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THE GEOLOGY OF THE NORTHERN GEM MINE, NEAR MINTO, B. C.

INTRODUCTION

This account is based on three days that I recently spent at the Northern Gem Mine mapping and studying the underground wor surface exposures and diamond drill cores.

Mr. A. R. Allen kindly acted as a guide to the surface showi while Mr. H. Shuttleworth facilitated the work in every way and assisted me in making a brunton and tape survey of the three level

SUMMARY

The ore-bodies of the Northern Gem Mine although small appear to be more continuous than previous descriptions would imply and they are remarkably rich in cobalt, gold and uranium so that a relatively large profit could be realised from a mill of only say twenty tons per day. This statement assumes that:

1. Development continues to find further ore as can be expected from the geological conditions.
2. Test work finds a suitable process for extracting the cobalt The absence of nickel and copper should make treatment simpler than it is for most cobalt ores.

GENERAL

Three previous reports are available for reference:

1. In 1940 C. C. Starr made a favourable report on the Little Gem as it was then known.
2. A lengthy report was made in the B. C. Minister of Mines Report for 1948 by Dr. J. S. Stevenson. It included the assays for a large number of samples, a description of the mineralogy and a history of the mine.
3. Mr. A. R. Allen P. Eng. made a report dated Nov. 1956 that also contains much information including the results of the work done since 1948.

For the purposes of the present report I specifically gave my attention to the mapping of the ore outlines and the various structures so far as the dirt-encrusted walls of the older workings would allow. This involved a check survey with brunton and tape and the compiling of a new map of the workings.

The following account is complete and up to date in its way but the interested reader is referred to the reports listed above for further details

SITUATION

The property is about 100 miles north of Vancouver in the Bridge River District, Lillooet Mining Division of B. C. and 10 miles northwest of Bralorne Mine.

It is accessible by road but the last 3 miles are at present negotiable only by vehicles with four wheel drives.

The deposit outcrops on the east side of the valley of Roxey Creek which is a tributary of Fan Creek that flows into Bridge River.

CLAIMS

The mine is adequately protected by a group of eight crown granted claims besides 26 other claims and fractions.

UNDERGROUND WORKINGS

There are three adit workings as shown on the accompanying plan at elevations of 6290, 6193 and 6035 ft respectively of which the third has been driven this year.

The total cross-cutting and drifting for each level are:

No. 1 Adit	530 ft
No. 2 Adit	430 ft
No. 3 Adit	470 ft.

GEOLOGY

The general geology of the surrounding area is well shown on the map by C. E. Cairnes with his Paper 43-15 for the Geological Survey of Canada in 1943.

A large mass of the Coast Range Intrusives has a 'nose' that extends for three miles to the east. The Gem mine is situated in a dioritic phase of the granodiorite half a mile south of its contact with argillite and serpentine at the base of the 'nose'.

An almost continuous shear can be traced in a N 65°E direction obliquely up the steep mountain side above the adits for a distance of 700 feet horizontally and 300 feet vertically. It contains brown-stained carbonates and minor quartz up to widths of 5 ft.

Subsidiary parallel shears at about 100 ft spacings are also present. At intervals there are cross-cutting carbonate zones that dip about 30°E and sometimes displace the main shear.

MINERALIZATION

Around and inside the portal of No. 1 adit there are several occurrences of massive sulpharsenides associated with the west end of the main shear and often surrounded by altered diorite containi disseminated sulphides.

The ore consists largely of arsenopyrite with its cobalt bear variety danaite and the iron diarsenide lollingite that probably carries cobalt as well. Gold and uraninite are also present in economic amounts but the silver content of the ore is practically nil.

It is interesting to note that only very low uranium assays have been obtained from the sulphides at the surface in this area but underground as much as 1.8% U_3O_8 was reported by Stevenson. This could be due to the leaching out of the uranium from the surface although it has a patchy distribution underground.

Just below the ridge about 700 feet along the strike to the east from No. 1 adit Stevenson recorded high assays in gold and uranium for a veinlet that also contains molybdenum and cobalt.

ORE - BODIES

On the surface immediately south of the portal of No. 1 tunnel there is an area of massive sulphides from three to seven feet wi that is cut off at its N.E. end by a flat fault and its covered b a dump at its S.W. end. Inside the tunnel only disseminated sulphide is seen that corresponds to the N.E. end of the outcrop but massive sulphides were obtained in diamond drill holes 37, 38 and 39 aimed to the S.W.

