical shafts, each 300 feet deep. In 1928 the April Fool group of claims produced a small lot of ore reported to have assayed 0.35 ounce of gold and 428 ounces of silver per ton. The Divide mine of the Ruby Silver Gold Mines Co. produced silver ore in 1928 which was shipped to Utah. The total value of ore produced from the district, according to record, is $3,652 from 31 tons of ore carrying 4,865 ounces of silver and 14 ounces of gold. The district also contains two undeveloped quicksilver prospects.

Geology and mines (data from Emmons, 1910, and Bailey and Phoenix, 1944)

The rocks exposed in the Rock Creek district are mainly Carboniferous quartzite capped by rhyolite and intruded by andesite and related rocks. A large mass of granodiorite, intrusive in the sedimentary rocks, is exposed at the headwaters of Willow Creek and Rock Creek.

Falcon mine.—The Falcon mine, at the head of a small tributary of Rock Creek, explores a fissure vein that is 2 to 5 feet wide and approximately vertical. Two deep shafts were sunk on

it and shallow pits were dug at several places. The country rock is andesite, which near the vein is altered to a light-gray rock composed largely of white mica; but the fresh dark andesite is exposed at several places within 300 or 400 feet of the vein. The ore is highly siliceous and contains a small proportion of finely divided pyrite and other dark sulfides, which are banded with the quartz and show comb and ribbon structure. The values are said to have been in ruby silver.

Teapot prospect.—The Teapot prospect is in sec. 12 (?), T. 40 N., R. 49 E. The rocks of the area are mostly andesitic flows that are locally cut by north-trending faults and quartz veins. A 55-foot shaft explores a shear zone that strikes N. 5° W. and dips about 80° E. In the shear zone cinnabar occurs as disseminated crystals with pyrite and also in narrow quartz veinlets that fill irregular cracks in the walls. The ore might be sorted to a good retort grade.

Rock Creek prospect.—The Rock Creek prospect is located in T. 40 N., R. 48 E., a mile north of Rock Creek and about a mile above the corrals in the mouth of the canyon. Only a small amount of development work has been done. The ore contains crystalline cinnabar coating altered andesite and covered by quartz and pyrite; some stibnite is said to accompany the ore.

RUBY VALLEY (SMITH CREEK) DISTRICT

Lead, zinc

Sources of information

Hill, J. M., 1916, Notes on some mining districts in eastern Nevada: U. S. Geol. Survey Bull. 648, p. 60–62.

Lincoln, F. C., 1923, Mining districts and mineral resources of Nevada: Nevada Newsletter Pub. Co., Reno, p. 54–55.

Location and history

The Ruby Valley district is on the east front of the Ruby Range about 11 miles north of the Ruby Valley post office. The district is largely in the area between Smith Gulch and Battle Creek. The principal properties are the Friday group of nine claims, on the south side of the mouth of Battle Creek, and the Short group of seven claims, at the forks of Smith Gulch. The Friday group was located in 1906; the Short group was located by J. F. and A. M. Short in 1903.

Production

The district is credited with t
ore containing 9 ounces of gold
pounds of copper, 227,700 poun
of zinc, valued in all at $62,496.

Geology and mines (data mainly from I

The mines of this district are
crystalline limestone that strikes a
N. The bedding has not been en
be parallel to the strike of the l
the summit of the range and is sa
prospects 12 miles southeast of I
of Ruby Range, are said to be i
has been intruded by a fine-grai
essentially of quartz, orthoclase
and a minor amount of oligocla
intrusion of this granite has me
lenses of lime-silicate rock cons
tremolite, with a little quartz. Ph
ity. Garnet does not seem to have
able extent. Some of these lenses
more rarely chalcopyrite. So fa
appear to be neither large nor per

