

F

O T T A W A

July 29th, 1943.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1466.

Concentration of a Scheelite Ore from
the Upper Canada Mines, Limited,
Dobie, Ontario.

=====

I/E/1466

bp

1759

O T T A W A

July 29th, 1943.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1466.

Concentration of a Scheelite Ore from
the Upper Canada Mines, Limited,
Dobie, Ontario.

=====

Shipment:

Thirteen bags of ore, total weight 775 pounds, were received on May 3rd, 1943, from the Upper Canada Mines, Limited, Dobie, Ontario, per R. J. Henry, Manager. A letter, dated April 26th, 1943, had been received previously from Mr. Henry, asking that a test (and report) for scheelite be made on this material.

Location of Property:

The shipment was composed of rock taken from the Upper Canada Mines property at Dobie, Ontario.

Sampling and Analysis:

The contents of the thirteen bags were combined, ground to minus 28 mesh, and a sample was taken by standard methods for assay and analysis. The remainder was bagged for investigative purposes. The results of the analysis were as follows:

	<u>Per cent</u>
Tungsten trioxide	= 0.30
Iron	= 4.65
Sulphur	= 3.80
Arsenic	= Nil.
	<u>Oz./ton</u>
Gold	= 0.065

CONCLUSIONS:

The low scheelite content of the ore would indicate considerable difficulty in obtaining satisfactory results in the treatment of this ore.

Due to the small amount of scheelite concentrate obtained in the various laboratory tests, certain conclusions must be based on conjecture as the laboratory work did not definitely establish these results.

In any single operation of either tabling or flotation, it would not appear possible to obtain both a concentrate high in tungstic trioxide and a high recovery. This may be attributed, in part, to the low values in the head sample and also to the characteristics of the ore which prevent obtaining a satisfactory clean concentrate from flotation.

Preliminary steps would suggest a flotation of the sulphides in the ore, to take off the gold values for treatment. Also, this would eliminate the pyrite and sulphides from the scheelite concentrate.

Tabling the product after the sulphide float would indicate the greatest possibilities for obtaining a high-grade scheelite concentrate, and it is possible that in actual continuous operation, with careful tabling and re-treatment of middlings, a concentrate of 70 per cent tungstic trioxide might be

(Conclusions, cont'd) -

obtained.

A low overall recovery of the scheelite must be expected under this operation, and might amount to 50 to 60 per cent of the tungstic trioxide in the ore.

As carried out in Test No. 11, a further flotation operation on the table tailings failed to produce a concentrate the grade of which could be raised by tabling to produce a secondary concentrate of a grade to warrant shipping for chemical treatment, and to raise the overall recovery.

Flotation of the scheelite, after the preliminary sulphide float, was successful from the standpoint of obtaining low tailings, but attempts to clean this concentrate on the table or on the super-panner presented considerable difficulty. Only in Tests Nos. 8 and 10 was a satisfactory shipping grade obtained. In the earlier tests it was thought that this was due to the contained soap reagents used in flotation, but after repeated tests where the concentrate was subjected to numerous washings in boiling water, filtering, and drying, no marked improvement was obtained.

From the tests carried out it is indicated that in the treatment of this ore, due to the carbonates or to other characteristics, tabling of the flotation concentrate in an effort to obtain a satisfactory grade of scheelite does not produce the desired results.

In view of the above, the following method of treatment presents itself as being the most practical;

A preliminary flotation of the sulphides containing the gold values, which could receive the standard cyanide treatment for concentrate to recover the gold. This could be followed by a straight table operation, after classification of the sulphide flotation tailing, which indicates the possibility of making both a high-grade concentrate from the sand portion for direct shipment and a separate

(Conclusions, cont'd) -

table treatment for the slime portion, to yield a product for chemical treatment.

This is in line with the trends of operations at some of the plants treating scheelite ore, at the present time.

Characteristics of the Ore:

Six polished sections of the ore were prepared and examined microscopically for the purpose of determining the character of the ore.

Gangue -

In general, gangue material, in the polished surfaces consists of hard, siliceous, greenish-grey rock containing a comparatively small amount of finely disseminated carbonate. In one section, however, the latter constituent is abundantly distributed in much coarser grain sizes.

Metallic Minerals -

Pyrite was the only metallic mineral observed in the six polished sections. It is abundantly disseminated through the gangue as irregular grains and subhedral crystals which contain occasional small inclusions of gangue. Its grain sizes range from medium to very fine, with the finer sizes predominant.

Scheelite -

An examination of the six polished surfaces under a fluorescent lamp and with the aid of a binocular microscope revealed some scheelite in three of them. It occurs as small, sparsely disseminated grains, the largest of which would be approximately one millimetre in size and ranging from that down to tiny points of light. The glowing grains would not number over two dozen in the section in which they are most abundant and the total amount of this mineral appears to be very small.

