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002738 PRELIMINARY REPORT ON THE
EMERALD PROPERTY, SOUTH OF SALMO, B. C. + drawing

July 11, 1942.

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Tungsten, in the form of scheelite, was first discovered on this old property in the early spring of 1942, first within bands of strongly metamorphosed limestone, or skarn, and later along a contact zone within an area formerly believed by the owners to be wholly underlain by granite. A description of the low-grade tungsten mineralization in the skarn has been given in a report by R. J. Maconachie to the Department of Mines, dated June 10th, 1942, at which time the new discovery had received very little development work. The present report deals solely with the new, higher grade discovery, which is of far greater immediate importance.

X The property consists of the following Crown-granted mineral claims: Jersey, Gold Standard, Standard fraction, Emerald, Emerald fraction, Morning, Sunshine, Dodger, Invincible, Job Trotter, Empire, Pickwick, Royal Canadian, Last Chance, Mark Tapley, King Alfred, King Solomon and of several others held by location. It is owned by Iron Mountain, Limited, chiefly an American estate that has held the ground for many years. The principal, with whom all dealings are made, and who has apparently full authority, is Stewart M. Marshall, 1911 Mills Tower, San Francisco. The company affairs, locally, are in the hands of Harold Lakes, of Nelson, who has carried out a little work during the past few years on the old lead-zinc showings. Mr. Marshall is connected with U. S. Steel, and at present works for the U. S. Government.

The property is at an elevation of about 4100 feet between Sheep and Lost Creeks, east of the Salmon River, and 8 miles south of Salmo. It is easily reached by 4 miles of road that leaves the highway at the mouth of Sheep Creek. An old camp has recently been rehabilitated, and can accommodate about 15 men. The Emerald lead-zinc showings, and the tungsten showings, are on a steep hillside that has largely been burnt over. There is, however, an adequate supply of second growth timber for mine purposes that has been untouched by fire. Water is scarce; some can be obtained from a diamond-drill hole in the old workings, and this, plus reinstallation of an old system from Annie Rooney Creek, nearly 2 miles distant, will supply camp needs. Lime Creek, below the showings, is no more than a trickle in the dry season. Water for milling operations will have to be obtained from Lost Creek or from the Salmon River or its South Fork, where a mill would have to be situated. An alternative location would be the mouth of Sheep Creek. X

The area is underlain by lower members of the Pend d'Oreille series, intruded by granites of the Nelson batholith. (See Geology and Mineral Deposits of Salmo Map-area, by J. F. Walker, G. S. C. Memoir 172). The sediments include blue-grey limestones, argillaceous sediments and schistose quartzites, striking from north 10 to 20 degrees east and dipping eastward into the hillside at angles between 15 and 70 degrees. The granitic bodies are elongated in general parallel with the strike of the sediments, but there is no evidence that they are sill-like. The limestones are quite pure, and, although strongly recrystallized, only locally have been converted to lime-silicate minerals. The argillaceous and quartzitic sediments show strong alteration, but no coarse-grained schists are developed, and the alteration is not much more intense at the actual granite contacts than at distances of several hundred feet. There is no marked folding or contortion of the sediments in the section under discussion.

The Emerald was first reported on in 1907, and was a small producer of lead ore until 1925. A small mill operated near the present campsite, but has been burned down. A small amount of development has been done by hand on the lead-zinc showings during the last few years.

Four bands of highly metamorphosed limestone occur beneath the lead-zinc workings. These bands of garnetite, or skarn, contain a little molybdenite, and it was during the course of investigation of this material during the early part of 1942, by Harold Lakes, that a sample was sent to the Department of Mines at Victoria, when the presence of scheelite was detected. No work has been done on these bands. An examination of them was made by R. J. Maconachie, during the course of which a 60-foot section of one band was carefully sampled, the average grade of which is about 0.15% tungsten trioxide.

