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WOOLSEY and SNOWFLAKE GROUPS

Revelstoke Mining Division

Report by

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[redacted]

WOOLSEY and SNOWFLAKE, Revelstoke Mining Division

Note: The Woolsey and Snowflake properties have been considered of interest as possible sources for tungsten and tin, and of silver, lead and zinc. Available information regarding values is from publications of the British Columbia Department of Mines, and from a report made available confidentially for this study. The report, based on examinations made by an engineer in private practice, quotes the findings of an engineer who examined the Woolsey property for the owners, and from a third engineer who examined the property for a prospective purchaser.

There has been controversy over values in the properties. For this reason the information available has been set forth at length and as it is so lengthy, it has been summarized in the following 10 pages.

Under silver-lead-zinc and under tin, estimates of grade cannot be accepted without question, and are to be regarded as the highest grades for which it is reasonable to hope, based on information available.

SUMMARY

The Woolsey and Snowflake properties adjoin and are reached by a common road and branch trails. The road runs northerly up Silver creek from Snowflake Siding on the main line of the Canadian Pacific Railway about 19½ miles easterly from Revelstoke. The Woolsey camp at 4450 feet elevation is about 7 miles from the railroad. Distant about 5½ miles from the railway and at 5800 feet elevation, a lower camp was connected with the Snowflake mine camp (elevation about 5400 feet) and with the principal workings, by a pack trail and a surface tramway.

The Woolsey has been referred to also as Morton-Woolsey, Regal and Regal Silver.

Workings on the two properties prospect the same vein system. The properties are under different ownership but are considered together here. In the absence of workings actually following a vein through, correlation of a vein exposed at one point with one exposed some distance away is conjectural. The main Snowflake working, Snowflake 4 level, elevation 5550, was extended easterly into Woolsey ground, no other working follows a vein across the property boundaries.

A good deal of work was done on the properties from 1926 to 1930; since 1938, there has been renewed interest in the Woolsey and an attempt to produce marketable scheelite concentrate. The Snowflake was explored by three short adits, elevations 5850, 5885, and 5945 feet, by No. 4, the principal level, elevation 5550 feet, and by a raise with some connected intermediate drifts between 4 and 2 levels. These workings have a combined length of about half a mile. The Woolsey has been explored in an extension of Snowflake 4 level, in adit levels numbered 3, elevation 5250 ft., 5, elevation 4963 ft., 8, elevation 4668 ft., 9, elevation 4578 ft., and 10, elevation 4455 ft., by Raise A connecting 10, 9 and 8 levels, and by two other raises. These workings have a total length of about 1½ miles.

The veins follow the bedding of argillaceous sediments, striking northwesterly and dipping 60 to 35 degrees northeastward. Vein widths up to 20 feet are recorded, filled largely with quartz and more or less altered wall rock. Original interest in both properties was in silver-lead-zinc sulphide mineralization. Later stannite, considered of interest as an ore of tin, was discovered; more recently scheelite - observed in 1929 in Snowflake 4 level - has been the mineral of primary interest in operations at the Woolsey. A mill built underground at the Woolsey in 1938 designed to make a silver-lead and a tungsten concentrate, was not an economic success, and apparently was not a metallurgical success either. Milling procedure, indicated by testing in Ottawa in 1938, would doubtless make a better saving of the tungsten mineral.

Silver-lead-zinc mineralization occurs in parts of the veins and more or less stannite may be associated with it. Scheelite occurs as small masses scattered widely in the veins and as concentrations in pyritic lenses of some size in the veins. Kidneys of rather high grade scheelite occur within the pyritic lenses. The mineralization may be divided into three classes, silver-lead-zinc, tin and tungsten, based on the principal values reported in particular parts of the workings. It is probable that for effective milling the ores would have to be segregated, similarly, to make the most economical recovery of the principal values, while the minerals present as minor values might be less completely recovered as bye-products.

Silver-lead-zinc. Information from one private source, either not checked by any other available information, or in conflict with the limited other information available, indicates two sections of the Woolsey workings in which values silver-lead and minor zinc might be considered as marginal milling ore. In addition, it is probable that selective mining of high grade pockets with sorting would produce a little crude silver-lead ore of shipping grade.

The writer considers that close examination, including check sampling, is necessary before reliable estimates can be made, and that further testing in the form of drilling or crosscutting might also be required. The most optimistic information available suggests that a length of 340 feet on No. 5 vein opened by drifts on Woolsey No. 10 level, might be credited with 6500 tons of probable and possible ore averaging Silver 6.5 oz. per ton, lead 6%, zinc 1.5%, tin 0.1%, and might also yield a little bye-product tungsten.

The section of No. 5 vein opened by the eastern part of Woolsey No. 5 level might be credited with 9,000 tons of probable and possible ore, averaging Silver 5 - 6 oz. per ton, lead 4 - 6%, zinc 1 - 1½%, tin about 0.1%. Crosscutting or test hole drilling to define the width might permit increasing the estimate.

No other parts of the veins exposed appear to approach this grade in silver-lead-zinc values.

Tin. Information regarding Snowflake workings is based on a report by B.T.O'Grady, published in Bulletin No. 1, 1929, British Columbia, Department of Mines. The present writer considers that more closely spaced sampling would be desirable in order to determine grade more exactly, and that exclusion of a limited high grade section, included in O'Grady's average would probably more nearly represent average grade of any quantity of ore. O'Grady's figures might be interpreted as indicating on Snowflake ground, opened by 4 level drift east and the raise above it, probable and possible ore, total say 3500 tons, averaging Silver 6.39 oz. per ton, lead 0.65%, zinc 5.3%, tin 0.7%. Average of samples in the drift which did not include the high grade pocket was, Silver 3.5 oz. per ton, lead nil, zinc 4.59%, tin 0.28%.

In the continuation of Snowflake 4 level drift easterly into Woolsey ground, unchecked sampling is reported to have averaged over widths of 17 to 41 inches, Silver 3 oz. per ton, lead 0.4%, zinc 1.5%, tin 0.5%. This might be interpreted as indicating say 2600 tons of probable and possible ore, not allowing for dilution.

Exposures on No. 6 vein, Woolsey 10 level drift east and Raise B, sampled by the same engineer, might be taken as indicating 20,000 tons of probable and possible ore, averaging Silver 2.5 - 3 oz. per ton, lead 1.5% or better, zinc 0.9%, tin 0.5%. The average values are much higher than indicated by less complete sampling by another engineer.

Tin ore, subject to the accuracy of information available, and accepting the higher figures in the case of conflict, might amount to a total of 26,000 tons probable and possible, averaging about 0.5% tin, with silver, lead and zinc. A tin concentrate could probably be produced by flotation. This concentrate might assay about 20% tin, and could not be higher grade than 26% tin. It would contain substantial quantities of impurities. Metallurgical difficulties and rather high tin losses are to be anticipated in producing refined tin from such a concentrate. So far as the writer has been able to learn, no tin smelter has been accustomed to accepting material of this kind.

