

TR16-291-296

R.631. Sampling and evaluation of the Razorback mill, Dundas.

At the request of Gippsland Minerals N.L. the mill at the Razorback mine was visited so that an assessment could be made of its operations.

The visit was made on Thursday, 17 June 1971 between 2.00 p.m. and 5.00 p.m.

The mill was operating and the operator was Cyril Bye of Zeehan.

DESCRIPTION OF THE MILL

The mill was situated on sloping ground some few hundred yards from the mine. The ore from the mine was dumped on to a steel plate which provided a smooth bottom for easy shovelling.

The ore was shovelled directly into the scoop box of the ball mill approximately 4 feet in diameter x 4 feet in length. Oversize material was broken on the steel plate by means of a pick. A small 6 inch x 6 inch jaw crusher was situated next to the scoop box of the ball mill for crushing large ore that would not readily break by means of the pick. Crusher discharge fell to the floor where it could be picked up by shovel and fed into the scoop box. The crusher did not operate during the time of the visit.

The ball mill charge consisted of balls up to 125 mm in diameter. The ball mill was fitted with a trommel using a 24# woven wire for screening. Trommel oversize fell to the floor where it could be picked up by shovel and fed to the scoop box. There was not much trommel oversize produced during the visit, perhaps one or two shovels-full.

The trommel undersize gravitated to a Wilfley table. The Wilfley table produced a concentrate, a middling and a tailing. The middling consisted of two fractions, the normal middling fraction and the fine portion of the tailing, i.e. the product overflowing the table from the drive end to a point about half way along the table. The product coming off the table between the two middling fractions was final tailing.

The two middling products gravitated to a drag classifier. The sand from the drag classifier was elevated by the classifier to a point where it could gravitate to the scoop box of the ball mill. The classifier overflow gravitated to a Curvilinear table.

The Curvilinear table produced three products, concentrate, middling and tailing. The middling collects in a box which is emptied periodically on to a middling dump which is accumulated and retreated on infrequent clean-up occasions. The overflow from the middling box gravitated to waste along with the tailings from the two tables.

A second Curvilinear table situated alongside the Wilfley table was not in use. It was stated that it was sometimes used for cleaning the rougher concentrates. There was an agitator not being used sited ahead of the idle Curvilinear table. It was apparently a holding tank for material to be fed to the idle Curvilinear table.

The equipment in the mill was driven from an overhead countershaft which was driven by a petrol motor.

A flow-sheet of the mill is shown in Figure 82.

