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Report on Cronin Mine of the Babine Bonanza Mining & Milling Co. Babine Range, B.C.

Report by John D. Galloway. October 26, 1937

Introduction

The Cronin Mine is a well-known silver-lead-zinc property situated over the divide from the head of Driftwood Creek which rises in the Babine range. It was developed to practically its present condition by the late James Cronin of Spokane, who spent many painstaking years in bringing it along. After his death the property was idle except for a short period in 1929 and 1930, when the decline in base metal prices made it impractical to do anything with it. Improving prices and revival of interest in base metals in the early part of 1937 prompted the present examination and report, made for the Babine Mining & Milling Co. which has held the property since acquired by Mr. Cronin from the original owners in 1909.

The Babine Bonanza Mining and Milling Co. Ltd. is a British Columbia incorporation with an authorized capital of 1,500,000 shares of $1.00 par value. 1,069,654 shares have been issued as at December 31st, 1936. Titles to the mineral claims are vested in the company, and are said to be in good order.

The Company is controlled by the Cronin Estate and Mr. Gus Theis of Spokane, Wash. Mr. Theis is President of the company and Mrs. Rose Cronin Andersen of Seattle is Secretary. The audited Balance Sheet of the company as of December 31st, 1936, shows the following actual money investment in the property:-

Development Account,	$238,423.95
Roads and Bridges	5,017.32
Equipment	11,020.94
Real Estate	125.60
	$254,587.81

Many engineers have examined this property and as a mineral deposit it has practically always been recommended. Difficulties in regard to transportation have generally been recognized

however. Reports and references to the property are to be found in the Annual Reports of the Minister of Mines for 1914, 1917, 1921 and 1922 and others, and in Geological Survey Summary Report Part A, 1924.

This present report is based on an 8-day study of the property and two days in connecting routes, and an examination of previous reports on it. A considerable amount of sampling was done to check previous statements regarding values.

Summary and Conclusions

1. The Cronin mine, owned by the Babine Bonanza Mining and Milling Company, is a promising silver-lead-zinc property.

2. While the mine is well situated for economical transportation when a truck or tractor road is completed to it, thelack of such transportation has delayed the bringing of it into production. Further development can be carried out with some improvements to the existing sleigh-road, but ultimately in the neighbourhood of $50,000 will be required for road construction. Some part of this, possibly up to 50% may be secured by a Government grant.

3. The property is well situated for all year operation, with reasonable climatic conditions, abundance of timber and water, and a small water power that can be developed. Other larger powers some distance away might later be utilized.

4. Comparatively little blocked out ore has been proven but considerable tonnages of "Probable and Possible Ore" are indicated. Making certain assumptions, a figure of 42,200 tons has been estimated as indicated probable ore by the present development. Several times this figure may be proven by further development.

5. The ore now indicated in the mine will have an average assay of about 0.02 oz. gold per ton, 16 oz. silver per ton, 8% lead and 8% zinc. At £20 per long ton for lead and zinc (London price) and 44¢ an oz. for silver, this ore has an approximate net value at the mine of $10.25 per ton. This assumes a 90% extraction of the three metals in a flotation mill. Preliminary metallurgical tests show the ore is easily amenable to differential flotation, with at least 90% recoveries. Total costs are estimated at $7.25 per ton giving a net profit of $3.00 per ton at the assumed metal prices, or approximately $100,000.00 per year.

6. To begin with, a preliminary development plan calling for an expenditure of $45,000 is recommended. It is expected that this will definitely prove sufficient ore to warrant the erection of a

100-ton mill.

7.- While this development program was under way, all material data would be assembled, including detail geological information on the veins, average sampling-assaying, investigation of proposed hydro-electric plant on Cronin creek, exact site of mill, survey of aerial tram and estimates of costs.

8. Provided development is satisfactory, as is believed probable, plans would be prepared for mining and milling on a 100-ton a day basis. Present estimates of cost are that equipping the mine on this basis would cost $200,000 (including road construction) but these may be lessened with more detailed information.

9. With considerable possibilities ahead of the property on further development, it is therefore recommended as a good mining speculation. The outlook is for higher prices for lead and zinc in the next few years, so that now is the time to prepare for production this attractive silver-lead-zinc mine.

Location, Property, etc.

The Cronin mine property consists of 12 Crown Granted mineral claims and fractions. They are situated 3 miles over the divide, northerly from the head of Driftwood Creek. Access to the property is by road and trail from Smithers, a divisional point on the Canadian National Railway, 230 miles east of Prince Rupert, B.C. At present there is a good motor road from Smithers to Nelson's ranch, a distance of 10 miles up Driftwood Creek; a further 5 miles can be travelled over a rough road by a light truck. From this point it is 5 miles by trail to the head of Driftwood Creek, and a further 3 miles up over the divide and down to the Cronin mine. The elevation at the head of Driftwood Creek is 5,200 feet, on the summit of the divide 6,000 ft. and at the Cronin Mine camp 5,200 feet.