DETAILS OF INVESTIGATIVE TESTS:

Test No. 1.

4,000 grams of the minus 28 mesh material was screened and the individual portions concentrated on a laboratory table, with a view to ascertaining the distribution of the scheelite and what results might be expected from table concentration of the ore at various sizes.

An examination of results showed that, at minus 28 mesh, 37 per cent of the sample by weight was minus 100 mesh and contained 44 per cent of the tungstic trioxide.

Results also indicate high losses in the table tailing in the finer sizes, which was not unexpected, and is common to table concentration of most minerals.

Results:

Mesh:	Weight,	Assay [⊕]	Dist'n.	Product	Weight,	Assay	Distribution	
	per	of WO ₃ ,	of total:		per	of WO ₃ ,	of WO ₃	
:	cent	per	WO ₃ ,	:	per	per	Per cent	Total
:	:	cent	per cent:	:	cent	cent	Content:	:
- 28:	12.22	0.207	8.60	Concentrate:	0.61	13.58	40.00	3.44
+ 35:	:	:	:	Middling	5.70	1.19	32.75	2.81
:	:	:	:	Tailing	93.69	0.06	27.25	2.35
- 35:	21.63	0.236	17.36	Concentrate:	2.32	6.86	67.44	11.71
+ 48:	:	:	:	Middling	9.41	0.44	17.12	2.97
:	:	:	:	Tailing	88.27	0.04	15.44	2.68
- 48:	16.70	0.281	16.10	Concentrate:	2.19	9.14	71.27	11.48
+ 65:	:	:	:	Middling	5.72	0.61	12.34	1.98
:	:	:	:	Tailing	92.09	0.05	16.39	2.64
- 65:	12.18	0.340	14.08	Concentrate:	4.35	5.50	70.35	9.90
+100:	:	:	:	Middling	7.21	0.17	3.59	0.50
:	:	:	:	Tailing	88.44	0.10	26.06	3.68
-100:	37.27	0.346	43.86	Concentrate:	6.71	2.93	56.80	24.91
:	:	:	:	Middling	7.98	0.06	1.30	0.57
:	:	:	:	Tailing	85.31	0.17	41.90	18.38
Sam- ple:	100.00	0.294	100.00	:	:	:	:	100.00

[⊕] Calculated.

(Test No. 1, cont'd) =

In Tests Nos. 2, 3, and 4, the ore was given a light grind and the sulphides floated off containing the gold values. The flotation tailings were concentrated on a laboratory sand table where a rougher concentrate was made. This concentrate was cleaned up on a superpanner in an endeavor to obtain a high-grade scheelite concentrate.

Test No. 2.

(Grinding, 77.9 per cent minus 200 mesh).

Reagents added (lb./ton):

To Grinding -

Soda ash - 1.0
Pot. amyl xanthate - 0.4

To Flotation -

Cresylic acid - 0.22

pH = 9.6

Results:

Product	Weight, per cent	Assays, WO ₃ , per cent	Distribution of WO ₃ , per cent
Feed	100.00	0.30	100.00
Sulphide conc.	5.90	0.13	1.66
Panner conc.	0.28	51.50	31.55
Panner tailing	3.64	1.33	10.58
Table middling	35.35	0.20	15.47
Table tailing	54.83	0.34	40.74
Total	100.00	0.46	100.00

(Continued on next page)

(Test No. 2, cont'd) -

Sulphur Assays

Panner concentrate = 7.20 per cent.
 Panner tailing = 2.31 "

Gold Assays

Sulphide concentrate = 0.68 oz./ton.
 Table middling = 0.04 "
 Table tailing = 0.015 "

Test No. 3.

Grinding, flotation and table procedures were the same as in Test No. 2, with the exception of 2 pounds per ton of sodium silicate added to the grinding circuit before flotation.

Results:

Product	Weight, per cent	Assays, W ₃ , per cent	Distribution, of W ₃ , per cent
Feed	100.00	0.30	100.00
Sulphide concentrate	5.95	0.0	0.0
Panner concentrate	0.21	58.28	33.08
Panner tailing	4.60	0.74	9.20
Table middling	27.10	0.15	10.97
Table tailing	62.14	0.28	46.75
Total	100.00	0.37	100.00

Sulphur Assays

Panner concentrate = 1.10 per cent.
 Panner tailing = 2.41 "

Gold Assays

Sulphide concentrate = 0.63 oz./ton.
 Table middling = 0.03 "
 Table tailing = 0.015 "

(Details of Investigative Tests, cont'd) -

Test No. 4.

Conditions were the same as in Test No. 2.