Tungsten. Information from three sources is in much better agreement regarding the tungsten content of several sections of the Woolsey workings.

The section on 8 level east of Raise A might well be credited with 5000 tons probable and possible ore, averaging 0.25% WO_3 per ton or better.

A section on No. 9 level west of Raise A may be credited with 1150 tons of probable and possible ore, averaging 0.3% WO_3 or better.

Both estimates are for width sampled and do not allow for dilution. In both cases there would be values in silver and lead which could probably be recovered in a bye-product lead concentrate.

Several other points in the workings where shheelite is exposed would doubtless yield moderate tonnages, but available information does not permit estimates. In a few places rather high grade scheelite is exposed and some could undoubtedly be mined selectively.

In milling the ore, sliming scheelite must be avoided, recovery of scheelite must be given precedence over recovery of silver-lead values. Tests at Ottawa indicated a concentrate assaying 55.9% WO_3 after roasting to eliminate sulphur.

Selective mining of high grade kidneys or lenses to produce crude tungsten ore of shipping grade would avoid loss of scheelite in sliming and the sorted crude ore might be of higher grade than a concentrate produced by milling. Rejects from selective mining and sorting could be milled with ore mined from low grade sections, if in sufficient quantity.

Estimates of Costs and of Net Returns

Preliminary studies suggest return from concentrates f.o.b. railway cars at Revelstoke per ton of ore milled, for silver-lead-zinc ore, and for tin ore, of about $5.50 per ton milled; tungsten ore might yield $6.00 to $7.00 per ton milled. Costs are apt to be from $4.00 to $8.00 per ton milled. Thus silver-lead-zinc, and tin mineralization are/sub-marginal, some tungsten could probably be produced at present prices.

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Vancouver, B.C.
June 23, 1943.

WOOLSEY and SNOWFLAKE GROUPS

Revelstoke Mining Division

CONFIDENTIAL

WOOLSEY and SNOWFLAKE GROUPS, Silver Creek, Revelstoke Mining Division

Workings on two adjoining properties have explored a system of quartz veins, which in general follow the bedding of Precambrian argillites. Early interest in both properties was directed toward values in silver, lead and zinc. In 1928 stannite was reported at the Snowflake and attracted some attention. More recently, on the Woolsey property, scheelite has been the mineral of principal interest.

From a siding on the main line of the Canadian Pacific Railway, about 1½ miles southwesterly from Albert Canyon, and about 19½ miles northeasterly from Revelstoke, the Woolsey property is reached by a tractor road which runs northerly up Silver Creek about 7 miles to the Woolsey camp at 4455 feet elevation. The Snowflake, lying immediately to the west and northwest, is reached by trail which branches from the tractor road.

Ownership of the Woolsey group has changed several times and recently has been the subject of litigation. One former owner was"Morton-Woolsey Mining Company Limited," and a more recent one was "Regal Silver Mines Limited," the property has been referred to as Woolsey, Morton-Woolsey, Regal and Regal Silver. The present standing of Snowflake Mining Company, which was and may still be the owner of the Snowflake property, is unknown to the writer.

The Woolsey group under different names has been referred to in Annual Reports, Minister of Mines, British Columbia, 1918 - 1931, 1938, 1940 and 1941, also in Bulletin No. 10, Tungsten Deposits of British Columbia, by John S. Stevenson, 1941, pages 81-93. The Snowflake has been referred to in Annual Reports, Minister of Mines, British Columbia, 1922-1931, in a pamphlet "Reports on Snowflake and Waverley-Tangier Mineral Properties, compiled by John D. Galloway, 1928," and in "Bulletin No. 1, 1929,", pages 52-55, in which B.T.O'Grady gave detailed information about tin values. The Annual Report, Minister of Mines, British Columbia, 1929, gives some details about work done after the publication of Bulletin No. 1, 1929.

Both properties were described by H.C. Gunning, Geological Survey, Canada, Summary Report 1928, Part A, pages 182-187.

Milling tests designed to indicate a flow sheet providing for recovery of the tungsten and lead-silver values of Woolsey ore, were described in "Investigations in Ore Dressing and Metallurgy, July to December 1938", Canada, Department of Mines and Resources, pages 78-82.

Another source of information is a report on the Woolsey, dated October 1939, made by an engineer (X) in private practice for a prospective purchaser. This report quotes results of sampling by an engineer (Y) who made a report for the owner of the property, and also quotes a third engineer (Z) who reported for a prospective purchaser regarding tungsten values. Information from the examinations by these engineers is indicated later by the letters (X), (Y), or (Z).

There has been controversy over the ore positions of both properties, and the information available from several sources is not entirely in agreement, particularly in regard to silver-lead-zinc, and tin values. However, the available information indicates that the values are low, and that they approach marginal or commercial grade in limited parts of the veins only. Under silver-lead-zinc, and under tin, in regard to which the information cannot be accepted without question, the estimates must be regarded as the maximum grade for which it is reasonable to hope, based on information available.

The properties are in a rugged area which has large annual snowfall. The upper part of the road is crossed by the courses of several snowslides. The Woolsey camp and other buildings are on a narrow timbered spur between two snowslide courses.

Both properties were provided with camps, facilities and equipment suitable for development work. Some buildings at the Snowflake were reported to have deteriorated since the property was shut down in 1930. Concerning the Woolsey, the Annual Report, Minister of Mines, British Columbia, 1941, says:

> "The property is equipped with a small complete mining plant and a combination gravity and flotation mill of about 70 tons daily capacity, the latter being located in a raise underground. From thirteen to nineteen men were employed under the direction of A.S. McCulloch. Efforts were directed to experimental work in an attempt to produce a marketable scheelite concentrate. A small roasting plant was built at Silver Creek siding on the railroad for this purpose."

Power is developed at the mine by oil-burning engines.

Adits on the Woolsey property are between 4460 and 5248 feet elevation, and on the Snowflake between 5550 and 5945 feet elevation. The principal workings are represented on a plan accompanying the present report, copied from a company plan. The nomenclature is that used by O'Grady (Bulletin No. 1, 1929) and by Stevenson (Bulletin No. 10, 1941).

A drift on Snowflake No. 4 level extends southeasterly into Woolsey ground, following the Snowflake No. 1 vein, which has been correlated with Woolsey 5a(?) vein, and another vein, referred to as the Snowflake No. 2 vein, which has been correlated with Woolsey 5b vein. Other correlations of veins on one property with those on the other are conjectural. In the absence of raises following the veins, correlation of veins from one level to another on the same property is conjectural to a degree.

At least five veins have been explored on Woolsey ground by adit-levels numbered 3 (elevation 5248 ft.), 5, 8, 9 and 10 (elevation 4460 ft.), by several raises, and by the drift on Snowflake No. 4 level. The total length of these workings including the long crosscut entry on 10 level is roughly 1½ miles. On Snowflake ground, four adit levels, a raise and a winze explore three veins, the total length of these workings is about half a mile. Shallow surface workings give some additional information about these and some other veins.