An alternative route into the property is by road from Telkwa, a station on the C. N. R. The first 8 miles of this is motor road and a truck can be driven an additional 8 miles over rough road to the bridge crossing Little Joe Creek. From this point a slashed but ungraded sleigh road extends to the mine, a further distance of 16 miles. The road is on an excellent grade for 30 miles, or until the last 2 miles are reached, which is a switchback road up Cronin Creek to the mine camp. This part of the road is on a 10% grade, but all downhill from the mine, thus making practicable the hauling out of tonnages of concentrates when the road is substantially improved. This "Cronin sleigh road" as it is generally called, has been used in past years when the mine was

being developed during the winter. It is a good feasible route for all the year round transportation, when sufficient money has been expended on it to make it a good truck road.

Timber

There is an abundance of good mine timber on the property and nearby, consisting of hemlock and spruce. For large scale operations a sawmill would be erected near the proposed mill site and this would provide all necessary timber and lumber.

Water Power

Cronin creek when viewed in July would supply a considerable horsepower, but undoubtedly it gets very much lower in the winter. However, it was estimated by the late Mr. Cronin that a flume one mile long would supply water for the year round to generate 200 h.p. at the mill site. As he was at the mine several winters, his estimate can be accepted as reliable and conservative.

On Driftwood Creek, about 6 miles from the mine, 500 h.p. could be developed. Several other water powers are known to occur within 5 to 10 miles of the mine and in due course these could be investigated. The power on Cronin Creek would first be developed and then others studied if mine operating conditions warranted it.

Climatic Conditions.

Approached by the trail over the Driftwood creek summit, the Cronin mine is almost inaccessible during several winter months; but with a good road from Telkwa, year round operation is quite feasible and practical. Snowfall at the mine probably rarely exceeds 8 feet and the average is probably less. Cold snaps when the temperature goes down well below zero occur during the winter similar to the Bulkley Valley climate, but when properly established with good camps, etc. winter conditions present no difficulties for steady operation. At the mine workings and proposed mill site, no danger would occur from snowslides and with some relocation none would occur on the road out to Telkwa.

Plans

In 1924 a complete surveyed plan showing all workings in the property was made by Mr. J. T. Cronin. A copy of this plan (large white print) accompanies the original of this report - Plate 1. Work subsequent to 1924, which is not of great extent, has been marked on this plan in red.

A copy of part of this plan has been made for this report.

In this I omitted Shafts Nos. 1 and 2 and Tunnel A. This was done to make the plan less confusing and tends to show more clearly the workings that principally developed the No. 2 or contact vein. On this plan - Plate III - are placed the position of all assay samples and a second plate - Plate II - is geologically coloured to show rhyolite schist and the main ore-shoots so far developed. Nos. 1 and 2 shafts and Tunnel A were inaccessible at the time of this examination, but I have previously examined them some years ago and am quite familiar with ore conditions exposed in them.

Many places in the workings show quartz and mineralization which are not marked on the plan as "ore." These areas are considered too low grade at the present time to be commercial.

Transportation

The question of whether the Cronin mine should be served from Smithers via Driftwood creek or from Telkwa via the Cronin road has always been controversial. A careful investigation and consideration shows thatthe Telkwa route is the only feasible one. To use the Driftwood creek road a power tram across Driftwood summit would be necessary. This tram would be about 3 miles long, over a 6000 foot summit and would probably cost $75,000 to build. Even so, a road of some sort would be necessary to put the property into production and this could only be by the present sleigh road. It is therefore strongly recommended that the Telkwa route should be used although the distance to the railway is about 9 miles further.

To improve the present Telkwa route requires an improvement of 8 miles of rough truck road and the building of 16 miles of truck road over the present sleigh road from Little Joe creek into the mine.

This route gives a level road most of the way and where there are grades these are in favor of the load coming out of the mine. Practically all the distance is good road material, plenty of gravel,and timber available for bridges and culverts.

It is estimated very roughly that $50,000 would make a first class truck road from the mine to Telkwa, a distance of 32 miles. Concentrates in bulk could be hauled over this road for $3.50 per ton.

Provided definite equipment of the mine for production was assured, I consider it highly probable that the Government would assist materially in this road construction. The 16 miles of truck road to Little Joe creek from Telkwa is now Government road gradually being improved as a transportation route into the

Babine Lake district. The 16 miles of sleigh road on into the Cronin mine serves this portion of the Babine Range in which other mineral properties occur.

During the past two years substantial grants have been made for certain mining roads from funds supplied jointly by the Dominion and Provincial Governments. I expect that from this source a suitable grant would be made towards improving the present sleigh road. In my estimates I have assumed a grant of $25,000 for this road program.

