PROPERTY FILE 011500

DEPUTY MINISTER OF MINES
& PETROLEUM RESOURCES
1463
REC'D NOV 21 '74

REFERRED TO DATE

Mr. J. E. McMynn
Deputy Minister
Department of Mines and
Petroleum Resources

RE: Letter of November 4, 1974 (attached)

Mining property file
92J/15W

92JNE
075

NAME: Minto mine

LOCATION: Situated on seven Crown-granted mineral claims, 5 miles northeast of Gold Bridge, British Columbia (see accompanying map).

Lot 5600	Omega	owned by:
5601	Omega #1	Minto Trading & Development Co. Ltd.,
5602	Omega #2	c/o Mrs. Marguerite Wiles,
5603	Omega #3	R. R. 1,
5604	Omega #4	Nanoose Bay, British Columbia
5719	Alpha Fraction	
7078	Jack Fraction	

Most of the workings are on Omega #1.

HISTORY OF PRODUCTION: Between 1934 and 1940 the mine produced 88,902 tons of ore, the metal content of which was: 17,558 ounces of gold, 50,584 ounces of silver, 21,327 pounds of copper, and 124,421 pounds of lead. Subsequent exploration on the lowest levels has failed to locate more ore.

DESCRIPTION AND HISTORY OF DEVELOPMENT: The property is underlain by basalts, ribbon cherts, and argillites of the Fergusson Group which are intruded by a number of north-trending feldspar porphyry and andesite dykes. The mineralization is genetically related to the dykes and one of them, known as the Minto dyke, forms the hanging wall to the principal vein.

The principal vein strikes north and dips east at about 75 degrees. It follows the sheared lower contact of the Minto dyke and the underlying sedimentary rocks. The vein is quite persistant, 3 to 4 feet wide, and well mineralized with arsenopyrite, pyrite, sphalerite, stibnite, galena, chalcopyrite, tetrahedrite, and pyrrhotite.

The vein was developed for a strike length of about 1,000 feet on four adits, the lowest of which is now beneath the level of Carpenter Lake. A winze from the lowest level (2010 feet elevation) permitted development of the vein on three lower levels, giving the vein a total depth of 800 feet.

Exploration from the lowest level beneath the adit workings gave poor results. Most of the ore had been stoped out by 1937, when the mill was shut down.

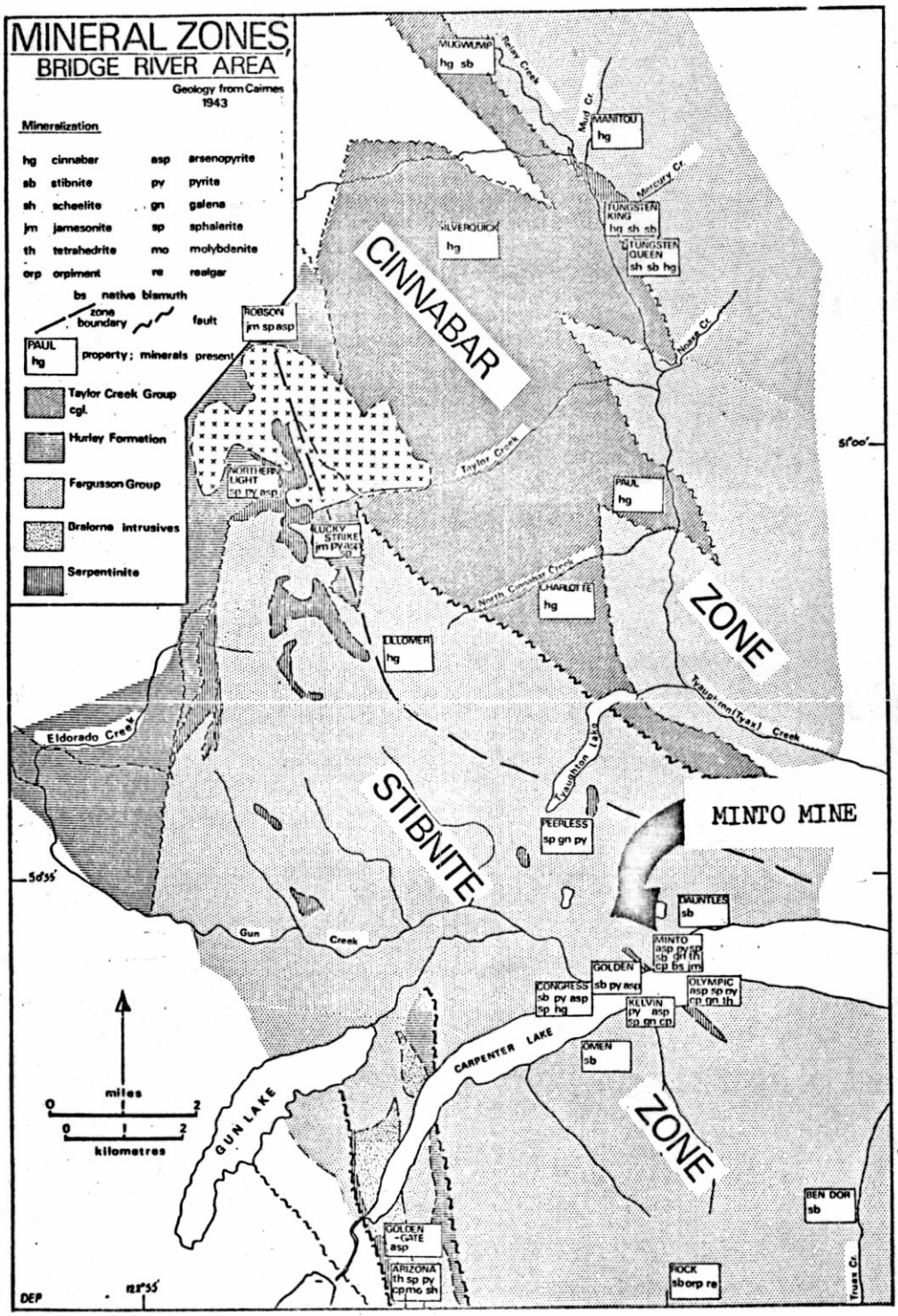
In August, 1941, an option was taken on the property by Pioneer Gold Mines Ltd., but dropped in early 1942.

CONCLUSIONS: Clearly the mine was a profitable venture some years ago. However, no mineralization worthy of note was found in exploratory drilling on the lowest level and the mineralization was present only for a known strike length of 1,000 feet. Moreover, the four lowest levels are now beneath river level and probably flooded. I cannot see that it would be a good exploration bet now.

This report was written without personal knowledge of the property. The opinion expressed above is based on a thorough search of the available information in the Department's files.

Respectfully submitted,

David E. Pearson
Geologist, Geological Division
Mineral Resources Branch



R-R-1 Nanoose Bay, B. C.
November 4, 1974

Mr E. Mc Mynn
Deputy Minister of Mines
Parliament Buildings,
Victoria, B. C.

Dear Mr Mc Mynn:

May I introduce myself- Mrs Marguerite W. Wiles formerly of Minto Mine B. C. in the Bridge River Valley.

If you recall during the time you were manager of Bralorne Mines in the year 1960 you obtained an option on my E and M. claims adjoining Minto Mine.

I am now appealing to you Mr Mc Mynn if you would be interested in buying my Minto Mine 8 Crown Granted M.C's. I referr to the old name for your information. The same property is under the name of Minto Trading and Development Company Limited. The Company has been kept in good standing with taxes paid to date.

As you know in the two years that Minto Mine operated, it produced over eight hundred thousand in gold and eighty thousand in silver, also considerable copper, lead and zinc.

I have the Tacoma Smelting Returns, etc.,

Bill 31 has prevented me from selling this property.

I am a widow struggling to hold this property, and am open to your offer regardless of price.

Further information may be obtained upon request.

Yours very truly,

Marguerite W. Wiles (Mrs)

Marguerite W. Wiles.

925

GCNL #25
5 FEB 1985

92J/15W (092JNE075)

BRALORNE GOLD CAMP ENTERED

AVINO MINES & RESOURCES LTD.(AVO-V)

- Avino Mines & Resources Ltd. president, Louis Wolfin has announced the purchase of the formerly producing Minto Group of claims, located near Goldbridge, just 110 km northeast of Vancouver, B.C. The mine has been developed on seven levels by some 6,000 feet of workings. Mine production between 1931 and the early 1940's totalled 83,960 tons grading 0.34 oz.gold per ton. In 1936, the B.C. Minister of Mines Report stated that sampling of the 400 level over a length of 152 feet and across an average width of 5 feet, assayed 1.66 oz. gold per ton.

Avino now plans a program of rehabilitation, with geological mapping, surface VLF - electromagnetic surveys and geochemical surveys to be followed by trenching and drilling.

