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R.691. Further treatment of metallurgical products from the Razorback Mine, Dundas

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This report details further treatment on the metallurgical products produced in R.686. The samples utilised were:

741105 (T1) A surface sample taken over 11.0 m between co-ordinates 4840 N: 2815 E and 4843 N: 2791 E.

741115 (T11) A sample from 'Brocks' taken over 30.9 m between co-ordinates 4815 N: 2824 E and 4801 N: 2797 E.

Initial treatment on both samples was directed by and largely performed by the staff of Minops Pty Ltd in the Department of Mines laboratories, Launceston.

The initial treatment of sample *741105* was:

(1) autogenously trommelled, aperture 5 mm, with the oversize being roll crushed;
(2) the products from the crushing and trommel were screened on 2.41 mm to yield an oversize product, S 1 O/S, and an undersize;
(3) this undersize was screened on 600 μm to yield an oversize product S 2 O/S, and an undersize;
(4) this undersize was hydraulically cycloned to yield two products, C 3 U/F and C 3 O/F, the latter being regarded as a waste product;
(5) the S 1 O/S, S 2 O/S and C 3 U/F were all mixed together and this composite formed the head sample H 1 in this project.

The results of this initial treatment were:

Product	*% Mass*	*% Sn Assay*	*% Sn Distn*	*Remarks*
C 3 O/F	16.3	0.28	7.3	discarded
H 1	83.7	0.69	92.7	head sample
	100.0	0.62	100.0	

The initial treatment of sample *741115* was:

(1) autogenously trommelled, aperture 5 mm, to produce an oversize, S 1 O/S, and an undersize S 1 U/S;
(2) the oversize, S 1 O/S, was crushed in closed circuit with rolls to pass a 2.41 mm screen, S 3 U/S;
(3) the trommel undersize, S 1 U/S, was hydraulically cycloned to produce an overflow, C 4 O/F which was discarded, and an underflow C 4 U/F;
(4) the cyclone underflow, C 4 U/F, and the screen undersize, S 3 U/S were attritioned, C5;
(5) the attrition product was screened on 600 μm to produce an oversize, S 6 O/S, and an undersize, S 6 U/S;
(6) this undersize was hydraulically cycloned to produce two products, C 7 U/F and C 7 O/F.

The results of this initial treatment were:

Product	*% Mass*	*% Sn Assay*	*% Sn Distn*	*Remarks*
C 7 O/F	9.0	0.01	0.2	discarded
C 7 U/F	50.6	0.81	82.3	used in this project
S 6 O/S	5.3	0.58	6.2	used in this project
C 5 F/D	64.9	(0.68)	88.7	attritioner feed
C 4 O/F	35.1	0.16	11.3	discarded
	100.0	(0.50)	100.0	

The products from the above used in this project are:

741105 composite of three products designated *H 1*.
741115 composite of two products, namely *C 7 U/F* and *S 6 O/S*.

METHOD

(a) Sizing and classification: Samples H 1 and C 7 U/F were individually wet screened with - 300 µm fractions being separately classified on a three spigot Geco classifier.

(b) Concentration of +600 µm fraction: The H 1 and C 7 U/F +600 µm fractions were separately fed to a Denver laboratory jig, the concentrates produced being separated on a Rapid high intensity dry magnetic separator. The non-magnetic fraction of each was then subjected to a heavy liquid separation at a density of 2.95 t/m^3.

(c) Primary concentration: The -600 µm sized and classified fractions were separately gravity concentrated on a Deister concentrating table.

(d) Magnetic separation: The primary table concentrates of H 1 and C 7 U/F were respectively combined and separately fed to a Jones wet magnetic separator set at maximum magnetic intensity and using the minimum plate gap.

(e) Secondary concentration: The Jones non-magnetic fraction from each sample was screened into the following fractions prior to final Deister table gravity concentration.

+300 (T 1 only), +150, +105, +75, +38 and -38 µm.

All figures stated are derived by considering each of the three samples treated as individually being 100% by mass.

This investigation has been carried out without any grinding, and all samples have been concentrated in the form that they existed as products of investigation R.686. No middling or coarse primary tailings retreatment has been undertaken on samples H 1 or C 7 U/F, but it is felt that in general, recovery figures similar to the initial recovery figures from the overall concentration process for each sample could be expected upon grinding these products.

