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LUBICON MINING LTD. (N.P.L.)

TUCHODI LAKE PROPERTY

LIARD MINING DIVISION, B. C.

GEOLOGICAL REPORT

094K071

by

094K01W

L. B. Halferdahl, P. Geol.

July 7, 1969

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## INTRODUCTION

A copper-bearing vein and contiguous ground were staked for Lubicon Mining Ltd. near Tuchodi Lake, Liard Mining Division, British Columbia, in the fall of 1968. This report describes the geological setting of this vein and the work done since then. This includes the opening and sampling of five trenches, the tracing of the vein on strike to the west, and testing the use of a light diamond drill to obtain satisfactory core recoveries in establishing the continuity of the vein down dip.

## SUMMARY AND RECOMMENDATIONS

A vein has been traced for 230 feet along strike and 120 feet down the dip across a steep-sided creek valley near the west end of Tuchodi Lake in dolomite of the Late Precambrian Tuchodi Formation. It is covered at both ends by an intensely sheared grey-green shale unit also of the Tuchodi Formation. Five samples of continuous chips across 7 to 15 feet range from 1.29 to 11.70 per cent and average 4.0 per cent copper across an average of 9.4 feet. Two other shorter and narrower copper-bearing veins are exposed in a cliff of dolomite on the west side of the creek. The vein material consists of massive and banded quartz, quartz-carbonate intergrowths which contain disseminations and pods of chalcopyrite, a small amount of galena in some places, and some pyrite. Oxidation of the chalcopyrite has produced malachite staining.

Along strike 470 feet farther west in the next creek valley are three copper-bearing veins; the best mineralized is  $2\frac{1}{2}$  feet wide and has been traced for more than 100 feet. It has not been sampled yet. A length of the vein along strike of 800 feet is now indicated and will be established by showing the continuity of the vein in the interval of 470 feet covered by shale.

Present access to the deposit is easiest by helicopter. Ground access will require the construction of at least 35 miles of new road.

#### RECOMMENDATIONS

Stage 1: Prospect the claim group for other veins. Diamond drill to the depth limit (about 250 feet) with the light drill already on the property in order to establish the extension of the Doug vein.

Stage 2: Diamond drill with a heavier drill to establish greater extensions of the Doug Vein and to obtain enough information to permit the driving of an adit to the Doug vein.

Stage 3: Drive an adit from the base of the cliffs between the deposit and Tuchodi Lake. Drift on the Doug vein from the adit. Cut diamond drill stations to drill the vein both above and below the adit.

COST:

<u>Stage 1:</u>	Prospecting: 2 weeks	\$ 1,500
	Diamond drilling: 3000 feet	24,000
	Camp	2,000
	Transportation to and from Fort Nelson	1,000
	Transportation -helicopter and fixed wing	5,000
	Engineering, administration	4,000
	Contingencies	<u>3,000</u>
		\$ 40,500
<u>Stage 2:</u>	Diamond drilling: 4000 feet	48,000
	Transportation to and from Fort Nelson	1,000
	Transportation - helicopter	5,000
	Engineering, administration	6,000
	Contingencies	<u>3,000</u>
		\$ 63,000
<u>Stage 3:</u>	Driving adit about 2500 feet	\$225,000
	Drifting 1000 feet and cutting drill stations	80,000
	Drilling: 4,000 feet	32,000
	Road construction about 35 miles	35,000
	Engineering, administration	20,000
	Contingencies	<u>10,000</u>
		\$402,000
	TOTAL.....	<u>\$505,500</u>

Respectfully submitted:

*L. B. Halferdahl*

L. B. Halferdahl, P. Geol.

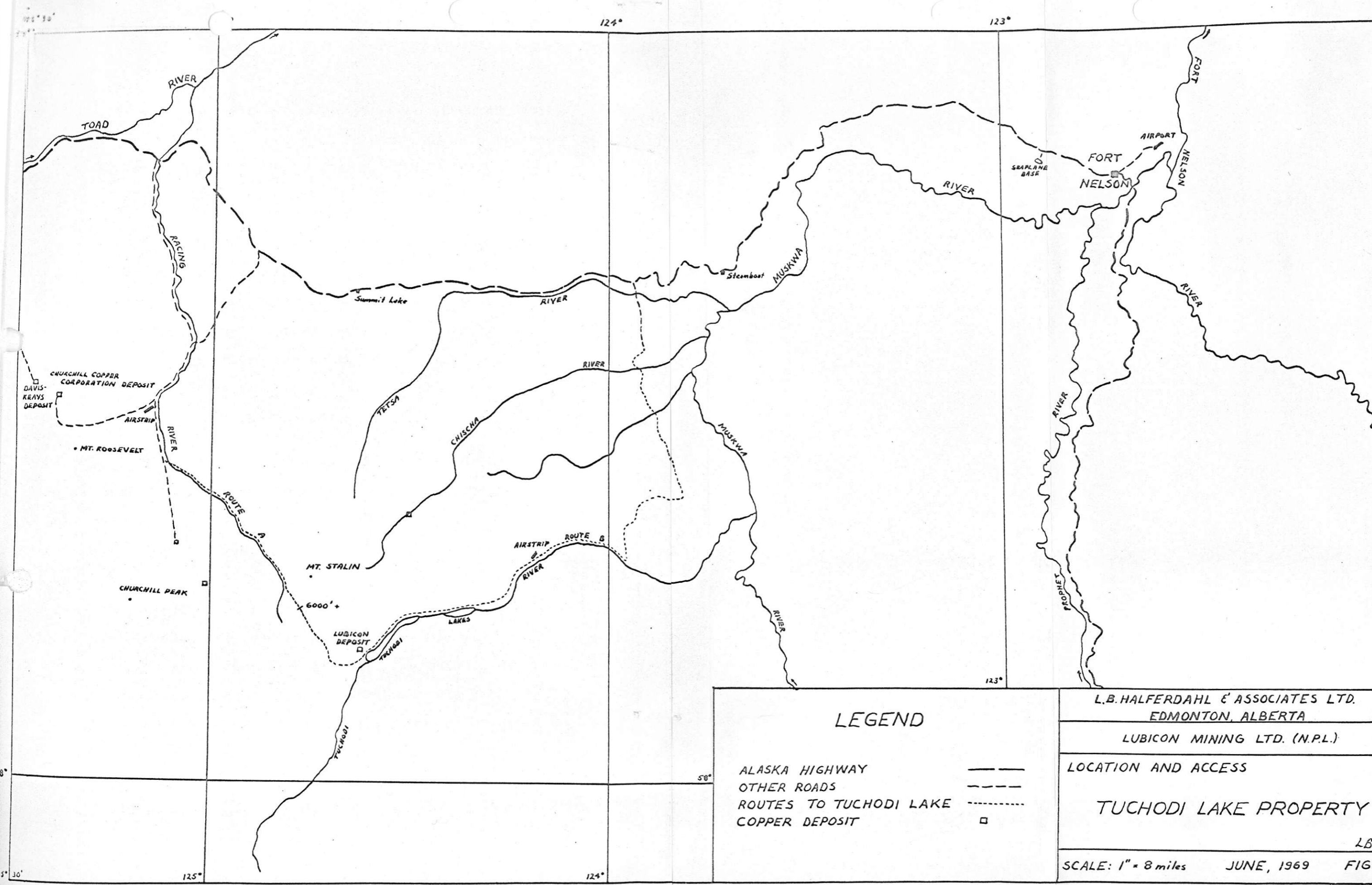
MINERAL PROPERTY

Lubicon Mining Ltd. possesses certificates of record for 52 claims covering a copper deposit and surrounding ground near Tuchodi Lake in the Liard Mining Division, British Columbia. Mineral Claims Doug 1 to 20, record numbers 32419 to 32438 inclusive were recorded on October 17, 1968. Mineral Claims Doug 21 to 52, record numbers 33850 to 33881 inclusive were recorded on October 30, 1968. Six additional mineral claims, Doug 53 to 58, were staked and recorded in June, 1969 but certificates of record have not yet been received.

LOCATION AND ACCESS

The copper deposit is 83 miles southwest of Fort Nelson, British Columbia in the Liard Mining Division. It is about one mile northwest of the west end of the upper Tuchodi Lake at an elevation between 4000 and 5000 feet.

From the west end of the upper Tuchodi Lake it can be reached on foot by climbing the partly eroded gravelly terraces and the less precipitous parts of the cliffs above on the east side of a small creek to a well-used game trail. The game trail leads northwesterly around the side of the mountain to the deposit which is on the first tributary creek entering the east side of the larger creek.



