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A Report On

Underground Ore Reserve Estimation

Bull River Mine

(With 4 Maps and 1 Table)

By

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This estimation was made by using current data and a scale map 1" = 40 feet. It outlines the distribution and estimates the tonnage and grade of mineralized zones in the so called 'underground area', located between sections 400E and 2000E and from 200N and 800S in the area from the centre of the tailings pond to the southwest corner of the plant site of the Bull River Mine, Cranbrook, British Columbia.

Correlation of Mineralized Zones Between Diamond Drill Holes

About 40 holes, ranging from 350 to 1200 feet in length, were drilled in this area during the period 1970 to 1972. Twenty-seven holes intercepted one to several mineralized zones as shown on the attached map (#7211W). The distance between the drill holes is usually 200 feet or more, and the azimuths and dip angles of these holes are not the same, and some of the holes are curved. Also, faulting and folding of pre and post mineralization were observed in this area. The mineralized zone correlation between drill holes and between sections becomes complicated and very critical for reserve estimation.

Some of the drill holes are not exactly lined up with the section plane. Faulting may occur between drill holes or between sections, and the orientation of mineralized zones may be somewhat different from each other. The method

of projecting the drill holes on to a vertical plane, to make a geological section, is therefore open for discussion. However, if the drill holes are very close to the section line and are projected along the general strike direction of the mineralized zones on to a section plane to produce a geological section, such a section can be used to aid the correlation of the mineralized zones.

It is believed that the mineralized zones occurring in this area are of hydrothermal origin. Therefore, the thickness and grade should change gradually from one point to the other within an individual zone. As a result of element differentiation in the process of hydrothermal mineralization, the ratio of Ag/Cu will increase gradually from its source towards its border. And, if the mineralized zones are formed at different stages or from different sources, their Ag/Cu ratios must be in different ranges. Therefore, thickness, grade, and Ag/Cu ratios are used as criteria for the correlation of mineralized zones in this report.

The coordinates and the elevation of the bottom of each mineralized portion of the drill cores are calculated by using drilling data, and are plotted along with its thickness, grade and Ag/Cu ratio on a 1" = 40 feet scale map.

Seven mineralized zones were recognized. Zones C and D are too small and negligible, zone G is almost vertical, and zone B is located between faults. Consequently, only zones A and E are significant.

Four major faults were confirmed by surface outcrops, diamond drill cores and the continuity of the mineralized zones. It is possible that some small displacements may occur in this area, especially in the eastern portion of zone A, but with the present data we are unable to locate them.

Method of Reserve Estimation

The two practical methods for estimating the reserve of vein type ore bodies are polygonal and sectional.

The sectional method is based upon the assumption that the thickness and composition of the ore zone in the one drill hole gradually changes to that of the adjacent hole on the same section, and that the sections must be reasonably spaced. However, due to the irregularity and wide spacing of the drill hole pattern, and the inaccuracy of the projected geological sections, the sectional method becomes unrealistic for present purposes.

Assumptions for the polygonal method, used in this report, are such that the thickness and the composition of the ore in one drill hole extends half way to any adjacent hole, and that if there is no adjacent hole the

mineralized zone has a 100 foot influence sphere. In some cases where there is not an adjacent drill hole, the limit of recoverable ore bodies is adjusted by some geological information such as faulting, bedrock, overburden contact, and the extension of the quartz-siderite vein and its Ag/Cu ratio. The reliability of this method depends on the number of drill holes and the distance between them.

Due to the underground working conditions, the cut-off thickness and grade of recoverable ore is set at 4 feet and 1.0% copper respectively. It is also estimated that 11 cubic feet of ore weighs one ton.

Mineralized Zones

There are seven mineralized zones generally striking in a east-west direction and dipping to the south at 50-65°. The thicker portion of the mineralized zone usually contains a higher copper percentage.