Geology

The geology of this property is fairly simple in general outline, although complex in detail in the mine workings. The main formation in the area is the Hazelton formation, consisting of highly altered sedimentary and volcanic rocks. These are intruded by dikes and bosses of various types consisting of diorite, quartz diorite, granite porphyry and rhyolite. On the Cronin property, the main rocks are rhyolite and a highly altered schistose argillite, generally referred to as schist. The rhyolite is generally quite fine grained, but in some places is sufficiently coarse to be called a granite porphyry or quartz porphyry.

The area has been geologically mapped by Dr. Hanson of the Geological Survey of Canada, being included in the Drifwood Creek sheet. This shows the intrusive rhyolite to have a surface outcrop of nearly oval shape with the long diameter 1600 feet and the short one 550 feet. It is probable however that at depth the intrusive has much larger dimensions. The contact between the rhyolite and schist, although shown on the map as being quite regular at the surface, is quite complex in the mine workings. Many "fingers" and apophyses reach out into the schist and in places blocks of schist are engulfed in the rhyolite.

Dr. Hanson has advanced the theory that the origin of the mineralization in the veins on the property is by local derivation from the intrusive rhyolite. A copy of the Driftwood Creek sheet is attached to the original of this report and I have a copy in my office.

Veins and Ore Bodies

The showings consist of fairly well defined fissure veins and a main vein which has been described as a contact ore-body. This latter vein - No. 2 vein - which is the most important mineral showing on the property, follows the contact to some extent, but

in places lies entirely within the rhyolite. It represents a fissuring which was controlled to some extent by structural weakness along the contact of rhyolite and schist. In places this vein is strongly mineralized, but it is very irregular and the ore-shoots fade in and out in short distances. Widths of one up to ten feet occur in it. While a lot of development has been done on this contact vein, a relatively small amount of further development should give much more information about it and probably show up much more ore than is now known. This vein is developed by B, C, and No. 2 Tunnels and some surface work.

Of fissure veins, only that known as No. 1 is of commercial importance at present. It lies entirely in the rhyolite and carries some shoots of commercial ore. It is developed by Nos. 1 and 2 shafts and No. 1 tunnel. The vein varies from 1 to 6 feet in width.

Mineralization

Sulphide mineralization in the veins consists essentially of galena and zinc blende, with smaller amounts of tetrahedrite (grey copper), pyrite and a very little chalcopyrite. The gangue filling of the veins is quartz, siderite, and silicified and altered schist and rhyolite. Surface oxidation is not a prominent feature and generally is only slight for a few feet down from the outcrop. In the mine workings however ore that has been exposed for years has in places a film of surface oxidation.

The principal values are in silver, lead and zinc, with only low gold values. The silver ration to lead is variable in different showings but averages about 2 oz. of silver to the unit of lead. Lead and zinc occur in practically equal amount on the average, but some ore-shoots contain more lead than zinc and vice versa.

The physical appearance of the ore with an absence of fine intergrowths of galena and zinc blende indicate that it should be easy to treat by differential flotation for separation of lead and zinc concentrates. Assays show that practically all the silver is contained in the galena and grey copper. Variations in the silver ratio to lead are caused by the presence of grey copper associated with the galena, much of which is not easily discernable by eye.

Development

Nearly one mile of underground development has been done on the property. The major portion of it is in the five tunnels

Nos. 1 and 2 and A, B and C. The large plan - Plate 1 - forwarded with this report shows all work. Most of this work was done by hand-drilling, the portable air compressor taken in to the mine in 1930 having only been used for a few weeks.

Nos. 1 and 2 shafts and No. 1 tunnel develop No. 1 vein. Tunnel A was started as a crosscut to tap No. 1 vein below No. 2 shaft. Near the portal the No. 2 vein was crosscut where it showed a considerable width - about 10 to 12 feet of milling ore. Tunnel A was continued and a raise put up connecting with No. 2 shaft. Tunnels B and C were driven to further develop No. 2 vein and No. 2 tunnel was driven to strike it 225 feet below Tunnel C. No. 1 tunnel is on the same level as Tunnel C, and a crosscut was driven from No. 1 tunnel over to strike No. 2 vein. Latterly Tunnel C and the workings from No. 1 tunnel were connected up.

The Wardell shafts were put down in the early exploration of the property. They are caved in now but were probably not more than 50 feet deep. The Homestake workings (shown on Plate 1) are also old work. Some ore is exposed which lies between rhyolite and schist and may be an extension of No. 2 vein. This area to the south (and southwest) is potentially of considerable value and much ore may be proven in it by drifting southerly on No. 2 vein.

Many drives and crosscuts were made from Tunnels C and No. 1 to prospect the No. 2 vein. Some of this work is incomplete in the sense that in the light of present information, further ore would soon be found with a small amount of work. The work done in 1929 and 1930 is shown in red on Plate No. 1. This was successful in showing rich ore at the end of Tunnel B and in a drive near the face of Tunnel C. A raise on Tunnel C to the surface also showed up new ore and a raise commenced on No. 2 tunnel plotted to reach the ore-shoot on Tunnel C shows good ore as far as it was driven.