There has been a considerable recent revival of interest in the Bralorne-Pioneer Gold Camp. Recent new discoveries in the area by the adjoining Levon Resources, in which Avino holds a large share interest, has attracted many major companies and work on these properties is presently underway.

As this program is getting underway, the mining operation in Mexico is continuing to expand with Ball Mill #4 now being installed.

North Am Gold Mining Ind. News
March 1 1985

Avino purchases former producing Minto property

92JNE075

VANCOUVER, British Columbia—The Minto group of claims, a former gold producing property located near Goldbridge, just 66 miles northeast of Vancouver, British Columbia, has been purchased by Avino Mines & Resources Ltd. The company plans a program of rehabilitation and exploration on the claims.

The mine has been developed on seven levels by some 6,000 feet of workings. Mine production between 1931 and the early 1940s totalled 83,960 tons grading 0.34 ounces of gold per ton. In 1936 the B.C. Minister of Mines Report stated that sampling of the 400 level over a length of 152 feet and across an average width of five feet assayed 1.66 ounces of gold per ton.

Avino now plans a program of rehabilitation, with geological mapping, surface VLF-electromagnetic surveys, and geochemical surveys to be followed with trenching and drilling.

There has been a considerable revival of interest in the Bralorne-Pioneer gold camp that produced more than four million ounces of gold. An extensive exploration pro-

Continued on page two

Avino Mines

NAGMIN
850301

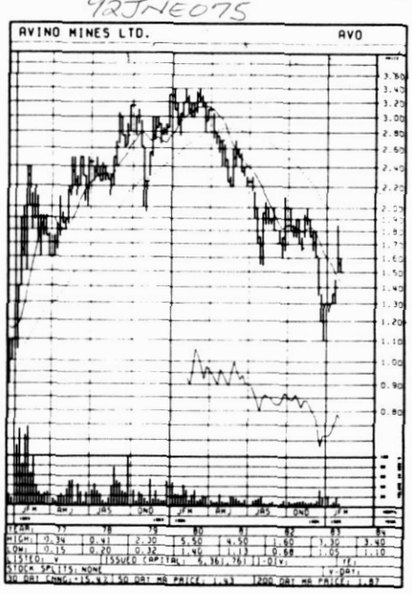
Continued from page 1

gram is now underway and is believed to hold an outstanding potential for success.

Recent new discoveries in the area by the adjoining Levon Resources, of which Avino holds a large share of interest, has attracted many major companies and work on these properties is presently underway.

As this program is getting started, Avino's mining operation in Mexico is continuing to expand with the present addition of ball mill #4 being installed. The mine is continuing at a satisfactory rate and the company hopes the price of silver will increase. A separate report on the Mexican operation is expected to be issued shortly. ⚒

92JNE075



Mines Branch Ottawa Investigations in Ore Dressing & Metallurgy
1934 Rpt 748

MINTO 092JNE075

Pulp ratio

3·43 : 1

Weight, per cent
3·7
28·2
68·1
100·0

Weight, per cent
0·5
99·5
100·0

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Ore Dressing and Metallurgical Investigation No. 589

ARSENICAL GOLD ORE FROM MINTO GOLD MINES, LIMITED, BRIDGE RIVER DISTRICT, BRITISH COLUMBIA

Shipment. A shipment of one sack of ore, net weight 100 pounds, was received June 1, 1934. The sample was submitted by Warren A. Davidson, Superintendent, Minto Gold Mines, Limited, Bridge River, British Columbia.

Characteristics of the Ore. Samples showing the more heavily mineralized portions of the ore were selected and examined microscopically to determine the metallic minerals and their modes of occurrence, and for this purpose six polished sections were prepared and examined under the reflecting microscope. In addition, the hand specimens were examined with the binocular microscope.

The gangue consists of fine-textured grey to white quartz and patches and veins of impure grey to white dolomite (or ankerite?), with inclusions of dense, fine-textured, dark grey country rock. A bright green transparent mineral occurs as fine stringers and spots in the dolomitic gangue, and this is probably mariposite.

The distribution of the metallic minerals is very erratic and spotty, and no two polished sections show quite the same mineralogical features. Much of the ore is barren of ore minerals, whereas some portions show marked concentrations of the sulphides, usually in the form of heavily mineralized stringers. In their order of abundance in the sections examined, the ore minerals present are: pyrite, arsenopyrite, pyrrhotite, stibnite, sphalerite, unknown mineral "A", tetrahedrite, chalcopyrite, native bismuth, galena (?), and native gold.

Pyrite, arsenopyrite, and pyrrhotite are locally abundant. The two former sulphides are often much shattered and brecciated, and pyrrhotite commonly invades and replaces pyrite. All three minerals have been seen to contain fine veinlets of dolomitic gangue.

Stibnite is very abundant in one section. It occurs as thick elongated crystals and groups of crystals in a dolomitic gangue, and does not appear to be associated with other ore minerals.

Sphalerite, although present in only a small amount, is rather widespread in association with the other sulphides. It occurs as small irregular grains, and invariably contains numerous tiny dots of chalcopyrite and in some places also of unknown "A" and galena (?).

Unknown "A" occurs as small irregular grains that are often isolated in the dolomitic gangue but are more rarely associated with sphalerite, tetrahedrite, and arsenopyrite. The following tests obtained on the mineral show that it is either jamesonite ($4PbS.FeS.3Sb_2S_3$) or a mineral closely allied in properties and composition.

Colour—galena-white.
Hardness—soft; B.
Crossed nicols—strongly anisotropic.
Etch tests: HNO_3—differentially iridescent to black.
KOH —slowly tarnishes brown—rubs grey.
HCl, KCN, $FeCl_3$, $HgCl_2$—negative.
Microchemical analysis: S—positive—strong.
Sb—positive—strong.
As—trace.
Bi—trace (?).
Fe—positive to trace.
Pb—doubtful—one test positive.
Co, Ni, Cu, Se, Te—nil.

Tetrahedrite occurs in very small amount as small grains associated with sphalerite, unknown "A" and galena (?). Microchemical tests failed to reveal the presence of silver in this mineral.

Chalcopyrite is very small in amount, and its only mode of occurrence is as tiny dots in sphalerite.

A very small amount of native bismuth is present as small irregular grains in pyrrhotite, and more rarely in unknown "A".

A few tiny irregular grains of a mineral closely resembling galena were seen in sphalerite and rarely in pyrite. Their identification is not positive.

Native gold was not seen in any of the polished sections. Examination of the hand specimens under the binocular microscope, however, showed a number of small flakes and grains of native gold occurring in a narrow discontinuous stringer of very dark quartz in light quartz. It is not known to what impurity the dark quartz owes its colour.

Assays show that the ore contains over two ounces of silver to the ton. No silver mineral was identified, but it is possible that such a mineral is present, or that the silver occurs in the tetrahedrite or galena (?).

Assays of the ore showed it to contain the following:

Gold	1·30 oz./ton
Silver	2·43 "
Copper	0·06 per cent
Iron	6·19 "
Arsenic	1·40 "
Lead	0·17 "
Zinc	0·70 "
Antimony	0·10 "
Sulphur	4·76 "
Insoluble	44·14 "

Experimental Tests

A series of small-scale tests was made on the ore to determine how it should be treated to recover the gold from it. The work consisted of tests by concentration, amalgamation, and cyanidation, both alone and in combination. The highest recovery obtained by flotation was 92·9 per cent of the gold in a concentrate amounting to 20·6 per cent of the weight of feed used. The average grade of the concentrate was 5 ounces gold

per ton and 9·7 per cent arsenic. By plate amalgamation 26·2 per cent of the gold was recovered. By straight cyanidation of the ore the highest extraction of the gold obtained was 87·3 per cent. This figure could not be raised appreciably by amalgamating the ore before cyanidation, or by tabling out and regrinding and re-cyaniding the sulphides.

Details of the tests follow:

GRINDABILITY TESTS

Samples of the ore, dry-crushed to pass through a 14-mesh screen, were ground in ball mills for periods of 15, 20, 25, and 30 minutes. The pulps were filtered, dried, and passed through a series of screens from 48 to 200 mesh in size. The fractions caught on each of the screens, as well as the one passing through the last screen, were weighed and the reduction in size of the ore particles determined.

The results of these tests are summarized as follows:

Weight, per cent	15-minute grinding	20-minute grinding	25-minute grinding	30-minute grinding
+ 48 mesh	0·3	.....	.....	.....
− 48+ 65 "	1·3	0·1	.....	.....
− 65+100 "	10·1	2·8	1·6	0·2
−100+150 "	16·1	8·6	6·0	2·8
−150+200 "	23·4	25·1	23·0	17·4
−200 "	48·8	63·4	69·4	79·6
Total	100·0	100·0	100·0	100·0

FLOTATION

Test No. 1

A sample of the ore was ground 69·4 per cent through 200 mesh and floated. An attempt at selective flotation was made, but owing to the small amounts of copper, lead, zinc, and antimony present, this was not practicable and the test was finished as a bulk flotation test.