Results:

Product	Weight, per cent	Assays, WO ₃ , per cent	Distribution of WO ₃ , per cent
Feed	100.00	0.30	100.00
Sulphide concentrate	6.67	0.00	0.00
Panner concentrate	0.25	44.44	39.42
Panner tailing	4.67	1.65	27.32
Table middling	34.57	0.10	12.24
Table tailing	53.84	0.11	21.02
Total	100.00	0.37	100.00

Sulphur Assays

Panner concentrate - 1.44 per cent
 Panner tailing - 1.67 "

Gold Assays

Sulphide concentrate - 0.64 oz./ton.
 Table middling - 0.02 "
 Table tailing - 0.015 "

In Test No. 5 the sample was given a finer grind and a sulphide concentrate floated in the first stage. The scheelite concentrate was floated in the second stage and cleaned in a cleaner cell without additional reagents.

(Test No. 5 continues on next page)

(Details of Investigative Tests, cont'd) -

Test No. 5.

(Grinding, 85.0 per cent minus 200 mesh).

Reagents added (lb./ton):

		<u>Sulphide Circuit</u>	<u>Scheelite Circuit</u>
To <u>Grinding</u> =			
Soda ash	=	1.0	
Aerofloat No. 31	=	0.14	
To <u>Conditioning</u> =			
Sodium silicate	=		2.0
Emulsol X-1	=		0.05
To <u>Flotation</u> =			
Orso	=		0.04
Cresylic acid	=	0.04	0.04
	pH =	9.6	

Results:

Product	:Weight, : per : cent	: Assays		: Distribution	
		: Per cent		: Per cent	
		: WO ₃	: S	: WO ₃	: S
Feed concentrate	: 100.00	: 0.30	: 3.80	: 100.00	: 100.00
WO ₃ concentrate	: 1.05	: 18.28	: 4.64	: 45.69	: 1.30
WO ₃ cleaner tailing	: 2.00	: 1.25	: 1.28	: 5.95	: 0.70
Sulphide concentrate	: 9.57	: 0.25	: 33.36	: 5.69	: 84.90
Flotation tailing	: 87.38	: 0.20	: 0.56	: 42.67	: 13.10
Total	: 100.00	: 0.42	: 3.76	: 100.00	: 100.00

Gold Assays

Sulphide concentrate	=	0.54 oz./ton.
WO ₃ cleaner tailing	=	0.075 "
Flotation tailing	=	0.01 "

In Tests Nos. 6 and 7, the samples were given a fine grind and a sulphide concentrate floated in the first stage. The scheelite concentrate was floated in the second

(Details of Investigative Tests, cont'd) -

stage and this concentrate was further concentrated on the superpanner.

Due presumably to the presence of the soap flotation reagents used in the second stage, a separation on the panner was impossible and the panner tailing assayed as high in tungstic trioxide as the concentrate. The scheelite appeared to float down the panner, making a more or less homogeneous mass for the full length of the panner surface.

Test No. 6.

(Grinding, 96.2 per cent minus 200 mesh)

Reagents added (lb./ton):

To <u>Grinding</u> -	<u>Sulphide</u> <u>Circuit</u>	<u>Scheelite</u> <u>Circuit</u>
Soda ash	= 1.0	
Pot. amyl xanthate	= 0.4	
To <u>Conditioning</u> =		
Sodium silicate	=	2.0
Emulsol X-1	=	0.10
To <u>Flotation</u> =		
Orso	=	0.10
Cresylic acid	= 0.22	0.08
pH	= 9.6	

(Continued on next page)

(Test No. 6, cont'd) -

Results:

Product	Weight, per cent	Assays, WO ₃ , per cent	Distribution of WO ₃ , per cent
Feed	100.00	0.30	100.00
Sulphide concentrate	7.68	0.07	1.34
Panner concentrate	0.08	2.56	0.51
Panner middling	0.26	5.71	3.70
Panner tailing	3.58	4.52	40.45
Flotation tailing	88.40	0.25	54.00
Total	100.00	0.40	100.00

Sulphur Assays

Panner concentrate = 5.92 per cent.
 Panner middling = 5.34 "
 Panner tailing = 2.45 "

Gold Assays

Sulphide concentrate = 0.72 oz./ton.
 Flotation tailing = 0.015 per cent.

Test No. 7.

Grinding, flotation and panning procedures were the same as in Test No. 6, with the exception of 2 pounds per ton of sodium silicate added to the grinding circuit before floating off the sulphides.

Results:

Product	Weight, per cent	Assays, WO ₃ , per cent	Distribution of WO ₃ , per cent
Feed	100.00	0.30	100.00
Sulphide concentrate	6.78	Nil	0.0
Panner concentrate	0.37	4.36	5.1
Panner tailing	7.99	3.45	86.9
Flotation tailing	84.86	0.03	8.0
Total	100.00	0.317	100.00

(Continued on next page)

(Test No. 7, cont'd) -

Sulphur Assays

Panner concentrate = 8.92 per cent.