An impressive showing of ore occurs on the surface above Tunnel C. This is No. 2 vein where it has swelled out to 20 to 30 feed width of good milling ore on the contact between schist and rhyolite.

At the present time the Wardell shafts Nos. 1 and 2 shafts and A tunnel are inaccessible (A tunnel is badly blocked at the mouth). Similarly the Homestake workings are not in condition for examination or sampling. I have, however, full knowledge of these workings, from previous examinations. It was therefore not considered advisable to spend time and money in reopening these old workings. Tunnel B was slightly blocked at the mouth and was reopened. Tunnel C, No. and No. 2 are in good condition, although

in places falls of ground have taken place. Considering the time elapsed since previous operation the main workings have stood up very well. Raises are in part blocked with muck or ore and some of them bulkheaded off.

With my previous knowledge of the mine, made in some five or six visits as a Government Resident Engineer, I consider that quite sufficient examination could be made of the various workings for the purposes of the present report.

Future development that should be carried out will be given under the section headed "Recommendations."

Sampling and Assaying

The Cronin Mine has been sampled quite extensively in the past. The late Mr. Cronin spent years on the property and sampled and assayed steadily while development was proceeding. In a report summarizing results in 1923 he estimated the average grade of ore as it would be mined at 18 oz. silver per ton, 12% lead and 7% zinc.

The property has also been sampled by several engineers and their figures check closely with those given by Mr. Cronin.

On this examination it was considered advisable to take a number of check samples. To thoroughly sample all possible ore in the mine would require several hundred samples and would entail considerable time and expense. This was not considered necessary and only a certain amount of check sampling of ore-shoots was carried out. In general, 10 foot intervals were taken in the sampling. 5 foot intervals would have been better but too much sampling would have been involved. The following table shows the assay results of 65 samples taken:-

Sample No.	Width in feet	Silver oz. per ton	Lead per cent	Zinc per cent
1	6.0	11.0	11.5	14.4
2	3.5	31.4	21.1	27.3
3	1.2	21.4	20.8	20.6
4	3.0	1.7	0.1	6.3
5	3.0	0.24	0.1	0.7
6	3.4	2.9	3.1	5.2
7	3.0	11.7	6.7	7.4
8	4.2	8.9	3.9	3.3
9	2.3	37.5	6.0	5.1
10	3.8	13.5	6.0	16.9

Sample No.	Width in feet	Silver oz. per ton.	Lead per cent	Zinc per cent
11	3.0	22.4	5.7	10.1
12	2.0	13.4	5.8	6.2
13	1.8	8.9	7.7	6.7
14	2.8	9.7	4.5	4.6
15	3.3	4.6	1.5	2.9
16	5.3	6.9	6.1	4.6
17	6.8	24.2	17.5	9.7
18	9.0	17.2	9.7	17.7
19	6.0	7.1	2.9	7.9
20	2.3	8.2	3.9	9.3
21	2.7	9.9	7.0	1.8
22	4.0	6.0	5.2	4.2
23	5.6	14.1	9.7	0.9
24	3.0	30.2	9.6	5.7
25	2.9	10.6	11.4	5.7
26	2.9	1.2	Trace	0.9
27	2.5	24.6	13.6	11.8
28	2.7	36.9	21.0	14.5
29	3.0	10.7	2.0	1.5
30	1.5	0.44	Trace	0.6
31	2.4	2.3	1.2	0.7
32	2.0	19.9	2.7	18.2
33	1.8	7.8	2.5	4.3
34	5.8	11.4	4.6	27.2
35	7.8	3.5	1.6	20.6
36	4.0	10.3	8.0	4.6
37	2.6	0.72	Trace	1.1
38	6.8	6.0	6.8	20.7
39	3.6	7.6	5.5	11.7
40	3.60	3.8	2.2	2.1
41	2.6	19.8	15.0	14.6
42	1.8	84.7	39.6	11.4
43	5.6	28.5	18.0	15.6
44	4.4	31.2	14.3	19.2
45	5.0	46.4	26.7	23.8
46	4.3	7.2	3.8	2.5
47	3.9	51.2	15.3	15.2
48	5.8	12.1	7.7	16.7
49	5.5	5.0	3.1	3.1
50	4.5	25.8	14.7	5.9
51	1.7	33.4	8.5	0.6
52	2.4	0.22	0.3	0.2
53	3.2	14.5	10.1	3.9
54	4.8	90.2	15.4	8.4
55	6.1	25.5	14.9	19.7

Sample No.	Width in feet	Silver oz. per ton	Lead Per Cent	Zinc Per Cent
56	6.4	23.3	11.6	10.7
57	6.0	21.3	11.3	25.0
58	6.4	36.8	21.9	17.6
59	6.6	12.9	10.8	10.9
60	8.0	14.0	8.1	17.6
61	6.1	15.8	4.8	9.7
62	5.0	33.9	10.5	12.1
63	3.3	31.1	9.6	8.7
64	4.3	17.4	8.5	3.9
65	2.4	3.9	1.5	1.7

No assays were made for gold as it was known from previous assaying that practically all samples run about 0.02 oz. perton in gold regardless of other values. Occasional samples have shown 0.03 and 0.04 oz. gold per ton.

