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*Confidential*

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THE RED ROSE TUNGSTEN MINE

The Red Rose Tungsten mine is one of several mining properties owned or leased by Western Uranium Cobalt Mines Limited, of Vancouver, British Columbia. The properties are situated in the Rocher Deboule mountains of west central British Columbia.

Two of the properties, the Red Rose Tungsten mine and the Rocher De Boule copper mine are now in operation. Both mines are about 10 miles from Skeena Crossing, a flag station on the Canadian National Railway, 163.6 miles east of Prince Rupert, which is the Pacific Terminal of this railway. From Skeena Crossing, the mines are reached by a fair truck road. The Mine camps are at elevations 4000 feet above sea level, but the mines extend up to over 6000 feet. The Red Rose is a profitable operation of about 80 to 90 tons per day and the owners believe that it is both possible and desirable to greatly increase the output. This would involve substantial capital expenditures and the present investigation is an attempt to determine the advisability or otherwise of investing the further large sums required. The Red Rose mine was examined in detail and a brief examination of the Rocher De Boule was made in order to determine its possible value as collateral security in further protecting the proposed capital investment.

HISTORY.

The Red Rose property was discovered early in the century before the completion of the Grand Trunk, now the Canadian National transcontinental railway. At that time it was explored for its gold and silver values, its tungsten content being unknown to the prospectors. Several short tunnels were driven to explore the vein on the opposite side of the mountain from that on which the same vein is now being worked for tungsten.

During the second world war, the Consolidated Mining & Smelting Co. of Canada, acquired an 85% interest in the property from Mrs. B. Sargent, of Hazelton, B.C. A 35 ton mill was built and put into production in January, 1942. The capacity was increased to 75 tons and a further expansion to 110 ton capacity was 3/4 completed when the operation was suspended in October 1943, because of a drop in the price of scheelite. Up to that time 25,895 tons of ore, averaging 1.73%  $WO_3$  had been milled. During that time the price was \$15.00 per unit of  $WO_3$  in a 60% concentrate or better, as compared with the present price of \$50.00 to \$60.00 per unit. The Consolidated Mining & Smelting Co. estimated an operating cost of \$14.10 per ton.

In 1951 Western Uranium Cobalt Mines Ltd. leased the property from Consolidated Mining & Smelting Co. A 10% gross royalty during the first year's operation and a 15% gross royalty after that is

payable to C. M. & S. The lease is for a minimum of 7 years. The mine and mill have been rehabilitated and are now producing and treating about 80 to 100 tons per day and recovering 1.15 units of  $WO_3$  per ton of ore.

#### GEOLOGY

The Red Rose mine is situated on a high sharp ridge in the Rocher Deboule mountains. The ore is confined to one larger persistent vein which strikes across the ridge outcropping on both sides.

On the west side of the ridge the veins have been explored by mine workings down to the 8th level at elevation 5660. On the east side of the mountain the vein outcrops in a gulch down to elevation 5971, which is 400 feet below the point where the vein crosses the summit of the ridge. In the same gulch and at elevation 5796 the vein was penetrated by an adit and a quantity of gold ore sacked for shipment in 1915. Still lower in the gulch at elevation 5556, another adit was driven as a crosscut and is reported to have reached the vein. This point is 1700 feet east of the western end of the vein at the same elevation.

The ridge is composed of ancient sediments and volcanic tuffs which have been steeply folded and intruded by a number of comparatively small bodies of a very fine black diorite, carrying an exceptionally high proportion of hornblende. The sediments are highly metamorphosed to a densely fine brownish rock consisting mainly of submicroscopic grains of biotite.

The vein in some places traverses the sediments and tuffs, in other places the diorite, and in still other places it is walled on one side by diorite and on the other by sediments.