Drill holes 13, 14, 15, 35, 36, and 37 found another sulphide band at ten feet in the hangingwall of the first and continuous

with a north striking band of sulphides at 35 ft in from the portal. This band has a length of 70 ft. but does not reach the surface apparently because of a flat fault. Underground the flat fault has moved the ore 20 ft to the east where it can be followed for another 60 ft as shown on the plan of No. 1 adit.

Where observed the dip of the sulphide lenses is from 70° to 90° S. They are usually enveloped by a zone of bleached diorite containing disseminated sulphides that often averages 0.30 oz gold and 0.4% cobalt.

The last lens mentioned above that is 60 ft long is cut by two dykes at 20 ft apart and between them the ore averages 0.5% U_3O_8 whereas elsewhere in the mine the uranium values have been very spotty.

The No. 1 tunnel was extended for 360 feet beyond the end of the last ore-body on a bearing of N 85°E. Some diamond drilling was done as shown on the plan but mostly to the south although on the surface the strike of the zone as a whole appears to be N 70°E so that even allowing for the dip of 70 to 80°S the zone would still lie to the north of the heading. The presence of several strong faults no doubt complicates the picture.

The irregular No. 2 adit failed to encounter the downward projection of the ore-bodies on the level above even with diamond drilling. A study of the relationships shows that the ore could still be present because the adit was too far into the footwall and the drill holes 9 and 12 were aimed too far to the west by Estella Mines as shown on the plan. Further to the S.E. at 35 and 50 ft in the hangingwall of the projected position of the ore around the No. 1 portal two other lenses of ore were found by drifting and diamond drilling. The upward projection of these two lenses was

not reached by the drilling on No. 1 level.

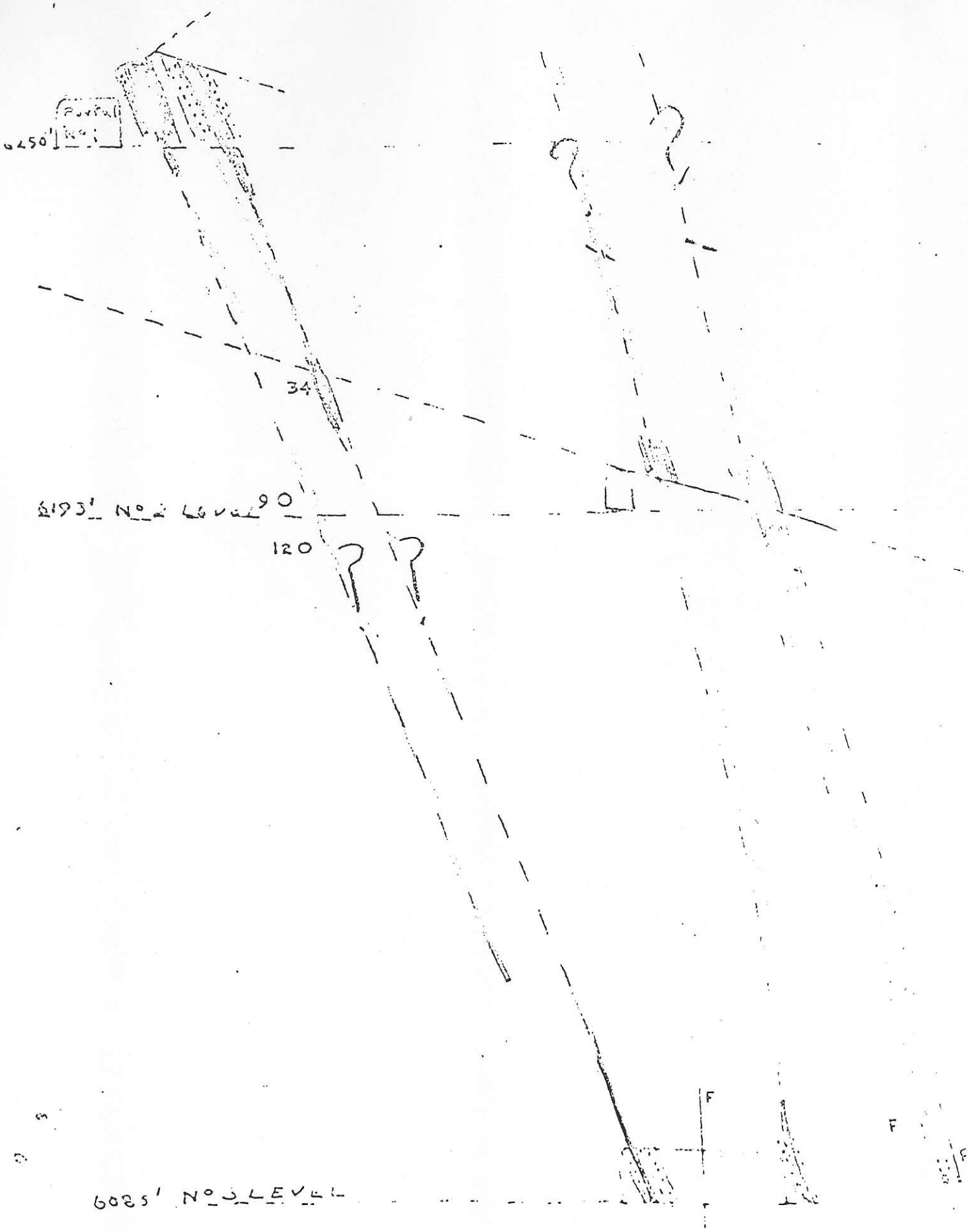
DDill holes 10 and 11 that were drilled up from the second level apparently demonstrated that the east ore-body on the first level did not extend for more than 15 ft below that level but almost certainly these holes passed through the gap made by the flat fault with a 20 ft movement on the first level. Also two down holes, 46 and 47, found ore to the east and 33 ft below that level. Two cross-cuts on the second level failed to find this ore but a rake to the east and/or faulting may be the explanation.

