TR18_181_185

R.659. Sulphide flotation of ore from Queen Hill, Zeehan.

L.J. Rhodes
H.K. Wellington

In previous work on this ore, a sulphide concentrate was produced that assayed 1.03% Sn and carried 28.9% of the tin in the original feed. The sulphide concentrate amounted to 58.4% by mass of the original feed (see Investigation R.643, Technical Reports 17, p. 196).

In this investigation, it was proposed to produce a high grade sulphur concentrate with low tin content, and then scavenge the remainder to produce a second sulphide concentrate, leaving a flotation tailing with a low sulphur content.

The sample used for this investigation was that remaining from Investigation R.643.

TEST WORK

The sample was ground in the Denver 12-inch (305 mm) x 12-inch diameter ball mill in closed circuit with an 18-inch (457 mm) Sweco screen fitted with a 300# screen. The screen undersize was allowed to settle and was then decanted and three flotation charges for the 10 kg Agitair flotation cell were taken by sampling the stirred, thickened pulp.

In Test N1, 500 g/t of calgon was added to the flotation charge followed by five minutes conditioning. To this, 20 g/t of sodium ethyl xanthate (NaEX) and 15 g/t of methyl iso-butyl carbinol (MIBC) were added and flotation was commenced. Stage additions of 20 g/t of NaEX and 8 g/t of MIBC were added on six occasions during rougher flotation (F1).

The rougher flotation concentrate was conditioned with 250 g/t of calgon for five minutes, and then floated with 20 g/t of NaEX and 8 g/t of MIBC. During cleaner flotation (F2) two additions of 40 g/t of NaEX and one addition of 8 g/t of MIBC were made.

The cleaner concentrate was then refloated (F3) and five flotation concentrates were taken over one minute periods.

The rougher, cleaner, and recleaner tails were bulked, and then conditioned for 5 minutes with 250 g/t of calgon. Flotation (F4) was carried out with the addition of 50 g/t of potassium amyl xanthate (KAX). Two stage additions of 50 g/t of KAX were made during flotation.

The scavenger concentrate was refloated (F5) and flotation concentrates were taken over one minute periods. The last concentrate was taken over a period of two minutes.

The flow sheet for Test N1 is shown in Figure 40.

A second test, N2, was commenced after the results of the first test, N1, were known. In this test, the scavenger cleaner concentrate (F5C) was given prolonged regrinding for 90 minutes in the 8-inch (203 mm) x 8-inch diameter laboratory ball mill.

In both tests, the rate of froth formation was controlled throughout flotation by reagent addition, and, or air addition so that the froth could be readily removed by means of a scraper.

