Ammtec Burnie

ASSESSMENT SUMMARY

FLOTATION AND GRAVITY ASSESSMENTS

QUEEN HILL COMPOSITES

FOR

STELLAR RESOURCES

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SUMMARY

A previous project (T0587) tested Queen Hill core composites. Assessments included analytical, mineralogical and flotation assessments for each and was based on a Renison style flowsheet. The table below summarises the key findings for each type. The current project (T0630) is focussed on improving the flotation response for both sulphide rejection and tin float concentrate grade and recovery. Gravity and leach assessments are also in progress. Results to date are presented in summary form below.

OVERALL ASSESSMENT

Sulphide Flotation Assessment: Both composites behave in a similar manner in sulphide flotation. 10% of feed cassiterite remains in the sulphide concentrate, a moderate proportion of this cassiterite is free and potentially recoverable. Tin loss has been reduced to a 7-12% recovery loss with a rejection of some 82% of feed sulphur. This leaves a non-sulphide stream of 61% mass with 1.40% Sn and 6.6% S for tin recovery treatment.

Tin Flotation Assessment: A concentrate of 8.0%Sn (60% recovery), 28%Fe and 16%SiO_2 are best to date. This fine sized rougher/single cleaner concentrate may be best treated by acid leaching for up-grade of tin values.

Gravity Assessment: Gravity tin recovery is acceptable at 71% from feed but iron carbonates strongly dilute the concentrate in all factions tested. Better upgrades may be achieved by reducing the top size to 106um and stage regrinding middlings. Further assessment required.

Leach Assessment: Leaching of carbonates from low grade float concentrate has been demonstrated to give high tin upgrade ratio. Remaining gangue are resistant silicates that will need to be separated. Test a combined gravity conc / tin float conc leach. Test a silicate prefloat prior to tin flotation.

FLOTATION TESTING

T0587 SULPHIDE FLOTATION

Sulphide float results are presented in the summary tables below. Sulphide rejection is quite acceptable at around 90% for most tests with less than 4% S in combined non-sulphide tails. Tin loss to concentrate is high, up to 35% of feed tin, when using PAX and without a depressant. A silicate depressant (sodium silicate) strongly reduces the loss of tin to the concentrate with losses reduced to around 15% of feed tin. Mineralogical assessment of sulphide concentrate indicates further gains can be made as a high proportion of the cassiterite is liberated in this product.

Assessment: Both composites behave in a similar manner in sulphide flotation. 14% of feed cassiterite remains in the sulphide concentrate, a high proportion of this cassiterite is free and potentially recoverable.

T0630 SULPHIDE FLOTATION

Flotation results are also presented in table 1 below (in bold). Results indicate that significant improvements can be made in the loss of tin in sulphide concentrate. These have been made by:

- Using a “weaker” xanthate collector (SEX rather than PAX)
- Using a guar depressant (Tall Bennett or Senmin)
- Regrinding sulphide rougher concentrate to a finer size.
- Holding Ph low in the cleaner sstage.

Assessment: Tin loss has been reduced to a 7-12% recovery loss with a rejection of some 82% of feed sulphur. This leaves a non-sulphide stream of 61% mass with 1.40% Sn and 6.6% S for tin recovery treatment.

TABLE 01: SULPHIDE FLOTATION RO/REG/CL TESTS

TEST	REAGENTS						REG min	RO CONCENTRATE			
	PAX	SEX	RO H2SO4	Na Silicate	Guar 1	Guar 2		%Sn	Rec	%S	Rec
T03	155		350	400			7	0.64	19.7	40.2	82.8
T04	155		790	400			10	0.40	20.0	42.5	91.1
T07	156		406	507			14	0.52	13.7	43.1	76.5
T08	155		1390	506			18	0.31	14.3	44.3	87.2
T09	155		426	502			14	0.54	15.4	42.8	78.4
T10	172		1390	505			18	0.33	18.1	43.6	93.0
T03		220	1572		275		20	0.28	12.0	43.8	92.0
T05		186	1485		250		20	0.29	11.7	47.0	84.7
T09		206	1558			273	20	0.24	9.0	48.2	79.4
T10		213	1605			281	20	0.23	8.3	49.3	80.5
T15		215	883			284	20	0.22	7.6	51.5	77.8
T17		208	1569			275	20	0.27	10.6	43.3	80.5
T20		121	899			219	20	0.42	19.5	41.24	91.9
T23		122	897			194	20	0.48	20.5	38.44	84.8
T24		137	1167			169	20	0.46	17.3	38.95	79.3
T27		128	831			275	20	0.46	20.0	37.88	82.0
T32		140	805			275	20	0.26	10.7	45.52	81.6
T37		140	840			275	20	0.28	12.2	46.08	82.9
T41		160	1263			275	20	0.26	10.3	43.10	83.1