One vein on Woolsey ground had been tested in surface workings before the first mention of the property, in the Annual Report, Minister of Mines, British Columbia, 1918. The Snowflake was not mentioned until the 1922 report. Work was carried on actively on each property in the period from 1927 to 1931 since which time the Snowflake has been inactive. Beginning with 1938, there has been activity at the Woolsey property concerned with scheelite-bearing mineralization. A mill built underground that year proved unsatisfactory. According to report, the mill was being rebuilt late in 1940.

Occurring in argillaceous rocks overlain by quartzites and underlain by interbedded limestone and argillite, the veins in general follow the bedding of the sediments. They are filled with quartz and more or less altered wall rock, and contain sulphides which generally form a minor part of the vein filling. Vein widths range up to 20 feet, but such widths often contain wide horses of wall rock. At some points, veins feather out into quartz stringers in the argillite. There has been a good deal of faulting both across and along the veins. The veins strike northwesterly and dip 60 to 35 degrees northeastward.

The sulphides, which generally form a small part of the total vein filling, occur as scattered small masses in vugs and fractures in the quartz, as concentrations in crushed quartz and wall rock at the footwall of veins, as lenses developed along fractures in the quartz and at some points as concentrations near the hanging wall. At a few points, lead-zinc mineralization has been found filling fractures away from the larger veins.

The sulphides, pyrite, galena, sphalerite, stannite, tetrahedrite, have been reported as visible to the unaided eye, but tetrahedrite is apparently rare. Chalcopyrite, ruby silver and pyrrhotite have been recognized under the microscope. Native silver has also been reported from microscopic study.

Scheelite was recognized in the Snowflake workings in 1929 and is now known to occur rather widely in the Woolsey workings. Stannite, recognized in Snowflake workings, apparently occurs very sparingly, if at all, in most of the Woolsey workings, with the exception of the drift into Woolsey ground driven from Snowflake 4 level. Scheelite is the only tungsten-bearing mineral reported to be present in any quantity, and stannite is the only tin-bearing mineral which has been reported.

Silver-Lead-Zinc

Early interest in both properties was in silver-lead-zinc values, and small shipments of sorted silver-lead ore have been made from each property.

Snowflake. The following statement by J.D. Galloway, then Provincial Mineralogist, is quoted from "Reports on Snowflake and Waverley-Tangier Mineral Properties, 1928."

> "So far as development has gone, no important quantities of shipping-ore have been proven. In the upper workings on the No. 1 vein milling-ore is indicated in several places, but as yet no appreciable tonnage is proven. No commercial ore has been found in the No. 4 crosscut tunnel.
>
> "The cutting of the vein in the No. 4 crosscut tunnel demonstrates the continuity of the vein at that depth, but not of the values. Further development by drifting on this level, however, may disclose shoots of galena ore.
>
> "The other veins on the property are similar to the No. 1 vein. They are parallel veins and can be developed by continuation of the No. 4 crosscut tunnel. Development of these should be left in abeyance until the economic value of No. 1 vein is demonstrated.
>
> "The property is still a prospect in the development stage, with the possibility of commercial ore-shoots being found, where structural conditions are favourable by reason of sufficient fracturing of the primary quartz to permit extensive replacement by metallic minerals."

Later work was described by B.T.O'Grady in Bulletin No. 1, 1929, and in the Annual Report, Minister of Mines, British Columbia, 1929. This work, including drifts on 4 level, and a raise driven from the east drift to 2 level, further explored the mineralization but does not seem to have blocked out or indicated any considerable tonnage of silver-lead-zinc ore.

Woolsey. Available information is principally from the report of the engineer (X) in private practice, who made examinations for a prospective purchaser, and in his report quoted results obtained by another engineer (Y) who had made a report for the owners of the property.

Results of sampling by (Y) on Woolsey 5 level and in Raise C driven from it, and by (X) in three crosscuts on 5 level are given in the Table I.

Table I

Woolsey No. 5 Level and Raise C

	Woolsey No. 5 Level							
	A	B	C	D	E	F	G	H
Width	5 ft.			16 ft.	5.75'	10.0 ft.	11.6'	15.5 f
Assay								
Ag oz/ton	5.0	7.5	5.0	5.0	5.7	1.9	2.8	1.8
Pb %	4.2	6.9	5.0	4.2	5.8	2.75	4.5	2.6
Zn %	1.0	1.1	1.2	1.5	1.4	1.61	1.6	4.2
Sn %	0.14	0.2	0.1	Tr	0.1	Nil	Nil	Nil
WO_3 %						0.05	0.05	0.14

Notes

Sampling by (Y)

A, Raise C, 0 to 132 ft. up dip from Woolsey No. 5 Level. Average width 5 ft.

B, In Raise C, average of samples, 25 to 88 ft. above 5 Level.

C, Average for all samples in length of 350 feet measured from the portal.

D, Average of sampling in No. 1, No. 2 and No. 3 crosscuts.

E, Average of samples in 120 foot length, 230 to 350 feet from portal.

Sampling by (X)

F, No. 1 Crosscut.

G, No. 2 Crosscut.

H, No. 3 Crosscut, combines footwall section of 10 ft. and hanging wall section of 5 ft. 6 in.

The section, incompletely explored by Woolsey No. 5 level and Raise C, with sampling data for 350 feet westerly from the portal and 132 feet up the raise, with a width of 5 feet, might be credited with 9000 tons of probable and possible ore, averaging Silver 5 oz. per ton, lead 4.2%, zinc 1%, tin 0.1%, without allowance for dilution. This estimate is based on available information, which should be checked by detailed examination and close sampling. If the average width is as great as indicated in the crosscuts, the tonnage might be considerably greater than 9000 tons. The raise is reported to have been advanced to a total slope distance of 220 feet from the level. The extra 88 feet of raise might permit increasing the tonnage estimate somewhat, but because of the irregular nature of the mineralization, the estimate could not be increased greatly.

On 10 level, No. 5 vein has been explored by drifts east and west of the crosscut entry. No. 5 vein drift east follows the vein 90 feet to the main fault, beyond which the working follows the fault. No. 5 vein drift west is generally in the footwall of the vein which was crosscut by several stub raises. These exposed a vein which for 150 feet west of the crosscut averaged 6 feet wide, according to (Y), beyond that the vein was narrower and poorly mineralized. Raise A followed the vein up the dip, and had advanced 208 feet when examined by (Y), who found the veins to be 1 to 6 feet in width with low values. An intermediate level was driven from Raise A about 180 feet up the dip from 10 level. This level, later continued easterly to the surface, is now called No. 9 level. (Y) found the ground on it generally broken and did not find commercial values.

Results of sampling by (Y) are given in Table II. Sampling by (X) at one point in the 90 foot section on 5 vein drift east and at one point on 5 vein drift west are given under A and C in Table VIII in the section headed "Tungsten". Assays of samples taken by (X) are materially below those taken by (Y).

Table II

10 Drifts East and West, and Raise A

	A	B	C
Width	7.5 ft.	6.0 ft.	1.0 -6.0 ft.
Assays			
Ag Oz/ton	5.2	7.6	1.5
Pb %	5.3	6.6	1
Zn %	0.5	2.6	Tr
Sn %	0.2	Tr	Tr

Notes

Sampling by (Y)

A, Drift east, average of samples 0 - 90 feet from crosscut entry.