The average of all samples taken showed silver 17.9 oz. per ton, lead 8.6% and zinc 9.3%. The average width sampled was 4.03 feet.

Mining widths where these samples were taken would be greater than shown as in many places the full width of the vein could not be sampled. In places the vein goes into the wall, or access to it was hindered by timbers or other physical features. Taking this into consideration an average width of 5 feet for the same grade is estimated as actually occurring.

The following table shows the averages for different sections of the mine sampled:-

Sample Nos.		Av.width in feet		Av.Silver oz. p/t	Av.Lead %	Av.Zinc %
39 - 43	B Tunnel	3.44	Area 1	28.88	16.06	11.08
44 - 50	B Tunnel	4.77	" 2	25.55	12.23	12.34
55 - 65	C Tunnel	5.51	" 3	21.44	10.32	12.51
7 - 29 & 38	#2 Tunnel	3.82	" 4	14.35	7.26	7.5
34 - 37	No.2 Tunnel	5.05		6.48	3.55	13.37

The missing sample numbers from this table were spot samples where ore occurs not fully developed.

Samples 7 - 29 show the main ore-shoot in No. 2 tunnel on No. 2 vein (junction drift) and the feeder vein coming into it nearly at right angles.

Samples 34 - 37 show the ore in the Paul drift No. 2 Tunnel.

Samples 39- 43 show a promising shoot of ore in Tunnel B opened up in the last work carried out.

Samples 44 - 50 show a good shoot of ore in Tunnel B first opened up.

Samples 55 - 65 show the important ore shoot in Tunnel C.

Samples 1, 2 and 3 show high grade ore opened up in a drive at the inner end of Tunnel C. This looks like the commencement of an excellent ore-shoot lining up with the general trend of No. 2 vein (contact vein).

Samples 4, 5 and 6 show mineralization (not commercial ore) in No. 2 Tunnel at about where No. 1 vein should occur on this level.

Samples 53 and 54 show excellent ore in a raise going up from Tunnel C towards Tunnel B. No ore shows on the level at this point.

The sampling admittedly is not complete but it indicates quite thoroughly there are important ore-shoots in the mine and "spots" of ore that indicate places for development.

A copy of the assay certificate by G. S. Eldridge & Co. is attached to this report.

Ore Reserves

Comparatively little ore can be classed as blocked out in the Cronin Mine, but a considerable tonnage is indicated as "Probable Ore." Assumptions have to be made as to continuity of the ore-shoots in order to present any figures of ore-tonnages. The several areas indicating ore are discussed under separate headings as follows:

Area No. 1. (Plate III)

This area is at the end of Tunnel B where there is a length

of 90 feet of ore taken at 4 feet width and assumed to have a vertical range of 100 feet. This gives 3,600 tons of ore.

Area No. 2 (Plate III)

This area is also in Tunnel B, where an ore-shoot 100 feet long, by 5 feet wide occurs. A vertical range of 100 feet is assumed for this ore shoot. This gives 5,000 tons.

Area No. 3 (Plate III)

This area has an ore-shoot 60 feet long, 6 feet wide and assumed to go to the surface or 100 feet on the dip. This gives 3,600 tons. Judging from the surface exposure which is much wider than the level, a considerably greater tonnage may be secured from this area.

Area No. 4 (Plate III)

No. 2 Tunnel has an ore-shoot 210 feet in length, occurring on the Junction drift and extending out of the tunnel for 100 feet. The average width sampled was 3.82 feet but 4 feet is taken for ore estimation. This working is 300 feet on the dip below Tunnel C, on which level the ore-shoot is much shorter, so far as is known by present development. Owing to the nature of the No. 2 vein and its pinching and swelling in short distances it is not expected that continuous ore will be found between levels. On the other hand, ore-shoots will be found above and below the levels that do not show on the levels.

From this reasoning it is estimated that the ore-shoot in No. 2 tunnel gives an indication of 25,000 tons between this working and Tunnel C. Before assuming this as proven however the raise from No. 2 Tunnel would be put through to Tunnel C and an intermediate level driven.

Area No. 5

Besides these areas some ore occurs in No. 1 and No. 2 shafts and No. 1 Tunnel on No. 1 vein. I did not do any sampling in these places, but checked over No. Tunnel. I am using the late Mr. Cronin's figures for indicated ore on No. 1 vein in these workings. This is a total of 5,000 tons for Area No. 5.

Ore shown on No. 1 and No. 2 veins by Tunnel A is taken account of in other estimates.

Recapitulating the total indicated probable ore on the property is as follows:-

Area No.	1	3,600 tons
"	2	5,000 "
"	3	3,600 "
"	4	25,000 "
"	5	5,000 "
	Total	42,200 "

In addition to this ore, good ore conditions exist at the face of Tunnel B and in a drive near the end of Tunnel C. Both are going into the hill southerly and additional ore is indicated in these places.