Just prior to this examination by Maconachie a series of old open-cuts was found, by Harold Lakes, in thick bush above the Jersey road and north of an old adit adjacent to the road. This ground was formerly believed to be underlain by granite. The old adit is in silicified granite and quartz, but the open-cuts explore sulphide mineralization along the granite contact and also in the sediments, chiefly in limestone. This zone was found to contain scheelite on May 20th, 1942, and it is this zone that is at present under development.

Scheelite is found in a contact zone that closely follows the contour of the hillside at an elevation of about 4100 feet, immediately above an old road that leads to the Jersey claim. The zone is as much as 140 feet wide, but the scheelite is, with the exception of small bedded replacements, found within a horizontal width of 50 feet or less. The total length over which scheelite is known to occur is about 1200 feet.

The contact zone is on the lower margins of a dyke-like body of granite that ranges from 120 to 300 or more feet in width. The lower contact is approximately parallel to both the contours and the bedding, and is relatively straight. The upper contact trends north-westerly, diagonally across the strike. At the northern limit of the mineralized zone the granite widens to a stock-like body, the limits of which have not been mapped.

The sedimentary section is predominantly limestone above the granite and predominantly quartzitic rocks below. West of Lime Creek the rocks are contorted schistose quartzites and quartz-mica schists; to the east these give way to schistose argillites and argillites. At the southern end of the mineralized zone the argillites are overlain by limestone at the Jersey road, but at the north end quartzitic argillites are in contact with the granite. East of the granite the rocks for some distance are predominantly limestones.

About 400 feet from the northern end of the mineralized zone there is a shallow depression, or gulley, that seems to mark the presence of a fault. No limestone appears in the zone north of the gulley, but south of the gulley there is a considerable amount of limestone. The presumed fault is not great, and has not noticeably affected the position of the granite contact, but its affect on the surface expression of the mineralization is important. That part of the ground to the north of the gulley will hereafter be referred to as the northern section, and that part lying to the south as the southern section.

Scheelite mineralization appears to occur entirely, or almost entirely, within the granite in the northern section. In the southern section it occurs in granite and in strongly altered limestone, at the contact, and also in veins or replacement bodies that follow the bedding of the limestone at some distance from the contact. The northern section, as exposed, is the larger and more uniform, and, at least in part, is of higher grade.

Scheelite occurs variously within vein quartz, silicified and otherwise altered granite, in quartz-sulphide veins or masses, in heavy sulphide and, in the southern section, in strongly altered limestone that has largely been converted to silicate minerals. The relative amounts, relationship and continuity of these various types of gangue are not apparent, owing to the fact that the scheelite-bearing zone is only partially exposed and is more or less oxidized at the surface. Even the question of whether the gangue or host rock is altered granite is in some cases in doubt, although the writer is sure in his own mind that the margins of that type of rock are mapped within close limits.

The granite outcrops along a prominent line of low cliffs just east of the mineralized zone. Near the zone it contains numerous quartz stringers, veins and patches with no apparent system, and granite and quartz to some degree intergrade. This is also well seen in that granite dyke through which the adit is driven in the southern section. The dyke, so far as exposed, is for a considerable distance wholly replaced by barren white quartz, and elsewhere is crisscrossed by many quartz stringers. In the adit there is complete gradation between quartz, quartz-invaded granite, and granite relatively free of quartz. The same condition apparently obtains within the mineralized zone, particularly in the northern section but is masked by varying degrees of oxidation.

In the mineralized zone, besides quartz veining and silicification, there is also some development of new silicate minerals in the granite. The most significant point though, is that the scheelite-bearing areas are marked by much coarse mica and by varying amounts of sulphides, neither of which appear in the granite where scheelite is not present. Vein quartz appears to occur as irregular veins and masses, and locally contains considerable amounts of scheelite. There is locally doubt as to the precise contact between (altered and silicified) granite and sediments in the northern section, but it does not appear that alteration and scheelite mineralization penetrates for more than a foot or so into the argillites.