Recently the new third level at 100 feet below the second encountered three parallel strands of ore and a fourth by drilling into the footwall as shown on the plan. As indicated on the accompanying N.W.-S.E. section the two footwall bands are correlated with the two at the portal of No. 1 adit and the two hangingwall ones with the two ore bands on the second level.

On the third level the lateral and vertical extents of the four bands of ore are now being tested by diamond drilling.

Although the main shear is well exposed on the surface from the No. 1 adit for 700 ft east to the ridge the only other section with ore minerals is the small high grade occurrence already mentioned as being just below the ridge.

Trenching has failed to reach below the cover of glacial material that blankets the east slope of the ridge so that a geophysical survey is suggested to determine whether sulphide bodies are present especially near the contact with the sediments at another mile along the strike direction.


6250' No 1
34
6193' No 2 Level
90
120
6025' No 3 Level
F
F
F

ORE RESERVES

It is difficult to estimate the amount of ore on a property such as this until experience has been gained by stoping operations that have extracted representative blocks of ore.

I did not consider it necessary to check sample the workings but have used the results of Messrs. Stevenson (B. C. Dept. Mines), McClean (Estella Mines) and Shuttleworth(Northern Gem).

A close check was obtained for two sets of samples along the second length of ore in No. 1 adit:

The average for 22 samples taken by Dr. Stevenson is

3.0 ft 0.79 oz Au 2.9% Co

The average for 8 samples by Mr. Starr is

3.3 ft 0.81 oz Au 2.73% Co

There are no raises to prove the continuity of the ore between the levels and only a limited number of drill holes found ore there. Therefore in making the following estimate I have had to restrict the vertical dimension as shown and the ore is classified as Probable. A minimum mining width of 5 ft has been assumed and tonnage factors of 7.5 and 10 cu. ft. per ton for massive and disseminated ore respectively:

Place	Au oz	Co %	Tons	Above ft	Below ft
No. 1 Level:					
Portal	0.40	3.2	450	15	15
South of portal	0.60	2.6	2250	25	25
55'-125' inside adit	0.45	1.7	2800	50	15
No. 2 Level					
North ore-body	1.25	2.8	2500	50	50
South ore-body	.35	1.15	3000	50	50
TOTAL	0.60	2.0	11000		

2. Much of the uranium may be in the flotation tailings and require leaching if the grade is economic.
3. The sulpharsenide concentrate will presumably average 2.0 oz Au and 7% cobalt per ton with a gross value of $350 per ton. This could be roasted to drive off arsenic and sulphur leaving an auriferous mixture of iron and cobalt oxides assaying about 12% cobalt that could be cyanided for its gold content and then lixiviated to extract the cobalt in a solution from which it would be precpitated as pure oxide.
4. Alternatively the sulphide concentrate could be shipped to a smelter that handles such material.
5. Pressure leaching of the sulphide concentrate may also be an effective method of treatment.

