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PROJECT TOODOGGONE

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REGIONAL BASE METALS

INVESTIGATIONS

LIARD AND OMINÉCA MINING DIVISIONS

BRITISH COLUMBIA, CANADA

by

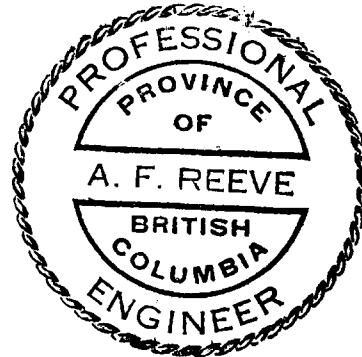
CORDILLERAN ENGINEERING LIMITED

400, 837 West Hastings Street
Vancouver 1, B.C.

for

Quebec Cartier Mining Company,
Port Cartier, Quebec

January 1969



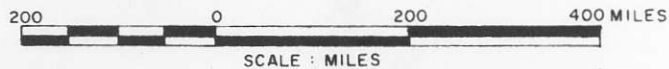
A handwritten signature in cursive script, appearing to read "A. F. Reeve", written in black ink.



QUEBEC CARTIER MINING COMPANY LOCATION MAP

PROJECT TOODOGGONE

KECHIKA RIVER AREA (NTS 94L)
 TOODOGGONE RIVER AREA (NTS 94E)
 McCONNELL CREEK AREA (NTS 94D)
 LIARD AND OMINICA MINING DIVISIONS
 BRITISH COLUMBIA



BY

CORDILLERAN ENGINEERING LIMITED

400-837 W. HASTINGS ST. VANCOUVER, CANADA

NOVEMBER 1968

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Key Map 1" = 10 miles -
Showing camp and property locations,
and 1968 work areas.

APPENDIX "B"

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Personnel and Contractors

INTRODUCTION

This report describes general base metals exploration carried out in Northern British Columbia, in 1968, for Quebec Cartier Mining Company by Cordilleran Engineering Limited. It has been compiled and edited by T. Kalnins, project geologist and A.F. Reeve.

The Toodoggone project was begun in 1967 and consisted of prospecting and geological and geochemical reconnaissance. In 1968, regional geological and geochemical work was continued and six mineral properties were staked and investigated in a preliminary way.

The results of regional exploration are summarized and shown on geological and geochemical plans in the folio which accompanies this report. A summary of property work is included.

More detailed descriptions of mineral property investigations are presented in separate covers.

A general reference map of the Toodoggone region is enclosed in Appendix "A".

The cost of this project was approximately \$138,000.00.

Continued exploration work is recommended for 1969 at an estimated cost of \$210,000.00

EXPLORATION REGION

The Toodoggone River region has an area of approximately 5,000 square miles; it occupies National Topographic Quadrangle #94E, centred at 127° west longitude, 57° 30' north latitude. It is remote, mountainous and uninhabited. The principal means of access is by light float equipped aircraft.

Details of geography, climate, access and general geology are included in a report entitled "Geology & Mineral Occurrences, Project Toodoggone - 1967", dated February, 1968.

In 1968 some exploration work was done outside of the Toodoggone quadrangle; in the Kechika area and in the McConnell Creek area. These are shown on the key map in Appendix "A".

REVIEW OF 1967 OPERATION & RESULTS

Research and program planning were carried out from January to late May, 1967. This included the compilation of an air-photo geological map of the Toodoggone Region. (Ref. Report, Photogeological Analysis & Metallogenic Study, April 1967).

Field operations commenced in early June and terminated in mid September. Final reports and maps were presented in February 1968.

Exploration work consisted of:

- a) Geological reconnaissance.
- b) Prospecting and examination of mineral occurrences.
- c) Geochemical reconnaissance by stream sediment sampling.

Results:

- a) On the basis of geology and known mineralization, three sub regions (825 sq.mi.) were selected for more intensive investigation.
- b) Forty-five mineral occurrences were located and examined. Copper was the principal commodity of interest. One of these was subsequently acquired by staking.
- c) Twenty-two geochemical anomalies were defined. Five of these were considered to be of first order importance. Five claim groups were later staked on the basis of geochemistry.

OPERATIONS - 1968Purpose and Scope

The objects of Project Toodoggone in 1968 were:

- a) To investigate geological and geochemical base metals targets developed by 1967 reconnaissance.
- b) To extend reconnaissance coverage into areas adjacent to the Toodoggone region.

Exploration Method

- a) Stream sediment sampling and regional mapping was intensified in three selected sub-regions within the Toodoggone quadrangle.

Six mineral properties (250 claims) were staked and investigated by: soil sampling, detailed mapping, ground magnetic surveys, and hand trenching.

- b) Regional reconnaissance was extended into the Kechika and McConnell Creek regions for approximately 1,000 sq. miles.

Logistics

The project was serviced by float equipped light aircraft from Smithers, B.C. (Telkwa Base), 200 miles to the south. Field mobility within the working area was provided by a Bell 47G 3B₁ helicopter. Radio contact was maintained with the air base at Telkwa. Three base campsites were occupied during the field season, they were located at Toodoggone Lake, Spinel Lake and Cordex Lake.