TEST	REAGENTS						REG min	CL CONCENTRATE			
	PAX	SEX	TOT H2SO4	Na Silicate	Guar 1	Guar 2		%Sn	Rec	%S	Rec
T24		137	2610			169	20	0.26	8.3	44.8	76.7
T27		128	2285			275	20	0.24	8.6	44.2	79.3
T32		140	2590			275	20	0.26	10.7	44.5	81.6
T37		140	2678			275	20	0.28	12.2	46.1	82.9
T41		160	3063			275	20	0.26	10.3	43.1	83.1

TIN FLOTATION

Tin float results remain poor. Tin recovery can only be achieved at the expense of high iron recovery. Tests to reduce iron recovery have only been partially successful. Tests T16 and T18 have been performed to extend testing into cleaning. These do not appear to yield better performance. Test with alternate iron depressants (ssf, edta, 7260, oxalic acid) indicate combinations with oxalic acid and NaSH show best results for iron carbonate rejection.

Assessment: A concentrate of 8.0%Sn (60% recovery), 28%Fe and 16%SiO2 are best to date. This fine sized rougher/single cleaner concentrate may be best treated by acid leaching for up-grade of tin values.

Tin flotation results are summarised in the table below.

TEST	H2SO4	SSF	SPA	OTHER	Ro %Sn	Ro Rec	Ro %Fe	Ro Rec	Ro %SiO2	Ro Rec
T12	717	386	615		4.33	37.2	33.5	19.6		
T13	434	357	714		12.3	39.7	28.8	9.3		
T04	863		1093		2.04	90.1	22.2	74.1	33.4	50.1
T06	673		898		3.05	68.7	23.3	40.7	34.9	27.4
T08	580		1029		2.37	84.0	23.9	70.3	30.7	36.2
T11	667		477	EDTA	3.96	42.7	23.3	18.2	25.4	12.8
T12	652		559	EDTA	1.57	12.8	24.7	14.6	26.7	10.1
T16	580		954		3.92	33.9	29.7	15.5	22.3	1.6
T18	580	92	1180		4.22	20.3	25.6	7.9	22.2	2.2
T19		535	988	Na2SiO3	2.53	56.1	25.7	38.0	27.3	20.0
T21	227	538	1978	Na2SiO3	3.25	65.6	29.1	32.8	24.3	16.5
T22	540	548	1088	Na2SiO3	2.99	68.0	26.5	35.2	26.8	20.4
T25	1510	454	898	Na2SiO3	2.69	82.0	26.2	47.4	23.6	46.0
T26	613	325		RTD1544	3.93	50.4	21.2	25.4	26.7	10.4
T28	998	434	1062		1.66	59.1	24.7	70.3	31.3	52.8
T34	2824		757	NaSH	2.31	30.5	23.4	24.1	25.4	16.5
T35	2195		835	NaSH	3.31	77.7	30.5	58.1	17.0	20.7
T38	5148		985	NaSH	3.31	56.9	25.5	33.1	21.8	17.1
T39	3591		1055	NaSH	2.73	82.1	28.7	60.6	20.3	28.9
T42	2812		1287	NaSH	3.06	63.1	26.6	43.6	20.5	21.3
T46	2575		1287	7260	2.91	82.2	29.0	65.8	18.7	28.1
T47	826		934	NaSH	2.41	87.2	22.2	77.1	32.9	35.8
T48	1285		934	NaSH	2.58	86.1	26.5	77.3	25.7	27.6
T49	984		937	NaSH/SS	2.64	83.4	26.4	72.9	23.9	24.1
T51	821		938	NaSH/QB	3.11	81.6	26.3	60.4	22.7	19.4
T52	920		944	NaSH/OX	2.93	82.6	27.5	64.8	23.1	20.4
T53	1412		1177	NaSH/OX	3.62	73.7	20.4	35.2	33.4	21.3
T55	2922		867	NaSH/OX	2.54	68.8	26.9	46.4	25.2	23.6
T57	3107		873	NaSH/OX	2.31	68.0	21.2	39.0	34.1	35.6