B, Drift west, average of samples 0 - 150 feet west of crosscut entry, vein exposed in crosscuts, and crosscutting stub raises.

C, Vein as exposed in Raise A, 0 - 208 ft. slope distance up dip from 10 level.

It seems probable that the vein is not well exposed east of the crosscut entry, and that it is exposed principally in crosscuts or stub, crosscutting, raise west of the crosscut entry. Sampling information therefore must be incomplete. The conflict between sampling by (X) and (Y) has been mentioned, sampling by (X) was probably less complete than by (Y), whose results on the level for a length of 240 feet indicates marginal ore; his sampling results in Raise A, and (X)'s results on the drifts on 5 vein, 10 level, are definitely sub-marginal. In the drifts (Y)'s results indicate for a length of 240 feet an average of, Silver, 6.5 oz. per ton, lead 6%, zinc 1.5%, tin 0.1%, and allowing a vertical extent of 50 feet the section could be estimated to contain about 6500 tons of possible ore. Conflict between results of the two samplings, incompleteness of the exposure and the low results in the raise, throw doubts on the estimate of grade. This doubt could be reduced in part by detailed examination and by check sampling.

The raise has since been carried through to No. 8 level, on which silver-lead-zinc mineralization appears to be definitely sub-marginal. Results of sampling in this and in various other workings are given in Tables in section headed "Tin" and "Tungsten". They show values much too low to be considered as silver-lead-zinc ore. If such material were treated for its tin or tungsten content, bye-product silver and lead would doubtless be recovered in a lead concentrate. The sampling shows very little zinc to recover.

Thus it appears that in No. 5 vein on Woolsey 5 and 10 levels, there are sections which may be marginal silver-lead-zinc ore. If check examination and sampling confirmed the results obtained by (Y), possible ore might be estimated at a total of 15,000 tons or so, and possibly considerably more, averaging Silver 5 to 6 oz. per ton, lead 4 - 6%, zinc 1 to 1½%, and tin about 0.1%. Material of this grade is patently marginal, but there might be some salvage in it if a substantial part of the overhead and capital expense would have to be made anyway, say for tin or tungsten recovery.

It is probable that a small tonnage of crude silver-lead ore could be won by selective mining and sorting from high grade pockets.

Tin

Information on tin values is principally from Bulletin No. 1, 1929, dealing with the Snowflake property. We also have some information from the report by (X) about tin on the Woolsey property. Except for the drift into Woolsey ground on the Snowflake 4 level, tin assays on the Woolsey property were given as Nil by the engineer (X). He quoted average assays (Y) of 0.5% Sn in No. 6 vein drift east 10 level and in the raise from it, and from 0.1 to 0.2% tin from other points in the workings. Thus for the drift and raise on 10 level, there is marked conflict between the two samplings but elsewhere they agree in showing that the tin content is negligibly small.

In Bulletin No. 1, 1929, tin assays from scattered workings on the Snowflake, including surface cuts which incompletely exposed veins, range from Nil to 2% tin. They are of interest as guides for prospecting but do not indicate any quantity of tin-bearing material.

Snowflake 4 level consists of a crosscut entry driven northeasterly from which a drift was driven northwesterly along the footwall of a vein, and another drift was driven southeasterly along the footwall of the vein, about 120 feet to the boundary of the Woolsey group. From this drift at a point 93 feet from the crosscut entry, a raise followed the vein up the dip. This raise had been driven 120 feet at the time of the examination reported in Bulletin No. 1, 1929. Later the raise was driven through to No. 2 level.

Samples taken by O'Grady in the west (more exactly northwest) drift, averaged Gold, nil, silver 0.22 oz. per ton, lead nil, zinc 1.42%, copper nil, tin nil. (Bulletin No. 1, 1929, p.53.

Concerning the drift east (more exactly southeast), the raise from it and workings at higher elevation in the same section, O'Grady wrote (Bulletin No. 1, 1929, p.53 and 54):

"Channel samples at 20-foot intervals along the east drift gave an average assay of: Gold, trace; silver 3.52 oz. to the ton; lead, nil; zinc 4.59 per cent; copper 0.46 per cent; tin 0.28 per cent; over an average width of 27½ inches and a length of about 112 feet. Sampling of the raise at similar intervals gave an average assay of: Gold, trace; silver, 8.86 oz. to the ton; lead, 1.81 per cent; zinc, 5.62 per cent; copper, 1.35 per cent; tin, 1.13 per cent; over an average width of 43 inches and a length of 120 feet. A very strong development of stannite occurs 25 feet up the raise, where a sample taken across a width of 33 inches, and included in the above average, assayed: Gold, trace; silver, 43.5 oz. to the ton; lead, 7.5 per cent; zinc, 6 per cent; copper 6.5 per cent; tin, 6 per cent. The combined average of the samples taken along the east drift and the raise therefrom is: Gold, trace; silver, 6.39 oz. to the ton; lead, 0.65 per cent; zinc, 5.31 per cent; copper, 0.94 per cent; tin, 0.73 per cent; over an average width of 34 inches. Although the samples taken in the east drift and raise were widely spaced, it appeared from an examination of the vein in both workings that the samples represented a fair average, in spite of the mineralization being of very irregular character.

"The 'backs' on the east drift to the No. 2 level, 335 feet vertically above it, have been estimated at about 550 feet. The raise in the east drift on the No. 4 level will when completed connect with the westerly drift on the No. 2 level a short distance from the crosscut intersection.

"The 'tin-shoot' in the east drift adjoins the boundary between the Snowflake and Regal Silver properties and its extension in strike and dip can be expected on the latter property, as the boundary-line forms an acute angle with the direction of the drift. The tin-bearing vein, with its dip of 52 degrees in the east drift, would enter Regal Silver ground in a slope-length of about 110 feet below the point of intersection of the crosscut and drift and in a few feet at the boundary line. There is, therefore, a small block of ground below the tin-shoot, triangular in shape, lying between the two properties. A sample across 18 inches in the face of the east drift adjoining the Regal Silver boundary assayed: Gold, trace; silver, 5.2 oz. to the ton; lead, nil; zinc, 13 per cent; copper, 1.1 per cent; tin, 0.7 per cent.