Field personnel consisted of:

- 1 Project geologist, supervisor
- 2 Senior geology students
- 1 Geochemical field lab technician (student)
- 4 Field assistants (students)
- 1 Cook
- 1 Pilot
- 1 Mechanic
- 11 Total field strength

See Appendix "B".

Competitive Exploration Activity

See Fig. 10, map folio - Mineral Claim Location Map.

Exploration work by others in the Toadoggone region increased considerably in 1968. The direction of the Q.C.M. program was not substantially affected by this. However, some care was taken to protect all important prospects by staking claims early in the season.

Three competitors maintained helicopter supported crews during the field season.

1. Cominco Exploration carried out regional reconnaissance and holds 5 mineral claim groups.
2. Kennco Explorations carried out regional reconnaissance and holds 8 claim groups.
3. Rip Van Mining Company of Calgary, Alberta, holds 3 claim groups.

Others who were active on a more limited scale include Union Carbide and Spartan Explorations. Eleven claim blocks are held privately in the Toadoggone region.

RESULTS - 1968Property Investigation

Six (6) properties, including a total of 250 mineral claims, were examined in detail. The results of this are summarized on the chart following. Locations are shown on the key map in Appendix "A". The commodities of interest are copper and molybdenum.

The most important prospects occur on the Riga and Spartan claim groups. Significant copper mineralization has been mapped at both locations in plutonic syenite and monzonite suggesting the possibility of large volume low grade "porphyry" type deposits. Molybdenum accompanies copper in the Riga prospect. A second type of occurrence was located on the Riga claims. It consists of a number of chalcopyrite replacement veins cutting altered andesite (volcanic) adjacent to the mineralized syenite intrusive. Well defined targets which require further investigation have been outlined on the Riga and Spartan properties.

On the Pillar group no strong mineralization has been found which can be related directly to an extensive geochemical anomaly (copper in soils 700' x 3000'). Strongly positive silver, lead and molybdenum values also occur in the anomalous area. W.F. Bondar, geochemist, in his report dated August 1968, suggests that the soil anomaly is

Results - 1968 (cont'd.)

related to rock alteration which may in turn be the halo of a "polymetallic" mineral deposit at depth. The exploration problem is compounded by very steep topography.

Additional mapping and prospecting will be required to evaluate the significance of copper mineralization on the Garnet group.

The 4 prospects mentioned above lie near or within a copper - zinc - molybdenum positive metalogenic belt that is described in detail under geology.

No further consideration is being given to work on the Opal or TK properties.

MINERAL PROPERTIES - QUEBEC CARTIER MINING COMPANY

PROJECT TOODOGGONE - 1968 - BRITISH COLUMBIA, CANADA

Name	No. of Claims	Assessment Anniversary	1968 Investigations	Results	Recommendation - 1969 -
TK X	18 (70 claims abandoned - Oct. 1968)	Oct. 13, 1969	- geological mapping - stream sediment sampling	- widespread, but inconsistent MoS ₂ & copper mineralization occurs in intrusive & metamorphic rocks.	-
Spartan	48 (42) June 27, 1969 (6) Sept. 25, 1969 2 (mag., partial I.P., drill)	June 27, 1969 Sept. 25, 1969	- soil sampling - geological mapping - hand trenching	- copper carbonates discovered by trenching 200' x 300'. - large area of interest indicated by geochemistry, and geology	- mechanical strip-ping, trenching & sampling. - drilling 1000' max.
Riga	32 (24) Apr. 9, 1969 (8) Sept. 16, 1969 Priority 1. (grid, mag, I.P. drill)	Apr. 9, 1969 Sept. 16, 1969	- geological mapping - hand trenching	- "porphyry" type Cu-Mo mineralization in 500' x 300' outcrop, - also, high grade chalcopyrite veins in a 2nd outcrop 500' x 350'.	- induced polarization and magnetic survey - 2000' max. diamond drilling - mapping
Pillar	28 (24) June 27, 1969 (4) July 12, 1969 3 (drill 1000')	June 27, 1969 July 12, 1969	- geological mapping - soil sampling - magnetic survey	- copper geochemical anomaly 700' x 3000'. - minor copper mineralization.	hand trenching and geological study of rock alteration.
Opal X	20	July 17, 1969	- soil & stream sediment sampling - geological mapping	- Mo geochemical anomaly source not discovered	-
Garnet	34	July 12, 1969	- geological mapping (incomplete)	- copper mineralization widespread in fractured volcanic rocks	complete mapping and prospecting
TDG	1	Oct. 13, 1969	- \$100 paid in lieu of assessment work	Toodoggone campsite	
Total: 251					

NEW MINERAL DISCOVERIES

Nine mineral occurrences were located and reported during the course of geological reconnaissance in 1968. Seven of these are copper showings and two molybdenite. They are referenced (Nos. 46 to 54) on 1968 revisions of regional geological and geochemical plans; and on the key map in Appendix "A". The new mineral occurrences are generally located near the east edge of the Toodoggone quadrangle and in the NW quarter.

No. 46 57° 34' N, 125° 55' W - Cu.

Traces of chalcopyrite and galena were found in 3 or 4 outcrops of granodiorite and paragneiss about 3-1/2 miles southeast of Fox Pass.

No. 47 57° 39' N, 126° 06' W. - Cu.