Zone A - (Map # 7112V-1) There are three faults cutting across this zone. The east fault is a left-handed strike-slip fault striking in a north-south direction. The middle and west faults are hinge which make the ore body on the western flank of the fault steeper than that on the eastern flank. Because of the nature of these faults, minor displacements and fractures may occur in the central and eastern portions of this zone. It is estimated that it has 351,885 tons of recoverable ore with 1.79% Cu. Its

dimension is about 900 feet along the strike and 300 to 580 feet along the dip with an average thickness of 9.8 feet.

Zone B - (Map #7212V-3) Seven diamond drill holes intercepted this zone which consists of two parallel mineralized veins. Distance between these two veins is from 5 to 25 feet. It has 39,091 tons of recoverable ore with 3.05% Cu. Because it is interrupted by faults and because its maximum thickness is only 5 feet, this zone has no significant economic value.

Zone C - Two diamond drill holes intercepted this zone. It is of low grade (0.14 to 0.37 % Cu) and is of no economic value.

Zone D - Only one diamond drill hole intercepted this zone, two feet thick and 1.96% Cu. No further extension of this zone was observed.

Zone E - (Map #7212V-2) It was intercepted by nine drill holes, two of which are under the cut-off grade and another one of which is questionable. It occurs as one zone in its eastern portion, but branches off into two zones from section 900W to the west. The ore body may extend down to the south or dip direction where it has not been fully explored. To the northwest, it is cut-off by

a normal fault separating zone G from E and F. It extends further down to a southwest direction where it becomes a zone of numerous quartz-siderite-sulfide veins and veinlets with negligible amounts of copper-bearing mineral. The total recoverable ore is estimated at 258,145 tons with 2.00% Cu. Its dimension is about 500 feet along the strike and 350 to 900 feet along the dip.

Zone F - (Map #7212V-3) Two drill holes intercepted this zone. Because of low tonnage and a deep occurrence, it has no immediate economic value.

Zone G - (Map #7212V-3) This mineralized zone, dipping to the north at 87.5° and striking east-west, occurs on the northern flank of a normal fault. It is over-turned and generally fractured as the result of faulting. It has 68,000 tons of recoverable ore with 1.92% copper.

Summary

The total tonnage of the recoverable ore in the underground area, estimated by polygonal method, amounts to 732,500 tons of which 610,000 tons has 1.88% Cu from zones A and E, and are considered to be significant from an economic viewpoint. It is believed that zones A and E may extend further down to their dip direction. Further exploratory work, such as diamond drilling, may increase ore tonnage to the order of 10% of the present figure, but the grade of the additional tonnage is expected to be lower

than the average.

It must be noted that because of the wide spacing of the drill hole pattern and the character of the vein type deposit, the tonnage estimated may differ from the true value in the range of ± 20%. Details of these mineralized zones are summarized in the following table.

Underground Ore Reserve

Zone	Tonnage*	Cu %	Average Thickness	Dim. (ft) Strike	Dip	Dip (Degree)	Elevation Highest	Lowest
A	351,885	1.79	9.8	900	300-580	50-65	3020	2540
B	39,091	3.05	6.5	270	240	52-53	2870	2560
C	Negligible							
D	Negligible							
E	258,145	2.00	7.5	500	350-900	58-62	2940	2160
F	15,371	1.45	5	200	200	60	2570	2400
G	68,000	1.92	10	260	300	87.5	2800	2500
TOTAL	732,492	1.94						

* In-situ tonnage.

