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PRELIMINARY REPORT

BAYONNE MINES PROPERTY

TYE, B. C.

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Preliminary Report

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Bayonne Mines Property

Tye, B.C.

A local group are looking into the feasibility of re-opening this old property. The writer was aked to make a preliminary report as he was consulting engineer in charge during the period it last operated in 1945-46. Changed conditions in the gold and silver situations and also change in transportation possibilities are the things that prompt this investigations

History

The location of this property took place in about 1896 and it has had several periods of operation during the years. Only two of these periods however are significant -prior to World War II up to 1942 and after the war in 1945-46.

In earlier times the Property was reached from Tye, a stop on the Kettle Valley Branch of the C.P.R on the East shore of Kootenay Lake, by means of a pack trail a distance of 23 miles. Everything had to be packed in and out on pack horses. However a road was built prior to the war and a 65 ton cyanide Mill installed. However this road left a lot to be desired-it went over two summits in the 23 miles of elevations up to 7100 feet and due to lack of good gravel was difficult to keep in condition. With steep grades and heay snowfall in the winters this meant high transportation.costs.

This operation was successful even under difficult conditions but it had to close in 1942 due to war conditions as to manpower and supplis.

After cessation of hostilities the Mine was re-opened in 1945 but the operation was short-lived.It was impossible to buy good tractors for transportation-and miners would just not stay in such a location at that time when there was lots of other work available.

Property

The Property did consist of 16 Crown Granted Claims. The Company lost the Claims due to not paying taxesand six of them were taken up under lease by Mr.Arthur Law.The present group have made an agreement with Mr.Law and have either reclaimed the rest of the property or are in the process of doing so.

Geology

Geology of the Property is basically simple.The Claims lie in a granite Batholith.The ore occurs in long,strong,fairly narrow shears in the granite.At least three veins are known but only one has been mined.

Minerals occuring in the shears are gold,silver,lead and zinc.No arrangements were made in the Mill to recover the lead and zinc as at the time it was built they were very low in price and not considered worth saving.In fact Assay Maps show that they weren't even assayed for.This is true for the last last operations as well as during the period before the war.

Ore Available at Present

A very comprehensive map is available showing Assay map,Location and ore reserves.This map was made up at the time the Mines closed in 1946 by R.B.King P.Engr. under the writer's supervision.

This Map shows an ore reserve of II,000 tons of 0.76 oz.gold per ton over a width of 20".

Subsequent to the time the map was made up according to Minister of Mines Reports leasers mined approximately 700 tons of ore of a grade of ;-

Au.(oz)	Ag.(Oz)	PB.(%)	Zn.(%)
0.64	4.7	4.5	2.4

It should be noted that whereas ore reserves show only gold assays,the shipments by leasers above indicate a gross value of $I9.45 in silver,lead and zinc.This at $I.00 oz. for silver,I0¢ per pound for lead and I2¢ a pound for zinc.

Operating Conditions Now

The big difference at present,if operations were to be resumed,would be transportation.The Provincial Gov't is building a road from Salmo to Creston which,according to maps,would pass within about five miles of the property.It is though that this road would be at or near the same elevation and in the same valley as the property and a road to the property would be comparatively inexpensive.This would have to be checked on the ground. This would to a large extent eliminate the main draw back to the property. Men are also more available than in I946 and thus the two main reasons for failure at that time would be eliminated.

Costs to Re-open

Without an inspection of the property this is difficult. At the time of closure the property was fully equipped for production at 65 tons per day.Since that time some equipment has

has been sold-how much is not known.Also undoubtedly some of the buildings have collapsed due to snow load.

A winze was sunk from the 8th. to 9th.Levels during last operations and this would be full of water.Since a considerable portion of ore available is in this winze it would have to be de-watered.Water seepage is somewhat heavy during break-up and during Fall rains and cost would depend at what time of year this was done.However water is at no time excessive.

With the above in mind I would suggest the following amount be made available for initial program;-

Rough road from Prov.Highway	$15,000.00
Dewater and Renovate Mine	$20,000.00
Engineering,Head Office,Equipment Rental etc,	$ 5,000.00
	$40,000.00

Amount of work necessary to renovate Mine except at portals should not be great since the workings are in granite and the ground good.