"The No. 1 and No. 2 levels of the Snowflake develop sections of the same No. 1 vein at elevations of 5,945 and 5,885 feet respectively, the elevation of the No. 4 level containing the tin-shoot being 5,550 feet. The westerly drifts in the upper two tunnels mentioned are situated approximately above the tin-shoot and, without allowances for any rake in the ore-body, might be expected to develop the upper part of the same shoot. The mineralization was not considered to be sufficiently continuous in these upper levels to warrant systematic sampling, and only a few samples were taken at promising points with a view to correlating silver-tin values if possible. In this connection three samples were taken in the No. 2 tunnel westerly drift and one sample in the face of the No. 1 tunnel westerly drift. A 64-inch sample taken at the intersection of the No. 2 level crosscut and drift gave an assay of: Gold, 0.02 oz. to the ton; silver, 11.8 oz. to the ton; lead, nil; zinc, 2 per cent; copper, 0.9 per cent; tin, 0.2 per cent. A 12-inch sample taken 35 feet along the westerly drift from the crosscut assayed: Gold, trace; silver, 0.35 oz. to the ton; lead, nil; zinc, 1.8 per cent; copper, nil; tin, nil. A sample across 18 inches in the face of the westerly drift on the same level assayed: Gold, trace; silver, 7.8 oz. to the ton; lead, 10.5 per cent; zinc, 3.8 per cent; copper, 0.1 per cent; tin, trace. A selected sample from a narrow but continuous streak in the same working was found to contain 8.4 per cent tungsten.

"A sample across 24 inches in the face of the westerly drift on the No. 1 level assayed: Gold, trace; silver, 15.5 oz. to the ton; lead, 3.3 per cent; zinc, 12.1 per cent; copper, 2 per cent; tin, 1.6 per cent."

It is obvious that "the combined average of samples taken along the east drift and the raise therefrom," would be very seriously reduced if the sample which assayed 6% tin, were not included. It appears that this represents a local enrichment of which repetition is unpredictable. As the complete sampling data were not published, it is impossible to analyze the sampling results, but it seems probable that conservative practice would be inclined to reject the single high tin assay in estimating the average grade for the block. A triangular block of which the base measures 112 feet along the drift, the apex is 120 feet up the dip at the top of the raise and the average thickness is 34 inches, contains 19,000 cubic feet and at 12 cu. ft. per ton would amount to 1580 tons. This might be allowed as "probable ore." Ground for a moderate depth below the drift and ground up the dip from the sloping sides of the triangular block, amounting to say an additional 2000 tons might be considered as possible ore. These estimates should be checked for continuity and grade by detailed examination and closely spaced samples should be taken to determine the grade.

Woolsey, on Snowflake 4 Level

Under arrangement between the owners of the two properties, the east drift of Snowflake 4 level was continued about 258 feet into Woolsey ground, near the end a crosscut was driven northeasterly about 25 feet and from it a drift on another vein was driven 140 feet or so southeasterly. An engineer (Y) reporting for the owners of the Woolsey property was quoted as giving average assays in the length of 258 feet of Silver 3.0 oz. per ton, lead 0.4%, zinc 1.5%, tin 0.5%, over widths ranging from 17 to 41 inches. The mean width then is 29 inches. With this width and length, and allowing for an extent of 50 feet on the dip, we can estimate say another 2600 tons of probable and possible ore. This also should be checked by detailed examination and close sampling.

10 Level

No. 6 vein, drift east

The vein is exposed in short crosscuts driven northerly short distances from the irregular drift. It is a strong vein sparingly mineralized with sulphides. The vein is explored by Raise B, for 200 feet above the level. Sampling data are recorded in Table III.

Table III

No. 6 Vein, 10 Level, Drift east and Raise B

	A	B	C	D	E	F
Width				8.0 ft.		4.5 ft.
Assay						
Au Oz/ton	0.02	Tr	Nil			
Ag Oz/ton	Tr	0.20	Nil	3.0	5.2	2.4
Cu %	Nil	Nil	Nil			
Pb %	1.22	1.63	1.63	1.5	4.1	2.7
Zn %	0.81	0.76	0.40	0.9	1.2	1.5
Sn %	Nil	Nil	Nil	0.5	0.4	0.5
WO_3 %	0.14	Nil	Tr			

Notes

Samples taken by (X)

A, In crosscut to north about 260 feet east of crosscut entry.

B, In crosscut to the north about 460 feet east of crosscut entry.

C, In crosscut to the north about 460 feet east of crosscut entry.

Samples taken by (Y)

D, Average for length of 520 feet, 0 to 520 feet, east of crosscut entry.

E, Average for length of 120 feet, 400 to 520 feet east of crosscut entry.

F, Average for 200 feet up Raise B.

ON (Y)'s figures probable and possible ore might be estimated at about 20,000 tons averaging Silver 2.5 to 3 oz. per ton, lead 1.5% or better, zinc 0.9% or better, tin 0.5%. It must be noted that the grade is entirely out of line with that indicated by the less complete sampling by (X).

The section opened by Snowflake 4 level and the Snowflake Raise on the two properties might be credited with a total of about 6000 tons of probable and possible ore, containing silver, lead and zinc in addition to about 0.5% tin. The section opened by 6 vein drift east on Woolsey 10 level, and by Raise B, might be credited with as much as 20,000 tons of probable and possible ore of similar grade, making a total of 26,000 tons.

The writer considers the estimates of grade are open to question, and that detailed examination and close sampling are necessary if dependable estimates are required.

Milling and Metallurgy

In the absence of information re milling tests, we can only guess what results would be obtained in milling ore containing pyrite, galena, sphalerite, tetrahedrite, stannite, etc. It is probable that a tin concentrate could be made by flotation. From the composition of the mineral, it seems probable that the flotability of stannite is intermediate between that of galena and sphalerite. Tetrahedrite and chalcopyrite are intermediate in flotability between galena and sphalerite. Accordingly, the "tin concentrate" to be produced would probably contain some galena and sphalerite, also a little chalcopyrite, and tetrahedrite, as well as the stannite; it would also probably contain some pyrite.

The analysis of the mineral determined as stannite, quoted by Gunning (G.S.C.Summary Report 1929, Part A, Page 185) is:

	Per cent
Sn	26.65
Cu	31.56
Fe	3.65
Zn	7.72
Mn	nil
Ni	nil
S	29.76
Total	99.34.

It is apparent that the "tin concentrate" would not exceed 26% tin and more probably would be nearer 20% tin. In addition to the constituents listed in the analysis of stannite, the "tin concentrate" would probably contain silver, lead, and antimony.

Commercial smelting of tin is based on concentrates of rather high purity, usually containing 60% tin or better, in the form of cassiterite. Impurities in the ore are apt to be reduced with and appear in the metallic tin produced. Elimination of the impurities complicates the smelting, adds to its cost, and increases loss of tin in smelting. So far as the writer has been able to learn, stannite has not been acceptable as either a major or considerable constituent of tin concentrates. It is apparent therefore that special provisions would have to be made to handle tin concentrates from these properties.

Tungsten

Information regarding tungsten on Snowflake ground and on Woolsey ground on Snowflake 4 level is limited to brief references in Bulletin No. 1, 1929, and Bulletin No. 10, 1941.

Concerning tungsten in the Woolsey workings, we have Stevenson's descriptions and estimates (Bulletin No. 10, 1941), and the report by the engineer (X), principally concerned with tungsten. This report quoted from engineers (Y) and (Z).