Sparse bornite and chalcopyrite were found at 8 locations in contorted schists quartzite and marble of the lower Ingenika group. A selected specimen assayed .26% Cu. These occurrences are included in a NW trending area 1 x 3 miles located at Warner Peak five miles NW of Fox Pass. A plutonic mass of granite lies about 1-1/2 miles east of the mineralized belt. The local topography is extremely rugged. (Relief 4500' ASL to 7000' ASL.)

New Mineral Discoveries (cont'd.)No. 48

57° 39' N, 125° 03' W. - Mo.

Traces of molybdenite were found as fracture coatings and disseminations in one outcrop of granite about 2-1/2 miles west of Warner Peak.

No. 49

57° 45' N, 126° 03' W. - Cu.

Sparse chalcopyrite and bornite were found at several locations in schistose metasedimentary rocks. These are known as the "North-Pole Creek" showings and are located about 10 miles NW of Fox Pass.

Copper mineralization at locations 46, 47 and 49 account for the broad geochemical response received from 1967 reconnaissance sampling. This is described as anomaly No. 2 in a geochemical report by W.F. Bondar dated February 1968.

Prospecting and more detailed stream sediment sampling in 1968 has outlined a copper positive metallogenic belt 18 miles x 5 miles NW of and including Fox Pass, associated with metasedimentary rocks adjacent to a felsic batholith. (See Figure 6, map folio.)

New Mineral Discoveries (cont'd.)No. 50

58° 00' N, 127° 09' W. - Cu.

Bornite and chalcopyrite occur in quartz and feldspar veins and siliceous "pockets" of granitic intrusive rocks, immediately west of the Frog River and 4 miles north of the T.K. claim group. This prospect is on claims owned by Rip Van Mining Company.

No. 51

57° 55' N, 127° 27' W. - Cu.

Weakly developed chalcopyrite mineralization was found with quartz stringers in a basic intrusive outcrop near a contact with slatey metasediments.

No. 52

57° 56' N, 127° 35' W. - Cu.

Sparse chalcopyrite occurs in a series of N. trending shears at several locations over a distance of several thousand feet.

Mineral occurrences No. 51 and No. 52 are located about 10 miles west of the T.K. group. This area is occupied by massive batholithic rocks of granitic composition containing roof remnants of meta-sedimentary rocks. A N.W. trending fault zone and several associated ultra basic intrusives are the youngest geological features locally. This area is very weakly copper positive.

New Mineral Discoveries (cont'd.)

No. 53 57° 46' N, 127° 30' W. - Mo.

One outcrop was found to be mineralized with MoS₂ along fracture planes and in quartz veinlets about 5 miles north of the Chukachida River. The mineralized rocks consist of diorite, granite and lamprophyre dikes.

No. 54 57° 48' N, 127° 43' W. - Cu.

One outcrop of pyritic chlorite schist is weakly mineralized with chalcopyrite about nine miles NNW of the junction of the Stikine and Chukachida Rivers.

GEOCHEMICAL RECONNAISSANCE

Intensification and extension of stream sediment sampling produced 3 geochemical targets that suggest possible economic mineralization. Samples were routinely tested for total heavy metals in the field, and analysed quantitatively for Cu, Pb, Zn and Mo in a laboratory.

1) Warner Peak Anomaly (Cu.)

Ref. - Fig. 6, map folio.

- Report by W.F. Bondar, August 1968, Anomaly 1.

A weakly positive regional copper anomaly is located on the east edge of the Toodoggone quadrangle. It is 18 miles x 5 miles and extends north-northwestward from Fox Pass including mineral occurrences Nos. 47, 48 and 49.

The strongest geochemical response occurs in an area 2 mi. x 6 mi. that includes Warner Peak. Most of the known copper mineralization occurs in this smaller area as well.

The regional background in stream sediment samples is 50 ppm copper. Values greater than 100 ppm are considered positive and more than 150 ppm strongly positive. The 12 square mile area of interest in the vicinity of Warner Peak includes 40 sample points with an average value of 180 ppm Cu. (Maximum 400 ppm.)

Geochemical Reconnaissance (cont'd.)

No apparent economic mineralization was found by prospecting in the Warner Peak area in 1968. However, the exploration possibilities should not be discounted completely at this time for the following reasons:

- a) The geochemical contrast is outstanding.
- b) The local topography is extremely rugged and has prevented complete prospecting coverage.
- c) The widespread presence of copper sulphide mineralization generally suggests that economic concentrations of copper are possible in metasedimentary rocks along an intrusive contact that passes through the area.

✓
Helicopter borne mag-EM
T.K.

2) Tucho Lake Anomaly (Cu.)

A well defined, weakly positive copper anomaly is located immediately southwest of Tucho Lake in the NW corner of the Kechika area. (See Figure 15) The positive geochemical response occupies two drainage basins with an area of about 10 square miles. There are twenty stream sediment sample points, eighteen of which exceed the regional background of 100 ppm Cu. Seven values exceed 200 ppm the maximum being 475 ppm.

No copper mineralization has been located in the area of interest. Immediately east of the anomaly there is an expired block of 48 claims. (TAK group)

Detailed prospecting
mapping, local sampling (TAK)
from fly camp. T.K.

Geochemical Reconnaissance (cont'd.)

2) Tucho Lake Anomaly (Cu) (cont'd.)

Paleozoic, greenstone, limestone and hornfels are the principal rock types. These form a roof pendant in a Cretaceous hornblende diorite batholith (see Kechika geology map folio).