**LEGEND**

ALASKA HIGHWAY	———
OTHER ROADS	- - - - -
ROUTES TO TUCHODI LAKE	· · · · ·
COPPER DEPOSIT	□

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EDMONTON, ALBERTA

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LOCATION AND ACCESS

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**TUCHODI LAKE PROPERTY**

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L.B.H.

SCALE: 1" = 8 miles      JUNE, 1969      FIG. 1

A pad suitable for helicopters has been constructed on the mountain side a few hundred feet from the deposit at about the same elevation.

Tuchodi Lake, about 6 miles long, can be reached by means of float-equipped aircraft from the base at Fort Nelson, B. C. Fort Nelson is on the Alaska Highway about 600 miles northwest of Edmonton and is served by Canadian Pacific Airlines. Helicopters can also be chartered at Fort Nelson to fly to the deposit. A privately-built airstrip 3000 feet long is about 20 miles east of the deposit on the north side of the Tuchodi River.

Study of aerial photographs, detailed topographic maps, and observations from a helicopter indicate two possible routes for access on the ground (Fig. 1). Route A leads northwest from the west end of Tuchodi Lake across a pass whose summit is at an elevation between 6000 and 6500 feet, down the Racing River to Delano Creek where it connects with the very good access road from the Alaska Highway to the Churchill Copper Corporation deposit. On this road, the Alaska Highway is about 25 miles northeast along the Racing River and Macdonald Creek for a total distance of about 65 miles from the deposit. A new road further up the Racing River and Churchill Creek has recently been constructed to the property of Copperline Mines. The 5 or 6 miles of this road along the Racing River shortens the length of new road



construction required to reach Tuchodi Lake to about 35 miles. This route has the advantages of providing access to the mill of the Churchill Copper Corporation deposit currently being readied for production, and of requiring less new road. It has the disadvantages of crossing a 6250 foot pass south of Mt. Stalin where heavy snow **conditions** can be expected for much of the year, and of steep grades to the pass itself. In spite of this it appears to be the more economical of the two. When ground access is required, the cost of this road is estimated at \$1000 per mile or a total of \$35,000.

Route B is along the north side of Tuchodi Lake and the Tuchodi River for about 30 miles, turns north up several small creeks, crosses the Chischa River and reaches the Alaska Highway near mile 362 for a total distance of at least 80 miles. The highest elevation on this route is about 3450 feet. North of the Chischa River the route could make use of an oil well access road for the last 7 or 8 miles after replacing a washed out bridge on the Tetsa River. This route has the advantage of easy construction along high level terraces on the north side of Tuchodi Lake and the Tuchodi River. These terraces are cut by several streams but there the stream crossings should not be difficult. Seismic lines and winter roads could be used for part of the remainder, but an all-weather route would have to deviate from them to avoid muskeg and soft ground along streams. These deviations

could well increase the length of the road to 150 miles. Steep banks on the Chischa River and possibly another stream may increase construction costs. Construction of a road along Route B cannot be estimated precisely until the route has been located more precisely, but would be at least twice that of Route A.

A route down the Muskwa River is not recommended because of the precipitous valley sides in some places.

#### EXAMINATION AND WORK

The writer examined the Tuchodi Lake property briefly on September 21, 1968, and directed the blasting, sampling, and drilling conducted May 30 to June 4, 1969. This program was designed to obtain chip samples of as fresh or unoxidized material from the vein as possible and to ascertain whether satisfactory core recoveries could be obtained from a light Prosper 35 diamond drill. Five trenches across the vein were blasted and sampled. One inclined core hole 48½ feet long showed that core recoveries ranged from 60 per cent for one 2-foot section of a vein to 88 to 100 per cent for the rest of the veins and the country rock, with an overall recovery of 92 per cent. The drill was left on the property.

In early April, 1969, a pad suitable for a small helicopter was constructed on the mountain side a few hundred feet from the deposit at about the same elevation. A platform for a tent was built nearby.

GEOLOGY

Available geological reports indicate that the region around Tuchodi Lake is underlain by Late Precambrian Proterozoic rocks which have been complexly folded and faulted. In the area of interest these rocks comprise the Tuchodi and Aida Formations as designated by R. T. Bell of the Geological Survey of Canada. The Tuchodi Formation is about 5000 feet thick and consists of brown-weathering, white to light grey and light brown feldspathic quartzites which are crossbedded, dolomitic siltstones, and sandstones, argillaceous, silty light grey-brown aphanitic dolomites, and minor red beds and shales. In places the top of the formation has been erosionally truncated. The Tuchodi Formation is overlain apparently conformably by the Aida Formation which is more than 4500 feet thick and consists of calcareous and dolomitic grey mudstones and siltstones, small amounts of fine grained sandstone, and a conspicuous green mudstone member overlain by a black mudstone member near the base. These formations, the overlying Gataga Formation, and older formations have been intruded by diabase dykes.