It appears that scheelite occurs most abundantly in parts of the veins in lenticular masses heavily mineralized with pyrite, which occur within the veins. These lenses also contain some galena and sphalerite. Fluorite has also been reported to occur with the scheelite. Stevenson describes the pyrite lenses as ranging in length from a few feet to 350 feet, and in width from 1 to 18 inches, with 6 inches a more common width. He also refers to kidneys of almost pure scheelite, which may occur within pyrite lenses, and to occurrences of scheelite in small masses up to ½ inch diameter, usually associated with small clusters of pyrite, scattered at wide intervals throughout the quartz veins. According to Stevenson, Woolsey No. 5 vein, explored on Woolsey 3, 5, 8, 9 and 10 adits, and on Snowflake 4 adit, is the only vein in which scheelite has been found in appreciable amounts.

Stevenson mentioned less important occurrences of scheelite, and gave estimates of the size of four important scheelite-bearing bands or lenses occurring in pyritic lenses. He stressed the difficulty in making quantitative estimates of the valuable content but presents estimates of the tungstic oxide (WO_3) content per vertical foot. He expressed the opinion that the vertical extent of the individual scheelite rich sections is not apt to exceed 50 feet.

His estimates are as follows:

No. 8 level - 150 to 250 feet east of A or Mill raise (several disconnected short ribbons and one large kidney of scheelite)
Length 100 ft., average width 6 in.
Tungstic oxide content per foot of depth, 48 lb.

No. 9 level - 10 to 110 feet east of A or Mill raise.
Length 100 ft., average width 6 in.
Tungstic oxide content, 200 lb. per foot of depth.

40 to 225 feet west of A or Mill raise
Length 185 ft., average width 6 in.
Tungstic oxide content per foot of depth, 176 lb.

No. 10 level -
At northwestern end of exposure of No. 5 vein.
Length 17 ft., average width 7½ in.
Tungstic oxide content per foot of depth, 400 lb.

The following information, obtained from private sources, is based on sampling of widths considerably greater than the four sections for which Stevenson gave estimates. In connection with the results, it is desirable to keep in mind the fact that tungsten assays are difficult, and that different assayers may not check closely on the same sample; therefore a chemical determination should not be regarded as exactly representing the tungstic oxide content. Assays for the element tungsten (W) are reported by (X). These have been multiplied by 1.26 to convert them to tungstic oxide, and are given as WO_3 in the present report.

Scheelite has been reported from higher levels, but no occurrence of important size and grade has been reported from workings higher than the Woolsey 8 level.

Engineer (X) reported that the best values in tungsten were obtained from samples taken on 8 level. At the top of the Raise A he took a sample (A, Table I) across 30 inches, the width of a lens which pinched out 30 feet west of the raise. Another lens comes in and is 6 feet wide in the face, where he took a moiled sample (B, Table I). In the section from 50 to 240 feet east of the raise, he found much pyrite, some galena and some sphalerite in the vein. At 190 and 230 feet east of the raise, he found specimen scheelite; elsewhere he found it in small amount. In the section 50 to 287 feet east of the raise, he took five samples (C,D,E,F,G, Table I). The first three assayed well in tungstic oxide, their average is given in the Table (H). In the next section of the working extending about 150 feet southeasterly to the crosscut entry, seven samples average width 5½ ft., were taken, they are low in tungstic oxide, contain some silver, lead and zinc. They represent less regular vein and two en echelon lenses in the footwall. The average of the seven is given under I, Table IV.

After reducing the high sample (E) in the 50 to 237 feet east of Raise A, (X) computed the average for five samples (C,D,E,F,G) as:

Ag	Pb	Zn	WO_3
0.5 oz.per ton	1.5%	0.7%	0.43%

for a length of 237 feet and average width of 5.5 feet. For the same section (Z) obtained an average of 0.37% WO_3 for a length of 240 feet and average width of 4.5 feet. Stevenson's estimate, 100 feet of this section, is 48 lb. WO_3 per foot of depth. If we consider the same yield from a section 5 feet wide, 100 feet long and 1 foot high, or say 8½ tons, we have a little better than 0.25% WO_3 per ton. It seems probable that there would be some scheelite outside the width of 6 inches which Stevenson considered. Therefore in 100 feet of length at least there is fair agreement between the three, and for approximately 240 feet there is better agreement between (X) and (Z). A section 240 feet long, 5 feet wide, and 50 feet in vertical extent would contain 5000 tons.

Table IV

No. 8 Level, Woolsey, Sampling by (X)

Refer Note	A	B	C	D	E	F	G	H	I
Width	2.5 ft.	6.0	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Assay(2)									
Au oz/ton	Tr	Tr	Tr	Tr	0.04	Tr	Tr		Tr
Ag oz/ton	Tr	5.20	0.40	0.36	2.66	Nil	0.06	1.14	0.29
Pb %	4.44	1.33	1.53	1.27	4.89	1.32	1.22	2.65	1.25
Zn %	1.86	0.35	0.67	0.46	0.93	0.66	0.86	0.69	0.72
WO_3 %	0.30	2.63	1.07	0.68	1.66	0.06	0.06	1.14	1.17

Notes

(1) Average width C - I inclusive, 5.5 ft.
(2) Copper and tin reported Nil throughout.

A, At top of Raise A, east side.
B, At face of drift, west of Raise A.

C)
D) In drift 50 to 240 feet easterly from top of Raise A
E) at increasing distances from raise.
F)
G)

H, Average of samples C, D and E.
I, Average of seven samples in 150 feet running southeasterly to crosscut entry.

Raise A

A 50-ton mill was installed underground in 1938 in an enlarged part of Raise A between 8 and 9 levels. This part of the raise has been called the "Mill Raise".

In cutting out for the mill, scheelite was exposed in the footwall of the raise. No. 5 vein is exposed in the raise from 10 level to 8 level, slope distance 388 feet. It is generally low grade from 10 level to a point above 9 level. Sampling data for this raise are recorded below in Table V.

Table V

Raise A, Sampling by (X)

	A	B
Width	1.5 ft.	5.7 ft.
Assay		
Au oz. per ton	0.01	0.04
Ag oz. per ton	0.05	3.06
Cu	Nil	Nil
Pb %	1.22	2.09
Zn %	0.71	0.81
Sn %	Nil	Nil
WO_3 %	2.80	0.16

Notes
A, Taken by (X) at footwall in Raise A.
B, Taken by (X), east side of raise 40 ft. above 10 level.

The section represented by the upper part of Raise A, (A Table V) and the drift west on 8 level (A and B, Table IV) contains scheelite but on the information available, no considerable tonnage of ore can be estimated.

No. 9 Level

Westerly from Raise A, (X) found a band consisting of argillite and quartz with a good deal of pyrite and a good deal of graphite. At one point, there is 3 feet of quartz ribboned with wall rock and containing some pyrite. Results of composite sampling by (X) of the section for about 150 ft. westerly from the raise are shown under A, Table VI. Sampling by (Z) in the section extending 173 feet westerly from the raise is shown under B, Table VI.