3) The West Anomaly (Pb, Zn)

(See Kechika geology and Figs. 13 and 14, map folio)

Eight stream sediment sample points have produced sharply anomalous results in a drainage basin of 3 square miles. Lead values range from 112 to 1500 ppm., (regional background -35 ppm) and zinc ranges from 265 to 3500, (background 175 ppm)

A lead, zinc, silver prospect located near the head of the anomalous drainage partially accounts for the geochemical effect.

The prospect is covered by 4 claims owned by Conwest Explorations Ltd. It consists of several outcrops of Paleozoic phyllite mineralized with sphalerite, galena, rhodonite and minor chalcopyrite in an area 500' x 200'. A selected specimen assayed 13.22% Pb, 7.33% Zn. and 3.5 oz. Ag/ton. Granitic intrusive rocks outcrop near the showings.

Geochemical Reconnaissance (cont'd.)

3) The West Anomaly (Pb, Zn) (cont'd.)

The distribution of anomalous sample points and local structural trends suggest that the valley immediately east of the Conwest property should be carefully investigated for additional mineralization. Outcrops on the valley rim are barren. Also the downstream extent of the geochemical response has not been cut off. ✓

*Reccy soil sample (THM) across creek
downstream.*

4) Nickel - See Fig. 9, map folio.

A group of 12 sediment samples taken from streams draining ultra basic rocks in the NW part of the Toodoggone quadrangle were analysed for nickel. Values ranged from 11 to 155 ppm Ni. The average nickel content of igneous rocks is 60 ppm and considerably higher in basic types. According to Dr. F.D. Forgeron, geochemist, (Bondar-Clegg & Co. Ltd.), significantly anomalous results from stream sediments in similar environments are often several hundreds ppm Ni.

GEOLOGY

Figure 1 in the Map Folio is a 1968 revision of the geology of the Toodoggone Region @ 1" = 2 miles. The gross geological setting is essentially as described in our report entitled, "Geology & Mineral Occurrences - Project Toodoggone 1967", dated February 1968.

Additional detail was obtained by geological reconnaissance and prospecting in three principal areas shown on the Key Map in Appendix "A". They are located on the eastern edge and in the NW corner of the Toodoggone region and the area designated "proposed air magnetometer survey". In addition, geological reconnaissance was directed toward the Sustut formation which passes through the SW quarter of the quadrangle. This was done in conjunction with uranium exploration. The map revisions consist of minor contact adjustments, addition of new mineralization, and printed notes on local lithology and structure.

Since the general geological picture is more or less unchanged from 1967, only selected features are discussed here with respect to Economic Geology.

There are two well defined metallogenic belts which offer base metals exploration potential:

- (a) Toodoggone Lake - Dryborough Peak area, - copper molybdenum (500 sq.mi.)
- (b) Warner Peak - Fox Pass area, copper, (approx. 100 sq. mi.)

Geology (cont'd.)(a) Toodoggone Lake metallogenic belt

(See diagram following page 24)

Ref. - Project Toodoggone Report, Feb. 1968
page 23.

- W.F. Bondar, Feb. 1968, page 20

- W.F. Bondar, Aug. 1968, page 12

- Research report, Apr. 1967,
pages 3, 18 and 22.

This area is approximately defined by the designation "proposed air magnetic survey" on the key map in Appendix "A". It extends northward from the end of Thudade Lake to Chuckachida Lake, and has a maximum EW width of 2 miles, 8 miles south of Toodoggone Lake.

Stratigraphy

The area of interest is confined to a NW trending synclinal assemblage of folded volcanic flow rocks. The average composition is andesitic to basaltic. Porphyritic and non-porphyritic types are present. Outcrops are massive with little evidence of layered structure. A discontinuous limestone horizon occurs near the base of the lava beds. Immediately to the northwest the sequence includes bedded tuffs and occasional silt horizons.

It is estimated that this sequence belongs to the upper Takla group of Late Triassic or Early Jurassic age. The rocks have not been affected substantially by regional metamorphism.

Geology (cont'd.)

Intrusive Rocks

Batholithic intrusives have extensively cut and replaced the Takla volcanics so that approximately 50% of the outcrop is plutonic rocks. They represent a single period of emplacement in approximately Upper Jurassic time and are part of a major northwest trending intrusive complex known as the Omenica-Cassiar Batholith. Replacement and stoping appears to have been the principal mechanism of intrusion rather than forceful diapiric means.

Structure

It is likely that folding and the emplacement of intrusive rocks have deformed the volcanic strata considerably, however the lack of distinguishable layering prevents detailed study of the resulting structures.

An important structural feature is a local downward flexure of the batholith roof. As a result the intrusive rocks are represented at the erosion surface by irregular stocks, dikes and small batholiths occupying cupolas in the volcanic host rocks. The main plutonic chamber emerges in both directions along the regional trend. Immediately north of Toodoggone Lake the total width of intrusive outcrop is approximately 2 miles. About 20 miles northwestward in the vicinity of the TK group it is an

Geology (cont'd.)

Structure (cont'd.)

essentially unbroken mass 30 miles wide. Forty-five miles to the southeast in the vicinity of McConnell Lake the intrusive outcrop is at least 15 miles wide.