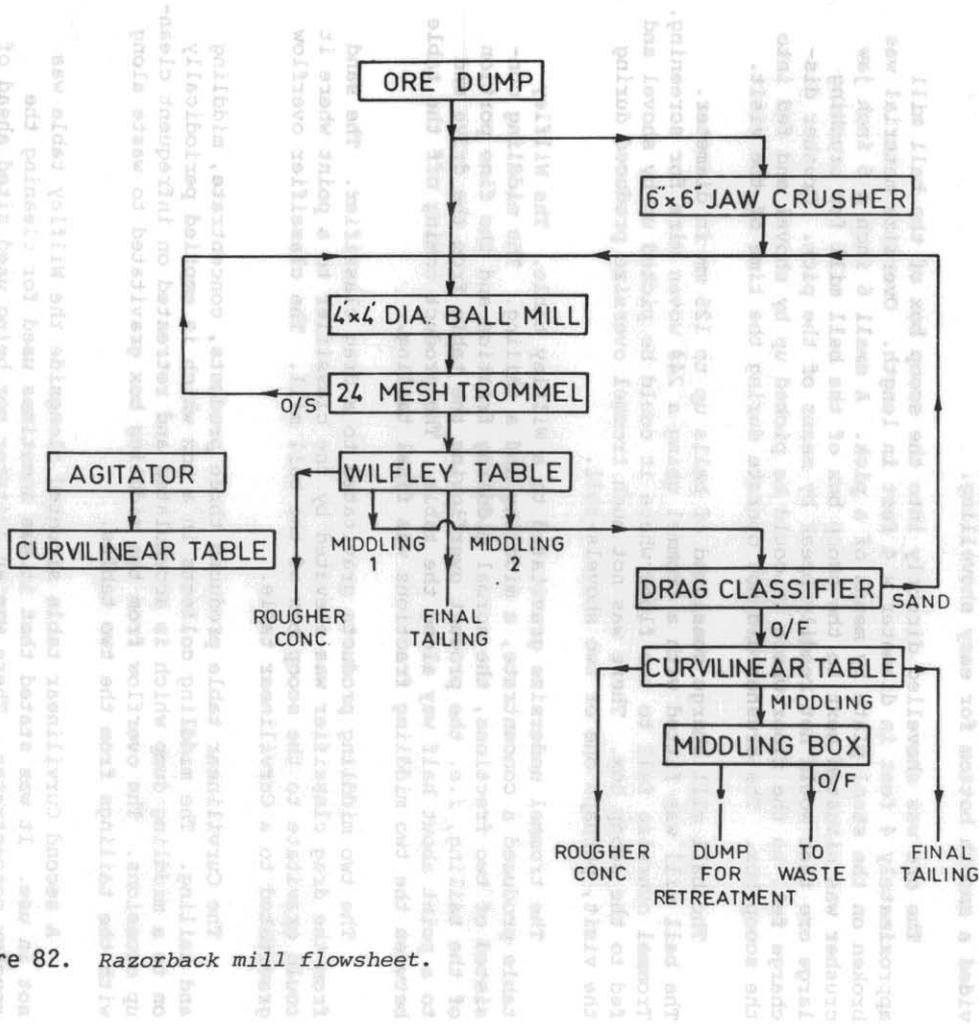


Figure 82. Razorback mill flowsheet.

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OPERATION

The mill had been operating for several hours when visited, and the operator reported that the circuit had settled down and was operating smoothly.

The ball mill was fed periodically with three or four shovels-full of ore, about 27-36 kg at a time. The operator made occasional excursions around the plant to check the operation of the tables and to provide lubrication where necessary. Very few adjustments were required.

The Curvilinear table middlings box was full and material entering the box escaped through the overflow pipe. This situation continued throughout the visit.

SAMPLING

It was impossible to get a representative sample of the mill feed. The sands from the drag classifier are returned to the mill, and it was impossible to sample this product. The mill discharge passed through a trommel attached to the trunnion and could not be sampled. The Wilfley table feed (trommel undersize) was not sampled because of the presence of the circulating middlings.

The following samples were taken at fifteen minute intervals:

- Wilfley table tail
- Curvilinear table feed
- Curvilinear table middlings box overflow
- Curvilinear table tail.

A grab sample of ore was taken from the ore heap from which the ball mill was fed. The sample was taken from a number of points on the exposed face from where the operator was shovelling. The sample was taken early in the sampling programme in the hope that it would be representative of the feed to the mill during the sampling programme.

Flow rate tests were made on the following products:

- Wilfley table tail
- Curvilinear table middlings box overflow
- Curvilinear table tail.

TEST RESULTS

The results of the assays and flow rates were as follows:

Product	Assay % Sn	Flow Rate lb/hr
Grab sample of ore	1.4	
Wilfley table tail	0.43	695
Curvilinear table feed	0.75	
Curvilinear table middlings box overflow	1.93	71
Curvilinear table tail	0.47	300

The four table samples above were screened and the screen undersizes were cyclosized and the size fractions assayed for tin. The results are shown in Tables 1 to 4 below. The assays shown for the bulked C/S4, C/S5 and C/S6 fractions are calculated assays.

