

TR13-153-156

R. 564

FLOTATION OF PYRITE—PART II

Object

To concentrate pyrite from Branch Creek ore by flotation conditions indicated by the best path established by the Box-Wilson method of analysis in the first part of this investigation. In addition a cleaner concentration stage has been included in each test.

Test Work

The results of the best path for Na_2CO_3 addition, size of grind, and pulp density indicated in Table 5 of the report on the first part of this investigation were considered strange and difficult to apply.

The Box-Wilson analysis sheet was studied and a second table was prepared in which pulp density and the sulphur recovery obtained were expressed as a decimal part of unity instead of a percentage; e.g. a pulp density of 25% solids was expressed as 0.25, and a sulphur recovery of 56.2% was expressed as 0.562. This second Box-Wilson analysis chart is shown on Table 6 in this report. The results of the best path for Na_2CO_3 addition, size of grind, and pulp density appear to be more meaningful.

Conditions chosen for the next test (N14) were those for line 31, with the figures rounded off for convenience. The actual conditions used were as follows:—

Soda Ash	Grind	CuSO_4	Pulp Density	Potassium Iso-Propyl Xanthate	Reagent R633	Flot. time
lb/ton	90%	lb/ton	% Solids	lb/ton	lb/ton	minutes
—	75 μ	2.0	25	0.8	0.3	8

The reasons for the deviations from the suggested path are as follows:—

- Grind—time for 90%—75 micron grind already established.
- CuSO_4 addition. Effect figure for CuSO_4 in original Box-Wilson analysis sheet was in error by a factor of 10.
- 25% solids was maximum pulp density possible when washing 500 grams of 60% pulp from the ball mill.
- iso-propyl xanthate was increased because it was thought to have most influence on recovery.

The results of this test are shown on Table 7. Recovery was almost identical with the recovery in Test N13, but grade was slightly lower.

The rougher concentrate was cleaned in a cleaner float with six drops of M.I.B.C. added and a flotation time of 5 minutes.

TABLE 6
 EXPERIMENT: R. 564 PART II OBJECT: BRANCH CREEK PYRITE DATA

<i>Factors</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	Error of single test $e = 0.24$ $e = 2.43 \times$ smallest effect Error effect = $e \frac{2}{8}$ $= 0.354e$	1 = ABCD = BCE = - ADE = ACF = - BDF = ABG Interaction of factors					
<i>Studies</i>	* <i>S.A.</i>	<i>G.</i>	<i>C.S.</i>	<i>D.</i>	<i>Ki-PX</i>	<i>R633</i>	<i>F.T.</i>		<i>H</i>	<i>J</i>	<i>K</i>	<i>L</i>	<i>M</i>	<i>N</i>
									<i>Data</i>	<i>Calculation</i>	<i>Effect of Each Factor</i>			
Base level	5.6	105	0.5	0.18	0.25	0.25	7.5							
Unit	5.6	37.5	0.5	0.07	0.15	0.25	2.5							
High level	11.2	150	1	0.25	0.4	0.5	10							
Low level	0	75	0	0.11	0.1	0	5							
Sample 1 Test N10	0	75	0	0.11	0.1	0	5	0.088	0.315	0.796	2.464	0.308	Average	
2 N7	11.2	150	0	0.11	0.4	0.5	5	0.227	0.481	1.668	-0.524	-0.0655	B	
3 N12	11.2	75	1	0.11	0.4	0	10	0.386	0.828	-0.152	0.178	0.0223	C	
4 N6	0	150	1	0.11	0.1	0.5	10	0.095	0.840	-0.372	-1.394	-0.1743	BC = AD = - E	
5 N11	11.2	75	0	0.25	0.1	0.5	10	0.266	0.139	0.166	0.872	0.109	ABC = D	
6 N9	0	150	0	0.25	0.4	0	10	0.562	-0.291	0.012	-0.220	-0.0275	AC = BD = - F	
7 N13	0	75	1	0.25	0.4	0.5	5	0.754	0.296	-0.430	-0.154	-0.0193	AB = CD = - G	
8 N8	11.2	150	1	0.25	0.1	0	5	0.086	-0.668	-0.964	-0.534	-0.0668	A	
Effect	-0.07	-0.06	0.022	0.109	0.17	0.027	0.019							
Effect times unit	0.37	-2.45	0.011	0.007	0.026	0.007	0.048	*Variables						
Change	-0.4	-2.63	0.012	0.008	0.028	0.007	0.051	S.A. = Soda Ash (lb/ton) G. = Grind 90% passing in microns C.S. = Copper Sulphate (lb/ton) D. = Density Ki-PX = Potassium iso-Propyl Xanthate (lb/ton) F.T. = Flotation Time (minutes)						
Best path	5.2	102.4	0.51	0.188	0.28	0.26	7.55							
	4.8	99.8	0.52	0.196	0.31	0.26	7.60							
	4.4	97.1	0.54	0.204	0.33	0.27	7.65							
	4.0	94.5	0.55	0.213	0.36	0.28	7.71							
	2.0	81.4	0.61	0.253	0.50	0.32	7.96							
	1.6	78.7	0.62	0.262	0.53	0.32	8.01							
Test N14	0	68.2	0.67	0.294	0.64	0.35	8.22							

Conditions of Test N15 were chosen by averaging the CuSO_4 , potassium iso-propyl xanthate, and reagent R633 additions, and the flotation times in Tests N13 and N14. The conditions used in Test N15 were as follows:—

Soda Ash	Grind	CuSO_4	Pulp Density	Potassium Iso-Propyl Xanthate	Reagent R633	Flot. time
lb/ton	90%	lb/ton	% Solids	lb/ton	lb/ton	minutes
—	75 μ	1.5	25	0.6	0.4	6.5

The results of this test are shown in Table 7. The rougher concentrate was cleaned in a cleaner float with similar conditions as in Test N14, except 0.6 lb/ton of potassium isopropyl xanthate was added in addition. The cleaner float was found to be sluggish, and a xanthate addition was made to provide better flotation. The amount of addition was relative to the feed in the rougher flotation. No doubt the xanthate addition is the reason for the improvement of the cleaner flotation results of Test N15 over Test N14.

Conclusions

It is possible to recover 75% of the sulphur in the Branch Creek ore in a concentrate assaying about 30% sulphur. By the addition of potassium iso-propyl xanthate in a cleaning operation, it is probable that 60% of the sulphur would be recovered in a concentrate assaying 44% sulphur.

TABLE 7.

<i>Product</i>	<i>Per Cent</i>			<i>Per Cent Distribution</i>	
	<i>Weight</i>	<i>S</i>	<i>Fe</i>	<i>S</i>	<i>Fe</i>
N14 Cleaner FC ..	16.2	42.0	37.9	45.9	36.9
Cleaner FT ..	23.2	18.7	19.9	29.3	27.7
Rougher FC ..	39.4	28.3	27.3	75.2	64.6
Rougher FT ..	60.6	6.05	9.72	24.8	35.4
Head	100.0	14.8	16.6	100.0	100.0
N15 Cleaner FC ..	19.4	44.1	39.9	57.4	45.5
Cleaner FT ..	11.3	11.0	14.4	8.4	9.6
Rougher FC ..	30.7	31.9	30.5	65.8	55.1
Rougher FT ..	69.3	7.35	11.0	34.2	44.9
Head	100.0	14.9	17.0	100.0	100.0