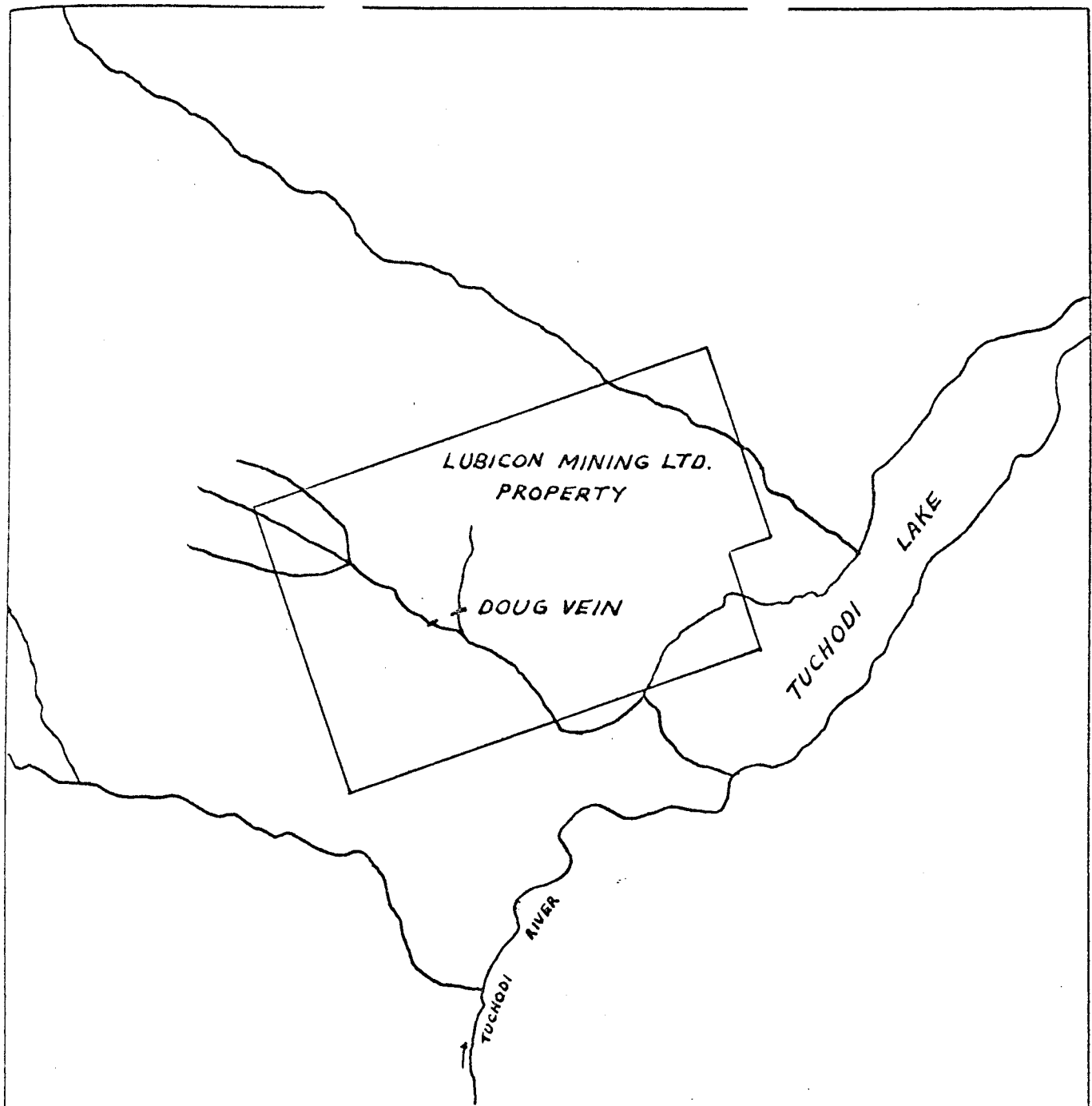
At the copper deposit more than 200 feet of buff-weathering medium to dark grey, very fine grained partly argillaceous dolomite in beds ranging from less than one inch to about one foot thick show some flexures and contortions.