Table 1. WILFLEY TABLE TAIL

Size Fraction	Weight		Assay % Sn	Sn Distribution	
	%	% Cum.		%	% Cum.
+36#	4.6	4.6	0.43	4.6	4.6
+52#	9.9	14.5	0.41	9.4	14.0
+72#	13.3	27.8	0.41	12.7	26.7
+100#	14.9	42.7	0.39	13.5	40.2
+150#	11.9	54.6	0.35	9.7	49.9
+200#	10.7	65.3	0.28	7.0	56.9
C/S1	4.6	69.9	0.91	9.7	66.6
C/S2	5.9	75.8	0.56	7.7	74.3
C/S3	5.4	81.2	0.54	6.8	81.1
C/S4	3.7	84.9	(0.43)	18.9	100.0
C/S5	1.7	86.6			
O/F	13.4	100.0			
Total	100.0		0.43	100.0	

Table 2. CURVILINEAR TABLE FEED

Fraction	Weight		Assay % Sn	Sn Distribution	
	%	% Cum.		%	% Cum.
150#	5.3	5.3	0.50	3.5	3.5
+200#	7.9	13.2	0.65	6.9	10.4
C/S1	5.5	18.7	4.64	34.0	44.4
C/S2	6.4	25.1	1.52	13.0	57.4
C/S3	9.2	34.3	0.77	9.4	66.8
C/S4	10.2	44.5	(0.38)	33.2	100.0
C/S5	5.7	50.2			
O/F	49.8	100.0			
Total	100.0		0.75	100.0	

Table 3. CURVILINEAR TABLE MIDDINGS BOX OVERFLOW

Fraction	Weight		Assay % Sn	Sn Distribution	
	%	% Cum.		%	% Cum.
+100#	6.9	6.9	0.49	1.8	1.8
+150#	21.9	28.8	0.57	6.5	8.3
+200#	28.1	56.9	0.80	11.6	19.9
C/S1	16.7	73.6	5.60	48.5	68.4
C/S2	9.1	82.7	3.86	18.2	86.6
C/S3	6.2	88.9	2.53	8.1	94.7
C/S4	3.0	91.9	0.93	5.3	100.0
C/S5	1.0	92.9			
O/F	7.1	100.0			
Total	100.0		1.93	100.0	

Table 4. CURVILINEAR TABLE TAIL

Fraction	Weight		Assay % Sn	Sn Distribution	
	%	% Cum.		%	% Cum.
+200#	6.1	6.1	0.39	5.1	5.1
C/S1	3.1	9.2	2.12	14.0	19.1
C/S2	5.2	14.4	0.83	9.2	28.3
C/S3	9.2	23.6	0.59	11.5	39.8
C/S4	11.2	34.8	0.37	60.2	100.0
C/S5	6.5	41.3			
O/F	58.7	100.0			
Total	100.0		0.47	100.0	

DISCUSSION

The operator indicated that the concentrate produced assayed about 50% Sn. The concentrate from the Wilfley table was collected in a container that held 14 kg of concentrate. There were about two full containers produced during the shift. It was estimated that about 2 kg of concentrate was produced on the Curvilinear table during the shift. This agrees with the statement by the operator that it takes about a week to fill the container on the Curvilinear table.

The flow rates reported earlier indicate a throughput of about 480 kg per hour of 3,360 kg per seven hour shift. The operator estimated a throughput of about 2,500 kg per shift.

Using the flow rates and extending them for the whole shift, and assuming that the assays of the tailings products applied for the whole shift, and relating the estimated concentrate production, a rough metallurgical balance can be established as shown below.

Product	kg Weight	Assay % Sn	% Sn Distn	Sn Units	Value \$
Tin Concentrate	30	50	44.6	1.45	40.60
Wilfley table tail	2,200	0.43	28.7	0.93	26.04
Curvilinear table middlings box O/F	230	1.93	13.2	0.43	12.04
Curvilinear table tail	950	0.47	13.5	0.44	12.32
Total	3,410	0.97	100.0	3.25	91.00

The value of the tin was based on a price of \$28.00 per unit.