In my mind the above is well warranted.Obviously there would have to be further sums provided,if,after careful analysis it was decided to go into production.

All of which is respectfully submitted.

C.Rutherford P.Engr.(Mining)

Ore Dressing and Metallurgical Investigation No. 62

GOLD-SILVER ORE FROM THE BAYONNE CONSOLIDATED GOLD MINES, LTD., NELSON, BRITISH COLUMBIA

Shipment. Two bags of ore weighing 120 pounds were received April 23, 1935, from the Bayonne Consolidated Gold Mines, Limited, Nelson, B.C. These were shipped on the advice of P. W. Racey, Consulting Engineer, Vancouver, B.C. One of the bags contained oxidized material, and the other oxidized and sulphide ore. This property is 23 miles from Tye station on the C.P.R., west of Kootenay lake, B.C.

Characteristics of the Ore: The shipment consisted of a siliceous gangue containing much oxidized material. Sulphides of iron, lead, and zinc were present. Gold and silver also were present but owing to the oxidized condition of the ore their relation to other minerals was not determined.

Experimental Tests

For this investigation, the contents of the two bags were mixed together and sampled. Analysis showed the lot to contain:

Gold	0·60 oz./ton	Lead	2·20 per cent
Silver	4·40 "	Zinc	0·60 "
		Copper	0·65 "

The test work included flotation, cyanidation, and amalgamation.

Flotation recovered 87 per cent of the gold, 53 per cent of the silver, and 42 per cent of the lead, with a ratio of concentration of 16·2 : 1. The concentrate contained 12·36 ounces of gold, 38·64 ounces of silver per ton, and 14·6 per cent lead. Cyanidation extracted 97 per cent of the gold and 80 per cent of the silver.

FLOTATION, BLANKETING, CYANIDATION

Test No. 1

A sample of the ore was ground in water to pass 48 per cent through 200 mesh with 2·5 per cent remaining on 65 mesh. The pulp was then passed over a corduroy blanket and the blanket tailing conditioned and a flotation concentrate removed. The flotation tailing was then cyanided for 48 hours.

Results:

Product	Weight, per cent	Assay, oz./ton		Distribution, per cent	
		Au	Ag	Au	Ag
Feed (cal.)	100·00	0·57	4·24	100·0	100·0
Blanket concentrate	7·10	6·89	13·45	86·3	20·4
Blanket tailing		0·425	3·815		
Flotation concentrate	2·21	8·15	48·8x	30·8	24·6
Flotation tailing	90·69	0·22	2·62	32·0	54·7

Cyanidation of Flotation Tailing:

	Au	Ag
Feed	0·22 oz./ton	2·62 oz./ton
24-hour cyanide tailing	0·08 "	0·97 "
48-hour cyanide tailing	0·045 "	0·895 "
Extraction	80·0 per cent	65·8 per cent

These results show that part of the gold is present as free gold and can be caught on blankets. The blanket concentrate was bulky, containing much gangue and sulphides. Flotation also recovered some of the precious metals. The silver assay of the flotation concentrate indicates that a considerable part of the silver is present as sulphide.

Cyanidation of the flotation tailing indicates the possibility of extracting the gold and silver by this method. The assays of the 24-hour and 48-hour cyanide tailing indicate the need of grinding finer than 48 per cent −200 mesh.

Test No. 2

A sample of the ore was ground wet to pass 100 mesh with 74 per cent −200 mesh. Six pounds of soda ash and 0·10 pound of cyanide were added to the grinding mill; 0·10 pound of butyl xanthate and 0·12 pound of pine oil per ton were added to the flotation cell and a concentrate removed. The flotation tailing was passed over a corduroy blanket to catch any free gold not floated.

Results:

Product	Weight, per cent	Assay, oz./ton		Distribution, per cent	
		Au	Ag	Au	Ag
Feed (cal.)	100·00	0·57	4·76	100·0	100·0
Flotation concentrate	6·17	11·94	39·10	84·6	50·6
Blanket concentrate	4·40	0·81	11·45	4·1	10·6
Blanket tailing	89·43	0·11	2·67	11·3	38·8

Test No. 3

This test is similar to Test No. 2 with the exception that the flotation tailing was not passed over blankets.