The value 0.96% WO_3 obtained by (X) for a length of 150 feet and a width of about 1 ft., is equivalent to 0.50% WO_3 in a width of 1.9 feet. The results of sampling by (Z) are given as 0.59% WO_3 for a length of 175 feet, and width of 1.9 ft. Stevenson's estimate of 176 lb. WO_3 per vertical foot in a length of 185 feet, and average width 6 in., is equivalent to 0.3% WO_3 in an average width of 1.9 ft., allowing 12 cubic feet per ton. It is probable that there would be some scheelite outside the band of which the average width is 6 inches. If we assume a vertical extent of 50 feet, length 150 ft., average width 1.9 ft., we can credit this section with say 1150 tons of possible ore, without allowance for dilution. The mean of the three values is a little more than 0.4% WO_3.

Easterly from the raise, the level shows a vein 5 feet wide at the raise, tapers to about 3.5 feet wide at the first crosscut, holds this width for about 40 feet and wedges out at 20 feet forth against the main fault. In a length of about 40 feet near the crosscut, there is a band rich in pyrite, about 12 inches wide, at the footwall and another 10 to 12 inches wide at the hanging wall. Samples cut by (X) across the vein C west of the crosscut, and D east of it, are listed in Table VI .

Table VI

No. 9 Level

	A	B	C	D
Width	1.0 ft.	1.9 ft.	5.0 ft.	4.0 ft.
Assay				
Au oz/ton	Tr		Tr	Tr
Ag oz/ton	1.40		0.04	0.20
Cu	Nil		Nil	Nil
Pb %	0.51		1.22	1.53
Zn %	0.60		0.53	0.81
Sn %	Nil		Nil	Nil
WO_3 %	0.96	0.59	0.30	0.25

Notes

9 Level drift west of Raise A.

A, taken by (X), composite of channels cut across graphic pyritic band in a length of 150 feet west of raise. Average width about 1.0 ft.

B, taken by (Z), composite of channels cut across band in a length of 175 feet, west of raise, average width 1.9 ft.

9 Level drift east of Raise A.

C, West of first crosscut.

D, East of first crosscut.

10 Level
No. 5 Vein Drift West of Crosscut Entry

The vein is exposed in the crosscut entry and in the drift to the west for about 200 feet; crosscuts show it to be up to 9 feet wide. Sampling by (X) in this section is recorded under A, Table VII. Farther west, a branch drift or crosscut running northerly which, where it leaves the line of the drift, cuts a pyritic lens. The lens is exposed continuing in the western wall of the working. Results from assaying a composite of three channels 12 to 18 inches wide, cut by (X) across the lens, are given under B, Table VII. Results of sampling by (Y), analyses not showing WO_3, are given in Table II.

No. 5 Vein Drift East

The vein is exposed in the drift to about 90 feet from the crosscut entry, crosscuts expose a width of 10 feet, average results from sampling by (Y) for the 90 ft. length are given in Table II. A sample taken by (X) midway along this section is recorded under C, Table VII. The working swings northeasterly for 50 feet along a fault, which is largely filled by quartz. At the face of this drift, toward the right hand side, a vein is exposed which was sampled by (X); results are given under D and E, Table VII.

Table VII

No.10 Level

	A	B	C	D	E
Width	6.8 ft.		7 ft.	2.5 ft.	2.5 ft.
Assay					
Au oz/ton	0.02	Tr	Tr	Tr	Tr
Ag oz/ton	(1)	0.08	0.04	Nil	1.00
Cu %	Nil	Nil	Nil	Nil	Nil
Pb %	3.97	1.07	0.46	1.53	1.84
Zn %	0.55	0.55	0.71	0.73	0.73
Sn %	Nil	Nil	Nil	Nil	Nil
WO_3 %	0.13	0.02	Nil	0.43	0.40

Notes

All samples taken by (X)
(1) Silver erratic.

Drift West on No. 5 Vein
A, In first crosscut.
B, Composite of three channels across lens 12 to 18 inches wide, exposed at collar of crosscut, turns north from west end of drift.

Drift East on No. 5 Vein
C, At crosscut about 45 feet east of crosscut entry.
D, At face of northeast drift, breast high.
E, At lower left hand corner of face.

Sampling results in the drift east on 9 level, and in 5 vein drift east on 10 level, indicate mineralization of moderate grade in scheelite, but the information does not permit estimating any considerable tonnage. The lens indicated toward the west end of 5 vein drift west on 10 level is of quite high grade material apparently of small extent.

The sections on 3 level east of Raise A, and on 9 level west of Raise A, probably would yield 6000 tons averaging about 0.3% WO_3. It is likely that 5 vein at other points would yield a considerable additional tonnage.

Mineralization poorer in scheelite but richer in tin-bearing or in silver, lead and zinc minerals might yield some bye-product scheelite.

Milling

The mill built in 1938, provided for making a flotation silver-lead concentrate, followed by tabling flotation tailings to recover scheelite. Fine grinding for flotation slimed the scheelite, which therefore was not recovered satisfactorily on the tables.

Report 756, Investigations in Ore Dressing and Metallurgy, July to December 1938, Canada, Department of Mines and Resources, deals with tests made on "a 700 pound sample of silver-lead tungsten ore..... received September 8, 1938, from the Regal Silver property." The procedure recommended is to table the ore, classified after a relatively coarse grind, then to grind the table concentrates and from them to float first a silver-lead concentrate and then a tungsten concentrate.

Overall Recoveries

In the tests, classified products were tabled separately to give a concentrate, middling and tailing. The concentrates from the + 65 mesh products were reground before flotation, the -65 mesh products were floated without regrinding.

The feed sample assayed:

Ag 0.955 oz. per ton Pb 0.84% Zn 0.36% WO_3 2.42%
Fe 15.68% S 15.48% Graphite 1.42%

Cleaning the flotation concentrates yielded the following final product:

From reground +65 mesh material (75% of ore after coarse grind)

	Assay				Distribution Per cent of material in +65 mesh product		
	Ag Oz/ton	Pb %	Zn %	WO_3 %	Ag	Pb	WO_3
WO_3 conc't	0.06			46.23	0.4		88.1
Pb conc't	6.95	9.71	1.38	0.47	61.3	65.5	1.2

From -65 mesh material (24.8% of ore after coarse grind)

	Assay				Distribution Per cent of material in -65 mesh product		
	Ag Oz/ton	Pb %	Zn %	WO_3 %	Ag	Pb	WO_3
WO_3 conc't	0.09			45.26	0.2		65.0
Pb conc't	55.44	67.71	0.26		71.6	90.3	

Considerable parts of the values not in final products were in middlings which in a continuous operation would be recirculated and from which some recovery would be made.

The results were reported to indicate the following overall recoveries:

Tungsten	81.5%
Lead	88.5%
Silver	80.4%

The low grade of the lead concentrate made from the + 65 mesh table products was said to be because insufficient lime and depressants were used in cleaning the bulk sulphide concentrate. The grade of the lead concentrate made from the -65 mesh table concentrates was good.

A portion of the tungsten concentrate carrying 46.23% WO_3 and 10.37% sulphur was roasted in an open dish at 550 degrees C. The calcine was cleaned by refloating, yielding a product which assayed 55.9% WO_3, 0.30% sulphur.

