

TR16-268-271

R.621. Concentration tests on Great Pyramid tin ore for Aberfoyle Ltd.

A composite sample from percussion drilling in the oxidised section of the ore body was submitted. The sample weighed approximately 60 kg.

Head Assay: 0.29% Sn

The aims of the investigation were to:

- (1) establish an initial grind size,
- (2) broadly assess recoverability of the tin,
- (3) isolate possible treatment difficulties,
- (4) produce a 50% Sn concentrate for further examination elsewhere by spectrographic analysis.

Test Procedure

1. The whole sample was wet and dry screened on 18 and 200#. The -200# fraction thus obtained was excluded from further test work as it was considered that the grain size of the cassiterite in this fraction had been unnaturally degraded by the percussion drilling. This factor could prejudice the recovery obtainable under controlled crushing and grinding conditions.
2. The +18# fraction was stage roll crushed to -18# and added to the -18 +200# fraction obtained as above.
3. The composite was screened on 30, 52, 100 and 200# and the fractions sampled and assayed to give a size analysis of -18# roll crushed ore.
4. The -18 +30# fraction was concentrated by jigging and the remaining fractions by tabling to produce low grade tin concentrates plus middlings and tailings.
5. Middlings and tailings coarser than 52# were ground by continuous closed circuit ball milling to -60#.
6. The -60# regrind products were screened on 100 and 200# and the fractions concentrated by tabling to low grade tin concentrates and final tailings.
7. The total crude concentrate was ground to -60#, sulphides removed by flotation and concentrated by tabling to relatively high grade tin concentrates in two sizes: +200# and -200#.
8. The dried concentrates were magnetically separated to give final tin concentrates and magnetic fractions.

TEST RESULTS

Sizing Analysis of -18# Roll Crushed Ore

Fraction B.S.S.#	% Wt	% Sn	% Sn Distribution
-18 +30	40.8	0.23	31.8
-30 +52	31.7	0.31	33.4
-52 +100	13.0	0.36	15.9
-100 +200	11.2	0.43	16.3
-200	3.3	0.23	2.6
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Composite Head	100.0	0.29	100.0

Primary Concentration of Sized Fractions

Product	% Wt	% Sn	% Sn Distribution	
			Individual	Overall
-18 +30# JC	0.2	13.5	30.4	9.7
JM	1.0	0.65	7.3	2.3
JT	39.6	0.14	62.3	19.8
Comp. -18 +30#	40.8	(0.22)	100.0	31.8
-30 +52# TC	1.9	3.5	65.1	21.7
TM	2.1	0.12	2.4	0.8
TT	27.7	0.12	32.5	10.9
Comp. -30 +52#	31.7	(0.32)	100.0	33.4
-52 +100# TC	0.7	5.0	77.8	12.4
TM	1.9	0.09	3.8	0.6
TT	10.4	0.08	18.4	2.9
Comp. -52 +100#	13.0	(0.35)	100.0	15.9
-100 +200# TC	0.7	5.7	86.4	14.1
TM	1.3	0.20	5.6	0.9
TT	9.2	0.04	8.0	1.3
Comp. -100 +200#	11.2	(0.41)	100.0	16.3
-200 TC	0.08	5.9	59.5	1.5
TT	3.22	0.10	40.5	1.1
Comp. -200#	3.3	(0.24)	100.0	2.6
Comp. Head	100.0	(0.29)		100.0

Summary of Primary Concentration Results

Product	% Wt	% Sn	% Sn Distribution
Low grade conc.	3.58	4.83	59.4
Middling	6.30	0.21	4.6
Tailing	90.12	0.12	36.0

Products for Regrinding to -60#

Product	% Wt	% Sn	% Sn Distribution
-18 +30# JM	1.0	0.65	2.3
JT	39.6	0.14	19.8
-30 +52# TM	2.1	0.12	0.8
TT	27.7	0.12	10.9
Comp. Regrind Feed	70.4	0.14	33.8

Concentration of -60# Reground Material

Product	% Wt	% Sn	% Sn Distribution
-60 +100# TC	0.7	1.73	4.4
-100 +200# TC	0.7	2.30	6.0
-200# TC	0.4	4.40	6.5
Comp. Regrind C	1.8	2.54	16.9
-60 +100# TT	24.1	0.07	6.3
-100 +200# TT	19.9	0.07	5.1
-200# TT	24.6	0.06	5.5
Comp. Regrind T	68.6	0.07	16.9
Comp. Regrind F	70.4	0.13	33.8

Total Crude Concentrate

Product	% Wt	% Sn	% Sn Distribution
Primary C	3.58	4.83	59.4
Regrind C	1.80	2.54	16.9
Composite Crude C	5.38	4.07	76.3

Upgrading of Crude Concentrate

Product	% Wt	% Sn	% Sn Distribution
+200# TC	0.25	55.7	46.3
-200# TC	0.15	34.5	17.2
Composite Final C	0.40	(47.6)	63.5
+200# M/A	0.10	6.3	2.1
-200# M/A	0.04	1.7	0.2
Composite M/A	0.14	(5.0)	2.3
FC	Trace	3.0	-
T/T	4.82	0.66	10.5
Composite Crude C	5.38	(4.27)	76.3

Final Metallurgical Balance

Product	% Wt	% Sn	% Sn Distribution
Final Tin Concentrate	0.4	47.6	63.5
Upgrading by Products	5.0	0.78	12.8
Final Gravity Tail	94.6	0.07	23.7
Composite Head	100.0	0.30	100.0

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CONCLUSIONS

The value of the ore at 0.29% tin is probably sub-economic at the recovery level obtained in the investigation. However, if the sample treated is typical of the whole or richer section of the ore body, valid data regarding treatment requirements have been obtained, and the objectives of the test achieved.

The conclusions to be drawn from the experimental work are as follows:

1. Crushing to -18# and gravity concentration of sized fractions results in a recovery of approximately 60% in low grade concentrates (4.83% Sn). However, regrinding to -60# and retreatment of about 70% of the primary tailings is necessary before an acceptably low tin content of final tailing is achieved. In view of this it would probably be desirable to grind initially to -60# or thereabouts before primary treatment. It is considered that overall recovery would not be seriously affected by this. Overall recovery in crude concentrates amounted to 76.3%.
2. A recovery of 63.5% was obtained. Had the head grade been higher, probably recovery also would have been somewhat higher. A recovery of between 60 and 70% could be expected in commercial treatment of this type of ore.
3. No difficulties were encountered in the treatment up to the stage of crude concentrate production. However, the abrasive nature of the quartzite ore should not be overlooked in assessment of crushing and grinding equipment for a commercial plant.

It was found difficult to achieve the required grade of concentrate consistent with a reasonable recovery figure in the concentrate upgrading operations. The crude concentrate contained a considerable amount of oxidised iron-bearing material, similar in appearance to the cassiterite, making the final gravity concentration rather difficult. Dry magnetic separation removed much of this from the final concentrate and this operation is a necessary phase of the treatment.

Sulphide content is low, but its nuisance value may necessitate its removal from the concentrate by froth flotation.

TEST RESULTS

Product	Weight %	Assay % Sn	Recovery %
Crude concentrate	4.83	31.2	76.3
Final concentrate	1.2	89.7	63.5
Primary tailings	Trace	39.4	0.1
Final tailings	Trace	10.8	0.2
Other	1.1	13.0	0.2
Crude concentrate	Trace	34.7	0.1
Final concentrate	1.2	71.7	1.1
Primary tailings	Trace	71.3	0.2
Final tailings	Trace	22.8	0.3
Other	0.8	38.4	0.3