Results:

Product	Weight, per cent	Assay, oz./ton		Distribution, per cent	
		Au	Ag	Au	Ag
Feed (cal.)	100·00	0·57	4·56	100·0	100·0
Flotation concentrate	5·98	12·28	49·66	83·0	83·0
Flotation tailing	94·02	0·13	2·27	16·1	46·9

There is a slight advantage to be gained by the use of blankets to trap any free gold not floated. Test No. 2 produces a blanket concentrate containing 0·81 ounce of gold, 11·45 ounces of silver per ton. This is bulky, representing 4·4 per cent of the weight of the feed. If this concentrate were cleaned, most of the bulk would be eliminated and the gold recovered

Test No. 4

In this test, no cyanide was added to the grinding mill. Amyl xanth was substituted for butyl xanthate. In all other respects the proced was the same as in Test No. 3.

Results:

Product	Weight, per cent	Assay, oz./ton		Distribution, per ce	
		Au	Ag	Au	Ag
Feed (cal.)	100·00	0·69	4·81	100·0	1
Flotation concentrate	8·67	5·13	39·25	81·5	7
Flotation tailing	91·13	0·15	1·52	18·5	9

The omission of cyanide from the circuit made the flotation mu slower, and the froth was heavy and sluggish. The gold in the tailing w higher and the concentrate more bulky and lower in grade than in Te No. 3.

Test No. 5

A test similar to Test No. 4 was made. The ore was ground with soi ash, conditioned with sodium sulphide and floated. Poorer results we obtained than those of Test No. 4. The concentrate was lower in gra and the tailing loss about the same.

Test No. 6

In this test, finer grinding was adopted. The ore was ground w with 6 pounds of soda ash and 0·10 pound of cyanide per ton until 89 pe cent passed 200 mesh; 0·10 pound of amyl xanthate and 0·12 pound pine oil per ton were added and a flotation concentrate removed. Th flotation tailing was cyanided 1 : 3 dilution with 3·0 pounds of potassiu cyanide per ton solution. Ten pounds of lime per ton was added to supp protective alkalinity.

Results:

Product	Weight, per cent	Assay				Distribution, per cent			
		Au, oz./ton	Ag, oz./ton	Pb, per cent	Zn, per cent	Au	Ag	Pb	Zn
Feed (cal.)	100·00	0·69	4·81	2·47	0·76	100·0	100·0	100·0	100·0
Concentrate	8·42	5·32	32·69	13·72	7·65	65·5	56·7	46·7	84·1
Tailing	91·67	0·145	1·715	1·44	0·10	34·5	43·3	53·3	15·9

Cyanidation Results—24 Hours' Agitation:

	Au	Ag
Feed	0·145 oz./ton	1·715 oz./ton
Tailing	0·02	0·67
Extraction	86·2 per cent	69·0 per cent

Reagents:

KCN	2·6 lb./ton solution
CaO	0·3

Reagent Consumption:

KCN	1·2 lb./ton ore
CaO	0·1

Increasing the time of agitation to 48 hours did not increase the recovery.

These results indicate that the gold left in the flotation tailing is readily soluble in cyanide solution. Flotation recovers 85·5 per cent of the gold in the form of a concentrate. Cyanidation extracts 86·2 per cent of the metal not recovered by flotation. A total recovery of 98 per cent of the gold is, therefore, obtained by the combined processes.

Test No. 7

To note the effect of cleaning the flotation concentrate, a sample was ground wet together with 6·0 pounds of soda ash and 0·10 pound of cyanide per ton until 89 per cent passed 200 mesh; 0·10 pound of amyl xanthate and 0·12 pound of pine oil per ton were added and a flotation concentrate removed. This concentrate was cleaned once, producing a concentrate and a cleaner tailing.

