

R.613. Wolframite concentration, Scamander Mining Corporation N.L.

A chip sample for the determination of the maximum recoverable amount of wolframite was supplied by the Scamander Mining Corporation and stated to be from their Scamander Tier lease. Special consideration was to be given to the production of a high grade wolframite concentrate and the rejection of the coarsest possible tailing. The chip sample was given the registered number 700174.

The chip sample was initially crushed to $-\frac{3}{4}$ in and found to contain 0.82% WO_3 . The sample consisted mainly of quartz plus some dolerite with minor amounts of an iron oxide mineral. Large slivers of wolframite up to 5/16 in were present.

SAMPLE PREPARATION

The $-\frac{3}{4}$ in ore was stage crushed to $\frac{1}{2}$ in in a laboratory Chipmunk jaw crusher, mixed, then riffled into four identical parts.

One part was further riffled to supply samples for a size analysis and a further head assay.

The second part was wet, then dry screened to provide the following fractions for concentration:

Size Range		Concentrating Operation
$-\frac{1}{2}$ in	$+\frac{1}{8}$ in	1
$-\frac{1}{8}$ in	+10#	2
-10#	+22#	3
-22#	+52#	4
-52#	+100#	5
-100#	+200#	6
-200#		7

The remaining two identical parts were retained for possible further work.

PROCEDURE

The sized fractions of the ore were gravity and magnetically concentrated (Table 1).

Jig Concentration

Jig conditions are shown in Table 2. As the jig concentration operations were not continuous, each fraction was fed through its respective jig three times.

Table Concentration

Minimum amounts of water and low feed rates were used to obtain quartz free concentrates from each fraction. The procedure used was identical for each fraction except when concentrating the -200# fraction, where a slime deck was used.

Table 1. CONCENTRATION PROCEDURE

Fraction	Concn Op.	Primary Concentration	Secondary Concentration
- $\frac{1}{4}$ in + $\frac{1}{8}$ in	1	Deco jig 3 $\frac{1}{4}$ in x 5 $\frac{1}{4}$ in	Heavy liquid separation
- $\frac{1}{8}$ in +10#	2	Deco laboratory jig 1 $\frac{1}{2}$ in x 2 in	Heavy liquid separation
-10# +22#	3	Deco laboratory jig 1 $\frac{1}{2}$ in x 2 in	Heavy liquid separation
-22# +52#	4	Deister sand table	Dry magnetic separation
-52# +100#	5	Deister sand table	Dry magnetic separation
-100# +200#	6	Deister sand table	Dry magnetic separation
-200#	7	Deister sand table	Dry magnetic separation

Table 2. JIG CONDITIONS

Fraction	Concn Op.	Jig	Stroke (in)	Hutch Screen Aperture	Ragging	Feed Water (l/min)	Hutch Water (l/min)
- $\frac{1}{4}$ in + $\frac{1}{8}$ in	1	3 $\frac{1}{4}$ in x 5 $\frac{1}{4}$ in	$\frac{1}{2}$	$\frac{3}{8}$ in	-\$\frac{1}{2}\$ in + $\frac{1}{8}$ in iron punchings	3.6	8.0
- $\frac{1}{8}$ in +10#	2	1 $\frac{1}{2}$ in x 2 in	$\frac{1}{4}$	$\frac{1}{4}$ in	-\$\frac{1}{2}\$ in + $\frac{1}{4}$ in iron and pyrrhotite	0.85	1.76
-10# +22#	3	1 $\frac{1}{2}$ in x 2 in	$\frac{1}{8}$	6#	-5# +6# iron shot	0.85	0.50

NOTE: The following head values were obtained:

	% WO ₃		% WO ₃
- $\frac{1}{4}$ in Ore (Reg. No. 700174)	0.82	Size Analysis - $\frac{1}{4}$ in ore	0.71
- $\frac{1}{4}$ in Ore Head R.613	0.71	Concentration Test - $\frac{1}{4}$ in ore	0.77

Magnetic concentration of the table concentrates was carried out on a Rapid high intensity dry magnetic separator giving high (M/A1) and fairly high (M/A2) magnetic products.