Three steeply inclined fault systems appear to be present in the Toodoggone metallogenic belt. They generally occupy the bottoms of valleys so that direct observation is seldom possible. The most common evidence of faulting is the apparent displacement of adjacent rock units, alignment of topographic features, and subsidiary shearing and fracturing.

A major northwest trending strike fault passes the west end of Chuckachida Lake. It has been observed directly at two locations and controls the emplacement of a series of ultra basic intrusive bodies. A parallel structure about 6 miles eastward appears to have been an important mineralization control.

The second group of faults have a north-south trend and are probably subsidiaries of the principal northwest - southeast displacement.

Two prominent cross faults have trends of east-northeast. They are apparently terminated by the major northwest trending regional fault described earlier. One occupies the valley of the Toodoggone River west of Toodoggone Lake and the other extends along the Findlay River northeast from the Firesteel.

Geology (cont'd.)

Economic Geology

* On the basis of comparison with other stratigraphic environments: rocks associated with the Takla group and their equivalents have accounted for more than 50% of the ore (in tons) produced in British Columbia to 1966. An equivalent of the Takla is the Nicola group which has been a prolific copper producer in the Kamloops, Merritt and Princeton areas in South Central British Columbia.

Thirty known sulphide mineral occurrences are located within and adjacent to the Toodoggone Lake metallogenic belt. All contain copper; chalcopyrite and bornite are the principal copper minerals. Zinc and molybdenum sulphides are of secondary importance.

Four mineral properties are held for Q.C.M. in the area of interest. Thirteen claim groups are owned by others.

Some general features and controls of copper mineralization are as follows:

1. Northwest trending faults appear to be the major "plumbing" through which mineral bearing solutions were delivered to the area. This is suggested by the presence of

* Tectonic History and Mineral Deposits of the Western Cordillera
- C.I.M. 1966.

Geology (cont'd.)

Economic Geology (cont'd.)

pyrite and late ultra basic intrusives along such structures.

A copper-zinc positive NW trending fault extends from the Findlay River to a point 4 miles south of Chuckachida Lake (Bondar Feb. 1968, Anomalies Nos. 8, 9, 11, 12, 14 and 15.) It is displaced about 3 miles by a cross fault at Toodoggone Lake. Associated copper mineralization has been found at nine locations along its strike.

2. There is a well defined relationship between the emplacement of copper mineralization and intrusive-volcanic contacts.

3. A number of occurrences suggest the possibility of "porphyry" type copper mineralization, porphyry being defined as a class of deposits developed during the past 8 years in British Columbia. These generally consist of large rock volumes pervasively mineralized with chalcopyrite and bornite, grading .75% copper or less. They usually have a direct association with felsic intrusive rocks and are not substantially enriched by supergene processes. The westernmost copper molybdenum showing at Drybrough Peak is an excellent example of this.

Geology (cont'd.)

Economic Geology (cont'd.)

4. Five mineralized locations associated with an intrusive-limestone contact suggest the possibility of copper-zinc sulphide, iron-oxide replacement deposits (Craigmont type) on the SW edge of the Toodoggone metallogenic belt.
5. Intrusive rocks are usually of syenite-monzonite composition where they are mineralized.
6. Mineralized areas are frequently marked by extensive gossans produced by widespread pyritization.
7. The most common modes of copper sulphide mineralization are fracture fillings and coatings, and disseminations. Sulphide bearing quartz veins are also common. Carbonate veins were observed at three locations.
8. Epidote is an alteration product which accompanies copper mineralization in volcanic rocks.
9. Late felsite and andesite dikes cut intrusive and volcanic rocks at four mineralized locations. The dikes and their walls are heavily pyritized. On the Spartan claim group a specimen of pyritic dike rock assayed .18% Cu.

Geology (cont'd.)

Economic Geology (cont'd.)

10. Complete removal of copper minerals by leaching, in pyrite gossans, has been observed to a depth of 3' below the surface.

(b) Warner Peak - Fox Pass metallogenic belt.

- Ref. - Bondar, Feb. 1968, Anomaly No. 1
- Bondar, Aug. 1968, pages 2 & 10.

This area extends north-northwest 18 miles from Fox Pass and is about 5 miles wide. It is underlain principally by Proterozoic metasedimentary rocks of the lower Ingenika group. These are composed of quartz feldspar biotite gneiss, quartzite, mica schists, garnet schist, chlorite schist, limestone and skarn. The metamorphic fabric has a general north-northwest trend. The sedimentary beds have been intensely deformed and altered by regional metamorphism. Crenulation, drag folding and apparently overturned fold structures were observed. The regional trend is deflected considerably eastward in the southwest part of the area. This is the apparent result of intrusive activity.