Product	Weight, per cent	Assay				Distribution, per cent			
		Au, oz./ton	Ag, oz./ton	Pb, per cent	Zn, per cent	Au	Ag	Pb	Zn
Feed (cal.)	100·00	0·57	4·46	2·13	0·62	100·0	100·0	100·0	100·0
Concentrate	6·15	12·25	28·64	14·45	10·25	87·3	39·1	41·4	97·5
Cleaner tailing	1·73	1·68	20·22	4·58	5·62	8·2	12·9	5·6	2·4
Flotation tailing	92·12	0·09	1·70	1·25	0·22	4·5	38·7	54·1	22·6

Ratio of concentration—16·2 : 1

CYANIDATION

Large samples of the ore were ground dry in a disk pulveriser to pass 48, 100, 150, and 200 mesh. Four series of tests were made on samples from these. They were cyanided with a 4·0 pound of potassium cyanide per ton solution, 1 : 3 dilution for 48 hours.

Grind:

Screen size	−48-mesh grind	−100-mesh grind	−150-mesh grind
− 48 + 65	20·0		
− 65 + 100	17·7	6·4	
− 100 + 150	15·3	29·5	15·0
− 150 + 200	49·0	64·0	85·0
− 200			

Test No. 8—Series I

Lime, equivalent to 12 pounds per ton of ore was added to each test.

Results:

Mesh	Agitation, hours	Feed, oz./ton		Tailing, oz./ton		Extraction, per cent		Titration, lb./ton solution		Consumption, lb./ton ore	
		Au	Ag	Au	Ag	Au	Ag	KCN	CaO	KCN	CaO
– 48	24	0·88	4·60	0·26	1·60	57·5	65·7	3·6	0·22	1·2	11·3
– 100	"	"	"	0·096	1·025	89·6	76·9	3·5	0·2	1·5	11·3
– 150	"	"	"	0·025	0·825	97·2	80·3	3·25	0·15	2·2	11·5
– 200	"	"	"	0·025	0·915	97·2	79·6	3·15	0·17	2·4	11·5
– 48	48	"	"	0·03	1·00	65·0	68·8	3·4	0·1	1·8	11·7
– 100	"	"	"	0·06	0·92	93·3	79·5	3·2	0·1	2·4	11·7
– 150	"	"	"	0·035	0·765	96·1	82·5	3·1	0·1	2·7	11·7
– 200	"	"	"	0·03	0·83	96·7	81·7	2·95	0·1	3·1	11·7

Test No. 9—Series II

	Lb./ton
CaO added	12·0
PbO added	2·0

Results:

Mesh	Agitation, hours	Feed, oz./ton		Tailing, oz./ton		Extraction, per cent		Titration, lb./ton solution		Consumption, lb./ton ore	
		Au	Ag	Au	Ag	Au	Ag	KCN	CaO	KCN	CaO
– 48	24	0·89	4·60	0·49	1·45	45·0	67·7	3·5	0·25	1·5	11·3
– 100	"	"	"	0·165	1·015	81·3	77·4	3·4	0·25	1·8	11·3
– 150	"	"	"	0·05	0·84	94·7	80·4	3·25	0·15	2·1	11·5
– 200	"	"	"	0·025	0·808	97·2	82·1	3·2	0·15	2·4	11·5
– 48	48	"	"	0·49	1·25	45·0	69·9	3·5	0·15	1·5	11·5
– 100	"	"	"	0·20	0·98	77·8	78·2	3·25	0·15	1·8	11·5
– 150	"	"	"	0·03	0·79	96·7	82·4	3·2	0·08	2·4	11·7
– 200	"	"	"	0·04	1·04	95·6	76·9	3·1	0·10	2·7	11·7

Test No. 10—Series III

In this series, no lime was added at the commencement. Four pounds per ton was added two hours before the end of the agitation period. The solutions were cloudy and the pulp slow to settle.