The grade of ore assumed for the mine is taken at 16 oz. silver per ton, 8% lead and 8% zinc. As shown by the assays, certain sections will run lower and some higher. The average of all sampling taken was slightly higher than the above average assumed grade.

In actual mining the determining grade would be fixed by metal prices and of course would be variable. However, it is certain that a considerable tonnage of the assumed grade could be mined.

METALLURGICAL TESTING

No large scale metallurgical testing of the ore has been carried out as yet. Some small shipments of hand-sorted ore were made in past years. They must be regarded as test shipments, as unless very high metal prices prevailed, operation of the mine in this way would not likely be profitable. Milling of the ore is essential for steady mining operation.

A preliminary test on concentrating the ore was made by G. S. Eldridge & Co. on a composite sample made up from a number of the assay samples taken on this examination. So far as possible the composite sample was taken to be free from oxidation. However, from the later testing it was apparent that a slight amount of oxidized material occurred in the sample. The samples were taken from mine workings exposed for years and slight surface oxidation occurs in many places. The ore as mined however would be free from this. As the ore was tested by flotation, oxidized sulphides are not recovered and the results are lower than could be expected under steady operating conditions. A copy of G. S. Eldridge & Company's report is attached hereto. It shows that the ore is easily amenable to flotation treatment with reasonably good results in recovery, grade of concentrates and procedure of treatment. In actual practice, a recovery of at least 90% of the silver, lead and zinc is indicated. The lead concentrate carries the major portion of the silver content and a product carrying 70% lead and 90% of the silver would be

produced. A zinc product assaying 55% zinc and about 7 oz. silver would be made. (This silver content in a zinc concentrate is of negligible value). The grade of both lead and zinc concentrates might be raised slightly by recleaning of concentrates. The zinc concentrate is only of slight value as but little is received for the silver content, hence the importance of getting as much silver as possible into the lead concentrate.

The ore tested was somewhat higher grade than the average run-of-mine would be, but the test is satisfactory as showing that excellent milling results would be obtained on actual treatment of this ore.

A standard type plant using differential flotation to make lead and zinc concentrates is indicated by the preliminary metallurgical testing.

Present Equipment

The property is equipped with a combination cook and bunk house, office, stable, roothouse, blacksmith shops, etc., all being log buildings. They are somewhat in disrepair but could easily be repaired to accommodate about 20 men. Ultimately, a new permanent mine camp would be required about the level of the No. 2 tunnel. A camp would also be required at the mill site, 1½ to 2 miles below No. 2 Tunnel by road, or 1 mile by aerial tram.

At the No. 2 Tunnel there is a portable Sullivan 220 cubic foot gas-driven compressor taken in to the property by the sleigh-road in 1930. It was a new machine and was only run for a few weeks. It will run a drifter and the air-driven sharpener also taken in at that time. There are 2 Sullivan drifters and 1 jackhammer, oil forge, about 40 drums of gasoline and a small supply of rails, pipe, steel, etc.

A certain amount of hand equipment is stored at Telkwa and at the mine. Generally speaking, with some renewals and repairs there is enough camp and hand mining equipment to recommence operations with 15 to 20 men. The compressor would be used and probably some hand work in the upper workings.

There is an assay outfit at the mine which is complete and suitable for all assaying required.

Metal Prices and Possible Profits

The profit-possibilities of any silver-lead-zinc mine are necessarily dependent on the market prices of these metals. Canadian

production of lead and zinc is sold on the basis of London quotations for these metals and silver is sold on the New York silver price. In the last year violent fluctuations have marked the course of London lead and zinc quotations. This is shown in the following table:-

London Lead and Zinc Spot Prices

	Lead	Zinc
Average price in 1936	£ 17.599	£ 14.920
Average price in January 1937	27.272	21.153
Average price in March 1937	33.027	33.188
Price October 25, 1937	17.75	16.5

Prices are now at about the level they were for two or three years before the boom which started last fall and culminated in March of this year.

It is a fact, however, that the statistical position of lead is sound, with but little over-production or excess stocks. Zinc is also in a fairly good position. The outlook is therefore for a moderate improvement in the next few months in the present low quotations for lead and zinc. The long-term outlook is furthermore quite promising for gradually increasing prices.

For this report a price of £20 per long ton for both lead and zinc has been taken.

Silver price has been very steady at 44¢ to 45¢ per ounce since January 1936. A price of 44¢ is therefore assumed in this report in valuing silver.

Calculated Value of Ore at the Mine

Assume ore assaying 16 oz. silver per ton, 8% lead and 8% zinc. Assume silver at 44¢ per ounce, lead and zinc at £20 per longton; Canadian exchange at $4.90 to the pound sterling. Assume 90% mill recovery of silver, lead and zinc. Deductions for freight and treatment from Vancouver to European smelters are as supplied by the leading metal buyer in Vancouver. A freight rate from Smithers to Vancouver of $5.50 is taken and on a good truck road $3.50 per ton is estimated from the mine to Smithers.