Gold Assays

Sulphide concentrate - 0.82 oz./ton.
Flotation tailing = 0.01 "

Tests Nos. 8 and 9.

(Grinding, 96.2 per cent minus 200 mesh).

Reagents added (lb./ton):

	<u>Sulphide</u>	<u>Scheelite</u>
To <u>Grinding</u> -	<u>Circuit</u>	<u>Circuit</u>
Soda ash	= 1.0	
Pot. amyl xanthate	= 0.4	
To <u>Conditioning</u> -		
Sodium silicate		= 2.0
Emulsol X-1		= 0.10
To <u>Flotation</u> -		
Orso		= 0.10
Cresylic acid	= 0.22	= 0.08

The scheelite flotation concentrate was run over the superpanner to raise the grade of the product.

Test No. 8.

Results:

Product	Weight, per cent	Assays, WO ₃ , per cent	Distribution of WO ₃ , per cent
Feed	100.00	0.30	100.00
Sulphide concentrate	6.3	Nil	0.0
Panner concentrate	0.24	14.20	12.1
Panner tailing	6.90	3.58	87.9
Flotation tailing	86.56	Nil	0.0
Total-	100.00	0.281	100.0

(Continued on next page)

(Test No. 8, cont'd) -

Sulphur Assays

Panner concentrate = 36.37 per cent.
Panner tailing = 7.45 "

Gold Assays

Sulphide concentrate = 0.82 oz./ton.
Flotation tailing = 0.01 "

Test No. 9.

Results:

Product	Weight, per cent	Assays, WO ₃ , per cent	Distribution, of WO ₃ , per cent
Feed	100.00	0.30	100.00
Sulphide concentrate	6.93	0.0	0.0
Panner concentrate	1.47	5.35	27.77
Panner tailing	5.01	4.08	72.23
Flotation tailing	86.59	0.0	0.0
Total	100.00	0.283	100.00

Sulphur Assays

Panner concentrate = 8.18 per cent.
Panner tailing = 6.12 "

Gold Assays

Sulphide concentrate = 0.72 oz./ton.
Flotation tailing = 0.01 "

Test No. 10.

Procedure was the same as in Tests Nos. 8 and 9, except that the scheelite flotation concentrate was run over a small laboratory table instead of over the superpanner. Much the same conditions were in evidence and a satisfactory weight of concentrate to accompany the grade was not obtained.

(Continued on next page)

(Test No. 10, cont'd) -

Results:

Product	Weight, per cent	Assays, W03, per cent	Distribution of W03, per cent
Feed	100.00	0.30	100.0
Sulphide concentrate	8.26	0.14	3.2
Table concentrate	0.10	15.08	4.3
Table middling	0.98	6.68	18.5
Table tailing	5.14	3.23	47.3
Flotation tailing	85.52	0.11	26.7
Total	100.00	0.352	100.0

Sulphur Assays

Table concentrate - 22.4 per cent.
 Table middling - 10.1 "

Gold Assays

Sulphide concentrate - 0.68 oz./ton.
 Flotation tailing - 0.01 "

With a recirculation of the table middlings and tailings an indicated extraction of 60 to 70 per cent of the tungstic trioxide in the ore is given.

Test No. 11.
TEST NO. 11.

This test had for its objective the making of a high-grade concentrate under tabling and a high extraction under flotation.

The tailings from the sulphide float were tabled and the table tailings ~~and the table tailings~~ given a further grind and floated. This latter flotation concentrate was washed in boiling water and cleaned on the superpanner, thus making two panner concentrates, one which might be of a grade for shipping and one for chemical treatment.

(Continued on next page)

(Test No. 11, cont'd) -

Results:

Product	Weight, per cent	Assays, WO ₃ , per cent	Distribution of WO ₃ , per cent
Feed	100.00	0.30	100.00
No. 1 panner concentrate	0.19	64.10	32.90
No. 1 panner tailing	2.96	1.13	9.04
No. 2 panner concentrate	0.41	1.82	2.02
No. 2 panner tailing	5.45	1.72	25.33
Sulphide concentrate	7.10	0.06	1.15
Flotation tailing	83.89	0.13	29.56
Total	100.00	0.37	100.00

Regardless of the flotation concentrate being washed thoroughly in boiling water before panning, a reasonable separation of the scheelite could not be made.

An analysis of the superpanner products of the above test gave the following results:

	Sulphur, per cent	Arsenic, per cent	Phosphorus, per cent
No. 1 panner concentrate	- 0.52	0.11	0.11
No. 1 panner tailing	- 1.97	Nil	0.23
No. 2 panner concentrate	- 6.68	Nil	0.54
No. 2 panner tailing	- 5.48	Nil	0.81

ooooooooooooo
ooooooo
o

WH:GHB.