Results:

Mesh	Agitation, hours	Feed, oz./ton		Tailing, oz./ton		Extraction, per cent		Titration, lb./ton solution		Consumption, lb./ton ore	
		Au	Ag	Au	Ag	Au	Ag	KCN	CaO	KCN	CaO
– 48	24	0·88	4·60	0·075	1·085	91·7	75·8	2·9	0·05	3·3	3·8
– 100	"	"	"	0·03	0·86	96·7	80·8	2·85	Nil	4·1	4·0
– 150	"	"	"	0·025	0·725	97·2	83·1	2·85	"	4·0	4·0
– 200	"	"	"	0·02	1·13	97·8	74·8	2·15	"	5·5	4·0
– 48	48	"	"	0·05	0·96	93·3	85·3	2·9	0·05	3·3	3·8
– 100	"	"	"	0·03	0·69	96·7	84·6	2·6	Nil	4·3	4·0
– 150	"	"	"	0·025	0·625	97·2	86·1	2·3	"	5·1	4·0
– 200	"	"	"	0·02	0·59	97·8	86·9	2·2	"	5·4	4·0

Test No. 11—Series IV

This series is the same as Test No. 10 with 2·0 pounds PbO per ton added.

Mesh	Agitation, hours	Feed, oz./ton		Tailing, oz./ton		Extraction, per cent		Titration, lb./ton solution		Consumption, lb./ton ore	
		Au	Ag	Au	Ag	Au	Ag	KCN	CaO	KCN	CaO
– 48	24	0·90	4·60	0·06	0·99	93·3	75·8	2·9	0·05	3·3	3·8
– 100	"	"	"	0·03	0·83	96·7	80·8	2·6	Nil	4·2	4·0
– 150	"	"	"	0·02	0·71	97·8	83·6	2·45	"	4·65	4·0
– 200	"	"	"	0·02	0·70	97·8	84·4	2·35	"	4·95	4·0
– 48	48	"	"	0·055	0·936	93·9	79·4	2·85	0·05	3·4	3·8
– 100	"	"	"	0·025	0·645	97·2	85·6	2·6	Nil	4·2	4·0
– 150	"	"	"	0·02	0·59	97·8	86·6	2·45	"	4·65	4·0
– 200	"	"	"	0·03	0·68	96·7	84·6	2·4	"	4·8	4·0

These tests indicate that 97 per cent of the gold and 80 per cent of the silver can be extracted within 24 hours from ore ground 85 per cent –200 mesh. When 12 pounds of lime per ton of ore is added at the commencement, a cyanide consumption of approximately 2·4 pounds of potassium cyanide or 1·9 pounds of sodium cyanide per ton is indicated. When the lime is omitted until near the end of the operation, the gold and silver are dissolved more rapidly from the coarser sizes, and a slightly higher recovery is made from the finer sizes. However, there is indicated a consumption of approximately 3·0 pounds of potassium cyanide or 4 pounds of sodium cyanide per ton of ore. The settling rate is very slow.

Test No. 12

A sample of the ore was ground wet in a porcelain mill containing iron balls until 89 per cent passed 200 mesh. The pulp was then diluted to 1 : 2·5 and cyanide added to make a solution strength of 4·37 pounds of potassium cyanide per ton. Lime equivalent to 13 pounds per ton of ore was added and agitation continued for 48 hours.

Results:

Feed	0·89 oz. Au/ton
Tailing	0·42 "
Extraction	53·3 per cent
Reagents—	
KCN	3·9 lb./ton solution
CaO	0·25 "
Consumption—	
KCN	3·7 lb./ton ore
CaO	12·4 "

Test No. 13

To determine why such a low extraction was obtained in the previous test, a sample was ground in the same manner with lime equivalent to 14 pounds per ton of ore and aerated in a Denver super-agitator (Wallace type) for 4 hours. Cyanide sufficient to make a 3·0 pound of potassium cyanide per ton solution and 5·0 pounds of lime per ton were added. Cyanidation was concluded after 48 hours.

Results:

Feed	0·20 oz. Au/ton
Tailing	0·09 "
Extraction	55·0 per cent
Reagents—	
KCN	3·0 lb./ton solution
CaO	0·3 "
Consumption—	
KCN	1·25 lb./ton ore
CaO	13·3 "

The only apparent benefit derived from aeration prior to cyanidation is the reduction in cyanide consumed. This is reduced from 3·7 pounds to 1·25 pounds per ton of ore. During the aeration period, the lime in solution is consumed, the solution titrating only 0·03 pound of lime per ton at the end of the 4-hour aeration period.