10 tons of above ore will yield 1 ton lead concentrate, 70% lead, containing 144 oz. silver; and 2,600 lbs. zinc concentrate

containing 55% zinc and negligible silver content.

Value of lead concentrate 70% less 3%		
= 1.340 lbs. @ 4.4¢ per lb.		$58.96
Value of 144 oz. silver less 2%		
= 141 oz. @ 44¢ per oz.		62.04
		$121.00
Less freight and treatment		
Vancouver to Europe	$16.00	
" freight mine to Vancouver	9.00	
" handling charges	2.00	27.00
Net value 1 ton lead concentrate at mine		$94.00
Value of zinc concentrate 55% less 8%		
= 940 lbs. @ 4.4¢ per lb.		$41.36
Less freight and treatment		
to Europe	$26.00	
" " mine to Vancouver	9.00	
" handling charges	2.00	37.00
Net value 1 ton zinc concentrate at mine		$ 4.36
" 2,600 lbs. " " "		$ 5.66
Total value at mine of 10 tons of ore		$99.66

or approximately $10.00 per ton.

From the milling test a small content of gold would be recovered amounting to approximately 25¢ per ton of ore, giving a total value of $10.25 per ton.

An increase of £1 in the price of lead per long ton would add about 30¢ per ton of ore in mine value. Similarly each additional cent per oz. in the price of silver would add 14¢ per ton of ore. Zinc is of little value and depending on marketing conditions would either not be recovered, or would be stored at the mine and shipped at times of favourable prices.

Better terms can be obtained in shipping these concentrates to European buyers than to the Trail smelter.

Estimated Mining and Milling Costs and Probable Profits

Provided the property was properly equipped with a suitable mining and milling plant, reasonable operating costs should be obtained.

The ground is firm and stands up well. For the most part it is probable that shrinkage stoping could be used. Where the sheared argillite is too schistose, other methods such as "cut and fill" might be required. Much of the ore lies in rhyolite which stands up very well.

Sufficient power is available on Cronin Creek to run a 100 ton mill and possibly part of the mining power. Other power would be supplied by Diesel power. Reasonably low power costs would however be obtained.

The following is an estimate of total costs operating on a 100 ton per day basis:-

Mining	$2.00 per ton
Tramming (aerial tram)	.25
Milling	2.00
Development	1.50
Overhead, taxes and depreciation	1.50
Total cost	$7.25 " "

The value of the ore at the mine (making assumptions as to metal prices) has been shown to be $10.25 per ton. Therefore profit per ton would be $3.00, or in round figures $100,000 per year.

As will be seen later under "Recommendations," estimated costs for (1) Preliminary Development Campaign, and (2) equipment on a 100 ton per day mining and milling basis total $245,000. This is believed to be a very liberal figure and probably would be reduced on detail investigation to approximately $200,000. From 2 to 2½ years operation would be required to return the investment on the basis of assumed metal prices. Higher prices would of course rapidly increase the return. An indicated tonnage of about 75,000 tons would be required to assure the return of the investment.

Recommendations

From the foregoing description of the Cronin mine it is concluded that the property warrants further development and later equipment for production. The procedure recommended is a preliminary development campaign and depending on results a permanent program.

Following is an estimate of cost of the preliminary development:

Repair buildings and making camp ready	$1,000
New camp supplies	1,000
Mining supplies	3,000
Repairs to road	5,000
Operation with 2 shifts on compressor and some hand work, foreman, engineer, assayer, bookkeeper and cook, total 17 men. Average wage $5 per day and 60% for supplies; approximately $4,000 per month for 8 months	$32,000
Miscellaneous overhead	3,000
	$45,000

Actual work recommended as follows:

1. Drive ahead Tunnel B on present face showing ore-shoot in No. 2 vein.

2. Drive on ore showing in drive near face of Tunnel C. This is high grade ore and a very promising area of ore-possibilities lies to the south going towards the Homestake workings.

3. Make complete ore-sampling of mine, plotting assay maps and compute tonnages of ore in detail. Map geology of mine workings and prepare geologic sections to gain additional information regarding ore-making conditions.

4. Complete raise started in ore-shoot on No. 2 Tunnel up to Tunnel C. There is about 250 feet on the dip of the vein to raise. This raise is well laid out and properly started. At 150 feet above No. 2 Tunnel an intermediate level would be driven each way on the vein.