Charge to Ball Mill:

Ore	2,000 grms. −14 mesh.
Water	1,500 c.c.
Soda ash	4·0 lb./ton.

Reagents to Cell:

Copper-Lead-Antimony

Sodium cyanide	0·10 lb./ton
Cresylic acid	0·07 "

Zinc

Copper sulphate	1·0 lb./ton
Sodium Aerofloat	0·10 "
Pine oil	0·025 "

Pyrite

Potassium amyl xanthate	0·10 lb./ton
Pine oil	0·025 "

6110—5½

Summary:

Product	Weight, per cent	Assay		Distribution of precious metals, per cent	
		Au, oz./ton	Ag, oz./ton	Au	Ag
Concentrate	20·6	5·0	10·85	92·9	97·6
Tailing	79·4	0·10	0·07	7·1	2·4
Feed (cal.)	100·0	1·11	2·29	100·0	100·0

Ratio of concentration—4·85 : 1.
The concentrate assayed 9·7 per cent arsenic.

Test No. 2

A sample of the ore was ground 69·4 per cent through 200 mesh and floated. In this test no attempt at selective flotation was made.

Charge to Ball Mill:

Ore	2,000 grms. —14 mesh.
Soda ash	4·0 lb./ton.
Minerec "A"	0·05 "

Reagents to Cell:

Potassium amyl xanthate	0·10 lb./ton.
Pine oil	0·10 "

Summary:

Product	Weight, per cent	Assay		Distribution of precious metals, per cent	
		Au, oz./ton	Ag, oz./ton	Au	Ag
Concentrate	15·4	7·0	14·50	78·5	93·0
Tailing	84·6	0·35	0·20	21·5	7·0
Feed (cal.)	100·0	1·37	2·10	100·0	100·0

Ratio of concentration—6·49 : 1.

PLATE AMALGAMATION AND FLOTATION

Test No. 14

A sample of the ore was ground 69·4 per cent through 200 mesh in a ball mill and then passed over an amalgamation plate. The amalgamation tailing was conditioned for 5 minutes with copper sulphate and soda ash and then floated with potassium amyl xanthate and pine oil.

Charge to Ball Mill:

Ore	2,000 grms. —14 mesh.
Water	1,500 c.c.

Reagents to Conditioner:

Soda ash	4·0 lb./ton.
Copper sulphate	1·0 "

Reagents to Cell:

Potassium amyl xanthate	0·10 lb./ton.
Pine oil	0·50 "

Summary:

Product	Weight, per cent	Assay		Distribution of precious metals, per cent	
		Au, oz./ton	Ag, oz./ton	Au	Ag
Flotation concentrates	15·0	3·46	13·86	54·0	84·5
Flotation tailing	85·0	0·52	0·45	46·0	15·5
Amalgamation tailing (cal.)	100·0	0·96	2·46	100·0	100·0

Recovery by amalgamation: (1·30-0·96) + 0·0130 = 26·2 per cent.
Recovery in flotation concentrate: (100·0-26·2) x 54 = 39·9 per cent.

FLOTATION WITH CYANIDATION OF FLOTATION TAILING

Test No. 19

A sample of the ore was ground 69·4 per cent through 200 mesh in a ball mill and floated. The flotation tailing was then agitated in cyanide solution, 2·0 pounds per ton KCN, for 24 hours. All products were assayed for gold.

Charge to Ball Mill:

Ore	2,000 grms. −14 mesh.
Water	1,500 c.c.
Soda ash	1·0 lb./ton.
Aerofloat No. 31	0·07 "

Reagents to Cell:

Potassium amyl xanthate	0·10 lb./ton.
Copper sulphate	1·0 "
Pine oil	0·10 "

Summary:

Product	Weight, per cent	Assay, Au, oz./ton	Distribution of gold, per cent	Reagents consumed, lb./ton	
				KCN	CaO
Flotation concentrate	12·4	8·12	83·3	.....	.....
Flotation tailing	87·6	0·23	16·7	.....	.....
Feed (cal.)	100·0	1·21	100·0	.....	.....
Tailing cyanided	87·6	0·12	8·0	1·9	4·25

BLANKETING AND FLOTATION

Test No. 20

A sample of the ore was ground 63·4 per cent through 200 mesh in a ball mill and then passed over a corduroy blanket set at a slope of 2·5 inches per foot. The blanket tailing was floated with the following reagents:

Soda ash	1·0 lb./ton.
Aerofloat No. 31	0·07 "
Copper sulphate	1·0 "
Potassium amyl xanthate	0·10 lb./ton.
Pine oil	0·25 "

Summary:

Product	Weight, per cent	Assay, Au, oz./ton	Distribution of gold, per cent
Blanket concentrate	9·6	10·79	67·3
Flotation concentrate	8·4	3·56	19·4
Flotation tailing	82·0	0·25	13·3
Feed (cal.)	100·0	1·54	100·0

FLOTATION AND BLANKETING

Test No. 21

A sample of the ore was ground 69·4 per cent through 200 mesh in a ball mill and floated. The flotation tailing was passed over a corduroy blanket set at a slope of 2·5 inches per foot. Samples of the blanket tailing were cyanided for periods of 24 and 48 hours. All products were assayed for gold.

Charge to Ball Mill:

Ore	2,000 grms. −14 mesh.
Water	1,500 c.c.
Soda ash	1·0 lb./ton
Sodium cyanide	0·10 "

Reagents to Cell:

Copper sulphate	1·0 lb./ton.
Potassium amyl xanthate	0·10 "
Pine oil	0·10 "

Summary:

Product	Weight, per cent	Assay, Au, oz./ton	Distribution of gold, per cent
Flotation concentrate	8·3	7·74	42·3
Blanket concentrate	6·4	9·02	38·0
Tailing	85·3	0·35	19·7
Feed (cal.)	100·0	1·52	100·0
Tailing cyanided	85·3	0·17	10·1

Test No. 22.

A sample of the ore was ground 69·4 per cent through 200 mesh in a ball mill and floated. The flotation tailing was then passed over a corduroy blanket set at a slope of 2·5 inches per foot. From this point this test differs from Test No. 21 only in the matter of the reagent combination.

Charge to Ball Mill:

Ore	2,000 grms. −14 mesh.
Water	1,500 c.c.
Soda ash	4·0 lb./ton.
Sodium cyanide	0·10 "

Reagents to Cell:

Copper sulphate	1·0 lb./ton.
Water-gas tar	0·09 "
Potassium ethyl xanthate	0·10 "
Pine oil	0·10 "

Summary:

Product	Weight, per cent	Assay, Au, oz./ton	Distribution of gold, per cent
Flotation concentrate	18·2	5·27	61·1
Blanket concentrate	5·2	10·05	33·3
Blanket tailing	76·6	0·115	5·6
Feed (cal.)	100·0	1·57	100·0

Test No. 26

A sample of the ore was ground approximately 90 per cent through 200 mesh in a ball mill and floated. The flotation tailing was then passed over a corduroy blanket set at a slope of 2·5 inches per foot. All the products were assayed for gold.

Charge to Ball Mill:

Ore	2,000 grms. −14 mesh.
Water	1,500 c.c.
Soda ash	4·0 lb./ton.
Sodium cyanide	0·2 "

Reagents to Cell:

Copper sulphate	1·0 lb./ton.
Water-gas tar	0·09 "
Potassium ethyl xanthate	0·10 "
Pine oil	0·10 "

Summary:

Product	Weight, per cent	Assay, Au, oz./ton	Distribution of gold, per cent
Flotation concentrate	17·2	4·82	68·5
Blanket concentrate	4·9	5·54	22·4
Blanket tailing	77·9	0·14	9·1
Feed (cal.)	100·0	1·21	100·0

A screen test of the blanket tailing showed it to be 87·5 per cent through 200 mesh.

Test No. 27

A sample of the ore was ground approximately 90 per cent through 200 mesh in a ball mill and floated. The flotation tailing was passed over a corduroy blanket set at a slope of 2·5 inches per foot. This test differs from Test No. 26 only in the matter of the reagent combination.

Charge to Ball Mill:

Ore	1,000 grms—14 mesh.
Water	750 c.c.
Soda ash	3·0 lb./ton.
Sodium cyanide	0·10 "

Reagents to Cell:

Barrett No. 4	0·18 lb./ton.
No. 208	0·20 "
Potassium ethyl xanthate	0·20 "
Copper sulphate	1·0 "
Pine oil	0·025 "

Summary:

Product	Weight, per cent	Assay, Au, oz./ton	Distribution of gold, per cent
Flotation concentrate	24·6	4·48	91·5
Blanket concentrate	4·5	1·34	5·0
Blanket tailing	70·9	0·06	3·5
Feed (cal.)	100·0	1·20	100·0

BLANKET CONCENTRATION

Tests Nos. 15, 16, 17, and 18

Samples of the ore were ground 48·8, 63·4, 69·4, and 79·6 per cent through 200 mesh in ball mills and passed over corduroy blankets set at a slope of 2·5 inches per foot. The products were assayed for gold.