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Reserve Estimation of Underground Area

Tonnage (pre-dilution) = planimeter reading x thickness x sec θ x 10/11

Average thickness = volumn/area

Weight: 11 cu ft = 1 ton

θ = dip angle of mineralized zone

Planimeter factor = 10

Zone A

Block	θ	Sec θ	Thickness	Planimeter Reading	Tonnage	Cu %	Tonnage x Cu %
1	50	1.556	4	1280	7,242	1.66	12,021.72
2	50	1.556	16	1739	39,354	0.90	35,418.60
3	50	1.556	5.5	1382	10,751	1.43	15,373.93
4	53	1.662	5.5	503	4,180	1.43	5,977.40
5	50	1.556	22	263	8,184	2.80	22,915.20
6	53	1.662	22	1024	34,034	2.80	95,295.20
7	50	1.556	6	1740	14,766	1.17	17,276.22
8	53	1.662	6	641	5,810	1.17	6,797.70
9	53	1.662	19	1032	29,623	1.55	45,915.65
10	57	1.836	19	522	16,552	1.55	25,655.60
11	53	1.662	4	1910	11,542	2.60	30,009.20
12	53	1.662	10	2564	38,736	1.26	48,807.36
13	53	1.662	10	493	7,448	1.43	10,650.64
14	59	1.942	10	1123	19,824	1.43	28,348.32
15	53	1.662	15.5	1040	24,353	2.42	58,934.26
16	58	1.887	15.5	63	1,675	2.42	4,053.50
17	58	1.887	8.5	970	14,143	2.87	40,590.41
18	53½	1.681	8.5	646	8,390	2.87	24,079.30
19	63	2.203	8.5	1162	19,779	2.87	56,765.73
20	65	2.366	7	2358	35,499	1.28	45,438.72
TOTAL					351,885		630,324.66

630,324.66/351,885 = 1.79

Tonnage = 351,885 tons Grade = 1.79 % Cu

Average thickness = 9.8

Ore body dimension = 900 ft along strike and 300 to 580 ft along dip

Ore body elevation = 3020 down to 2540

Zone B

Block	θ	Sec θ	Thickness	Planimeter Reading	Tonnage	Cu %	Tonnage x Cu %
1	52	1.624	5	2452	18,098	3.55	64,247.90
2	53	1.662	9	1544	20,993	2.61	54,791.73
TOTAL					39,091		119,039.63

119,039.63/39,091 = 3.05

Tonnage = 39,091

Average thickness = 6.5 ft

Ore body elevation = 2870 down to 2560

Grade = 3.05 % Cu

Ore body dimension = 270 ft along strike and 240 ft along dip

Zone C - Negligible

Zone D - Negligible

Zone E

Block	θ	Sec θ	Thickness	Planimeter Reading	Tonnage	Cu %	Tonnage x Cu%
1	62	2.130	8	422	6,537	1.43	9,347.91
2							
3	61	2.063	4	2,677	20,080	1.88	37,750.40
4	60	2.000	4	2,565	18,653	4.61	85,990.33
5	62	2.130	14.5	2,713	76,166	1.44	109,679.04
6	61½	2.096	8.5	3,467	56,147	2.01	112,855.47
7	58	1.887	8	3,834	52,611	1.78	93,647.58
8	58	1.887	5	3,259	27,951	2.36	65,964.36
TOTAL					258,145		515,235.09

515,235.09/258,145 = 2.00

Tonnage = 258,145 tons

Grade = 2.00 % Cu

Average thickness = 7.5 ft

Ore body dimension = 500 ft along strike and 350 to 900 ft along dip

Ore body elevation = 2940 down to 2160

Zone F

Block	θ	Sec θ	Thickness	Planimeter Reading	Tonnage	Cu %
1	60	2.000	5	1691	15,871	1.45

Tonnage = 15,371 tons Grade = 1.45 % Cu

Average thickness = 5 feet

Ore body dimension = 200 ft along strike and 200 ft along dip

Ore body elevation = 2570 down to 2400

Zone G

Tonnage = 68,000 tons Grade = 1.92 % Cu

Dip = 87.5° Average thickness = 10 ft

Ore body dimension = 260 ft along strike and 300 along dip

Ore body elevation = 2800 down to 2500

Total Reserve

Tonnage = 732,492 tons
Grade = 1.94 % Cu

} At cut-off grade and thickness of 1.00% Cu and 4 ft respectively.