This balance gave a calculated head of 0.97% Sn compared with the grab sample from the ore heap of 1.4% Sn. Recovery in the concentrate was only 44.6%, most of which is recovered on the Wilfley table.

However, the recovery on the Wilfley table is poor due to the large size range of the feed to this table. Recovery on the Curvilinear table was very low. Most of the tin recovered on this table was lost by allowing the middlings box to remain full with the consequent loss of the middlings overflowing to waste.

It should be possible to recover about 75% of the tin in the middlings from the Curvilinear table by pumping this product to a 200# screen

set up similarly to a D.S.M. screen and treating the undersize on the idle Curvilinear table and returning the oversize to the Wilfley table. The pump for this duty would not be required to be much larger than a washing machine pump. This modification to the present plant would not involve much expenditure and should result in a return of about \$9.00 a shift.

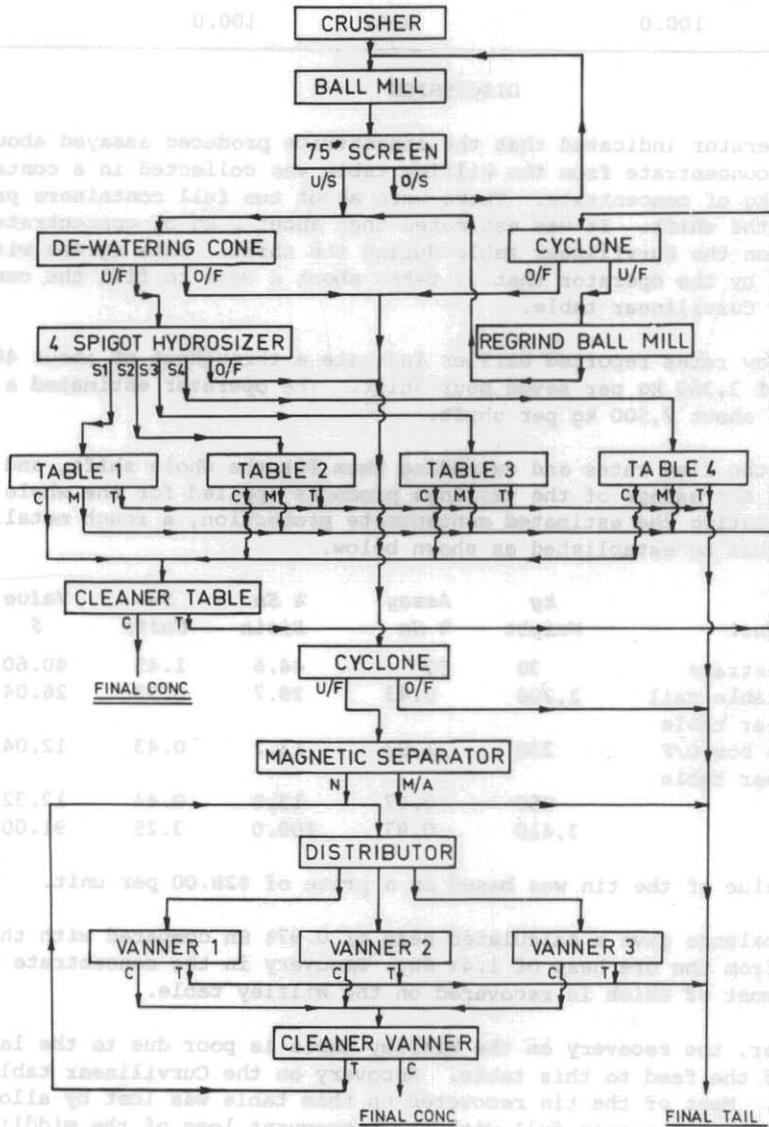


Figure 83. R.631. Proposed flow sheet