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REPORT ON THE

OLD FORT MINERAL CLAIMS

BABINE LAKE, B.C.

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VANCOUVER, B.C.
NOVEMBER 12, 1966

Garry D. Bysouth
Geologist

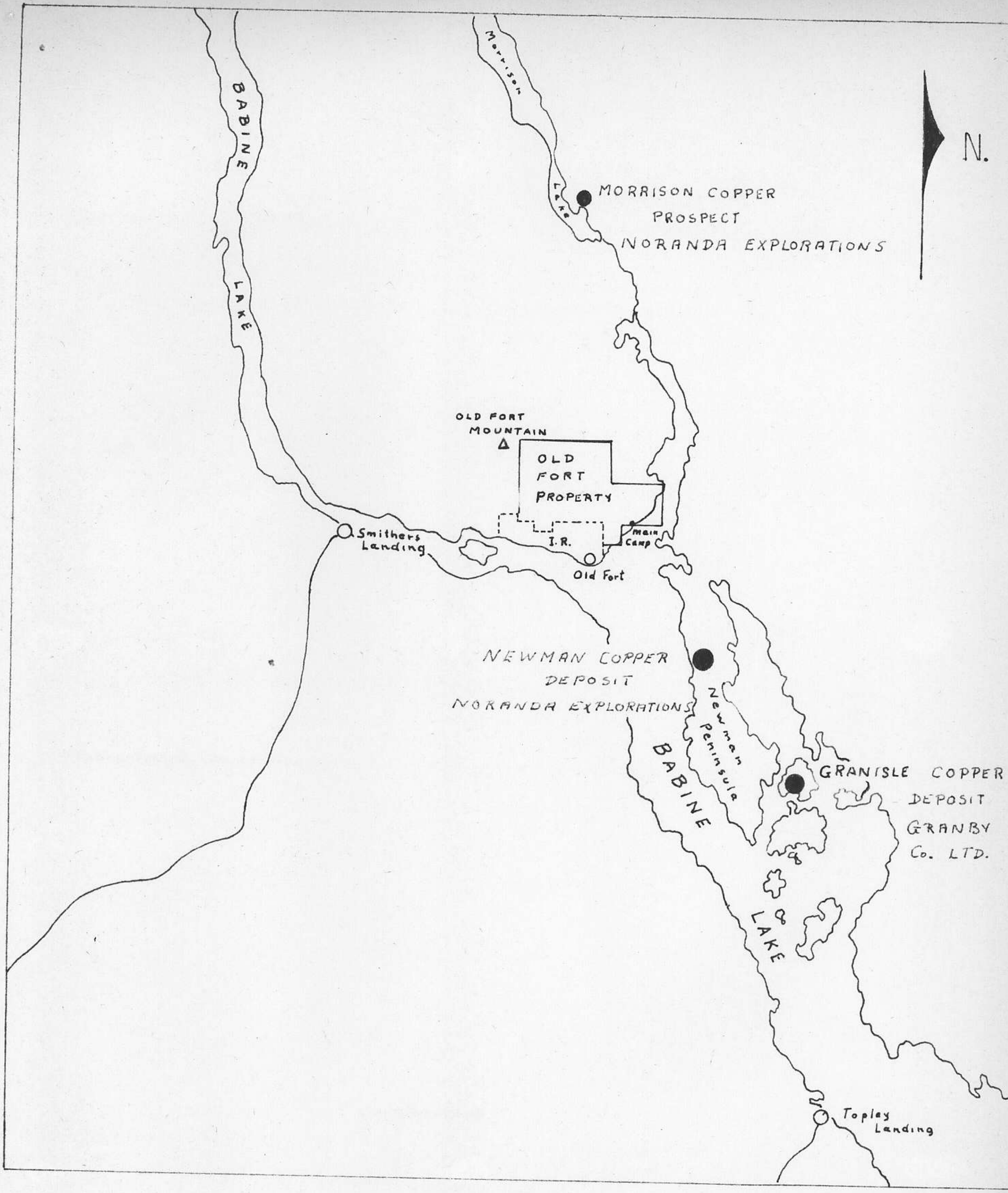


FIGURE 1

FALCONBRIDGE NICKEL MINES LTD.
OLD FORT PROPERTY

Scale 1" = 4 miles OCT. 30, 1966

REPORT ON THE
OLD FORT MINERAL CLAIMS
BABINE LAKE, B.C.
1966

INTRODUCTION

The Old Fort claims cover a "porphyry copper" prospect located in the Babine Lake district northwest of the Newman and Granisle copper deposits. (see figure 1) The property lies approximately 40 miles northeast of Smithers, B.C. from which it is accessible by gravel road to Smithers Landing and by water to the main camp. A bulldozed road leads from the main camp to the principle showings northwest approximately 3 miles.