TEST	H2SO4	SPA	NaSH	Cl %Sn	Cl Rec	Cl %Fe	Cl Rec	Cl %SiO2	Cl Rec
T52	920	944	1015	8.02	60.1	27.9	17.4	16.3	3.8
T53	1412	1177	1012	6.06	60.9	21.7	18.6	26.6	8.4
T55	2922	867	1065	4.52	56.2	25.9	20.5	24.4	10.5
T57	3107	873	1073	3.33	54.7	21.2	21.8	33.6	19.5

Tin float results remain poor. Tin recovery can only be achieved at the expense of high iron recovery. Tests to reduce iron recovery have only been partially successful. Tests T16 and T18 have been performed to extend testing into cleaning. These do not appear to yield better performance. Test with alternate iron depressants (ssf, edta, 7260, oxalic acid) indicate combinations with oxalic acid and NaSH show best results for iron carbonate rejection. A concentrate of 8.0%Sn (60% recovery), 28%Fe and 16%SiO2 are best to date. This fine sized rougher/single cleaner concentrate may be best treated by acid leaching for up-grade of tin values.

GRAVITY SEPARATIONS

Diagram 1 below summarises the first gravity routine performed on the sulphide tail. Coarser oversize was ground and resulting fines classified to three fractions for separations. Results indicate relatively poor overall upgrade and recovery. Concentrate is strongly diluted by iron carbonates in all fractions. (Some 40% of tin can be recovered to a 10%Sn concentrate)

	%Wt	%Sn	Sn Dist%	%Fe	Fe Dist %	%SiO2	SiO2 Dist %
CONC	35.43	3.82	81.91	26.6	59.4	16.98	12.5
TAIL	64.57	0.46	18.09	9.96	40.6	65.14	87.5
FEED	100.00	1.65	100.0	15.84	100.0	48.08	100.0

A locked cycle gravity test indicated that some 48% of feed tin (sulphide tail) reported to a <38um fines stream. Of the remaining tin 71% was recovered to a low grade concentrate of some 7.0%Sn.

Assessment: Gravity tin recovery is acceptable at 71% from feed but iron carbonates strongly dilute the concentrate in all factions tested. Better upgrades may be achieved by reducing the top size to 106um and stage regrinding middlings. Further assessment required.

LOCKED CYCLE GRAVITY TEST SUMMARY
Sulphide Tails: classify to fractions
Gravity separation of each,
Remove <38um, not gravity separated
Regrind coarse tails, medium and fine mids.
Classify d/c with new feed

Stream	CombConc	+75 Mids	+38 Mids	+150 Tail	Feed
gm	326.0	111.7	167.4	116.3	464.2
%Sn	7.00	2.02	2.28	0.75	1.94
%Fe	35.93	25	31.7	13.2	18.01
%SiO2	5.30	26.4	13	60.9	46.76
%S	19.64	5.24	7.73	3.60	4.61