RESULTS

H1 - Primary concentration

Fraction	*% Mass*	*% Sn*	*% Sn Distn*	*% Sn recovery per individual fraction*	*Remarks*
H/L S/K 2.95	0.19	55.7	15.7	48.9	
H/L F/T 2.95	0.21	0.10	0.1	0.3	
M/S N	0.40	25.9*	15.8	49.2	*by calcn 26.5
M/S M/A	1.34	0.79	1.5	4.7	

Fraction	*% Mass*	*% Sn*	*% Sn Distn*	*% Sn recovery per individual fraction*	*Remarks*
J C	1.74	6.70	17.3	53.9	
J T	45.27	0.22	14.8	46.1	
+600 µm F	47.01	0.48*	32.1	100.0	*by calcn 0.46
T C	1.04	7.30	11.3	64.2	
T M	0.88	0.38	0.5	2.8	
T T	17.65	0.22	5.8	33.0	
-600 +300 µm F	19.57	(0.60)	17.6	100.0	
T C	0.67	31.6	31.4	87.7	
T M	0.41	0.86	0.5	1.4	
T T	14.41	0.18	3.9	10.9	
S 1 F	15.49	(1.56)	35.8	100.0	
T C	0.29	9.2	3.9	79.6	
T M	0.50	0.36	0.3	6.1	
T T	3.90	0.12	0.7	14.3	
S 2 F	4.69	(0.71)	4.9	100.0	
T C	0.34	7.9	4.0	83.3	
T M	0.18	0.34	0.1	2.1	
T T	3.85	0.13	0.7	14.6	
S 3 F	4.37	(0.74)	4.8	100.0	
T C	0.48	2.83	2.0	41.7	
T T	8.39	0.22	2.8	58.3	
C/O F	8.87	(0.36)	4.8	100.0	
Head H 1	100.00	(0.67)	100.0	-	
Head Assay		0.69			

Primary gravity concentration - Summary (excluding +600 µm F)

Fraction	*% Mass*	*% Sn*	*% Sn Distribution*
+600 µm F	47.01	(0.46)	32.1
Σ T C	2.82	(12.6)	52.6
Σ T M	1.97	(0.47)	1.4
Σ T T	48.20	(0.19)	13.9
Head	100.0	(0.67)	100.0

Jones magnetic separation.

Fraction	*% Mass*	*% Sn*	*% Sn Distn*	*% Sn recovery per individual fraction*
M/S N	1.01	27.2	40.7	77.4
M/S M/A	1.61	2.40	5.7	10.8
M/S M*	0.20	20.9	6.2	11.8
E Primary T C	2.82	(12.6)	52.6	100.0

*M = washings from Jones M/S.

Secondary gravity concentration

Fraction	*% Mass*	*% Sn*	*% Sn Distribution*
T C	0.09	55.5	7.4
T T	0.19	3.95	1.1
+300 μm F	0.28	(20.5)	8.5
T C	0.05	64.7	4.8
T T	0.08	1.90	0.2
+150 μm F	0.13	(26.1)	5.0
T C	0.06	65.6	5.8
T T	0.02	1.35	0.1
+105 μm F	0.08	(49.5)	5.9
T C	0.05	64.7	4.8
T T	0.01	3.8	0.1
+75 μm F	0.06	(54.6)	4.9
T C	0.08	61.1	7.2
T T	0.02	3.1	0.1
+38 μm F	0.10	(49.5)	7.3
T C	0.16	37.4	8.9
T T	0.20	0.85	0.2
-38 μm F	0.36	(17.1)	9.1
Jones M/S N	1.01	(27.2)	40.7

Summary of overall concentration (including +600 μm fraction)

Fraction	*% Mass*	*% Sn*	*% Sn Distribution*
Σ Secondary T C	0.68	(54.2)	54.6
Σ Primary T T	0.52	(2.31)	1.8
Σ Primary T M	1.97	(0.47)	1.4
Jones M/S M	0.20	20.9	6.2
Jones M/S M/A	1.61	2.40	5.7
+600 JC M/S M/A	1.34	0.79	1.5
Σ Primary T T	93.68	(0.21)	28.8
H 1	100.00	(0.67)	100.0