A batholithic intrusive mass of unknown age occupies the southeast quarter of the area. It is elongated in a northwest - southeast direction and locally is 3 to 4 miles



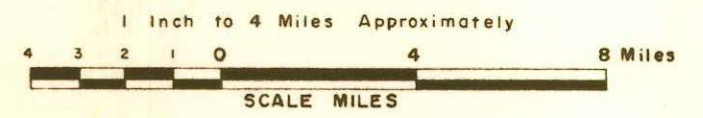
EXPLANATION

INTRUSIVE AND VOLCANIC ROCKS

- UPPER TAKLA (?) SEDIMENTS
- CASSIAR-OMINECA BATHOLITH
- TAKLA VOLCANICS

SYMBOLS

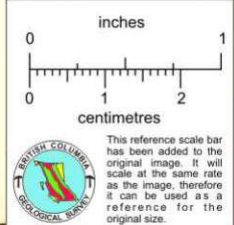
- MINERALIZATION
- CONTACT
- FAULT
- GOSSAN



QUEBEC CARTIER MINING COMPANY
 TOODOGGONE LAKE METALLOGENIC BELT
 BRITISH COLUMBIA CANADA

by
 CORDILLERAN ENGINEERING LIMITED
 400-837 W. HASTINGS ST. VANCOUVER 1, B.C.

JANUARY 1969



Geology (cont'd.)

Economic Geology (cont'd.)

in width extending an unknown distance southeastward. The composition varies from a mafic poor granite (alaskite) to amphibolite. It includes remnants of paragneissic meta-sedimentary rock.

Copper mineralization is described at three locations in the area of interest (Mineral occurrences Nos. 46, 47 & 49) and one minor MoS_2 showing is reported (No. 48).

At location No. 47 metasedimentary rocks carry scattered copper sulphide mineralization in a 1x3 mile area along the southwest flank of the intrusive. Chalcopyrite is the most common copper mineral, bornite and chalcocite were also observed. Pyrite, pyrrhotite, specular hematite and magnetite accompany some of the copper. Pyrite also occurs as a rock accessory without copper minerals.

Copper sulphides were most commonly found in oxidized chloritic schist and sericite schist; as disseminations and coatings on foliation planes and cross fractures. A narrow vein of chalcocite and magnetite was found in a quartzite boulder west of Warner Peak.

Concentrations of copper sulphide are very sparse and none of the individual showings demonstrate a great deal of economic promise. There does not appear to be any strong

Geology (cont'd.)

Economic Geology (cont'd.)

Geological similarity between this type of prospect and deposits which have been substantial producers in British Columbia. The mode of mineralization and gross geological environment could be compared very approximately to the Hail deposit at Vavenby.

The most attractive aspects of the area's exploration potential are its sharply defined copper positive limits and the presence of sulphide mineralization. For this reason further general reconnaissance on a limited basis is justified.

SUMMARY

In 1968 Cordilleran Engineering Limited carried out a base metals exploration programme for Quebec Cartier Mining Company in the Toodoggone River region (NTS Quadrangle 94E) of Northern British Columbia. It consisted of geological and geochemical reconnaissance, mineral property acquisition and preliminary property investigation.

An eleven-man field crew was supported by helicopter and light float planes. The work was generally based on the results of geological and geochemical reconnaissance obtained during the previous year. (Project Toodoggone 1967).

The cost of project Toodoggone 1968 was approximately \$138,000.00. Cost breakdowns are presented under a separate cover.

Several other exploration groups operated in the Toodoggone region during 1968. Kennco, Cominco and Rip Van Mining Company fielded helicopter supported crews and acquired mineral claims.

Nine discoveries of "new" mineralization were made, 7 copper prospects and 2 of molybdenum. None of these demonstrated immediate economic significance; however, 4 are located in an area that requires further general reconnaissance.

Summary (cont'd.)

Six mineral properties were investigated by soil sampling, magnetic surveys, geological mapping and hand trenching. Copper and molybdenum prospects on the Spartan and Riga claim groups offer well defined exploration potential and it is suggested that diamond drilling and mechanical stripping are required in the next phase of investigation. Copper showings and geochemical anomalies on the Garnet and Pillar groups require further geological study to evaluate their exploration potential. No consideration is being given to further work on the Opal and TK mineral claims.

Two geochemical anomalies outlined by reconnaissance work immediately north of the Toodoggone quadrangle require further preliminary investigation. They are copper at Tucho Lake and lead, zinc, silver near the "West" claim group of Conwest Exploration.

The results of field work in 1967 and 1968 have isolated two areas totalling about 600 square miles, in which economic copper mineralization is likely to occur. The most promising of these, in terms of geological environment and known mineralization, is the Toodoggone Lake Metallogenic Belt (about 500 sq.mi.) located in the south central part of the region. A copper positive area of about 100 sq.mi. is located in the vicinity of Warner Peak and Fox Pass on the eastern edge of the region. It is of secondary importance.

Excepting the Tucho Lake and West geochemical anomalies future exploration should be limited to these areas.

RECOMMENDATIONS

It is suggested that exploration operations be continued in the Toodoggone region during 1969. The principal objects of such a program would be to:

- (a) Evaluate the four most promising mineral properties presently held.
- (b) Investigate in detail two geochemical anomalies discovered in 1968.
- (c) Carry out airborne geophysical surveys over two metallogenic belts defined by work in 1967 and 1968.

It is expected that this work will produce a critical evaluation of the \$290,000 invested in Project Toodoggone to date.

Following are the major elements of proposed Project Toodoggone 1969:

(A) Property Investigation

Riga group

- i) Ground magnetic survey - to assist geological interpretation in drift-covered areas and trace iron oxide zones along intrusive volcanic contacts.

Recommendations (cont'd.)(A) Property Investigation

Riga group (cont'd.)

- ii) Additional geological mapping.
- iii) Induced polarization survey - (about 20 line miles) to explore lateral extensions and continuity of porphyry-type Cu - Mo mineralization.
- iv) Diamond drilling (approx. 2,000') to sample and test downward continuity of known mineralization.