The sediments, the diorite and the vein are traversed by two or three dark green porphyry dykes from 3 to 5 feet wide. They are of no significance except that where they cut the vein they dilute the ore to some extent. So far, they have caused little trouble but on the eighth or lowest level one of these dykes has continued for 25 feet in the vein and is still in it at the face of the drift. It dilutes the ore to some extent but it appears to be crossing the vein and passing in to the hanging wall.

The diorite and the metamorphosed sediments occupy large areas surrounding the vein and outcrop at many places far below the base of the mountain in which the vein is located. It is, therefore, safe to conclude that these favorable formations will persist many hundreds of feet below the present mine workings.

#### VEINS

The Red Rose vein is from 4 to 15 feet wide, averaging about 5 feet. It is straight, strikes northwest and dips to the southwest at 60 to 65 degrees. Its straight steep dip, together with its good width and generally good walls, combine to make for easy and cheap mining.

The vein consists mainly of quartz, but contains an important proportion of scheelite. Calcite and perhaps other carbonates are

plentiful. There are besides these, gangue minerals, small amounts of chalcopyrite, pyrite, pyrrhotite, arsenopyrite, safflorite and tetrahedrite. The chalcopyrite is generally distributed throughout the vein but the other metallic minerals are largely confined to the lower showings on the east side of the mountain and carry appreciable amounts of gold and silver.

#### ORE RESERVES

The known ore reserves are as yet confined to the one vein though other tungsten veins have been found in the district and probably still others will be found. The accompanying section in the plane of the vein, Figure 1, indicates the areas of vein which have been mined out, the areas explored by drifts and raises, and the possible extension of the vein area. What is believed to be the same vein is exposed in an old tunnel on the south side of the mountain at elevation 5550, which is 100 feet lower than the 8th level, which is at present the lowest in the mine. The length of the vein at this level would be about 1700 feet.

The width of the vein is well known from measurements in the present workings and from many measurements recorded by the C.M. & S. engineers on their old stope maps. From these measurements the following average widths have been calculated:

<u>STOPE</u>	<u>NO. OF MEASUREMENTS</u>	<u>AVERAGE WIDTH</u>
250	67	5.6
350	92	6.1
351	49	6.2
550	40	4.9
650	86	4.2
8th level	18	3.6

These average widths indicate a narrowing of the vein with depth. However, the small average width on the 8th level is partly due to the presence of the above mentioned porphyry dyke, which displaces part of the vein. Notwithstanding this, however, there is a gradual decrease in width with depth. This could be the beginning of the end of this ore body, or it might be only a local condition, below which the vein will again widen to its normal width; only deeper exploration will tell.

The average of all the width measurements is 5.1 feet and a 5 foot width is used in estimating ore tonnages in the unexplored part of the vein.

The following table of proven, probable and possible ore tonnages was deduced from a consideration of the accompanying Figure 1.

	<u>TONS OF PROVEN ORE</u>	<u>TONS OF PROBABLE ORE</u>	<u>TONS OF POSSIBLE ORE</u>
350 Stope	3,400		
East of Stope 350	-	7,500	7,500
550 Stope	4,700		
East of Stope 550	-	10,500	20,900
East of Stope 650	4,050	1,600	25,900
Between 800 & 600 levels	29,200	21,500	135,850
Below 800	<u>-</u>	<u>5,833</u>	<u>168,333</u>
	<u>41,350</u>	<u>46,900</u>	<u>358,483</u>

Proven and probable ore amounts to 88,000.

The prospects of increasing the proven and probable ore in the near future are believed to be good because the

faces of the 300, 500 and 800 levels are all in good ore and all are being advanced steadily. The 600 level face is not in ore but since the vein structure is strong here and since both levels above and the level below are in good ore, its present barren condition is thought to be a local condition of limited extent. These drifts, together add to the proven tonnage about 240 tons per foot of advance, or about 1000 tons per day.

The so-called possible ore takes in the entire area of the vein down to the 1000 level. Experience shows that veins seldom, if ever, contain continuous ore shoots over such areas, but on the other hand, the ore might extend far below the 1000 level.