PROPOSED DEVELOPMENT

This year:

1. Complete the diamond drilling programme on the third level to extend the ore both laterally and vertically.
2. On the first level extend D.H.33 for 25 ft and from the position of D.H.41 drill parallel to D.H.33. These two holes should find the upward extension of the ore now known on the 2nd level.
3. On the second level from the set-up of D.H.3-56 drill due south and to S.S.E. each for 50 ft to intersect the downward extension of the ore at the portal of No. 1 adit.

Next year:

4. Complete any of the above drilling not done in 1957.
5. Drive a new adit 200 feet below No. 3 to intersect the ore-bodies at their projected positions.
6. Raise on one of the ore-bodies from the third to the second level with a sub-level halfway between from which to investigat

the other ore-bodies by diamond drilling.

7. Make suitable storage facilities for development ore instead of losing it down the hillside.
8. Conduct a self-potential survey of the projection of the strike on the east side of the ridge where there is a cover of glacial overburden.
9. Make a transit survey of the mine workings.

CONCLUSION

The Northern Gem mine has an unusual mineral content that is rich in cobalt, gold and some uranium that have now been found over a vertical range of 200 feet in what may be continuous ore-bodies.

The finding of ore in the proposed new adit at another 200 feet below will warrant going into production.

It is expected that test work in Ottawa will indicate the most suitable form of treatment.

A. L. Hall

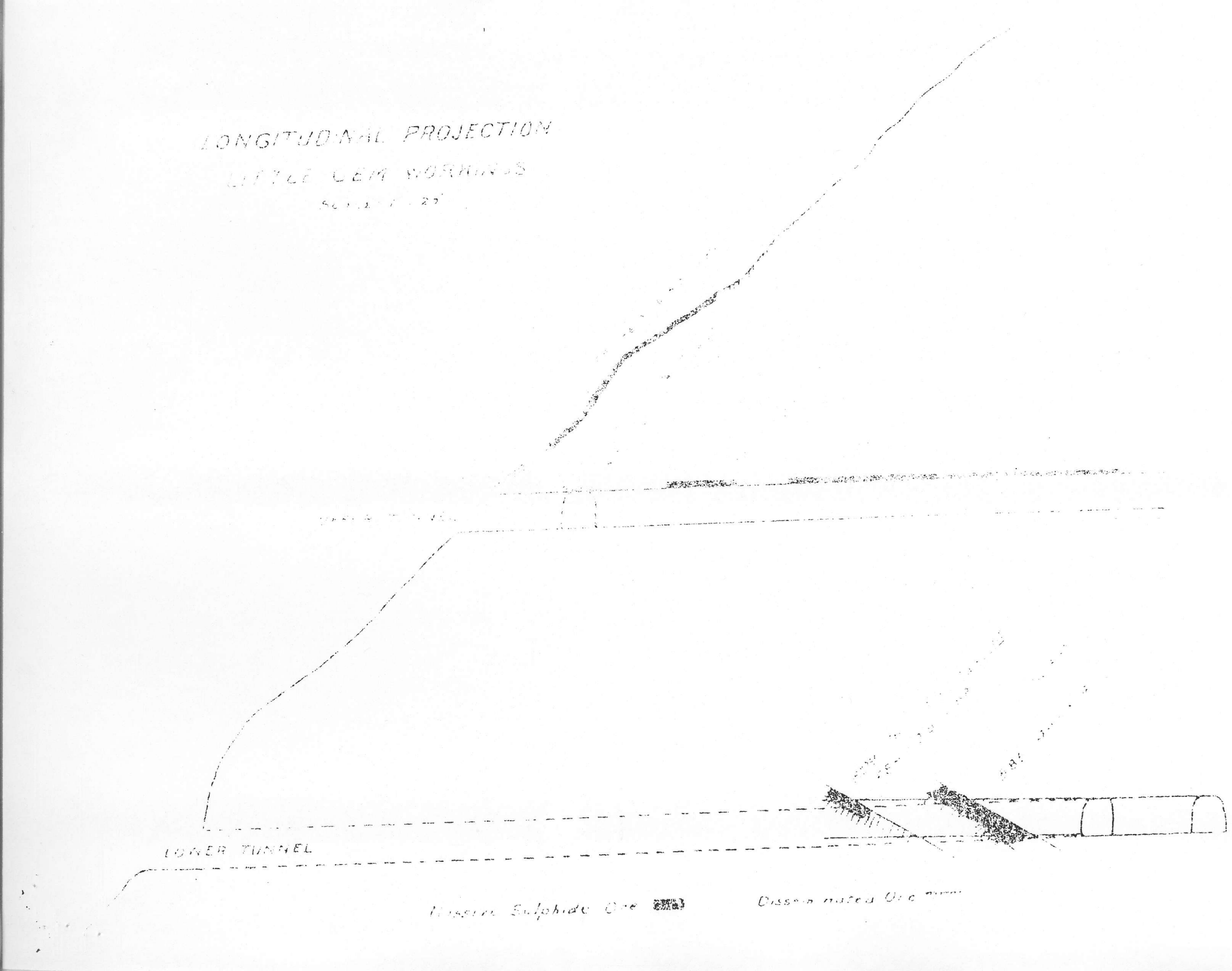
Note:

It is respectfully requested that if this report is published nothing is deleted or added without my consent.

A. L. H.

LONGITUDINAL PROJECTION

LITTLE CEM WORKINGS



LITTLE GEM WORKINGS

BRIDGE RIVER DISTRICT

SCALE: 1" = 20'

Survey by Compass

SAMPLING AND ASSAYS

The most complete and conservative sampling of the property has been done by Stevenson,[2] and his results are as follows:

B.C. Department of Mines, September, 1948.

ASSAYS, LITTLE GEM MINE
(Nos. 1-39: channel samples)

Sample No.	Width Inches	Gold oz./ton	Silver oz./ton	Equivalent Per Cent Uranium Oxide	Cobalt Per Cent.	Iron Per Cent.	Arsenic Per Cent.	Sulphur Per Cent.	Silica Per Cent.
1	24	1.04	nil	0.0055	3.6				
2	30	0.41	nil	0.030	1.3	28.7	42.6	14.5	6.3
3	72	0.52	nil	0.022	5.1	20.3	48.2	3.7	5.9
4	84	0.32	nil	0.0025	5.1	20.0	61.2	1.6	3.7
5	24	0.24	1.1	0.02	0.3				
6	25	0.27	trace	0.0035	4.4				
7	24	0.35	nil	0.02	3.9				
8	18	1.60	nil	0.007	4.3	25.2	42.2	14.2	2.7
9	60	0.27	nil	0.010	0.9				
10	96	0.87	nil	0.003	0.8				
11	60	0.22	nil	0.01	0.3				
12	24	0.02	trace	0.014	0.5				
13	13	1.24	0.1	0.008	6.0				
14	36	0.53	nil	0.038	3.5				
15	12	0.61	trace	0.005	5.7				
16	33	0.62	0.1	0.022	4.1				
17	36	0.51	nil	0.032	2.5				
18	39	0.15	trace	0.21	1.5				
19	36	1.09	0.1	0.026	6.6				
20	36	0.23	trace	1.01	1.3				
21	38	0.48	0.3	1.54	2.9	15.4	12.8	4.9	23.2
22	40	0.38	0.1	0.24	3.0				
23	53	0.84	0.3	0.57	4.0	20.1	27.2	9.8	9.8
24	49	0.01	nil	0.23	0.7				
25	52	0.51	0.4	0.21	3.5				
26	34	1.21	0.1	1.04	5.3	21.7	36.8	13.0	9.5
27	23	1.78	trace	0.53	7.2	18.4	32.8	11.6	14.4
28	60	0.76	nil	1.89	5.4				
29	39	1.58	0.1	0.0095	3.8	21.5	31.5	11.3	12.5
30	39	1.82	nil	0.010	1.3				
31	38	0.58	trace	0.003	0.6				
32	24	0.83	0.1	0.003	0.5				
33	48	1.00	nil	0.003	1.4				
34	33	1.26	nil	0.0025	1.1				
35	26	1.40	trace	0.0015	1.2				
36	12	0.34	nil	0.002	0.4				
37	60	0.12	trace	0.004	2.0				
38	80	2.21	trace	0.87	3.1				
39	72	2.14	nil	0.018	4.4	19.8	45.4	3.1	7.6

2. Stevenson, J.L. B.C. Minister of Mines Report 1948 pp. A112-119