Spartan group

- i) Mechanical stripping (D-6 bulldozer) trenching and sampling, to prospect a broad zone of geochemical response and test the depth of carbonate-oxide weathering of the mineralized area.
- ii) Diamond drilling (approx. 1,000') contingent upon the results of stripping.

Pillar group

Hand trenching, sampling and geological mapping is required to determine the extent and quality of a Cu, Pb, Ag, Mo positive alteration zone which is suspected to be the halo of a concealed sulphide deposit.

Recommendations (cont'd.)

(A) Property Investigation (cont'd.)

Garnet group

Additional geological mapping and prospecting is proposed to determine the significance of known mineralized outcrops.

No further exploration work is recommended for the Opal and T.K. groups.

(B) Investigation of Geochemical Anomalies

Detailed prospecting, geochemical sampling, and mapping should be carried out in a 10 square mile area to determine the source of geochemical response near Tucho Lake.

Stake at least 60 claims in the drainage basin immediately east of the "West" claim group. This ground would then be investigated by additional stream sediment sampling, soil sampling, detailed prospecting, and mapping.

(C) Airborne Geophysical Surveys

Fly detailed air magnetic traverses at average intervals of one-half mile with a ground clearance of

Recommendations (cont'd.)(C) Airborne Geophysical Surveys (cont'd.)

300 to 500', to cover 600 square miles over the Toodoggone Lake, and Warner Peak - Fox Pass metallogenic belts. This will require about 1200 line miles. Provide for 250 line miles for extra detail. The air survey would be followed by prospecting and ground magnetic investigations in selected areas.

The purpose of this work would be to improve geological detail in areas of special interest and to explore directly for copper mineralization associated with iron oxides.

Provide 50 line miles for possible reconnaissance over the "West" and Tucho Lake geochemical anomalies.

Field operations will be supported by helicopter and fixed wing float planes. Base camp will be located at Toodoggone Lake.

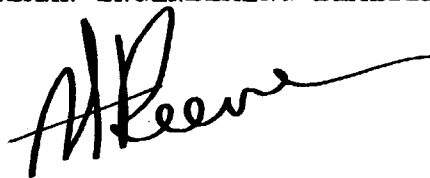
Personnel requirements will be as follows:

1	Party chief	
1	Senior assistant	
1	Field geologist	
4	Field assistants and labourers	
1	Cook	
4	Diamond drilling crew - contractor	
2	Helicopter crew	- "
1	Dozer operator	- "
<u>15</u>	Total	

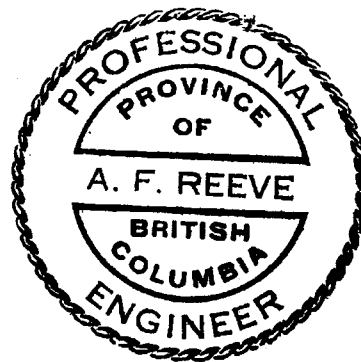
Recommendations (cont'd.)

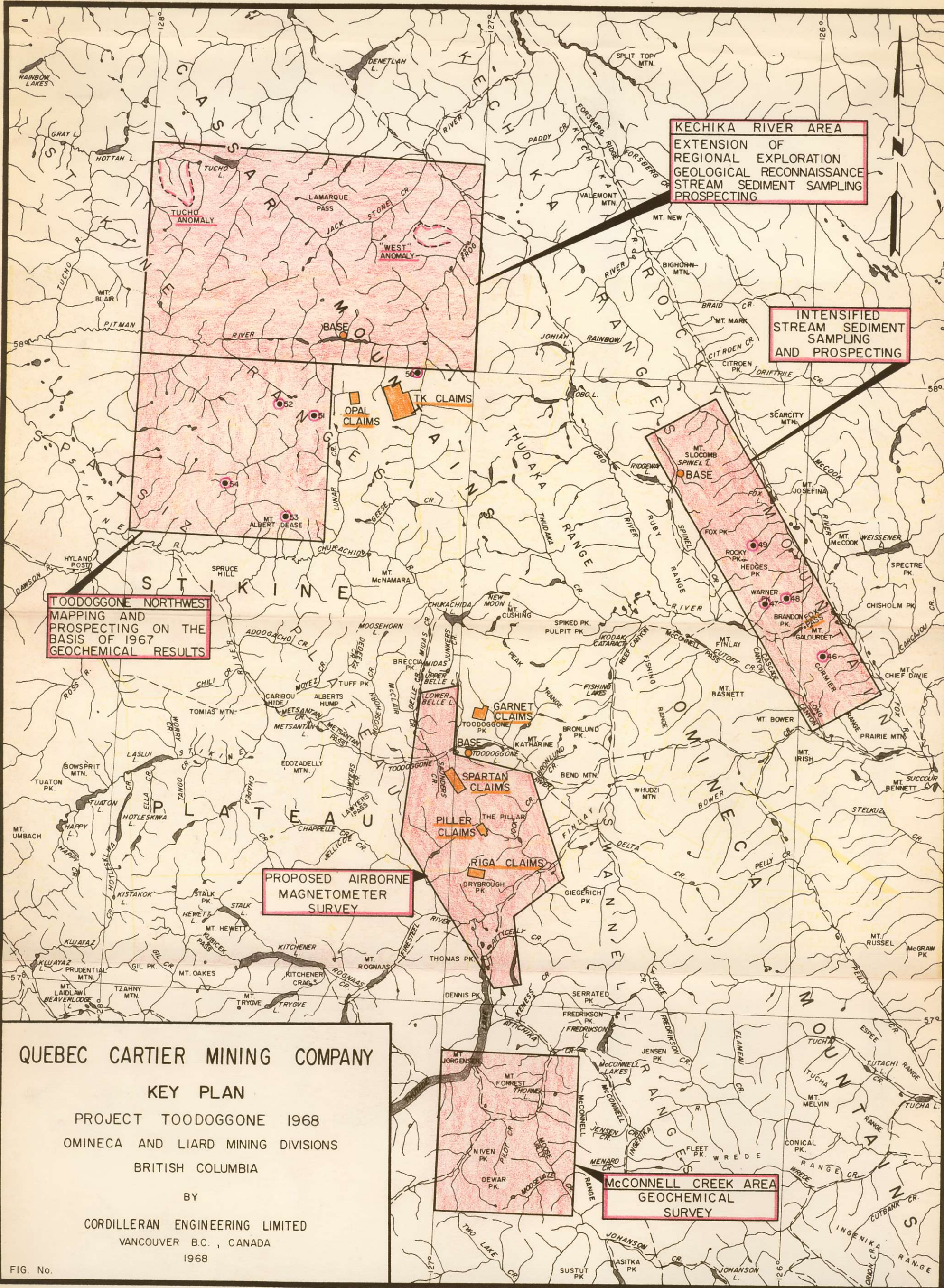
The estimated cost of proposed Project Toodoggone 1969 is \$240,000.00 exclusive of contingency allowances, general overhead and administration expenses. Details of this estimate are presented separately. (Summary Report, Mineral Exploration, British Columbia, Canada, 1968)