In the southern section the geology is different. In this section, at least within the small area so far exposed, scheelite mineralization favors altered limestone. The alteration ranges from a dense green (chloritic?) product to limestone heavily studded with coarse mica, perhaps some coarse chlorite, and locally actinolite, In addition, there is irregular silicification and impregnation by varying amounts of sulphides. There is a strong tendency for this alteration to extend to varying distances along bedding planes, so the outline, both in plan and section, is likely to be quite irregular. Scheelite occurs in all types of alteration, in varying amounts, as well as with quartz and sulphides. It has not been seen, in the limited amount of stripping, to penetrate more than 2 to 3 feet into the granite, which is here relatively unaltered.

The difference in geology between the two sections is highly significant. In the northern section the western limit of mineralization is the granite-sediment contact, which is apparently quite straight, and the eastern limit appears to be gradational within narrow limits. The basic geology is uniform and may be expected to be so for some depth. In the southern section the granite-limestone contact is more irregular, and the mineralization is also irregular; also, widths are smaller than in the northern section.

Mineral Showings.

The scheelite-bearing zone is locally heavily covered with boulder clay. Trenching and stripping by hand has been resorted to, and in the northern section data is obtained only from these trenches. Outcrops of sediments to the west and granite to the east, are unmineralized. In the southern section there are outcrops of limestone and of granite, but alteration and the attendant mineralization can only be seen in open-cuts and strippings, as well as in the adit.

Northern Section.

The length of this section is placed at 400 feet, the distance from the gulley fault to the northernmost known extent of mineralization. The horizontal width is a maximum of about 40 feet reduced to the floor of the trenches 416 south and 417. The 418 trench shows about 11 feet of heavily oxidized mineralization, east of which a deeply buried section, not stripped, would allow an additional width short of unmineralized granite of perhaps 10 to 15 feet, or a possible width of 20 to 25 feet, judging from the evidence of the other trenches.

The northern limit is still in doubt, because, although scheelite mineralization plays out as mapped, the rock in the face of 416 north trench is altered granite, and this trench is being now pushed eastward. In any event the zone appears to narrow sharply, and the bend in the granite is certain to mark its limit.

The dip of the contact is not known. The granite surface dips steeply westward at the eastern margin of strongest mineralization, and it is assumed that the entire zone also dips steeply westward. The margin, as exposed in trenches 416 south, 416C and 417 east is hard to evaluate in terms of horizontal width. Blasting is going ahead in the face of 416 south trench, in order to prove this point on the surface, and diamond-drilling will prove the average dip. The nature of the western margin of the zone cannot be studied, apart from the fact that it is quite sharply defined.

Trench 417 west is an old one, and heavily oxidized, so much so that the nature of the mineralization is hard to determine. Masses of relatively solid sulphide occur in it, as well as pockets of vein quartz, but for the most part the original character is unrecognizable.

Trench 418A exposes a 7-foot width of almost solid sulphide, the eastern half of which contains considerable scheelite. Between the sulphide and argillaceous rock there is 2 feet of mineralized quartz.

Trench 416 south is the most spectacular, a total horizontal width of 40 feet is shown, as well as a north-south section 7½ feet wide and 50 feet long, of which neither the eastern nor southern margins are seen. The rock is quartz and extremely altered granite that contains much mica. Both quartz and "granite" contain scattered sulphide, but are so oxidized that the kind and amount of sulphide cannot be judged; the amount is certainly not high. A body of solid sulphide, 26 inches wide and only partly exposed, contains an amazing amount of scheelite (sample no. 110H; tungsten trioxide: 7.5 percent).

Southern Section.

Details of this section are rather confused. Too little work has been done on an undoubtedly irregular zone of mineralization for one to assess its limits with any degree of accuracy. Study of the accompanying map will make this statement evident. Reference has been made to the irregularity of the contact and of the widths of alteration and of mineralization along it. The dyke of granite (aplitic, but most probably an off-shoot of the main body) might or might not enlarge with depth and seriously alter the picture. In the adit scheelite occurs in sulphide-free quartz averaging 12 feet wide, almost vertically below the contact zone at surface, but entirely within granite; the relation between this and the surface mineralization is not known, nor is it known whether a vertical dip is proved.