In general, the dolomite beds strike between  $N20^{\circ}E$  and  $N10^{\circ}W$  and dip  $15^{\circ}$  to  $30^{\circ} W$ . These dolomites are conformably overlain by more than 100 feet of intensely sheared greyish green siltstone or shale. The attitude of the cleavage in the shale varies somewhat but some strikes  $S55^{\circ}E$  to  $S65^{\circ}E$  and dips from vertical to  $75^{\circ}N$ . A second cleavage strikes  $N30^{\circ}E$  and dips  $80^{\circ}$  to  $90^{\circ} W$ . The dolomite and overlying shale are units of the Tuchodi Formation.

At the west end of the copper deposit, a diabase dyke 25 to 35 feet wide striking about  $S45^{\circ}W$  and dipping vertically or steeply to the southeast intrudes both the dolomite and shale. Although not traced on the ground, float from a second diabase dyke was found on the mountain side a few hundred feet east of the copper deposit. This dyke has also been observed from the air. A third diabase dyke has been observed from the air a few thousand feet farther west.

#### MINERALIZATION

The copper deposit consists of quartz-ankerite veins. These carry massive white-quartz with minor disseminated chalcopyrite, and interbanded purplish brown aggregates of quartz and ankerite which contain disseminated chalcopyrite in grains or aggregates from less than one millimetre to more than two centimetres, and its oxidation products chiefly malachite with minor azurite. In places pyrite and galena are present.



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LUBICON MINING LTD. (N.P.L.)
PROPERTY PLAN
TUCHODI LAKE AREA
L.B.H.
SCALE: 1" = 4200 ft. approx.    JUNE, 1969    FIG. 2

The widest and best mineralized vein, the Doug vein strikes S80°W and dips 75°S. It is exposed on the almost vertical west side of a creek valley for a vertical distance of 120 feet. It can be traced continuously across the creek and up the steeply-sloping east side for a horizontal distance of 230 feet. It ranges in width from 7 to 15 feet. The vein is in the very fine grained dolomite, and does not extend into the overlying grey-green shale, which covers it at both east and west ends.

Sixty feet south of this vein a second vein striking N80°W and dipping vertically is exposed in the cliff face. This vein is about one foot wide at the top and pinches out about 80 feet down in the cliff face. Green copper oxidation products are present in the upper 20 feet.

A third vein striking N70°W and dipping vertically is exposed in the cliff face 27 feet north of the first. It consists of quartz and altered black dolomite veined with narrow quartz stringers for a width of 4 feet. Chalcopyrite and green oxidation products are most conspicuous in the upper part. About half way down the cliff another en echelon vein about one foot wide takes its place. At the bottom of the cliff this vein peters out into narrow quartz stringers.

In the creek valley 470 feet west on strike three other veins are exposed for horizontal and vertical distances of about 100 feet. All are observed to be offset one to two feet in a nearly vertical face on the west side of the creek.

There the widest vein is  $2\frac{1}{2}$  feet wide and strikes  $S75^{\circ}W$  and dips very steeply S; it consists of quartz, ankerite, chalcopyrite, and green copper oxidation products. The chalcopyrite is present disseminated in bands and in aggregates up to one inch or more in size. This vein ends at a diabase dyke and has not yet been traced beyond it because of difficult access.

A second vein slightly less than  $2\frac{1}{2}$  feet wide and 13 feet south of the first, and a third vein up to  $1\frac{1}{2}$  feet wide 25 feet farther south contain some green copper oxidation products but less than the first.