C 7 U/F Primary gravity concentration

Fraction	*% Mass*	*% Sn*	*% Sn Distn*	*% Sn recovery per individual fraction*
T C	0.8	11.9	10.7	38.6
T M	4.2	0.74	3.5	12.6
T T	26.7	0.45	13.5	48.8
-600 +300 µm F	31.7	(0.78)	27.7	100.0
T C	1.2	24.1	32.6	74.1
T M	2.0	1.04	2.3	5.2
T T	23.2	0.35	9.1	20.7
C/S 1 F	26.4	(1.48)	44.0	100.0
T C	0.4	18.1	8.1	73.6
T M	2.3	0.25	0.6	5.5
T T	13.3	0.15	2.3	20.9
C/S 2 F	16.0	(0.61)	11.0	100.0
T C	0.6	11.5	7.8	82.1
T M	2.4	0.25	0.7	7.4
T T	9.3	0.10	1.0	10.5
C/S 3 F	12.3	(0.69)	9.5	100.0
T C	2.8	1.5	4.7	60.3
T T	10.8	0.25	3.1	39.7
C/O F	13.6	0.51	7.8	100.0
C 7 U/F	100.0	(0.89)	100.0	-
Head Assay		0.81		

Primary gravity concentration - Summary

Fraction	*% Mass*	*% Sn*	*% Sn Distribution*
Σ T C	5.8	(9.79)	63.9
Σ T M	10.9	(0.59)	7.1
Σ T T	83.3	(0.31)	29.0
C 7 U/F	100.0	(0.89)	100.0

Jones magnetic separation

Fraction	*% Mass*	*% Sn*	*% Sn Distn*	*% Sn recovery per individual fraction*
M/S N	3.34	12.0	44.4	69.5
M/S M/A	0.78	4.5	3.9	6.1
M/S M	1.68	8.4	15.6	24.4
Σ Primary T C	5.80	(9.95)	63.9	100.0

Secondary gravity concentration

Fraction	*% Mass*	*% Sn*	*% Sn Distribution*
T C	0.16	45.0	7.3
T T	0.34	10.4	3.6
-600 +150 μm F	0.50	(21.5)	10.9
T C	0.12	36.6	4.5
T T	0.08	1.49	0.1
+105 μm F	0.20	(22.6)	4.6
T C	0.15	49.4	7.5
T T	0.15	1.26	0.2
+75 μm F	0.30	(25.3)	7.7
T C	0.16	56.7	9.2
T T	0.17	1.00	0.1
+38 μm F	0.33	(28.0)	9.3
T C	0.20	47.1	9.6
T T	1.81	1.27	2.3
-38 μm F	2.01	(5.83)	11.9
Jones M/S N	3.34	(13.1)	44.4

Summary of overall concentration

Fraction	*% Mass*	*% Sn*	*% Sn Distribution*
Σ Secondary T C	0.79	(47.5)	38.1
Σ Secondary T T	2.55	(2.48)	6.3
Σ Primary T M	10.90	(0.59)	7.1
Jones M/S M	1.68	8.4	15.6
Jones M/S M/A	0.78	4.5	3.9
Σ Primary T T	83.30	0.31	29.0
C 7 U/F	100.00	(0.94)	100.0

S 6 O/S Summary of overall concentration

Fraction	*% Mass*	*% Sn*	*% Sn Distribution*
H/L S/K 2.95	0.32	61.0	36.7
H/L F/T 2.95	0.02	0.10	trace
M/S N	0.34	(57.4)	36.7
M/S M/A	0.64	3.10	3.7
J C	0.98	(21.9)	40.4
J T	99.02	0.32	59.6
S 6 O/S	100.00	(0.53)	100.0
Head Assay		0.58	

CONCLUSIONS

Conservative recovery figures indicate that the relatively unoxidised sample T 1 will give a much higher tin recovery than the heavily oxidised sample T 11.

Sample	*% Recovery*	*% Sn*
H 1	57.2	53.6
C 7 U/F	38.1	47.5

For a basis of comparison, the figures above are derived such that they do not include any middling or coarse tailing tin (and are therefore conservative) and also entirely omit the +600 µm fraction of each sample.

Concentration of +600 µm fractions in both samples gave results as follows:

Sample	*% Recovery*	*% Sn*
H 1 +600 µm	48.9	55.7
S 60/S +600 µm	36.7	61.0

These results indicate the presence of some comparatively coarse cassiterite readily recovered at a saleable grade. The +600 µm magnetic fractions were seen to be relatively high in tin, giving the following results:

Sample	*% Sn*
H 1	0.79
S 6 O/S	3.10

From the test work carried out, and the results obtained, it is felt that in order to achieve maximum recovery, final tailing discharge should occur only at a particle size of the order of -150 µm.

It is recommended that a jig be incorporated in the grinding circuit prior to the ball mill to recover coarse cassiterite.

All primary tailings should be ground to -150 µm before final concentration and discharge.

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