Calgon additions in Test N2 were as for Test N1. Response to flotation

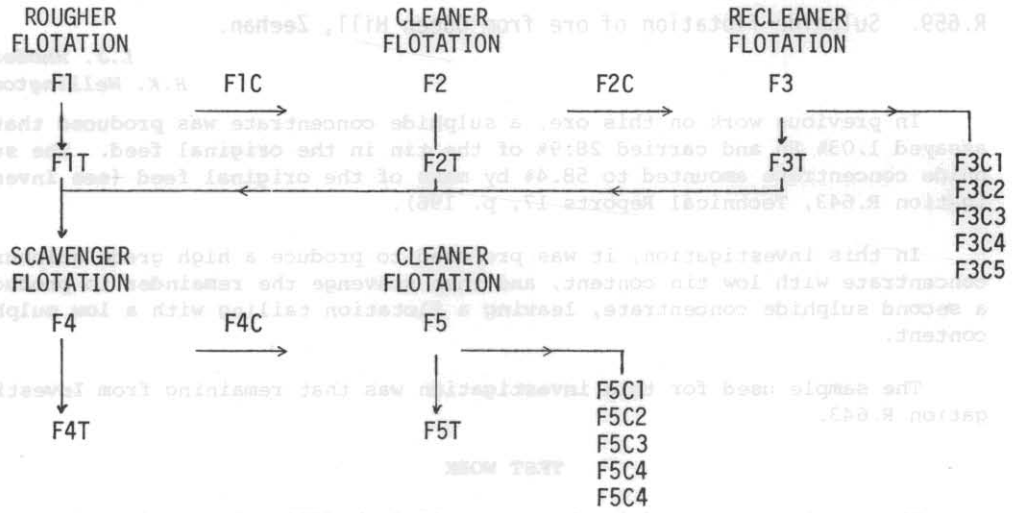

Figure 40. *Flow sheet for Test N1.*

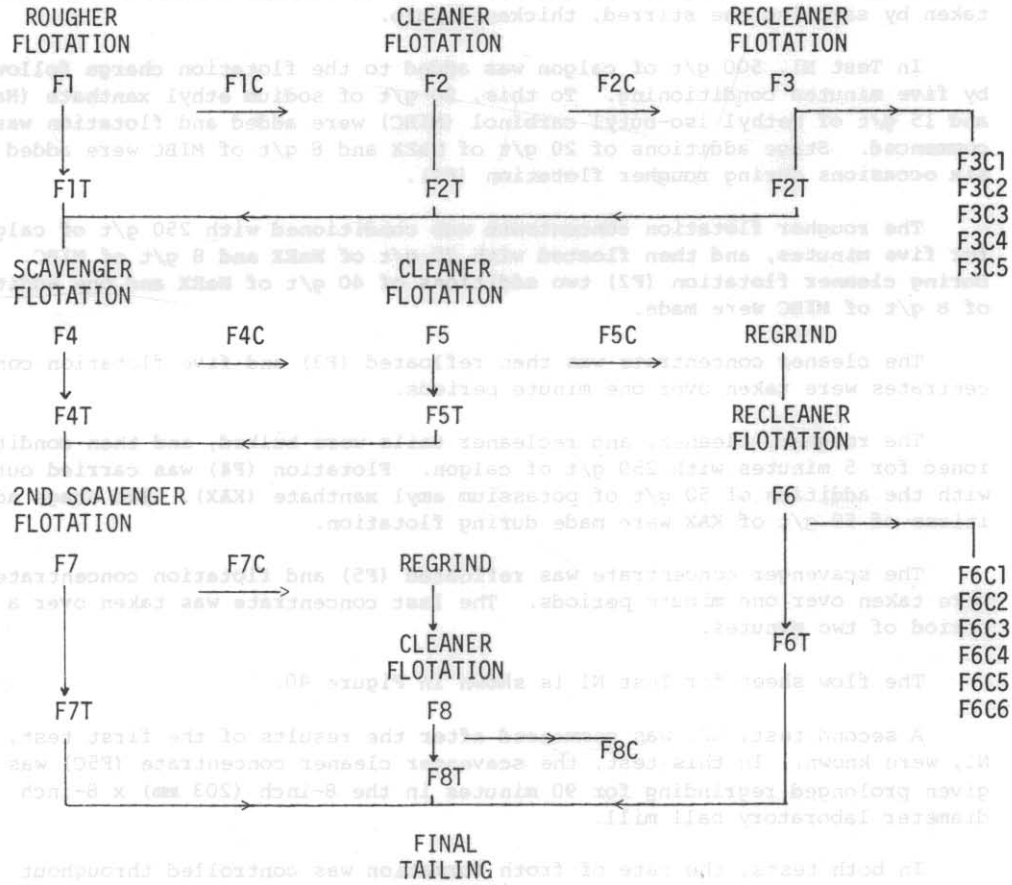

Figure 41. *Flow sheet for Test N2.*

was not as ready as in Test N1 probably due to aging of the sample, and it was found necessary to use increased amounts of xanthate.

In rougher flotation (F1), 60 g/t of NaEX and 25 g/t of MIBC were added initially and it was found necessary to make a further eight stage additions of 20 g/t of NaEX for adequate flotation; 80 g/t of MIBC was added during the stage additions of NaEX. In cleaner flotation (F2) reagent additions were the same as for Test N1 except that there was no stage addition of 8 g/t of MIBC.

Recleaner flotation (F3) was conducted with two stage additions of 8 g/t of MIBC. Five flotation concentrates were taken over one minute periods.

The rougher, cleaner, and recleaner tails were bulked and floated (F4) with reagent conditions as in Test N1. The scavenger concentrate was cleaned (F5) with a stage addition of 20 g/t of KAX. MIBC was added as required to maintain an adequate froth. This cleaner concentrate (F5C) was reground in the 8-inch x 8-inch diameter laboratory ball mill, by halving the concentrate and grinding each half for 90 minutes.

The regrind product was then subjected to flotation (F6) with an initial addition of 20 g/t of KAX. Four concentrates were taken over one minute periods with 20 g/t of KAX being added at the end of each minute. The fifth concentrate (F6C5) was taken over a five minute period.

At this stage the concentrates were dried and weighed, and the weight of concentrates showed that the amount of sulphides produced so far in Test N2 was reduced considerably compared with the amount of concentrate produced in Test N1.

Regrind recleaner flotation (F6) was then continued, and it was found necessary to make quite large xanthate additions to get the remaining sulphide to float. This may have been due to the large surface area that had been generated by the fine regrinding, as well as aging of the sample. Three stage additions of 50 g/t of KAX and seven stage additions of 100 g/t of KAX were made. Three stage additions of 500 g/t of sulphuric acid were also made. The concentrate produced was F6C6.

The flotation tails from scavenger flotation (F4) and the scavenger cleaner (F5) had been bulked and were subjected to further flotation (F7) with two additions of 100 g/t of KAX. The concentrate produced was reground for 90 minutes and then refloated (F8) to produce the concentrate F8C.