Summary of Tests Nos. 15 to 18:

Test No.	Product	Weight, per cent	Assay, Au, oz./ton	Distribution of gold, per cent
15	Concentrate	6·5	13·78	66·9
	Tailing	93·5	0·475	33·1
	Feed (cal.)	100·0	1·34	100·0
16	Concentrate	4·9	17·355	61·9
	Tailing	95·1	0·55	38·1
	Feed (cal.)	100·0	1·37	100·0
17	Concentrate	6·2	12·84	64·4
	Tailing	93·8	0·47	35·6
	Feed (cal.)	100·0	1·24	100·0
18	Concentrate	5·2	19·425	68·7
	Tailing	94·8	0·485	31·3
	Feed (cal.)	100·0	1·47	100·0

HYDRAULIC CLASSIFICATION

Test No. 13

A sample of the ore was ground 63·4 per cent through 200 mesh and passed through a hydraulic classifier where coarse gold and heavy minerals were allowed to settle out against a slowly rising current of water. This test is intended to give some idea of the results to be expected from the use of a hydraulic trap in practice.

Summary:

Product	Weight, per cent	Assay, Au, oz./ton	Distribution of gold, per cent
Classifier oversize	4·6	14·91	54·5
Classifier overflow	95·4	0·60	45·5
Feed (cal.)	100·0	1·26	100·0

CYANIDATION

Tests Nos. 3 to 10

In this series of tests four lots of the ore were dry-crushed to pass through 48-, 100-, 150-, and 200-mesh screens, respectively. Samples of each were agitated in cyanide solution, 2·0 pounds KCN per ton, for periods of 24 and 48 hours. The tailings were assayed for gold.

Summary of Tests Nos. 3 to 10:

Test No.	Grind, mesh	Period of agitation, hours	Tailing assay, Au, oz./ton	Extraction, per cent	Reagents consumed, lb./ton ore	
					KCN	CaO
3	− 48	24	0·21	83·8	1·3	12·3
4	−100	24	0·17	86·9	2·8	13·9
5	−150	24	0·17	86·9	3·1	14·8
6	−200	24	0·165	87·3	4·6	15·5
7	− 48	48	0·215	83·5	2·4	12·5
8	−100	48	0·18	86·2	3·6	14·4
9	−150	48	0·18	86·2	4·2	15·1
10	−200	48	0·175	86·5	5·7	16·3

BARREL AMALGAMATION AND CYANIDATION

Tests Nos. 11 and 12

Samples of the ore, ground dry to pass through 48- and 100-mesh screens, respectively, were barrel-amalgamated for thirty minutes and sampled for assay. Portions of the amalgamation tailings were agitated in cyanide solution, 1·0 pounds KCN per ton, for 24 hours. The cyanide tailings were also assayed for gold.

Summary of Tests Nos. 11 and 12:

Test No.	Amalgamation tailing assay, Au, oz./ton	Cyanide tailing assay, Au, oz./ton	Total extraction, per cent	Reagents consumed, lb./ton ore	
				KCN	CaO
11	0·58	0·22	83·1	1·3	9·6
12	1·08	0·16	87·7	1·9	12·0

CYANIDATION WITH TABLING

Tests Nos. 23 and 24

In each of these tests a sample of the ore was ground approximately 80 per cent through 200 mesh in a ball mill and agitated in cyanide solution, 1·0 pound KCN per ton, for 24 hours without lime. The cyanide tailing was then sampled and assayed and the remainder of it passed over a small concentrating table. The table concentrate was reground and agitated in cyanide solution, 5·0 pounds KCN per ton, for 48 hours. All products were assayed for gold. Assays of the cyanide tailings from the ore were 0·34 and 0·185 ounce per ton in gold, respectively.

Summary of Test No. 23:

Product	Weight, per cent	Assay, Au, oz./ton	Distribution of gold, per cent	Reagents consumed, lb./ton ore	
				KCN	CaO
Table concentrate	21·1	1·04	69·9	4·2	5·25
Table tailing	78·9	0·12	30·1	.....	
Table feed (cal.)	100·0	0·31	100·0	.....	
Table concentrate cyanided	21·1	0·325	.....	.....	

Extraction by cyanidation of ore	76·2 per cent
Extraction by cyanidation of table concentrate	11·4 "
Total extraction	87·6 "

Summary of Test No. 24:

Product	Weight, per cent	Assay, Au, oz./ton	Distribution of gold, per cent	Reagents consumed, lb./ton ore	
				KCN	CaO
Table concentrate	24·6	0·46	57·7	5·75	6·25
Table tailing	75·4	0·11	42·3	.....	.....
Table feed (cal.)	100·0	0·196	100·0	.....	.....
Table concentrate cyanided	24·6	0·34	.....	.....	.....

Extraction by cyanidation of ore	85·4 per cent
Extraction by cyanidation of table concentrate	2·2 "
Total extraction	87·6 "

CYANIDATION WITH PRE-AERATION

Test No. 25

A sample of ore was ground approximately 80 per cent through 200 mesh in a ball mill and then aerated for 4 hours in a Denver super-agitator. Cyanide and lime were then introduced, and the pulp agitated in a large bottle for 24 hours.

Results:

Feed sample	Au,	1·30 oz./ton
Cyanide tailing	Au,	0·18 "
Extraction		86·2 per cent
Reagents consumed	KCN,	2·0 lb./ton ore
	CaO,	1·7 "

It will be observed that pre-aeration reduced the amount of reagents consumed, although it did not improve the extraction.

CONCLUSIONS

Although the results obtained from the tests carried out on this ore have not been particularly satisfactory, they seem to indicate two possible methods of treatment: straight cyanidation, on the one hand, and concentration by flotation and blanketing, the concentrate to be treated at a smelter, on the other.

The best extraction obtained by cyanidation of the ore was 87·6 per cent of the gold. The ore in its natural state is sufficiently alkaline to be cyanided without the addition of lime but, owing to its carbonate content, will consume 15 or more pounds of lime per ton of ore if lime be added to it. In Tests Nos. 23 and 24 the ore, ground approximately 80 per cent through 200 mesh, was agitated without lime and in each case during the ore agitation period 3·2 pounds KCN per ton of ore was consumed. In Test No. 5, with perhaps a little finer grinding, cyanide consumption was about the same but nearly 15 pounds of lime was consumed.

By aerating the pulp before it comes in contact with lime or cyanide, as in Test No. 25, cyanide consumption was reduced to 2·0 pounds per ton and lime consumption to 1·7 pounds per ton of ore with the same grinding as in Tests Nos. 23 and 24. Extraction, however, was not improved by aeration of the pulp.

As for concentration of the ore, good grade concentrates containing 90 per cent or more of the gold were made in Tests Nos. 22, 26, and 27, and if the sample received is representative of the grade of ore in the mine there should be no difficulty in producing concentrates of good shipping grade. The arsenic content of the concentrates will come within the penalty limits of 3 per cent and 15 per cent. This feature, along with a rather low ratio of concentration, detracts somewhat from the feasibility of concentrating.

It appears, therefore, in the light of results so far obtained, that the solution to the problem presented by this ore is to be found in one or other of the above-mentioned processes.

No further work on the ore was possible, because the sample received had all been used, and if any additional information is wanted a new sample will have to be sent in.

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Gold Ore from Morton Lake District, Manitoba. Two bags, weighing 50 pounds, were received August 26, 1935, containing quartz and highly silicified country rock, the quartz locally with small tourmaline needles, and, in order of abundance, arsenopyrite, pyrrhotite, marcasite, chalcopyrite, and native gold, the last less than 1100 mesh and enclosed in dense arsenopyrite. The assay was 0·12 ounce of gold per ton, 0·47 per cent of arsenic, and a trace of copper.

Amalgamation recovered only about 50 per cent of the gold, but after grinding to 75 per cent through 200 mesh cyanidation extracted over 90 per cent.

Gold Ore from O'Neill Thompson Gold Mines, Limited, Joanne Township, Témiscamingue County, Quebec. Seven sacks, weighing 460 pounds, were received August 12, 1935, containing pinkish grey feldspathic rock with quartz and veinlets of carbonate. Pyrite and arsenopyrite are abundant. The assay was 0·27 ounce of gold per ton.