The most southerly known mineralization is on the Jersey road 350 feet south of the adit. A bedded zone in limestone, 1 foot wide, is succeeded to the east by 2 feet of limestone, beyond which oxidized material is seen. Correlation between this and any other bedded mineralized zone is impossible across the drift-covered intervening section.

The small bedded zones, of which there are two or three, are only exposed for lengths of a few feet each. Samples of these are not wholly reliable, and their behavior on dip and strike cannot be foretold.

Undoubtedly interesting scheelite mineralization is to be seen along the contact zone, where stripped, but the irregularity is such that no estimate of tonnage or of grade can be made. It would certainly appear that there is minable ore along this contact, and that widths may locally exceed 10 feet. But, sectionsof the zone may be very narrow, and there may be intervening section of waste rock between or within local sections of mineralization.

The length of the southern section of the scheelite-bearing zone is considered to be 800 feet long only because an isolated trench shows some scheelite 800 feet to the south of the gulley fault.

The results of Maconachie's samples are shown on the accompanying map, and the assay numbers and widths of my own samples are shown pending returns. Maconachie obtained an average of 0.80 percent tungsten trioxide in the adit, weighted as to total length of samples; this figure can be changed to 0.85 per cent tungsten trioxide if the samples on each side are weighted separately and the mean of the two sides is taken. The zone is 9 feet wide on the north side and 15 feet wide on the south, and is vertical. The fluorescence is strong, but some of the scheelite is extremely fine-grained, so much so that whole areas of quartz fluoresce, in which the individual scheelite grains cannot be seen.

Mineralogy:

As already stated, scheelite occurs in quartz, in highly altered granite, in quartz-sulphide masses, in practically solid sulphide, and in strongly altered limestone. Unfortunately completely fresh ore is seen in only solid sulphide, in sulphide-free quartz and in altered limestone, and consequently precise descriptions are as yet impossible.

One striking feature is the widespread appearance of mica, chiefly biotite, in everything but vein quartz. It is strongly developed in the altered granite, particularly where scheelite is most abundant, and the association is obvious. It occurs in even the most solid sulphide, and is the chief secondary mineral (with perhaps chlorite) in limestone. Actinolite (?) is seen also in the limestone and in quartz within that rock, and perhaps also in relatively solid sulphide in the northern section.

The common, widespread mineral is pyrite, and the more massive sulphide is largely pyrrhotite. Other sulphides include chalcopyrite, arsenopyrite and molybdenite; the latter is rare. The ore has only been subjected to visual examination, and the various types of relatively solid sulphide have been submitted to the Department for microscopic examination. Some of the sulphide contains as high a percentage of tungsten trioxide as does any other type of gangue.

Powellite, which appears in the skarn bands farther east and up the hill, is rare. A fluorescent mineral that may be powellite occurs in the northern angle in the stripped contact of the southern section, in minor amounts. Trench 417 east contains a similar mineral, but acid treatment of this in the field showed scheelite and did not give the reddish color reaction apparently characteristic of powellite. This point is being checked by the Department.

The associates of scheelite are mica and sulphides, and the only exception to this statement is found in the scheelite-bearing quartz of the adit. The association is so close as to suggest that they are essentially contemporaneous.

The scheelite is all fine-grained, i.e., no grain was seen approaching even the size of a pea. There are some clusters or granular aggregates, but surprisingly few isolated concentrations.

SAMPLING.

The scheelite, for the most part, is so uniformly distributed that channel sampling is considered to be quite accurate, as accurate as in the case of most other ores. All samples have been liberal, and two bags were used in several cases rather than attempt to reduce the size of the sample. Care was exercised in moiling that chips were not thrown ahead onto the uncut section. Channels were first dressed down and then swept with a broom and chips were lifted to a gasoline tin instead of caught on canvas, so the inclusion of fines was kept to a minimum, and there was no possibility of salting one sample from another.