Heavy Liquid Separation

The heavy liquid separation of the jig concentrates involved the use of commercial acetylene tetrabromide which has a specific gravity of 2.95. Jig concentrates are not shown in the tables of results as jig concentrate heavy liquid float products have been reconstituted with their respective jig tailings.

RESULTS

Table 3. SCREEN ANALYSIS OF 1/4 IN ORE

Aperture (µm)		B S S #		% Wt	% WO ₃	% Distribution	
						WO ₃	WO ₃ Cum.
-6350	+3350	-1/4 in	+5	26.7	0.44	16.7	16.7
-3350	+2800	-5	+6	9.7	0.37	5.1	21.8
-2800	+2400	-6	+7	7.8	0.68	7.5	29.3
-2400	+2000	-7	+8	5.6	0.53	4.2	33.5
-2000	+1680	-8	+10	5.7	0.94	7.6	41.1
-1680	+1000	-10	+16	12.5	0.87	15.4	56.5
-1000	+710	-16	+22	6.8	0.98	9.5	66.0
-710	+300	-22	+52	10.4	1.02	15.0	81.0
-300	+150	-52	+100	4.9	1.11	7.7	88.7
-150	+105	-100	+150	1.8	1.11	2.8	91.5
-105	+75	-150	+200	1.4	1.11	2.2	93.7
-75		-200		6.7	0.66	6.3	100.0
Head				100.0	(0.71)	100.0	-

Analysis of head sample of -1/4 in ore:

WO₃ 0.71% Sn Nil

Table 4. RESULTS OF CONCENTRATION TESTS

Fraction	% Wt	% WO ₃	% Distribution WO ₃
Tailings			
J1T	35.96	0.09	4.2
J2T	20.15	0.09	2.3
J3T	18.82	0.14	3.4
T4T	10.08	0.08	1.0
T5T	4.03	0.05	0.3
T6T	2.31	0.09	0.3
T7T	6.89	0.18	1.6
Total	98.24	(0.10)	13.1

Table 4 - continued

	Fraction	% Wt	% WO ₃	% Distribution WO ₃
Middlings	T4C, M/S M/A2	0.07	2.25	0.2
	T5C, M/S M/A2	0.09	4.73	0.6
	T6C, M/S M/A2	0.09	0.77	0.1
	T7C, M/S M/A2	0.03	0.84	Trace
	Total	0.28	(2.42)	0.9
Concentrates	J1C, H/L S/K	0.52	33.6	22.6
	J2C, H/L S/K	0.29	46.3	17.5
	J3C, H/L S/K	0.25	57.5	18.6
	T4C, M/S M/A1	0.20	57.0	14.8
	T5C, M/S M/A1	0.10	44.0	5.7
	T6C, M/S M/A1	0.07	45.2	4.1
	T7C, M/S M/A1	0.05	42.5	2.7
Total	1.48	(44.8)	86.0	
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	Product	% Wt	% WO ₃	% Distribution WO ₃
Overall Balance	Concentrates	1.48	(44.8)	86.0
	Middlings	0.28	(2.42)	0.9
	Tailings	98.24	(0.77)	13.1
	Head	100.00	(0.77)	100.0
	Assay	-	0.71	-

CONCLUSIONS

A recovery of 86% of the WO₃ present was obtained at a grade of 44.8% WO₃. The low grade was due to the fact that the overall concentrate incorporated composite particles from the coarse concentrates as well as being contaminated in the finer fractions by an iron oxide mineral of similar magnetic susceptibility as wolframite.

Coarse concentrates could be up-graded at an expected recovery of no less than the overall recovery obtained of 86%.

The magnetic middling fraction was composed of the iron oxide mineral with only minor amounts of wolframite.

Minus 1/4 in +10# tailings, representing 56% of the overall weight and containing only 15.5% of the overall WO₃, were shown to be discardable.

In general, the wolframite was easily concentrated, the only real problem being the presence of the iron oxide mineral.

RECOMMENDATIONS

Further work should be directed at removing the magnetic iron oxide mineral from the concentration products.

Suggested approaches to this problem are:

- (1) closer control of gravity concentration,
- (2) closer control of magnetic separation
- (3) flotation,
- (4) leaching.