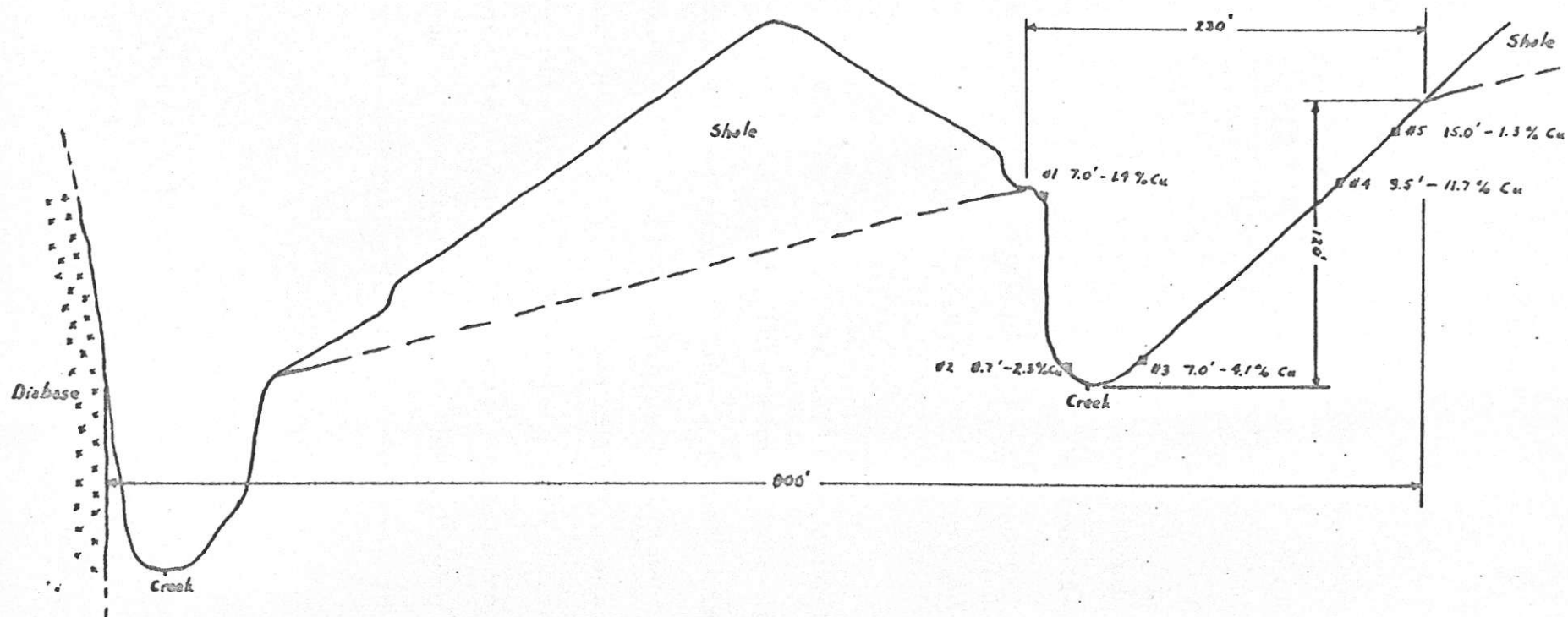
The veins exposed in both creeks indicate the possible existence of a zone of tension fractures containing copper mineralization.

#### SAMPLING

The length of 230 feet of the Doug vein was sampled at five locations where considerably fresher material had been obtained by blasting, although oxidized material was not completely eliminated. At each location the samples consisted of continuous chips across the full width of the vein with the following results.

WEST

EAST



*Note: Section is approximate: it is based on compass and tape measurements*

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LONGITUDINAL SECTION

DOUG VEIN

COMPASS AND TAPE CONTROL

L.B.H.

SCALE: 1" = 100 ft. JUNE, 1969

FIG. 3



<u>Location</u>	<u>Width</u>	<u>Per Cent Copper</u>
#1	7.0 ft.	1.40
#2	8.7 ft.	2.33
#3	7.0 ft.	4.10
#4	9.5 ft.	11.70
#5	15.0 ft.	1.29

These give an average of 4.0 per cent copper across an average width of 9.4 feet. The two samples with the lower assays were obtained right below the overlying shale. They suggest that the higher grade material can be expected farther from the shale.

One inclined hole drilled approximately at right angles to the Doug vein intersected a few thin stringers with disseminated chalcopyrite and a 4-foot vein at 27.3 feet and a 6½-foot vein at 33.5 about 25 feet down the dip of the Doug vein at location #3. The 4-foot vein contained disseminated chalcopyrite and the 6-foot vein both disseminated and massive chalcopyrite. Assays have not yet been received. Further drilling is required to learn the relation of the veins, to sample them adequately, and to explore for other veins.

#### EXPLORATION

The claim group except for the part near the Doug vein requires prospecting with particular attention being paid to parts near the diabase dykes.

The trenching and sampling already carried out on the Doug vein show that copper concentrations greater than the 3.5% copper possibly required for ore grade in this type of deposit are present across widths greater than the minimum mineable of 4 feet. The trenches were blasted and sampled where the nature of the ground permitted access. Access is possible at two or three other places, where it is recommended that chip samples be obtained after blasting.