Amalgamation recovered 57·4 per cent of the gold. Cyanidation extracted over 90 per cent, when grinding was 90 per cent through 200 mesh, the tailing concentrated on tables and the concentrate reground and re-treated in cyanide. Grinding to 70 per cent through 200 mesh gave equally good recoveries.

Gold-bearing Concentrate from Minto Gold Mines, Limited, Bridge River District, British Columbia. A shipment of 50 pounds received September 6, 1935, assayed: gold 2·71 ounces and silver 5·11 ounces per ton; arsenic 16·27 per cent, antimony 0·52, zinc 1·29, iron 36·86, silica 2·8, sulphur 33·34 pr cent, and no lime.

After roasting at low heat until arsenic was driven off and grinding the calcine wet, an extraction of 83·6 per cent of the gold and 63·3 per cent of the silver was obtained by cyanidation for 48 hours, with 1 : 3 dilution and a solution having 3 pounds of potassium cyanide per ton; 5 pounds of lime per ton being added for protective alkalinity.

Arsenical Gold Ore from Thompson Cadillac Mining Corporation, Limited, Cadillac Township, Abitibi County, Quebec. Five bags, weighing 348 pounds, were received July 18, 1935, containing siliceous gangue with sulphides of iron and arsenic. The assay was 0·35 ounce of gold per ton and 2·75 per cent of arsenic.

Cyanidation recovered 44 per cent of the gold; amalgamation shows that only 27 per cent is free when the grinding was −100 mesh. Flotation recovered 96·9 per cent with a concentration ratio of 4·6 : 1. Flotation followed by cyanidation of the roasted concentrate gave a total recovery of 83·9 per cent.

Gold-bearing Tailing from San Antonio Gold Mines, Limited, Bissett, Manitoba. One can of wet mill tailing and one bottle of cyanide solution were received on October 8, 1935, for investigation of cause of increased tailing losses.

The mill is probably operating on too great a tonnage, which should be reduced for observation before adding agitators or grinding equipment. The cyanide solution showed some reducing salts; aeration of the barren solution before re-entering the circuit might oxidize these.

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III

INVESTIGATIONS THE RESULTS OF WHICH ARE SYNOPSIZED

Gold Ore from the Holdsworth Mining Co., Ltd., Township 28, Range 24, Algoma West, Ontario. A shipment of 320 pounds was received June 15, 1936, and consisted of chalcopyrite, pyrite, sphalerite, and galena in a quartz gangue. It assayed 0·39 ounce of gold and 0·12 ounce of silver per ton, and 0·02 per cent of copper.

Good extraction was obtained when the coarse gold was removed by trap or blanket and amalgamated and the residue cyanided.

Flotation Concentrate from Minto Gold Mines, Ltd., Bridge River District, British Columbia. A shipment, 30 pounds, was received March 27, 1936, and assayed 3·04 ounces of gold and 5·40 ounces of silver per ton; and percentages of arsenic 10·95; antimony 0·68; lead 0·9; zinc 3·4; copper 0·18; iron 27·6; sulphur 26·2; insoluble 21·34; lime 1·72; and a trace of magnesia.

Cyanidation after fine grinding and a short leach with dilute acid extracted about 80 per cent of the gold. Oxidizing, roasting, grinding with iron balls for one hour, and leaching with cyanide gave 90 per cent. Roasting with addition of salt, grinding for one hour, and leaching with cyanide gave 95 per cent of the gold and extracted 66 per cent of the silver.

On November 23, 1936, 110 pounds was received, assaying 1·24 ounces of gold and 8·64 ounces of silver per ton; percentages of arsenic 9·32; antimony 0·89; iron 28·13; copper 0·21; lead 0·96; zinc 3·15; bismuth nil; silica 15·08; lime 1·10; magnesia 6·65, and sulphur 27·29.

Cleaner concentrate was made carrying 2·26 ounces of gold per ton and a middling product 0·67 ounce. Cyanidation of the middling gave a tailing about the same as that from cyanidation of original bulk concentrate. It was impossible to concentrate the refractory gold in the cleaner concentrate.

Arsenical Gold Ore from the Cameron Island Mine, Duport Mining Co., Ltd., Shoal Lake, Ontario. A shipment of 780 pounds was received on June 9, 1936, being similar to that described in Investigation 440, M.B. Report 736, 1932. It assayed 0·79 ounce of gold and 0·17 ounce of silver per ton; arsenic 2·41 per cent; iron 10·24 per cent and sulphur 6·95 per cent.

The tailing from a blanket concentration was concentrated on a table, the concentrate being screened into four sizes, each tabled separately and a small high-grade concentrate taken, representing about 0·25 per cent of product treated. This assayed 12·41 ounces of gold per ton and 14·35 per cent of arsenic. The blanket concentrate was about 1·24 per cent and assayed 19·88 ounces of gold per ton and 5·47 per cent of arsenic. This represents a recovery of 35 per cent of the gold in the ore.

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Ore Dressing and Metallurgical Investigation No. 710

ORE AND CONCENTRATE FROM THE MINTO GOLD MINES, LIMITED, BRIDGE RIVER DISTRICT, BRITISH COLUMBIA

Shipment. A number of parcels of ore, concentrate, and tailing were received at different times, for tests, from the Minto Gold Mines, Limited, Bridge River district, British Columbia. The present investigation is a summary and discussion of the whole.

(1) A shipment of one sack of ore, net weight 100 pounds, was received on June 1, 1934. The sample was submitted by Warren A. Davidson, Superintendent, Minto Gold Mines, Limited.

(2) One bag of concentrate weighing 50 pounds was received on September 6, 1935, from the Minto Gold Mines, Ltd., per J. A. MacKenzie.

(3) Two bags of gold ore weighing 190 pounds were received on November 22, 1935, and a box containing 10 pounds of mill tailing arrived four days later. These were forwarded by J. A. MacKenzie, for the Minto Gold Mines, Ltd.

(4) One bag of concentrate weighing approximately 30 pounds was received on March 27, 1936, from the Minto Gold Mines, Ltd. The sample was submitted by W. Asselstine, Consulting Engineer for the company.

(5) One bag of concentrate weighing approximately 110 pounds was received on November 23, 1936.

One bag of ore weighing approximately 202 pounds was received on November 23, 1936.

(6) One bag of ore weighing 110 pounds was received on March 16, 1937. The sample was submitted by A. W. Holloway.

Characteristics of Samples:

Shipment No. 1. Samples showing the more heavily mineralized ore were selected and examined microscopically to determine the metallic minerals and their modes of occurrence, six polished sections being prepared and examined under the reflecting microscope. In addition the hand specimens were examined with the binocular microscope.

The gangue consists of fine-textured grey to white quartz and patches and veins of impure grey to white dolomite (or ankerite?), with inclusions of dense, fine-textured, dark grey country rock. A bright green transparent mineral occurs as fine stringers and spots in the dolomitic gangue, and this is probably mariposite.

The distribution of the metallic minerals is very erratic and spotty, and no two polished sections show quite the same mineralogical features. Much of the ore is barren of ore minerals, whereas some shows marked concentration of the sulphides, usually in the form of heavily mineralized

stringers. In their order of abundance in the sections examined, the ore minerals are: pyrite, arsenopyrite, pyrrhotite, stibnite, sphalerite, unknown mineral "A", tetrahedrite, chalcopyrite, native bismuth, galena(?), and native gold.

Pyrite, arsenopyrite, and pyrrhotite are locally abundant. Pyrite and arsenopyrite are often much shattered and brecciated, and pyrrhotite commonly invades and replaces pyrite. All three minerals have been seen to contain fine veinlets of dolomitic gangue.

Stibnite is very abundant in one section. It occurs as thick elongated crystals and groups of crystals in a dolomitic gangue, and does not appear to be associated with other ore minerals.

Sphalerite, although present only in small amount, is rather widespread in association with the other sulphides. It occurs as small irregular grains, and invariably contains numerous tiny dots of chalcopyrite and in some places also of unknown "A" and galena(?).

Unknown "A" occurs as small irregular grains, often isolated in the dolomitic gangue but more rarely associated with sphalerite, tetrahedrite and arsenopyrite. The following results of tests on the mineral show that it is either jamesonite ($4PbS.FeS.3Sb_2S_3$) or a mineral closely allied in properties and composition.

Colour:	Galena-white.
Hardness:	Soft; B.
Crossed nicols:	Strongly anisotropic.
Etch tests:	HNO_3—differentially iridescent to black.
	KOH—slowly tarnishes brown—rubs grey.
	HCl, KCN, $FeCl_3$, $HgCl_2$—negative.
Microchemical analysis:	S —positive—strong.
	Sb—positive—strong.
	As—trace.
	Bi—trace (?).
	Fe—positive to trace.
	Pb—doubtful—one test positive.
	Co, Ni, Cu, Se, Te—nil.

Tetrahedrite occurs in very small amount as small grains associated with sphalerite, unknown "A" and galena(?). Microchemical tests failed to reveal the presence of silver in this mineral.