It is true that there has been surficial enrichment owing to leaching out of sulphides, and a consequent decrease in gangue matter, while the scheelite may be presumed to have been unaffected, but the effect of this enrichment is not considered very important, except perhaps in the case of completely oxidized, granular material. Samples of such strongly or completely oxidized material are indicated by the word "oxide" on the assay plan. It is perhaps doubtful, however, except in the complete leaching of heavy sulphide, that the residual product is not a reasonable indication of the fresh material. The highest assays taken in 417 west trench include some muck resulting from the complete leaching of massive sulphides, but other samples marked "oxide" on the assay plan are believed to be relatively free from such material.

Discussion of Grade and Possible Tonnages.

Grades, as so far indicated by samples in hand and by visual inspection, are amazingly high. Maconachie's weighted average across 29 feet 4 inches in 416 south trench was: tungsten trioxide: 7.38 percent. My weighted average for a length of 34 feet in the same trench is: tungsten trioxide: 5.6 percent. The weighted average across an average width of 7 feet 5 inches on the western margin of the zone abreast of this trench is: tungsten trioxide: 4.0 percent for a length of 50 feet. A simple calculation of the area exposed (34 by 5 feet plus 50 by 7½ feet) gives roughly 450 tons for every 10 feet of depth over this sampled area alone; a value at the above average of $44,000.

This is the only section over which averages may be safely applied. Other assays are not all yet available, but from visual inspection with an ultra-violet lamp sections in the other trenches will be quite comparable to these averages. Four hundred and seventeen east trench, it should be remembered, may contain some powellite, in which case values in the eastern part of this trench may be less than they apparently are to the eye.

It is safe to assume, from the data in hand and from the marginal continuity of the northern section, a scheelite-bearing zone of 30 by 300 feet, with probably a greater total area. There is no reason to suppose that any appreciable part of this zone will assay lower than a mining grade, assumed at one half of one percent. On the other hand, the data in hand at time of writing, my samples 94H to 115H, indicate, in addition to Maconachie's an average somewhere between 2 and $3\frac{1}{2}$ percent.

The near-surface tonnage, and the indicated grade, are amazing in this northern section alone. Add to this the fact that geological conditions have every appearance of being uniform to a depth of perhaps 100 feet, and the tonnage is huge. No great depth can be presumed at this stage of development for obvious reasons, chief of which is that the bend in the contact at the northern end may dip or plunge to the south, but on the other hand mineralization could persist for some distance in granite beneath the contact.

The southern section is narrower, more irregular, and perhaps of lower grade, but the possibilities have hardly been explored. At the central part of this section there is an indication that the granite may be still more irregular in outline at depth, but in the northern part the zone will be bounded by argillites at a depth of about 100 or 150 feet below the outcrop.

<u>Present Development Program.</u>

Diamond-drilling is slated to commence almost immediately. This will prove width, attitude, and depth, and will give a quite reliable indication of grade and character of ore.

A series of drilling stations are cut on the Jersey road that, with slightly inclined holes, will give a depth below the trenches of 75 to 100 feet. The first hole is directed beneath 418 trench and a hole will be rayed on each side of the first. The holes are not expected to be more than 100 to 120 feet long, provided there is a steep westerly dip to the zone. The first three holes should be drilled in 7 or 8 days. The zone can be proved to a depth of at least 150 feet from these stations, or as deep as any possible near-by tunnel site that could develop the northern section.

It is planned to drift on the southern section northward from the present adit, with backs of about 50 feet, since stripping is unsatisfactory and the target is too irregular for diamond-drilling. It is proposed also to collar an adit at the site of the first drill station to crosscut the zone at a depth ranging from 50 to 65 feet. As soon as is possible a lower tunnel site will be chosen, but it is not likely that a site would be more than 100 feet below the Jersey road, above the bed of Lime Creek, to tap the northern section.