Respectfully submitted,
CORDILLERAN ENGINEERING LIMITED



A.F. Reeve, P.Eng.





KECHIKA RIVER AREA
 EXTENSION OF
 REGIONAL EXPLORATION
 GEOLOGICAL RECONNAISSANCE
 STREAM SEDIMENT SAMPLING
 PROSPECTING

**INTENSIFIED
 STREAM SEDIMENT
 SAMPLING
 AND PROSPECTING**

**TOODOGGONE NORTHWEST
 MAPPING AND
 PROSPECTING ON THE
 BASIS OF 1967
 GEOCHEMICAL RESULTS**

**PROPOSED AIRBORNE
 MAGNETOMETER
 SURVEY**

**McCONNELL CREEK AREA
 GEOCHEMICAL
 SURVEY**

QUEBEC CARTIER MINING COMPANY
 KEY PLAN
 PROJECT TOODOGGONE 1968
 Omineca and Liard Mining Divisions
 BRITISH COLUMBIA
 BY
 CORDILLERAN ENGINEERING LIMITED
 VANCOUVER B.C., CANADA
 1968

REFERENCES

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Project Toodoggone 1967
Cordilleran Engineering Limited February 1968
- Results of Geochemical Surveys
in the Toodoggone River Area
by W.F. Bondar February 1968
- Follow-up Geochemical Surveys
Toodoggone River Area
by W.F. Bondar August 1968
- Photo-geological Analysis
Toodoggone River Area
Cordilleran Engineering Limited April 1967
- Tectonic History & Mineral Deposits
of the Western Cordillera
- C.I.M. 1966
- Geology & Mineral Deposits
of Aiken Lake Map Area, B.C.
Memoir 274 - G.S.C. 1954
- McConnell Creek Map Area
Cassiar District, B. C.
Memoir 251 1948

PERSONNEL & CONTRACTORS

PROJECT TOODOGGONE 1968

Personnel

Party Chief - T. Kalnins, Cordilleran staff

Geologists - W. Ash, Student, Michigan Tech.
- F. Pelletier, Student, Colorado

Technician - B. Kromhout, Student, U.B.C.

Field Assistants - F. Hastings, Student, U.B.C.
- R. Ritchie, Student, Haileybury
- R. Deakin, Student, H.S. Vancouver
- G. Smiley, Student, U.B.C.

Cook - L. Tanguay, Cook

Contractors

Leo Lannon Helicopters Ltd. of Vancouver
Bell 47-G3B₁ helicopter on monthly charter

Pilot - P. Bronson
Mechanic - R. Zimmerman

Services on non-contract basis

Omineca Air Services Ltd., Telkwa, B.C.
Air service between Telkwa, B.C. and the Project
area. Float equipped Beaver, Otter and Cessna
aircraft.

Chief Pilot - Wm. Harrison

Bondar-Clegg & Co. Ltd., North Vancouver, B.C. & Ottawa, Ont.

Geochemical analysis, assaying and consulting
geochemical services.

F.D. Forgeron & W.F. Bondar - geochemists

Warnock Hersey Ltd. - Vancouver
Assaying

Personnel & Contractors (cont'd.)

Services on non-contract basis (cont'd.)

Goodacres Store - Smithers, B.C.
Food supplies

Standard Oil of B.C. Ltd., Vancouver

Aviation fuel and lubricants.

K.G. Clarke, representative