Chalcopyrite is very small in amount, and its only mode of occurrence is as tiny dots in sphalerite.

A very small amount of native bismuth is present as small irregular grains in pyrrhotite, and more rarely in unknown "A".

A few tiny irregular grains of a mineral closely resembling galena were seen in sphalerite and rarely in pyrite. Their identification is not positive.

Native gold was not seen in any of the polished sections. Examination of the hand specimens under the binocular microscope, however, showed a number of small flakes and grains of native gold occurring in a narrow discontinuous stringer of very dark quartz in light quartz. It is not known to what impurity the dark quartz owes its colour.

Shipment No. 2. This sample apparently represents a table concentrate made from a flotation concentrate, and contains 35 per cent of arsenopyrite, 50 per cent of pyrite, with small amounts of sphalerite, stibnite, etc., and less than 10 per cent of gangue material.

No microscopic examination was made.

Shipment No. 3. The constituents recognized in this sample of mill tailing are: gangue, pyrite, arsenopyrite, stibnite, sphalerite, chalcopyrite, and pyrrhotite.

A microscopic examination of polished sections of the gold ore showed that the shipment is similar in mineral-bearing character to the ore previously examined (Shipment No. 1). Two tiny grains of native gold are visible in the sections, both in dense pyrite and measuring 35 and 3 microns (400 and 2300 mesh).

Shipment No. 4. This represents a flotation concentrate, containing 24 per cent of arsenopyrite, 40 per cent of pyrite, with some sphalerite, stibnite, etc., and 25 to 30 per cent of gangue.

Shipment No. 5. This concentrate sample represents a low-grade flotation concentrate, containing 20 per cent of arsenopyrite, 40 per cent of pyrite, with some sphalerite, stibnite, etc.

The sample of ore sent with this shipment is apparently of somewhat lower grade than that employed for regular mill feed.

Shipment No. 6. This ore appears to be similar in general mineral characteristics to samples previously submitted.

Analyses of Samples:

Shipment No. 1. The analysis of this ore sample is as follows:

Gold	1·30 oz./ton	Silver	2·43 oz./ton
Arsenic	1·40 per cent	Copper	0·06 per cent
Iron	6·19 "	Lead	0·17 "
Sulphur	4·76 "	Antimony	0·10 "
Zinc	0·70 "	Insoluble	44·14 "

Considering the later results obtained in mine development, this sample is not at all representative of the average mill feed.

Shipment No. 2. This concentrate sample showed:

Gold	2·71 oz./ton	Silver	5·11 oz./ton
Arsenic	16·27 per cent	Copper	Not determined
Iron	36·86 "	Lead	"
Sulphur	33·34 "	Antimony	0·58 per cent
Zinc	1·29 "	Silica	2·80 "

Shipment No. 3. The mill tailing of this shipment showed:

Gold	0·0825 oz./ton
Silver	0·57 "

Metallic constituents not determined.

The gold ore sample showed on analysis:

Gold	0·305 oz./ton	Silver	1·54 oz./ton
Arsenic	2·56 per cent	Copper	Not determined
Iron	Not determined	Lead	0·12 per cent
Sulphur	"	Antimony	0·21 "
		Zinc	0·65 "

Shipment No. 4. This concentrate showed:

Gold	3·04 oz./ton	Silver	5·40 oz./ton
Arsenic	10·95 per cent	Copper	0·18 per cent
Iron	27·60 "	Lead	0·90 "
Sulphur	26·20 "	Antimony	0·68 "
Zinc	3·40 "	Insoluble	21·34 "
Lime (CaO)	1·72 "	Magnesia	Present.

Shipment No. 5. The sample of concentrate of this shipment assayed as follows:

Gold	1·24 oz./ton	Silver	8·64 oz./ton
Arsenic	9·32 per cent	Copper	0·21 per cent
Iron	28·13 "	Lead	0·96 "
Sulphur	27·29 "	Antimony	0·89 "
Zinc	3·15 "	Silica	15·08 "
Lime	1·10 "	Magnesia	6·66 "

The ore sample showed on analysis:

Gold	0·105 oz./ton	Silver	0·88 oz./ton
Arsenic	1·02 per cent	Copper	0·01 per cent
Iron	5·66 "	Lead	0·13 "
Sulphur	3·00 "	Antimony	0·12 "
Zinc	0·15 "	Insoluble	46·34 "
Lime (CaO)	9·27 "	Magnesia	9·82 "
Alumina	9·35 "	Bismuth	Nil

Shipment No. 6. This ore showed:

Gold	0·415 oz./ton
Silver	0·59 "

Experimental Tests

*Shipment No. 1

Assay:

Gold	1·30 oz./ton
Silver	2·43 "

Concentration Tests

Flotation. A recovery of 92·9 per cent was made in a concentrate weighing 20·6 per cent of the feed. The concentrate assayed 5·0 ounces of gold per ton and the tailing, 0·10 ounce of gold per ton.

Amalgamation. By plate amalgamation the recovery was 26·2 per cent of the gold content. By barrel amalgamation the recovery was 56 per cent of the gold content.

Cyanidation. Grinding to −100 mesh, an extraction of around 87 per cent was obtained, with an average tailing of 0·175 ounce gold per ton.

Flotation with Cyanidation of Tailing. A flotation concentrate weighing 12·4 per cent of the feed and assaying 8·12 ounces of gold per ton recovered 83·3 per cent of the gold content. The flotation tailing at 0·23 ounce of gold was cyanided and a final tailing of 0·12 ounce of gold obtained. The cyanide extraction was 8 per cent and the total recovery 91·3 per cent. (Test No. 19.)

Flotation and Blanketing. The average of three tests showed a recovery by flotation and blanket concentration of 93·9 per cent of the gold. The flotation concentrate assayed from 4·48 to 5·27 ounces of gold per ton, with tailing of 0·06 ounce to 0·14 ounce. The combined concentrates comprised 22 to 29 per cent of the feed. (Tests Nos. 22, 26, 27.)

*Details of the test work on this shipment will be found in Invest. No. 589: Ore Dress. and Met., July-December 1934, Mines Branch, Dept. of Mines, Rept. 748, pp. 61-71 (1935).

Shipment No. 2

Cyanidation. Straight cyanidation on −200-mesh concentrate gave 67·2 per cent extraction and a tailing of 0·89 ounce of gold per ton.

Cyanidation after pre-treatment with caustic soda and aluminium to break up antimony minerals gave an extraction of 55 per cent of the gold and a 1·22-ounce tailing.

Roasting Concentrate and Cyaniding Calcine. Roasting concentrate at low heat, grinding wet and filtering, and cyaniding ground calcine gave an extraction of 83·6 per cent of the gold and a tailing of 0·78 ounce.

Shipment No. 3

Mill Tailing

Assay:

Gold	0·0825 oz./ton
Silver	0·57 "

Flotation. In Test No. 1, flotation on a sample ground 65 per cent −200 mesh recovered 21·3 per cent of the gold in 4·03 per cent of the feed as a concentrate assaying 0·45 ounce of gold per ton. The tailing was 0·07 ounce per ton. In Test No. 2, flotation on a sample ground 90·7 per cent −200 mesh recovered 25·1 per cent of the gold in 3·87 per cent of the feed as a concentrate assaying 0·54 ounce of gold per ton. The tailing was 0·065 ounce per ton.

A grain analysis of the sulphides showed:

75 per cent by volume	− 400 mesh
48 " "	− 800 "
32 " "	−1100 "
17 " "	−1600 "
8 " "	−2300 "

89 per cent of the sulphides are free.
11 per cent of the sulphides are combined with gangue.

In the flotation concentrate no free gold was observed in Test No. 1, and two grains about 60 microns long and 6 to 8 microns in thickness were observed in the concentrate of Test No. 2.

Ore Sample

Assay:

Gold	0·305 oz./ton
Silver	1·54 "

Cyanidation. Several variations of the cyanide process were tried, with best results obtained on −100-mesh grind, the average extraction being 65·6 per cent with a tailing averaging 0·105 ounce of gold per ton.

Flotation. Grinding 91 per cent −200 mesh and floating, a concentrate weighing 20·3 per cent of the feed and assaying 1·39 ounces of gold per ton with a recovery of 93·4 per cent was obtained. The tailing assayed 0·025 ounce per ton.

Roasting Concentrate and Cyaniding Calcine. A quantity of concentrate was floated for roasting. The concentrate assayed 1·80 ounces of gold per ton and 9·36 ounces of silver per ton, copper 0·24 per cent, arsenic 6·07 per cent, lead 0·61 per cent, antimony 1·48 per cent, and zinc 2·55 per cent.