DISTRIBUTIONS		**AV**	**FROM NEW FEED (%)**						
		(C6-8)	**Cycle 1**	**Cycle 2**	**Cycle 3**	**Cycle 4**	**Cycle 5**	**Cycle 6**	**Cycle 7**
MASS	<38 Fines	31.7	20.3	31.8	29.4	24.9	25.9	32.0	31.4
	150 conc	1.9	1.7	1.9	2.3	1.7	2.3	2.1	1.7
	75 conc	4.9	1.6	2.4	3.7	5.3	5.5	4.7	5.2
	38 conc	4.3	1.0	1.9	5.0	6.9	4.6	3.6	5.1
	75 tail	25.9	15.6	20.5	36.2	25.6	26.9	25.6	26.1
	38 tail	26.9	9.3	24.8	25.1	38.0	21.4	24.8	29.1
	Calc Recycle	4.4	50.6	16.7	-1.7	-2.3	13.2	7.4	1.3
TIN	<38 Fines	47.8	30.5	48.0	44.3	37.6	39.1	48.3	47.3
	150 conc	5.4	5.7	6.8	7.3	5.2	6.1	5.6	5.2
	75 conc	15.6	9.7	8.8	16.7	17.8	17.8	16.2	14.9
	38 conc	15.9	6.3	13.6	15.5	24.7	17.5	14.5	17.3
	75 tail	3.9	2.1	2.5	8.0	4.3	3.9	3.7	4.2
	38 tail	6.9	1.1	6.5	5.4	14.5	5.1	4.6	9.1
	Calc Recycle	4.6	44.6	13.9	2.8	-4.1	10.6	7.2	2.0
OA TIN RECOVERY (%		36.8	21.7	29.1	39.5	47.7	41.3	36.3	37.4
IRON	<38 Fines	44.0	28.1	44.1	40.8	34.6	36.0	44.4	43.6
	150 conc	3.6	3.5	3.7	4.3	3.3	4.6	3.9	3.4
	75 conc	9.6	3.1	4.9	7.7	10.6	10.6	9.2	9.9
	38 conc	8.8	1.9	3.7	10.5	14.2	9.4	7.1	10.6
	75 tail	8.4	4.7	6.0	16.7	9.3	8.8	8.3	8.6
	38 tail	16.6	2.4	15.6	13.9	33.0	12.5	11.5	21.6
	Calc Recycle	8.9	56.3	21.9	6.2	-5.0	18.1	15.5	2.4
SILICA	<38 Fines	19.9	12.7	19.9	18.4	15.6	16.2	20.1	19.7
	150 conc	0.4	0.3	0.4	0.5	0.3	0.4	0.5	0.3
	75 conc	0.7	0.1	0.3	0.3	0.5	0.7	0.5	0.9
	38 conc	0.3	0.1	0.1	0.4	0.4	0.3	0.2	0.3
	75 tail	42.6	26.8	35.3	54.9	42.2	44.7	41.9	43.3
	38 tail	35.5	15.8	32.1	35.1	40.7	29.4	36.3	34.6
	Calc Recycle	0.8	44.3	11.9	-9.8	0.2	8.2	0.6	0.9
SULPHUR	<38 Fines	34.9	22.3	35.0	32.3	27.4	28.5	35.2	34.6
	150 conc	7.4	7.3	6.2	7.4	7.2	8.1	7.9	6.9
	75 conc	21.4	8.1	11.2	16.0	23.5	21.3	22.2	20.6
	38 conc	19.6	4.7	10.2	19.4	30.6	21.6	15.3	23.8
	75 tail	4.1	3.1	3.2	9.5	4.5	4.9	4.3	4.0
	38 tail	6.6	0.9	5.8	5.2	13.2	5.6	4.3	9.0
	Calc Recycle	25.6	58.3	38.6	29.5	24.1	31.5	26.1	25.1