Pure scheelite contains 80.6% WO_3. Stevenson refers to lenses of almost pure scheelite. The difficulty in making a high grade scheelite concentrate, and the considerable losses in milling, suggest the advisability of selective mining followed by cobbing and sorting to recover a considerable part of the scheelite as sorted crude ore. The yield would not be high but as the product is of high value, this procedure should be considered.

Net Return from Ore

The following estimates are for net return per ton of each of three classes of ore milled, from concentrates f.o.b. railroad cars. Present United States prices for silver, lead and zinc are used, duty is deducted, and net return is given in Canadian funds. For tin the price $0.45 per pound, and for tungsten the price $24.00 Canadian per unit is used.

Silver-lead-zinc

Taking as mean grade, Silver 5.5 oz. per ton, lead 5%, zinc 1.2%, tin 0.1%, return from silver and lead in a lead concentrate would be $3.00 to $3.50 per ton milled; zinc, tin and tungsten might yield an additional small amount, probably not more than $0.50 per ton.

Tin

We have no proven basis for estimating return from a tin concentrate, in which tin values are in stannite, and which assays say 30% tin, and also contains silver, lead and zinc. Neither have we any data on which to predict accurately recoveries and grades of concentrates.

Taking grade of ore to be milled as Silver 3 oz. per ton, lead 0.4%, zinc 1.5%, tin 0.5%, assuming recovery as payable metal, Silver 65%, lead 65%, tin 80%, and price for tin $0.45 Cdn. per pound, return from tin, lead and silver would be about $3.50 per ton milled. Zinc and tungsten might yield an additional few cents per ton.

Tungsten

Assuming grade of ore milled as .25% to 0.3% WO_3 and 80% recovery in concentrate assaying 60% WO_3 at $24.00 per unit, the tungstic oxide content per ton of ore would yield $5 to $6 per ton. Silver and lead might yield a few cents per ton.

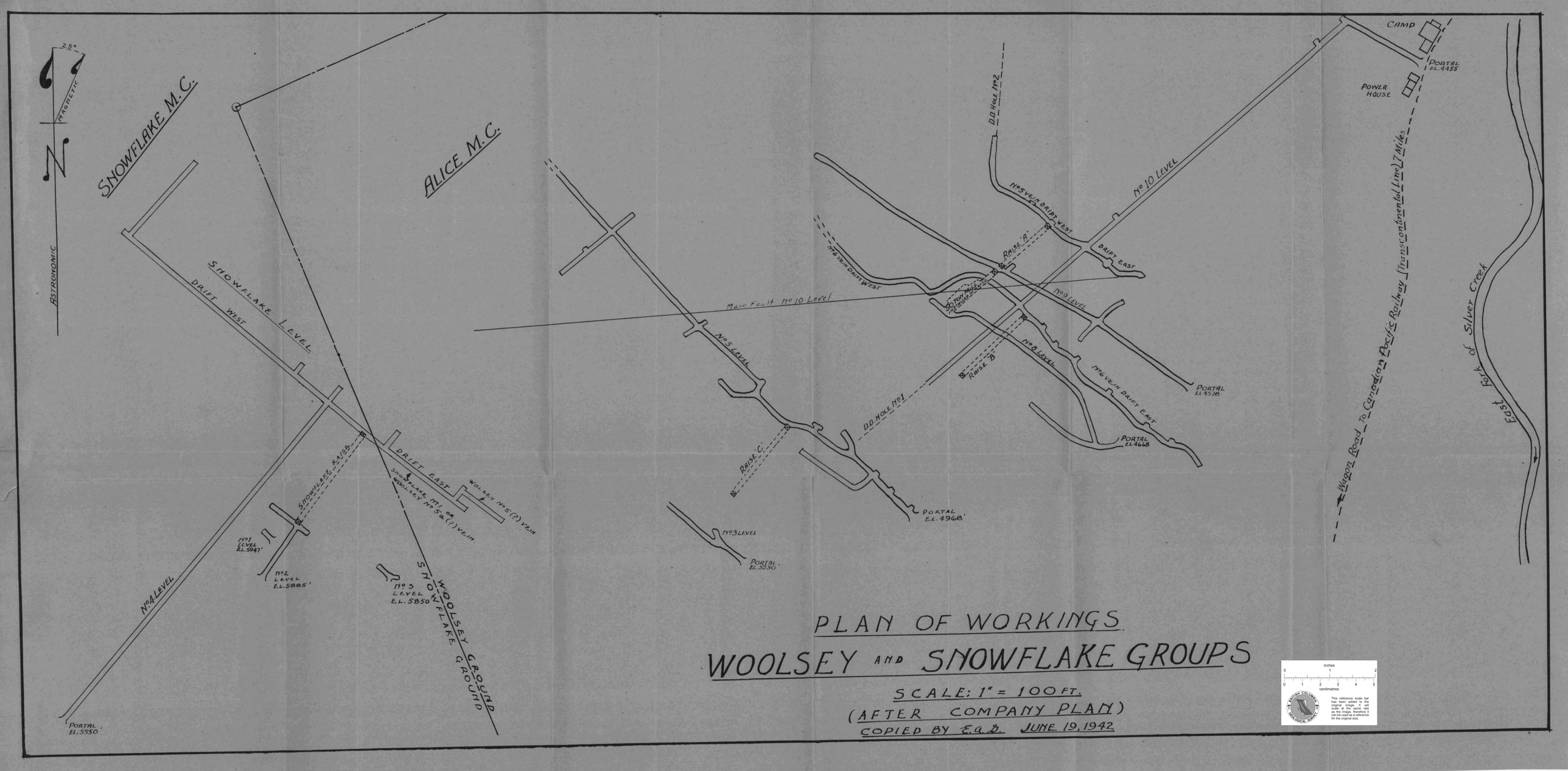
Costs

Widths of ore range from less than 2 feet to more than 5 feet. Selective mining would be desirable. A good deal of handling would be required in moving ore from scattered workings. Milling would recover values in three and perhaps four products, the tungsten concentrates would probably have to be roasted. Transportation to and from the railway, 7 to 8 miles, would be an item of some importance. Uncertainty about these factors combine to make it difficult to predict costs, but the factors make it certain that costs would be high. Operating costs including development would probably be from $4.00 to $8.00 per ton of ore milled, assuming rate of production of 50 to 100 tons per day of milling ore of all classes. Capital charges are difficult to predict. However as the Woolsey is already largely equipped, charges for extra equipment should not be great. The uncertainty of the ore position and the fact that total ore is apt to be less than 100,000 tons indicate the wisdom of keeping further capital expense down even though that involves greater operating costs.

Some tungsten can probably be won at about the present price. Silver-lead-zinc and tin mineralization appears to be quite definitely sub-marginal.

Vancouver, B.C.
June 24, 1942.

H. Sargent,
Mining Engineer.



PLAN OF WORKINGS
WOOLSEY AND SNOWFLAKE GROUPS

SCALE: 1" = 100 FT.

(AFTER COMPANY PLAN)

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