The concentrate was dead-roasted and water-washed. Analysis showed: gold 2·33 ounces per ton, silver 12·97 ounces per ton, copper 0·29 per cent, arsenic 0·60 per cent, lead 1·02 per cent, antimony 0·66 per cent, and zinc 2·80 per cent.

Cyanidation. Samples of the water-washed calcine were reground and cyanided. The gold extraction was 62·7 per cent and the silver 64·2 per cent.

Shipment No. 4

Assay:

Gold	3·04 oz./ton
Silver	5·4 "

Cyanidation. The concentrate was acid-washed with warm acid solution, water-washed, and cyanided. Cyaniding after a 45-minute grind gave a gold extraction of 68·12 per cent, and cyaniding after a 2-hour grind gave a gold extraction of 81·2 per cent. The tailing assays were 1·02 ounces and 0·56 ounce respectively.

Roasting Concentrate and Cyaniding Calcine. A series of tests, comprising 11 roasts of varying procedure with 28 cyanide tests of the calcines was made, and furnished some interesting results. Oxidizing roasting with 30-minute wet grinding and cyanidation with lime as protective alkali gave results of about 60 per cent extraction of gold. Neutral pulps gave extractions up to 83 per cent. One-hour grinding of the calcine increased the extraction to around 90 per cent.

Roasting with an addition of salt to the charge with one-hour grinding resulted in a further increase in extraction to 95 per cent. By passing the calcine over a blanket some 35 per cent of the gold is removed in a very high-grade concentrate.

The lowest tailing obtainable was 0·19 ounce per ton.

The highest silver extraction was 66 per cent and was obtained in a chloridizing roast test.

Shipment No. 5

Concentrate

Assay:

Gold	1·24 oz./ton
Silver	8·64 "

Purpose of Test. The purpose of the test work on this shipment was to determine if the middling product from floating the reground concentrate could be satisfactorily cyanided.

In refloating, a concentrate assaying 2·26 ounces of gold per ton was obtained with a middling assaying 0·67 ounce per ton, the ratio of concentration being 3·36 : 1.

Cyanidation of the middling gave a cyanide tailing of 0·45 ounce per ton. Cyanidation of the concentrate resulted in a cyanide tailing of 0·425 to 0·465 ounce per ton, showing an extraction of 65·7 to 62·5 per cent.

Roasting the concentrate and cyaniding the calcine after a short grind gave 80 per cent cyanide extraction.

Roasting with addition of salt improved extraction 5 per cent, and it is possible that longer grinding would result in a still higher cyanide extraction as in earlier test work.

Assay: *Ore Sample*

Gold	0·105 oz./ton
Silver	0·88 "

This sample is much lower than the reported grade feed to mill.

Using caustic soda in place of sodium carbonate in flotation resulted in a cleaner higher grade concentrate and an increased recovery. A composite synthetic sample was prepared from this ore sample and the concentrate to give a 0·3 ounce of gold feed.

Comparative tests with soda ash and caustic soda showed a higher concentration and a higher recovery in favour of the latter.

Assay: **Shipment No. 6**

Gold	0·415 oz./ton
Silver	0·59 "

Purpose of Tests. The purpose of the test work on this sample was to determine the maximum cyanide extraction obtainable. Recent tests on concentrate carried out by a neighbouring mill reported an extraction of slightly over 80 per cent of the gold.

Cyanide Tests. Cyanide tests on various sizes of the ore and under varying conditions were conducted. On 24-hour tests, grinding to −48 mesh, the gold extraction was 71 per cent; on −200-mesh material the extraction was 77 to 78 per cent. Cyaniding for 48 hours −48-mesh material showed 77 per cent extraction and −200 mesh 80·7 per cent extraction. The cyanide consumption on 24-hour −200-mesh material was 2·82 pounds of potassium cyanide per ton and on the 48-hour −200-mesh, 3·48 pounds of potassium cyanide per ton.

The fouling of the cyanide solution resulted from the formation of thiocyanate, ferrous salts, and copper salts.

Amalgamation. A barrel-amalgamation test showed a recovery of 53 per cent of the gold on a sample ground 63 per cent −200 mesh.

DISCUSSION

From the microscopic examinations of the various samples submitted it is apparent that the metallic minerals and the modes of their occurrence are fairly consistent. The distribution of the metallic minerals is, however, somewhat erratic and spotty. The principal minerals in their order of

abundance are: pyrite, arsenopyrite, pyrrhotite, sphalerite; with much lesser quantities of stibnite, tetrahedrite, chalcopyrite, native bismuth, an unknown mineral somewhat resembling jamesonite, and a mineral resembling galena. The gangue consists of quartz, siliceous rock, dolomite, and possibly other carbonates. Free native gold has been observed in an occasional hand specimen and also in two microscopic sections, and from the test work it is evident that the amount of free gold is variable.

The mode of occurrence of the silver has not been determined, nor has the silver mineral been isolated or identified.

The chemical analyses made of the various samples confirm the observations made above as to mineral occurrence and distribution.

The erratic and spotty nature of the mineral distribution and the varying and irregular occurrence of free native gold increase the difficulty of arriving at any definite conclusion as to the best mode of treatment to be employed, or as to the recoveries that can be maintained. The ore is not completely amenable to cyanidation, as a substantial proportion of the gold is locked up in the sulphides. Results of tests of various shipments have shown extractions ranging from 65 to 80 per cent of the gold by straight cyanidation.

The alternative, therefore, becomes one of concentration of the mineral constituents of the ore to produce a product having a value that will permit shipment to a smelter or treatment at site by means of roasting followed by cyanidation of the calcine. Laboratory tests have shown that 92 to 93 per cent of the precious metals can be obtained in a concentrate weighing about 20 per cent of the feed.

The grade (in gold) of this concentrate varies according to the grade of ore feed. For instance, on Shipment No. 1, with a feed of 1·30 ounces of gold per ton, a concentrate was obtained carrying 5·0 ounces of gold per ton, a recovery of 93 per cent; in Shipment No. 3, with an 0·30 ounce per ton feed, a concentrate carrying 1·39 ounces of gold per ton, a recovery of 93·4 per cent, was obtained; and in Shipment No. 5, with a feed of 0·105 ounce of gold per ton a concentrate carrying 0·54 ounce of gold, a recovery of 80 per cent, was obtained.

From the test work it may be deduced that with an ore feed around 0·5 ounce of gold per ton there would be no great difficulty in producing a primary concentrate carrying over 2 ounces of gold, with a reasonable recovery from the ore. With an ore feed between 0·2 ounce and 0·4 ounce of gold, a primary concentrate carrying less than 2 ounces of gold would be obtained, and with a feed below 0·2 ounce the concentrate would be under 1 ounce.

Recleaning the low-grade concentrate appears to be practical to obtain a shipping grade (over 2 ounces) of concentrate, but the greater the extent of recleaning the lower the recovery is likely to be. It is evident that the gold occurs as free native gold of varying sized particles and as gold locked in arsenopyrite and pyrite. The ore of higher grade probably carries proportionately more of the free gold than that of lower grade.

In the ores of Shipments Nos. 1 and 5 the ratio of pyrite to arsenopyrite is about 2 : 1. The ore sample of Shipment No. 3 was not fully analysed. In the sample of the concentrate of Shipment No. 5 the ratio of

pyrite to arsenopyrite is similar; in Shipment No. 4 the ratio is 1·7 : 1, and in Shipment No. 2, which was a table concentrate, the ratio is not comparable.

Examination of the mill tailing sample in Shipment No. 3, by microscopic measurement of the sulphides, shows 48 per cent of the sulphides of a size −800 mesh, 32 per cent −1100 mesh, 17 per cent −1600 mesh, and 8 per cent −2300 mesh. It is estimated that 89 per cent of the sulphides occurring are free, with 11 per cent combined with gangue.

Flotation tests on this tailing, grinding to over 90 per cent −200 mesh, showed a recovery of only 25 per cent of the gold. The tailing dropped from 0·083 ounce to 0·065 ounce after re-treatment. Analysis of the final tailing was not made, but it was obvious that it contained sulphide minerals.

Treatment of the tailing with aqua regia, which dissolves the sulphides and gold contained therein, left a tailing assaying less than 0·01 ounce of gold. This indicates that a very minor proportion of the gold is contained in quartz or other gangue, and the non-recoverable gold is probably locked up in the very fine sulphides, which, being probably attached to gangue matter, may explain the difficulty in getting them to float. Even were they free, their fineness (−1100 mesh and under) would militate against their easy flotation. The conclusion is therefore that the tailing loss (in gold) will be governed by the amount of fine non-floatable sulphide in the ore feed. The maximum recovery should also be obtained at the finest practicable grinding. Talc in the ore increases the difficulty of obtaining a clean concentrate and also may have some effect (such as forming a coating of slime on fine sulphides) that decreases the flotability of the finer sulphides.

