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O T T A W A April 8th, 1943.

R E P O R T

of the

ORE DRESSING AND METALLURGICAL LABORATORIES.

Investigation No. 1384.

Concentration Tests on a Sample of Wolframite Ore from Boulder Creek, near Atlin, British Columbia.

(Copy No. 14.)

BUREAU OF MINES
DIVISION OF METALLIC MINERALS

ORE DRESSING AND
METALLURGICAL LABORATORIES

CANADA
DEPARTMENT
OF
MINES AND RESOURCES
MINES AND GEOLOGY BRANCH

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Shipment:

One sack, containing 93 pounds of wolframite ore, was received on January 14th, 1943. The shipment was marked Sampling Plant No. 676T and was submitted by J. T. Mandy, Mining Engineer, Box 308, Prince Rupert, British Columbia, on behalf of B.C. Department of Mines.

Location of Property:

This ore originated from a property located at the head of Boulder creek, one of the main tributaries of Pine creek in the Atlin area of northern British Columbia. The property is 15 miles from the town of Atlin.

Characteristics of the Ore:

Six polished sections were prepared and examined under the ore microscope.

Non-Metallic Minerals -

The non-metallic mineral portion of the polished sections predominates and consists essentially of milky white quartz with a small amount of soft rock material. It bears numerous local brown stains of iron oxides and is transected by a few narrow sinuous fractures.

When examined under an ultra-violet lamp, four of the six polished surfaces revealed the presence of a small amount of scheelite as medium to fine irregular grains which are usually closely associated with wolframite.

Metallic Minerals -

Wolframite, the only abundant metallic mineral visible in the polished sections, occurs largely as small masses and coarse grains sporadically distributed through the non-metallic mineral assemblage, but a small percentage is disseminated in the finer sizes also. In some places it is badly pitted and contains numerous inclusions of non-metallics many of which are too small to be economically removed by grinding. Since hubnerite, wolframite, and forberite cannot be differentiated by means of the microscope, the mineral has been named from a spectrographic analysis which gives the

(Characteristics of the Ore, cont'd) -

following result:

Essential constituents	=	Fe, Mn, W
Trace	=	Si
Faint trace	=	Mg

Pyrite is present in small amount as occasional, medium to very tiny grains and crystals in non-metallic minerals and in wolframite. As already mentioned, "limonite" is visible as stains and as rare, small, irregular grains in non-metallic minerals.

Sampling and Assaying:

The sample received was assayed and reported as follows:

Gold	=	0.005 oz./ton.
Silver	=	0.64 "
Tungsten trioxide	=	19.74 per cent.
Arsenic	=	None detected.
Antimony	=	" "
Tin	=	" "
Sulphur	=	Trace.
Lime	=	"
Iron	=	5.67 per cent.
Manganese	=	0.96 "
Phosphorus	=	0.01 "

Experimental Tests:

Magnetic and gravity concentration tests, both alone and in combination, were conducted on samples of this ore. The tests have shown that the ore should be ground finer than 14 mesh in order to free the mineral. By magnetic concentration alone 80 per cent of the tungsten can be recovered, while by gravity concentration the recovery will be about 95 per cent. Magnetic concentration fails to get the finest material, as well as any middling product that happens to be in the feed.

Details of Tests:

Test No. 1.

A sample of the ore was crushed minus ¼ inch and sized on the following screens: 8, 14, 35, 48 and 65 mesh. The two coarser sizes were treated in a jig, where a high-grade concentrate was taken off. The jig tailings were then crushed minus 14 mesh, sized in 35-, 48-, and 65-mesh screens, and concentrated on tables along with the finer sizes of the original feed.

Summary of Test No. 1.

Product	Weight, per cent	WO_3 assays, per cent	Content, per cent of total WO_3
Concentrate	26.55	71.40	91.53
Middling	3.52	20.84	3.54
Tailing	69.93	5.64	4.93
Feed (cal.)	100.00	20.71	100.00
Conc. and middling	30.07	65.48	95.07

This test was conducted on a small table but it is probable that a large table in practice would give a higher-grade product and perhaps higher recovery.

Test No. 2.