#### GRADE OF THE ORE

As in all tungsten deposits, the scheelite is irregularly distributed, which makes it difficult to determine average grade by sampling. The C.M. & S. engineers state in their report to their company that it was found more practical to control the grade of the mill feed by estimating it from a visual examination under the mineral light than by sampling in the usual way. All the samples indicated on the section having "R" numbers, were taken by Western Uranium engineers, but taken along the bottoms and edges of the old stopes in many places where mining had been stopped because of small widths or values, or both,

The samples marked by "A" numbers were recently taken by Western Uranium engineers in the active stopes and raises. Those on the 8th level were taken by the writer. The average of all samples available is 1.73%  $WO_3$ .

The 25,895 tons milled by C.M. & S. company is stated in their report to have averaged 1.7%  $WO_3$ .

The following mill control assays were examined by the writer.

	DATE	MILL HEADS % $WO_3$	TAILINGS	
1950 August	12	2.66	0.53	
	15	1.26	0.39	
	16	1.08	0.30	
	20	1.65	0.51	
	21	1.32	0.31	
	22	1.79	0.50	
	23	2.30	0.33	
	25	2.33	0.41	
	26	2.26	0.54	
	27	2.10	0.39	
	Sept.	17	1.11	0.12
		18	1.82	0.33
		21	1.15	0.37
		24	1.02	0.19
26		1.00	0.30	
27		1.26	0.13	
28		1.10	0.17	
Oct.	29	1.14	0.14, 0.25, 0.11	
	2	1.11	0.20, 0.23, 0.27	
	3	1.48	0.18, 0.20, 0.19	
	4	1.61	0.19, 0.21, 0.30	
	5	1.94	0.21, 0.27, 0.23	
	6	1.31	0.20, 0.31, 0.34	
	7	0.96	0.13, 0.12, 0.31	
	9	1.90	0.23, 0.28	
	10	1.56	0.26	
	11	2.00	0.06, 0.18, 0.30	



The average of the above mill heads is 1.37%  $WO_3$ , and of the tailings is 0.248%  $WO_3$ , indicating a recovery of 1.13 units of  $WO_3$  per ton of ore.

At the mine a record is kept of the ore milled and the weight of dry concentrate recovered. These records show that about 32.7 pounds of concentrate is recovered per ton of ore and as the concentrates average 71.5%  $WO_3$ , the amount of  $WO_3$  recovered is 23.38 pounds, or about 1.16%.

The ore included in these records consisted of nearly 60% development ore from the several drifts and raises now being driven.

All the above figures are in close agreement and indicate an average mill head throughout the life of the mine of better than 1.50%  $WO_3$ . The tailings loss is high but in recent months it has been reduced considerably.

A favorable factor is the unusually high tungsten content of the concentrates. The average  $WO_3$  content of 22 shipments of concentrates is 73.25.

#### COSTS

Up until recently, little or no cost accounting has been done, but this deficiency is now being corrected. The C.M. & S. company estimated their costs at \$14.10 per ton. In view of the following favorable conditions, it is the writer's opinion that under good management, costs should be well under this figure. The ore is confined to one well defined quartz

vein because of which little or no "dead" work need be done in exploring and developing the ore. The width and the steep attitude of the vein, together with its good wall rocks make for cheap mining. All the ore which will be mined in the next two or three years is situated above the mill and is accessible by adits. Therefore, it will require no hoisting and the mine will require no pumping.

Recent changes in the mill have increased both its recovery and its capacity, moreover, these results have indicated methods by which still better recoveries may be achieved.

A 1600 horsepower hydro-electric power plant has just been put into operation, which is now substituting for a diesel power plant, which will be retained as a standby.

Also, the stepping up of the output which is now being planned will, in itself, further reduce unit costs. On a basis of 200 or 300 tons per day, it is expected that the mining and milling costs will be between 10 and 12 dollars per ton.