In recent test work on the ore sample of Shipment No. 5 the recovery by flotation was improved by some 5 per cent by using caustic soda instead of soda ash in the flotation. It is suggested that this procedure be tried in present plant operations.

Roasting the concentrate and cyaniding the calcine showed extraction up to 95 per cent of the gold. The latter figure was obtained by the special procedure of roasting with salt and grinding the calcine extremely fine. This procedure tends to improve the silver extraction also.

In following this procedure, however, it would be necessary to determine gold losses by volatilization, mechanical dusting, etc. Such losses will be governed by the type of roasting plant used and conditions pertaining thereto, and can not be determined with any accuracy under laboratory-scale conditions.

On Ore Sample (6) attention was directed entirely to the possibility of direct cyanidation, as requested by the company. The results indicated a maximum extraction of 80·7 per cent of the gold, but the cyanide consumption was high with excessive fouling of the solution. Amalgamation of this sample indicated, on a medium to fine grind, that 53 per cent of the gold was recoverable, so that at least 60 per cent of the gold content in this sample is in the nature of free gold.

CONCLUSIONS

The difficulties associated with the treatment of this ore have been outlined above. The determining factor as to the most profitable mode of treatment depends upon the amount of free gold present in the ore.

A gold recovery of 92 per cent can be made by flotation, provided an ore feed averaging 0·4 ounce is procurable. With lower grade feed, necessitating recleaning of the concentrate, the recovery should be somewhat lower. The concentrate from flotation is not necessarily amenable to cyanidation, results varying according to the free gold content.

Roasting the concentrate and cyaniding the calcine gave a possible gold recovery of over 90 per cent on the calcine under special roasting and grinding conditions. With this procedure attention should be paid to possible losses through volatilization and dusting.

The possibility of direct cyanidation has received attention. Ore Sample (6), representing the latest feed ore, gave on direct cyanidation an extraction of 80 per cent of the gold. This is more promising and economical than floating a concentrate and shipping it to a smelter, or floating a concentrate, roasting, and cyaniding the calcine.

Direct cyanidation of the ore, however, involves high chemical consumption and entails the discarding of barren solution to obtain the maximum extraction of gold.

MAHOGANY MINERALS RESOURCES LTD.(MOY-V) GOLDSIL RESOURCES LTD.(GOO-V)

OWERSHIP REVIEWED - Geoff H.Burrill, president of Mahogany Minerals Resources Inc. has reported that following a number of recent changes there are now 2,739,077 shares issued of which 44.3% are held by Goldsil Resources Ltd. Until recently Goldsil had held 68% of the issued shares of Mahogany. Goldsil also holds an option to purchase a further 441,176 treasury shares of Mahogany at 46¢ each until May 3,1985. (See reviews of the exploration results on the Mahogany property at Star Lake, 140 km north of LaRonge, northern Saskatchewan.

Mr.Burrill stated that the testing program is continuing on the property with trenching and sampling and that all of the flow-through funds of $266,000 raised in Dec.1984 will have been spent within the required time in March 1985. Additional funds with which to continue exploration are being sought through both flow through and equity fundings.

B.C. MINISTRY OF ENERGY, MINES AND PETROLEUM RESOURCES

OIL/GAS RIGHTS SALE RAISED $6,000,000 - The January sale of oil and gas rights by the Ministry of Energy, Mines and Petroleum Resources has added a total of $6,080,315 to provincial revenue. Competitive bidding generated a tender bonus of $5,924,160 with a further $156,155 received as statutory fees and rents. 71 parcels were offered, covering 50,812 hectares. Bids were accepted for 63 parcels totalling 47,392 hectares. The average price was $125.00 per hectare.

Bonus bids on the two permit parcels offered, covering 13,980 hectares, were accepted for a total of $630,615 The highest price was $51.13 per hectare by Westcoast Petroleum Ltd. with a bid of $478,730 for a parcel located 70 Km south of Fort St.John. The average price per hectare was $45.10.

Bids on seven of eight drilling licences offered, covering 23,345 hectares, were accepted for a bonus total of $2,410,956. Highest price was $177.11 per hectare in a $418,885 bid by Shell Canada Resources Limited for a parcel 160 Km NE of Fort Nelson. Average price per hectare was $103.27.

Out of 61 lease parcels offered, 54 parcels covering 10,067 hectares were picked up, with bonus bids totalling $2,882,588. Highest price per hectare was $1,444.44 by Silverton Resources Ltd. with a bid of $102,555 for a lease located 70 Km north of Fort St. John. Average price per hectare for lease parcels was $286.34.

The next disposition of oil and gas rights will be held on 13Mar85 with one permit, three drilling licences and 71 leases being offered.

NU PACIFIC RESOURCES LTD.(NEP-V)

OIL/GAS INTERESTS SOUGHT - K.L. Hall, president, reports that Nu Pacific Resources Ltd. have dropped their option on 5 mineral claims, the Mak Sikkar properties, in Osoyoos mining division, B.C., as recommended by thier geologist following disappointing results from assaying samples taken last September.

Mr. Hall says Nu Pacific are now directing their investment interests towards oil and gas properties. They are currently seeking a joint venture drilling proposal from Intensity Resources Ltd. of Calgary and an option to buy an interest in producing gas wells in the Cisco Dome field in eastern Utah in the area operated by NP Energy Inc., of Houston, Texas. The investment in either of these opportunities would be in the $250,000 to $500,000 range.

U.S. PRECIOUS METALS, INC.(USP-V) BAKER GOLD LTD.(BKG-V)

AMALGAMATION PLANNED - Amalgamation of U.S. Precious Metals, Inc. and Baker Gold Ltd. will be proposed at their annual meetings at 10 and 11a.m. respectively, on 22Feb85 in the 5th floor boardroom at 535 Howe St., Vancouver. The proposal is for one share of the amalgamated company to be exchanged for each of the 4,352,751 outstanding shares of U.S. Precious Metals and one share of the amalgamated company for each of the 2,967,128 outstanding common shares of Baker. Thus, the new company would then have a total of 7,319,879 common shares outstanding.

The proposed authorized capital of the amalgamated company is 50,000,000 shares without par value divided into 30,000,000 common shares and 20,000,000 preferred shares issuable in series.

Head office will be on the 6th floor, 535 Howe St. Vancouver, and the registered office at 1900-1030 W. Georgia St., Vancouver.

U.S. Precious Metals' balance sheet as at 31Dec84 indicated working capital of $1,368,048 and this reflected, in part, $660,700 represented by a note receivable from an affilite which is not identified. Baker had working capital of $1,051,510 at 31Dec84 and this reflected, as to $808,238, a loan receivable from California Silver Ltd. The principal amount of this loan, under a 4July83 agreement, was $660,700; California Silver issued shares in place of interest in the first 6 months, whereafter the notes bore interest at 24% per year.

The first directors of the amalgamated company would be David Reesor, president; Jacques Barbeau, Henning Brasso and David Griffith, vice president exploration. All are of the Vancouver area.

A note to a proforma balance sheet of the amalgamated company shows a holding of 1,963,250 shares of California Silver, being 23.5% of those outstanding and representing effective control of that company.

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* AVINO MINES & RESOURCES LTD.(AVO-V)

BRALORNE GOLD CAMP ENTERED - Avino Mines & Resources Ltd. president, Louis Wolfin has announced the purchase of the formerly producing Minto Group of claims, located near Goldbridge, just 110 km northeast of Vancouver, B.C.

The mine has been developed on seven levels by some 6,000 feet of workings. Mine production between 1931 and the early 1940's totalled 83,960 tons grading 0.34 oz.gold per ton. In 1936, the B.C. Minister of Mines Report stated that sampling of the 400 level over a length of 152 feet and across an average width of 5 feet, assayed 1.66 oz. gold per ton.

Avino now plans a program of rehabilitation, with geological mapping, surface VLF - electromagnetic surveys and geochemical surveys to be followed by trenching and drilling.

There has been a considerable recent revival of interest in the Bralorne-Pioneer Gold Camp. Recent new discoveries in the area by the adjoining Levon Resources, in which Avino holds a large share interest, has attracted many major companies and work on these properties is presently underway.

As this program is getting underway, the mining operation in Mexico is continuing to expand with Ball Mill #4 now being installed.

FOR THE RECORD

FUTURTEK COMMUNICATIONS INC.(FTK-V) have had 858,500 B warrants exercised to buy 429,250 common shares for $197,455. As a result, there are now 14,434,586 common shares outstanding and 858,500 C warrants that expire 28July85. Each 2 C warrants are exercisiable to buy one common share for 52¢.

MAPLE VALLEY EXPLORATIONS LTD.(MVE-V) directors, following a change of control, are Messrs. James Barnes; Dana Fraser, president; and David Melvin, secretary, replacing Douglas parent, Vook Look Phang and Guan Heng Neoh who have resigned.