5. Exploration for continuation of ore should be made northerly from the Junction and Paul drifts in No. 2 Tunnel.

Following is a tentative estimate of the cost of equipping the mine after the preliminary development has been carried out:-

Remaking present road into truck and tractor road to mine	$50,000
Less: Government assistance	25,000
	25,000
Mine Equipment Plant	25,000
New Camps	5,000
Sawmill	5,000
Preparation mine for production	5,000
Aerial tram to mill site	20,000
Hydro-electric plant at mill (?)	20,000
100-ton flotation concentrator	65,000
Bunkers and tracks at TElkwa	5,000
Tractor, trucks and miscellaneous equipment	10,000
Miscellaneous and working capital	17,000
	$200,000

The estimate for the hydro-electric plant is practically a guess as no accurate data has been secured on whic h to base a proper estimate. Similarly with modern bull-dozer equipment, the cost of making a suitable road may be less than estimated. Other figures should be reasonably close estimates.

John D. Galloway

G. S. Eldridge & Co. 16633

October 12, 1937.

Mr. J. D. Galloway,
920 Stock Exchange Bldg.,
City.

Dear Sir,

We have made flotation tests on an average of the unoxidized samples of Babine-Bonanza ore submitted by you and reports as follows:

The ore with 75% water was ground in a rod mill with 3.0 lbs. of zinc sulphate and 3.2 lbs. of soda ash per ton of ore. The Pulp was then conditioned with .25 lbs. of sodium cyanide per ton in an M.S. sub-aeration flotation machine for 4 minutes. Then .05 lbs. of pine oil and .05 lbs. of Butyl xanthate were added and the pulp agitated for 3 minutes longer. Then the pulp level was adjusted and a clean galena froth came up and concentrate #1 was taken off. Added .03 lbs. of butyl xanthate and Concentrate #2 (a lead middlings) was taken off. Added .5 lbs. of copper sulphate ($CuSO_4$) and .03 lbs. butyl xanthate. The zinc froth was not very strong so added .03 lbs. butyl and .25 lbs. $CuSO_4$ and .01 lbs. of pine oil and a strong zinc froth came up and was removed as a Zinc Concentrate #3. After the nature of froth seemed to be changing a 4th concentrate wastaken off. Then added .03 lbs. butyl xanthate per ton and .25 lbs. of copper sulphate and took off Concentrate #5, until there was practically no mineral in the froth.

Sieve Tests on Tails

On 60 mesh: 1.4%; on 100-5.4% ; on 150-12.9%; on 200 - 9.9%; minus 200- 60.4%

Results of Tests.

		Gold		Silver		Lead		Zinc		Copper	
Con.	Wt. %	Oz. Ton	Distribution	Oz. Ton	Distribution	%	Distribution	%	Distribution	%	Distribution
1	13.42	0.07	27.6%	122.9	76.6	71.7	81.5	3.5	3.6	1.2	54.0
2	2.76	0.14	11.3	96.2	12.2	30.6	7.1	19.7	4.2	2.1	19.3
3	15.10	trace		5.9	4.1	2.2	2.8	57.3	67.1	.25	12.6
4	5.69	0.08	13.2	8.2	2.2	2.8	1.3	45.1	19.9	.25	4.7
5	4.03	0.26	30.8	10.3	1.9	3.8	1.3	8.1	2.5	.25	3.3
Tails	59.00	0.01	17.1	1.1	3.0	1.1	6.0	0.6	2.7	Trace	

	Gold	Silver	Lead	Zinc	Copper
Heads 100.0% Assays Calculated	0.342 ozs.	21.6 ozs.	11.8	12.9	
Head assays run on separate sample	0.035 ozs.	20.1 "	11.2	13.0	0.3

Calculated Products

		Gold		Silver		Lead		Zinc	
Lead Conc.	15.1	0.08	38.0	120.0	84.0	69.0	87.9	3.4	4.0
Zinc Conc.	21.8	Trace		6.6	6.7	2.4	4.4	53.2	90.3

The above results indicate that by recleaning the lead middlings and adding the lead portion to Conc. #1 that a lead concentrate can be made running 69.0% lead and 120 ozs. of silver and 3.4% zinc, showing a recovery of 87.9% of the lead and 84% of the silver values. If Conc. #3 and Conc. #4 were combined with tailings from cleaning the lead middlings, a zinc concentrate can be made without cleaning, with a zinc content 53.2%; silver 6.6 ozs. per ton and lead 2.4 and the zinc recovery would be 90.3%. The ratio of concentration with this higher grade of feed would be somewhat lower than with a lower grade feed. It would take 6.6 tons of ore to make 1 ton of lead concentrate and 4.57 tons of ore to make a ton of zinc concentrate.

Silver assays on the sieve products of the tailings were as follows:

	Weight per cent	Silver Oz. per ton
On 60 mesh	1.4	.66
100 "	15.4	.64
150 "	12.9	.46
200 "	9.9	.40
Minus 200 mesh	60.4	1.42

These silver results would indicate that finer grinding would not improve the silver recovery.

The lead content of the tailings is higher than would be expected, but on examination of a concentrate of the tails practically no galena was found, indicating that the lead was present as lead carbonate. There was evidence of some oxidation in the average sample and qualitative tests showed the presence of lead carbonate. It is possible that Plant practice with recleaning the zinc concentrates will give a higher grade zinc concentrate.

C. S. ELDRIDGE & COMPANY