#### VALUE OF THE ORE

The concentrates are at present sold to Darby & Company of London, England. The contract is for 1,250 long tons of concentrates at a floor price of \$45.00, and a ceiling price of \$110.00 per short ton unit. There are about 81 short ton units in a long ton of concentrates. The contract is till September 1953, and contains an option to buyers to extent contract. The in-between price now being received is the world market price of \$47.00 per short ton unit, less freight, storage,

insurance, etc. which amounts to about \$3.50 per unit, leaving a net price of \$43.50 per unit.

According to Mr. Douglas, the new manager, a new contract with the United States Government, through General Services Administration Division, has just been consummated. It is for a minimum of 1000 tons of concentrates or 73,000 units, to be delivered before June 1955. A price of \$57.00 is guaranteed till May 31, 1953, \$55.00 till May 31st, 1954 and \$53.00 till June 30, 1955, F. O. B. at Blaine, Washington, all taxes, assaying, engineering are for the account of the buyer.

The lease from the C.M. & S. company calls for a gross 10% royalty to them for the first year, after which it is to be increased to 15%. The C.M. & S. company own only an 85% interest in the property, the remaining 15% being owned by Mrs. B. Sargent, of Hazelton, B. C.

The mill is now recovering about 1.15 units of  $WO_3$  per ton of ore. Of this, 10% now goes to the C.M. & S. company, leaving 1.03 units for the operating company. Next year, 15% will go to the C.M. & S., leaving 0.97 units for the operating company. At the present price of \$43.50 per unit of  $WO_3$ , the operators receive about  $\$47.00 \times 1.03 = \$44.80$  per ton of ore mined and milled. Assuming an overall cost of \$15.00, the profit per ton of ore is \$29.80 per ton. Next year, with the royalty increased to 15%, a ton of ore will net only \$42.19, and assuming the same costs, the profit will be \$27.19 per ton of ore.

It is not known to the writer how Mrs. Sargent's 15% interest is being taken care of, but negotiations are now in progress.

According to these contracts, Western Uranium are assured of markets for 86,000 units to Britain and 73,000 units to the United States.

However, to avail themselves of this market, the total 159,000 units must be delivered before June 30th, 1955. This means the mining and milling of 159,000 tons of ore in two and a half years, or about 64,000 tons per year. To accomplish this the production rate would have to be increased as soon as possible to somewhat over 300 tons per day. If this can be done, the profits will be about \$2,338,000.00 on the British shipment, and about \$2,774,000.00 on the United States shipments, assuming an average price of \$54.00 per unit and a freight and handling charge of \$1.00 per unit, between the mine and Blaine, Washington. The total profit would, therefore, be 5.1 million before making any provision for taxes, or for the amortization of past expenditures, or for the cost of providing and amortizing the large, additional capital expenditures which would be required to boost the production from 90 tons to 300 or 400 tons per day.

These estimated profits might be increased by lowering costs and there is a possibility that the present high prices might be continued beyond the two year guaranteed period, but this is very uncertain. It is well known that if Chinese

tungsten again reached world markets, the price would drop suddenly and drastically. Also the United States stockpiles might reach a point of sufficiency. Also the full 159,000 tons might not be found and the grade of the ore might, as it frequently does, decrease with depth. However, the profit on the British shipments for which ore is practically available, is well assured. Additional reserves are now being added at a rate of nearly 1000 tons per day and in a few months the several tunnels now being advanced will have reached the east side of the mountain and the amount of added ore can be calculated.

In any event, the additional profits which would be earned by expanding the rate of production are well worth the effort and the chances that the mine will be able to supply the ore are certainly good.

Therefore, this policy of expansions is recommended.

The return of the capital, (estimated to be about \$1,000,000.00) is well assured out of profits, providing the management is capable and efficient.

Respectfully submitted,