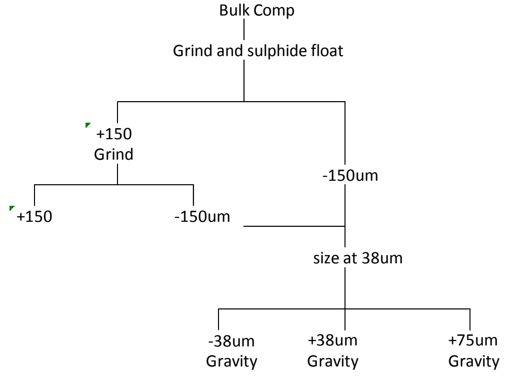
BATCH GRAVITY ASSESSMENT RESULTS

TEST TYPE	GRAVITY
Stage 1	Grind,Classify,Grind
Stage 2	Classify,Gravity Mozley

SEPARATION REPORT SHEET

PROJECT	T0630
TEST NO	T45
DATE	60711
TECH	ID

START MATERIAL	
Comp 1+2 Sulphide Tails	
START WT (gm)	1000
FROM TEST NO	



GRAVITY SEPARATION RESULTS

NAME	Wt (gm)	Calc (gm)	Wt (%)	Sn (%)	DIST (%)	Fe (%)	DIST (%)	MgO(%)	DIST (%)	Ca(%)	DIST (%)	SiO2(%)	DIST (%)	S(%)	DIST (%)
T45 +150 over size	5.23	5.23	0.52	0.21	0.1	6.2	0.2	0.20	0.2	0.6	0.1	78.60	0.8	1.40	0.1
+75 Conc	6.18	6.18	0.61	11.48	4.2	26.3	1.0	0.66	0.6	2.1	0.5	6.50	0.1	10.73	1.0
+75 Mids1	52.45	52.45	5.18	4.97	15.6	29.7	9.7	0.96	7.7	3.4	6.2	9.80	1.1	7.11	5.4
+75 Mids2	92.30	92.30	9.12	1.63	9.0	20.6	11.9	0.91	12.9	4.0	12.9	32.00	6.1	3.27	4.4
+75 Mids3	15.07	15.07	1.49	1.51	1.4	19.2	1.8	0.86	2.0	3.6	1.9	37.50	1.2	3.51	0.8
+75 Tail	303.73	303.73	30.02	0.40	7.3	8.8	16.7	0.48	22.3	1.9	19.8	69.80	43.6	15.72	69.7
+38 Conc	15.49	15.49	1.53	11.23	10.4	30.7	3.0	0.76	1.8	1.9	1.0	3.90	0.1	9.39	2.1
+38 Mids1	18.80	18.80	1.86	5.16	5.8	33.5	3.9	0.97	2.8	2.6	1.7	5.10	0.2	7.23	2.0
+38 Mids2	49.65	49.65	4.91	2.25	6.7	30.2	9.4	1.02	7.8	4.0	7.0	8.40	0.9	3.79	2.7
+38 Mids3	31.62	31.62	3.13	1.48	2.8	26.7	5.3	1.08	5.2	6.4	7.1	14.00	0.9	2.26	1.0
+38 Tail	190.68	190.68	18.85	0.26	3.0	7.2	8.6	0.41	12.0	2.4	15.8	70.90	27.8	0.51	1.4
-38 Conc	17.92	17.92	1.77	15.96	17.1	29.1	3.3	0.60	1.6	0.9	0.5	2.00	0.1	9.14	2.4
-38 Mids1	25.58	25.58	2.53	4.20	6.4	33.8	5.4	0.98	3.8	2.5	2.3	4.10	0.2	4.37	1.6
-38 Mids2	33.39	33.39	3.30	1.29	2.6	23.3	4.9	0.92	4.7	5.4	6.3	25.70	1.8	2.14	1.0
-38 Tail	153.60	153.60	15.18	0.85	7.8	15.8	15.1	0.62	14.6	3.1	17.0	48.30	15.3	1.87	4.2
TOTAL	1011.69		100.00	1.65	100.0	15.84	100.0	0.65	100.0	2.8	100.0	48.1	100.0	6.8	100.0

Mass (gm)	%Sn	%Wt	Sn Dist%	
358.45	3.82	35.43	81.91	CONC
653.24	0.46	64.57	18.09	TAIL
1011.7	1.65	100.00	100.0	FEED

ACID LEACHING

Acid leach tests are currently in progress, best results from tin float concentrate leaching are indicated below. A final concentrate of 30%Sn was obtained from a 12%Sn feed with some 82% dissolution of iron carbonate, remaining gangue was silicates. An acid consumption of some 735kg/t was recorded. Two leach results are indicated below.

Stream	Mass	Fe		Sn		SIO2	
	(gm)	(%)	Rec (%)	(%)	Rec (%)	(%)	Rec (%)
Start Solids	100.0	30.20	100.0	11.90	100.0	7.71	100.0
Final Residue	42.3	12.65	17.7	30.30	100.0	15.8	86.7

Stream	Mass	Fe		Sn		SiO2	
	(gm)	(%)	Rec (%)	(%)	Rec (%)	(%)	Rec (%)
Start Solids	100.0	31.60	100.0	6.83	100.0	15.2	100.0
Final Residue	36.9	10.30	12.0	16.10	100.0	36.1	87.6

Assessment: Leaching of carbonates from low grade float concentrate has been demonstrated to give high tin upgrade ratio. Remaining gangue are resistant silicates that will need to be separated. Test a combined gravity conc / tin float conc leach. Test a silicate prefloat prior to tin flotation.

FLOWSHEET DEVELOPMENT

The following flow sheet has been developed as testing has progressed. This is the result of extensive testing in each of the circuit areas. Further refinements are in progress including silica rejection in tin float, gravity locked cycle and more detailed leach kinetic testing.