The flow sheet for Test N2 is shown in Figure 41.

A weighted composite was made from all concentrates produced after re-grinding, *viz.* F6C1, F6C2, F6C3, F6C4, F6C5, F6C6 and F8C. The composite sample was then cyclosized and a tin distribution was determined.

RESULTS

The result of Test N1 is as follows:

Product	*% Mass*	*% Sn*	*% S*	*% Sn Distn*	*% S Distn*
F3C1	10.6	0.33	51.2	1.6	19.9
F3C2	6.7	0.30	50.8	0.9	12.5
F3C3	5.0	0.32	50.1	0.8	9.2
F3C4	7.6	0.52	48.6	1.9	13.5
F3C5	3.7	0.71	47.0	1.2	6.4
F5C1	5.9	1.19	46.7	3.3	10.2
F5C2	9.3	1.80	42.0	7.7	14.3
F5C3	5.0	2.36	36.6	5.5	6.7
F5C4	3.7	3.49	26.3	6.1	3.6
F5C5	2.4	4.78	14.7	5.3	1.3
F5T	2.8	4.42	8.0	5.8	0.8
F4T	37.3	3.45	1.14	59.9	1.6
Assay Head	100.0	2.17	27.3	100.0	100.0
Calculated Head		(2.15)	(27.2)		

The result of Test N2 is as follows:

Product	*% Mass*	*% Sn*	*% S*	*% Sn Distn*	*% S Distn*
F3C1	6.2	0.29	51.4	0.8	11.6
F3C2	10.4	0.34	50.8	1.6	19.4
F3C3	4.3	0.30	50.7	0.6	8.0
F3C4	3.1	0.31	50.0	0.4	5.7
F3C5	4.1	0.39	49.6	0.7	7.5
F6C1	1.8	1.04	43.7	0.9	2.9
F6C2	6.5	1.31	45.1	4.0	10.8
F6C3	5.0	1.58	43.4	3.7	8.1
F6C4	2.6	1.70	42.0	2.1	4.0
F6C5	4.3	1.88	39.6	3.8	6.2
F6C6	8.3	1.75	36.9	6.8	11.3
F8C	5.6	4.33	13.5	11.3	2.8
*Tailing	37.8	3.59	1.24	63.3	1.7
Assay Head	100.0	2.17	27.3	100.0	100.0
Calculated Head		(2.15)	(27.2)		

*The tailing consisted of F6T, F7T and F8T.

The result of the tin distribution from the cyclosizing of the reground concentrate from Test N2 is as follows:

Fraction	*% Mass*	*% Sn*	*% S*	*% Sn Distn*
C/S 1	8.9	1.78		7.8
C/S 2	9.6	2.34		11.0
C/S 3	11.9	3.07		17.9
C/S 4	15.2	3.32		24.7
C/S 5	7.1	2.65		9.2
O/F	47.3	(1.27)		29.4
Assay Head	100.0	2.04	37.1	100.0
Calculated Head		(2.04)	(36.7)	

The results of Tests N1 and N2 can be summarised as follows:

Test	*Product*	*% Mass*	*% Sn*	*% S*	*% Sn Distn*	*% S Distn*
N1	F3C	33.6	0.41	49.9	6.4	61.5
	F5C	26.3	2.28	37.3	27.9	36.1
	*Tailing	40.1	3.52	1.63	65.7	2.4
N2	F3C	28.0	0.33	50.7	4.1	52.5
	F6C + F8C	34.2	2.04	36.7	32.6	46.1
	*Tailing	37.8	3.59	1.24	63.3	1.7

*The tailing consisted of F4T + F5T.

*The tailing consisted of F6T, F7T and F8T.

These results can be further summarised as follows:

Test	*Flotation Product*	*% Mass*	*% Sn*	*% S*	*% Sn Distn*	*% S Distn*
N1	Concentrate	59.9	1.23	44.4	34.3	97.6
	Tail	40.1	3.52	1.63	65.7	2.4
N2	Concentrate	62.2	1.27	43.0	36.7	98.3
	Tail	37.8	3.59	1.24	63.3	1.7

CONCLUSIONS

After grinding to 100% -300# a high grade pyrite concentrate can be produced which assays over 50% sulphur and about 0.35% tin. This concentrate carries over 50% of the sulphur and only about 5% of the tin, in the feed (see first summary of results).

The remaining pyrite, which can be floated off in a scavenger concentrate, carries about 30% of the tin. Regrinding of this concentrate to 81.5% <C/S2 (27 µm) of tin. The tin distribution in the cyclosizing of the reground sulphide concentrate indicates that very fine grains of cassiterite are still composited with the pyrite.

The second summary of results shows that regrinding of the scavenger concentrate, in Test N2, did not significantly alter the overall result when compared with Test N1, where no regrinding was carried out.

[8 February 1973]