These plans are those of Harold Lakes at the present time, and seem entirely reasonable. Development has been slow to date, but there is no reason that another three weeks should not see a lower tunnel collared and at least the general outlines of an operation fully decided upon, if the work is pushed aggressively.

There is no question that there is a mine here; it simply remains to decide the size and type of operation.

SUMMARY.

Scheelite occurs in a contact zone between Nelson granite and Pend d'Oreille sediments. The contact trends east of north, with the contour of the hillside and roughly parallelto the sedimentary strike; the intrusion does not appear to be sill-like. The sediments dip eastward into the hill and towards the granite. The mineralized zone is 1200 feet long.

In the northern section of the zone, 400 feet long, the sediments are argillites, argillaceous quartzites and similar rocks for a considerable distance. In the southern section, south of a presumed fault, the granite is in contact with pure limestones which overlie argillites and quartzitic rocks; the latter rocks are presumed to be in contact with the granite at some depth between 100 and 150 feet.

In the northern section scheelite occurs in strongly altered granite across a width ranging from 25 to 40 feet. In the southern section scheelite is in granite and in strongly altered limestone close to the contact; in addition there are small, bedded vein-replacements as much as 140 feet from the contact. The northern section is large and regular in outline, while the southern section is quite irregular and is narrower than the northern.

The associates of scheelite are mica (chiefly biotite) and sulphides. The mineral occurs in quartz, in granite that is strongly altered and silicified, in quartz-sulphide masses, in solid

sulphide and in strongly altered limestone. The surface of the northern section is oxidized, with the exception of massive sulphide bands, so that the exact character of the gangue is not easy to determine.

The distribution of scheelite, although varying in amount between bands and in pod-like areas, is amazingly uniform over large total widths. Many assays are amazingly high.

The amount of sampling is insufficient to prove average grade, and many samples taken are of more or less oxidized material, but it is believed that in all but a few instances they are closely indicative of actual grade. The most reliable sampling, that about 416 trenches, gives weighted averages of 5.6 percent tungsten trioxide for an east-west length of 34 feet and 4.0 percent tungsten trioxide for a north-south length of 50 feet. These two surfaces alone, carried to a depth of 10 feet, would, at these figures, be productive of $44,000.

A perfectly reasonable estimate in the northern section gives an area of 30 by 300 feet with an average grade, at the surface, somewhere between 2 and 3½ percent tungsten trioxide. This estimate of nearly 9,000 tons for each 10 feet of depth is conservative.

The southern section cannot yet be assessed, although there is much material that is of ample mining grade. The adit crosses an average width of 12 feet that assays 0.80 percent tungsten trioxide.

No estimates are made as to possible depth. Even a shallow depth in the northern section would be productive of very large tonnages. The geology of this section is quite uniform, although it is to be expected that the northern margin of the zone will plunge southward, perhaps steeply.

Diamond-drilling on the northern section is slated to commence immediately, on the Jersey road, to give a depth below outcrops of between 75 and 100 feet. This will prove continuity and will give reasonably reliable values. From the same stations drilling can also prove depth to about 150 feet, or about the lowest level that an adit can be located, above the bed of Lime Creek, to develop the northern section.

Drifting from the existing adit on the southern section, with 50 feet of backs, is contemplated. An adit collared at the first diamond-drill hole is also contemplated to crosscut the northern section, with backs of from 50 to 65 feet.

There is no doubt whatever that this will become a producing mine. It simply remains to determine the size and type of operation.

Test work on the ore is going forward at the University, and that, as well as the advice given on the ground by the Departmental engineers, has been and will continue to be valuable.

Development work has to date been slow, and it is to be hoped that the work will be pushed aggressively. At present there is difficulty in getting men and materials. This property should immediately receive full recognition, in order that there should be no possible handicaps in getting it developed.

By M. S. Hedley.