Diamond drilling is recommended for testing for extensions of the vein both beneath the shale and to depth. The location of the exposed part of the Doug vein in a narrow steep-sided valley and the extension on strike in another steep-sided valley means that blasting is required for the preparation of diamond drill stations for testing for depth extensions. Accordingly it is proposed to drill holes in a fan pattern from a limited number of drill stations using first the Prosper 35 drill to its depth limit of about 250 feet and later a heavier drill for greater depths. Testing for strike extension will require long holes with a heavier drill through the overlying shale. Access to the deposit can continue to be provided by helicopter for drilling with the Prosper 35 drill and with a heavier drill.

Once the continuity of the vein is established, a survey should be undertaken to enable accurate maps and sections to be prepared. These are required for the next

stage of exploration which involves the driving of an adit for about 2500 feet to the vein from the top of the high level terraces along Tuchodi Lake, and then drifting along the vein and cutting stations for additional diamond drilling. A road to the deposit will be required in order to implement this stage.

#### ECONOMIC CONSIDERATIONS

The available data are insufficient to permit a full economic assessment of the Tuchodi Lake property of Lubicon Mining Ltd. The work performed so far indicates that what is considered to be ore at two nearby deposits is present in the Doug vein across mineable widths. These two deposits are the Magnum property of Churchill Copper Corporation which is being prepared for production, and the Davis-Keays Mine which is being explored underground. At these deposits veins similar to the Doug vein have been traced for vertical and horizontal distances of more than 1000 feet. The potential of the Tuchodi Lake property can be better assessed when similar lengths are established for the Doug vein.

CONCLUSIONS

The Doug vein and the other narrower veins on the property of Lubicon Mining Ltd. on Tuchodi Lake, B. C. are the filling of tension fractures produced either during the mountain building movements which resulted in the folding and faulting, or during the intrusion of the diabase dykes. The dykes are Precambrian in age and hence, much older than the latest mountain building. In any event, the copper mineralization in the veins is spatially related to the diabase dykes in a manner similar to the deposits of the Churchill Copper Corporation and Davis-Keays Mining Company.

The formation of the tension fractures which were later mineralized is clearly related to the competency of the rocks on the Tuchodi Lake property of Lubicon Mining Ltd. They are present in competent dolomite but not in a less competent overlying shale. According to measurements of sections of the Tuchodi Formation by officers of the Geological Survey of Canada, dolomites and more competent quartzites are present for thousands of feet below the exposed parts of the vein. Parts of this section of the Tuchodi Formation are exposed on the cliffs facing Tuchodi Lake.

The trenching and sampling on the Doug vein has shown what is believed to be copper mineralization of ore grade across mineable widths. Further work should be aimed

at establishing extensions to the Doug vein both on strike and at depth, so that when large enough tonnages are indicated underground exploration can be undertaken.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "L. B. Halferdahl".

L. B. Halferdahl, P. Geol.

Edmonton, Alberta  
July 7th, 1969.

CERTIFICATE

I, Laurence B. Halferdahl, residing at 11539 - 73rd Avenue, Edmonton 62, Alberta do hereby certify that

1. I am a consulting geological and mineralogical engineer.
2. I am a graduate of Queen's University, Kingston, Ontario (B.Sc. in 1952 and M.Sc. in 1954 in the Geological Sciences Department of the Faculty of Applied Science) and of The Johns Hopkins University, Baltimore, Maryland (Ph.D. in 1959 in the Department of Geology).
3. I am a registered Professional Geologist in the Province of Alberta and have pending an application for registration as a Professional Engineer in the Province of British Columbia.
4. From 1957 to 1969 I was on the staff of the Research Council of Alberta as a mineralogist and geologist where I was in charge of the mineralogy laboratory and conducted various field and laboratory investigations.
5. Prior to 1957 I obtained experience in mineral exploration with a number of mining companies.
6. The data in this report were obtained chiefly during personal examination of the Tuchodi Lake property of Lubicon Mining Ltd. May 30 to June 4, 1969, supplemented by information from published reports.

7. I have not received, nor do I expect to receive any interest, direct or indirect in the property of Lubicon Mining Ltd. nor do I own directly or indirectly any securities of Lubicon Mining Ltd.

Respectfully submitted,



L. B. Halferdahl, P. Geol.

Edmonton, Alberta  
July 7, 1969.