In this test, magnetic concentration alone was used on ore crushed through ¼ inch and sized on the following screens: 8, 14, 35 and 65 mesh. The non-magnetic tailings assayed as follows:

Size	Weight, per cent	WO_3 assay, per cent	Content, per cent of total WO_3
-¼ in + 8 mesh	36.18	5.40	9.68
-8+14 mesh	18.32	3.28	2.98
-14+35 "	11.78	1.29	0.75
-35+65 "	4.00	1.95	0.39
-65 "	6.90	17.61	6.02
Average tailing	77.18	5.18	19.82

(Continued on next page)

(Test No. 2, cont'd) -

These assays indicate that the ore should be crushed finer than 14 mesh in order to free the mineral. The high assay for the minus 65 mesh non-magnetic material is due to the fact that the machine will not lift the fine wolframite through a covering of gangue.

Summary of Test No. 2.

Product	Weight, per cent	WO_3 assay, per cent	Content, per cent of total WO_3
Concentrate	22.82	70.94	80.18
Tailing	77.18	5.18	19.82
Feed (cal.)	100.00	20.19	100.00

Test No. 3.

This test consisted of magnetic concentration of a sample of ore crushed through 14 mesh followed by gravity concentration of the non-magnetic tailing. The ore was treated on the magnetic machine without sizing but the non-magnetic tailing was sized for gravity concentration. After sizing, the non-magnetic tailing assayed as follows:

Size	Weight, per cent	WO_3 assay, per cent	Content, per cent of total WO_3
-14+35 mesh	43.21	0.81	0.84
-35+48 "	9.84	1.44	1.49
-48+65 "	5.12	4.09	4.25
-65 "	19.61	12.70	13.19
Average tailing	77.78	4.92	19.77

(Continued on next page)

(Test No. 3, cont'd) -

After gravity concentration, the tailings assayed as follows:

Size	Weight, per cent	WO_3 assay, per cent	Content, per cent of total WO_3
-14+35 mesh	42.57	0.33	0.34
-35+48 "	9.50	0.28	0.28
-48+65 "	4.72	0.30	0.29
-65 "	16.64	3.44	3.03
Average tailing:	73.43	1.03	3.94

This means that an additional 15.83 per cent of the tungsten has been recovered from the non-magnetic tailing by gravity concentration and the greater part of it was recovered from the fine sizes. The gravity concentrates obtained from the various sizes of non-magnetics assayed as follows:

Size	Weight, per cent	WO_3 assay, per cent	Content, per cent of total WO_3
-14+35 mesh	0.64	32.73	0.50
-35+48 "	0.54	34.00	1.21
-48+65 "	0.40	49.03	3.96
-65 "	2.97	64.60	10.16
Average grade	4.55	56.09	15.83

The coarsest of these concentrates are of middling grade only and this is probably the reason why they were not picked up by the magnetic machine. The finest size is almost up to required grade but was missed by the magnetic machine owing to its fine size and the fact that it was well covered on the feed belt by the non-magnetic portion of the feed.

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(Test No. 3, cont'd).-

Summary of Test No. 3.

Product	Weight, per cent	WO_3 assay, per cent	Content, per cent of total WO_3
Magnetic concentrate	92.22	69.90	80.23
Gravity concentrate	4.35	56.09	15.83
Average concentrate	96.57	67.64	96.06
Gravity tailing	73.43	1.06	3.94
Feed (cal.)	100.00	18.73	100.00

It should be noted that recovery in the magnetic concentrate was not improved by the finer crushing as compared with Test No. 2.

A sample of average concentrate was assayed for impurities and reported as follows:

Arsenic	-	None detected.
Antimony	-	"
Molybdenum	-	"
Tin	-	"
Copper	-	"
Lead	-	"
Bismuth	-	0.06 per cent.
Sulphur	-	0.06 "
Phosphorus	-	0.002 "

CONCLUSIONS:

Tests conducted on this sample of ore indicate that a good grade of concentrate and a good recovery can be obtained by crushing the ore through 14 mesh, keeping fines down to a minimum, and concentrating. Concentration may be done by an all-gravity process or by magnetic concentration followed by gravity concentration of the non-magnetic tailing.

These tests have shown a slight advantage for the

(Conclusions, cont'd) -

latter method but it is possible that in practice, using large tables, equally good results could be obtained by gravity concentration alone. At the same time the flow-sheet would be much simpler.

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