Test No. 14

As only 50 to 55 per cent of the gold was extracted by cyanidation when the ore was ground wet in a jar mill as against 97 per cent when ground dry in a disk pulveriser, it was assumed that the small ball mill was not grinding the gold, but merely flattening and hammering the particles so that they were slow to dissolve. To check this point, a sample was ground as in Test No. 12 and amalgamated. After removing amalgam, the tailing was cyanided as in Test No. 12 for a period of 24 hours.

Results:

Feed	0·20 oz. Au/ton
Amalgamation tailing	0·045 "
Recovery	77·5 per cent

Cyanidation:

Feed—Amalgamation tailing	0·045 oz. Au/ton
24-hour cyanide tailing	0·025 "
Extraction	79·2 per cent
Reagent Consumption—	
KCN	2·4 lb./ton ore
CaO	13·2 "

Total recovery, amalgamation plus cyanidation 93·9 per cent. It is apparent that the free gold in the ore which amounts to 70 per cent of the total, is responsible for the low recoveries in Tests No. 12 and 13. To obtain uniform high recoveries, this gold should be removed before the pulp reaches the agitators.

SUMMARY AND CONCLUSIONS

As this property is quite isolated and shipment of concentrate would involve a long truck-haul followed by a rail-haul of 90 miles to the smelter, it is imperative that the gold be recovered as bullion on the property or that a high-grade concentrate of small bulk be produced.

Owing to the presence of sulphides of iron, lead, and zinc in the ore, these minerals will tend to produce a bulky flotation concentrate. By flotation 87 per cent of the gold and from 50 to 60 per cent of the silver can be recovered in a concentrate assaying 12·26 ounces of gold, 23·64 ounces of silver per ton, 14·6 per cent lead, and 10 per cent zinc. From

100 tons of ore 6·16 tons of concentrate can be expected, and 86 per cent of the gold in the flotation tailing is readily extracted by cyanidation, giving an overall recovery of 98 per cent.

When the ore is ground 89 per cent −200 mesh, 70 per cent of the gold is free and can be amalgamated.

The cyanide tests indicate that maximum extraction will be obtained from ore ground approximately 65 per cent −200 mesh. A fairly strong cyanide solution should be used, one containing from 4 to 5 pounds of available potassium cyanide per ton, to obtain good silver recovery.

The presence of lime during the agitation period has a tendency to decrease the rate of solution of the gold and silver. However, when no lime is used, the amount of cyanide consumed becomes prohibitive. The quantity of lime used should be kept at a minimum, only enough being added to obtain a satisfactory settling rate in the thickeners. The amount necessary to add will vary, depending on the degree of oxidation of the feed.

A mill to treat a small daily tonnage must of necessity be of simple design. Single-stage grinding will be used with one classifier in closed circuit with the mill.

The presence of free gold in the ore, unless locked in the grinding circuit by an elaborate system of classification, has been shown to produce high tailing losses. This gold either must be removed prior to agitation, or ground as fine as the gangue and sulphides. This gold could be removed by jigging or caught on corduroy blankets.

The flow-sheet suggested for treatment of a small daily tonnage of this ore is as follows:

Grinding should be done in cyanide solution with lime added to the feed. This should pass to a tube mill capable of fine grinding. The mill discharge should then pass to two or more concentrating tables of the Wilfley type. The concentrates from these tables should be reconcentrated on another table where a narrow band of gold concentrate could be taken off, also high-grade lead concentrate. The tailing from all these tables should go to a bowl classifier, the oversize from which should be returned to the mill for further grinding. The classifier overflow adjusted to give approximately −200 particles should pass to a thickener and thence through agitators where 24 hours' contact should suffice to give maximum extraction.

The gold concentrate from the table should be barrel-amalgamated and bullion recovered. The lead concentrate, which should not amount to more than 2·6 tons from each 100 tons of feed, should be shipped to the smelter.

The ore on which this investigation was conducted was a mixture of oxidized ore and sulphide ore. Any change in the character of the ore may change the metallurgy. There is the possibility that clean unoxidized sulphides may not respond to the treatment as does this oxidized material. When such ore is obtainable from below the oxidized zone, it would be advisable to have this point checked to govern future mill operation.