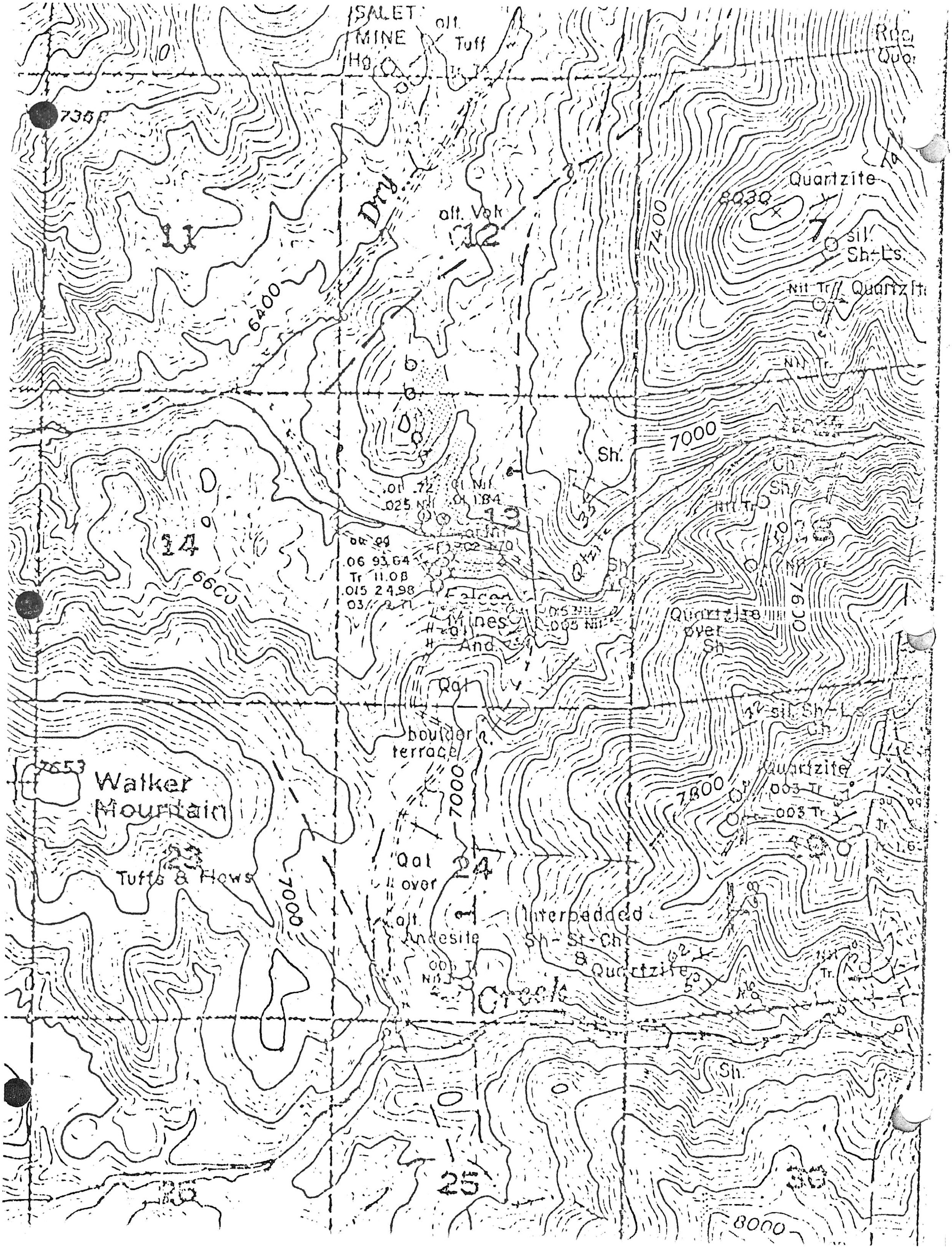
Friday group.—The main dev
consists of a tunnel and open cu
ridge south of Battle Creek. Th
about 400 feet through a marble
cate manner by a fine-grained l
consists essentially of quartz, o
biotite, the quartz constituting m
mass. The limestone in the ridge
rock, and near the granite it h
brownish-pink aggregate of cal
quartz. In the small lenslike ore bo
radial clusters is intergrown with
is the most abundant sulfide, th
been present, as there is a small
the surface ore. Cerussite and an

The Crescent workings, about
tunnel, consist of a shallow shaft
N. 15° W. and cutting white cr

Upper plate rocks: gold 0.1; silver 1; zinc 450; lead 35; arsenic 20; antimony 30.

Lower plate rocks: gold 0.1; silver 1; zinc 125; lead 35; arsenic 25; antimony 30.

The carbonaceous shales in the upper plate sequences of rock exhibit an abnormally high background value for zinc while arsenic had a slightly higher background in the lower plate rock sequences. Aside from gold itself, the best indicator metal for gold proved to be arsenic. At the Boot Strap mine, the area of 100 ppm plus arsenic, shown on the soil sample plan sheet 1, essentially mirrored the ore body as known today from drilling. The absence of anomalous arsenic in the drainage immediately east of the Bootstrap ore body illustrates the effective masking of values by the lake bed deposits. Anomalous arsenic areas mark the footwall of the Carlin deposit as well as the Pete group ore body and the Blue Star and Big Six mine areas. Although the presence of gold on Sections 33 and 2, 1 1/2 miles east of Blue Star, has been known for some time, the arsenic anomalies there pinpoint targets for further work. Both lead and arsenic anomalies occur in the vicinity of the gold-silver bearing veins of the Falcon Mine west of Tuscarora (see soil sample sheet 2). Additionally, a strong arsenic anomaly exists in a covered area northeast of the Falcon mine. The trend is parallel to one system of northeast veining in the Divide mine area. To date, no prospect pits have been dug in the area of this anomaly. Antimony values show a wider dispersion from mineralized sources than does arsenic, and is considered less definitive than arsenic for prospecting purposes. In a siliceous (upper plate) environment, iron, gold, lead, and arsenic are considered relatively immobile, while zinc, antimony, and silver are relatively mobile. Of particular interest geochemically, is a long, continuous


SALET
MINE
Hg
alt.
Tuff
7356
Quartzite
8030
7400
sil.
Sh+Ls.
Nil Tr.
Quartzite
11
12
Dry
alt. Volc
6400
Nil Tr.
7000
Sh.
13
14
6600
.01 .72 .01 Nil
.025 Nil .01 1.84
.06 93.64
Tr 11.08
.015 24.98
Falcon
Mines
And.
Qal
Quartzite
over
Sh.
7600
boulder
terrace
7000
Walker
Mountain
7653
Quartzite
7800
.003 Tr.
.003 Tr.
23
Tuffs & Flows
7000
Qal
over
24
alt.
Andesite
Interbedded
Sh-St-Ch
& Quartzite
Creek
Sh.
26
25
8000