Most of the claims were staked in 1965, and to date, the property consists of the RAID, OFF, DDT and ITCH claim groups, which together total 116 claims (see figure 2).

PREVIOUS WORK

The discovery in June 1965 of copper mineralization within a small quartz-diorite pluton caused the initial interest in the area. "Follow-up" soil sampling later yielded some highly anomalous copper-rich soils, and due to local competitive activity, the area was staked immediately. By mid-August preliminary geochemical work revealed that a large copper-rich soil anomaly overlay the quartz-diorite, and detailed prospecting indicated that the quartz-diorite was well mineralized in places with chalcopyrite and molybdenite. Similarities were noted too, between this prospect and the Granisle deposit in regards to geology and mineralogy. It was therefore decided to further the exploratory work. A permanent camp was constructed at the Lake and access roads were bulldozed from here to the main showings. An exploration grid consisting of east-west picket lines and surveyed base lines was cut over the area underlain by the quartz-diorite and related hornfels. Within the grid a geochemical soil survey, a ground magnetometer survey and a self-potential survey were completed, along with a preliminary geologic mapping project (scale 1 inch to 200 feet). One of the mineralized zones was also explored by means of a large trench along which assay samples were taken. Near the end of the season, the area was photographed by Lockwood Surveys for the preparation of topographic maps. The work for the season ended on October 24, 1965.

A more complete account of the activity in this area during 1965 is given in the report on Takla-Babine 1965 by E.D. Dodson, under whose direction the above work was carried out.

THE CLAIMS

Most of the claims were located in 1965; the Itch Group and the last four claims of the DDT group were, however, staked in 1966. The recording dates are given below:

Claim	Date Recorded
DDT #1 - 40	July 14, 1965
OFF #1 - 18	July 14, 1965
RAID #1 - 18	July 14, 1965
ITCH #1 - 20	January 14, 1966
ITCH #21- 36	June 14, 1966
DDT #41 - 44	June 14, 1966

EXPLORATORY WORK 1966

Work on the Old Fort property from June 1 to August 12, involved a diamond drill program and related geological mapping. A study of the geochemical soil anomalies was also made, a discussion of which follows in a later section.

The Falconbridge crew consisted of four men: two men who did the line-cutting and surveying; the writer who did the geologic work and supervised the drill programme; and R. Macphee who organized and administered all non-geologic matters. The drill contract was made with Canadian Longyear Ltd., who provided a crew of seven men, including a cook. Copies of the contract and drill log are included in the appendix.

During the period September 2nd to September 16th, the writer attempted to map the general geology of the property. (scale 1 inch to 1,000 feet). In addition, some reconnaissance soil sampling was done by a four-man crew brought in for this purpose.

Geologic data obtained from the drilling and mapping is discussed in the geological section of this report. An outline of the actual work done is given below:

DIAMOND DRILLING

The drilling was confined to the quartz-diorite stock and southern hornfels contact. (see figure 4). The drill sites and completed drill holes were located by transit and chain. The drilling began on June 17 and by July 19th a total of 2,199 feet had been completed. About this time however, the availability of accessible water began to pose a problem. Return water was used, and wells were dug in nearby seepages and small streams. But, by August 9th, the water was so low that drilling had to cease. The total footage from start to finish was 3,652 feet; a total of 17 holes were completed to depths of 200 to 290 feet. A "breakdown" of the drilling costs is given below:

(1)	Drilling costs at $5.20 per foot		$18,755.60
(2)	Moving costs: From Smithers to camp	$2,948.81	
	Between drill sites .	$1,652.20	
	From camp to Smithers	$1,277.07	
	Total		$ ~~5,746.08~~ 5878.08
(3)	Excess overburden, casing, reaming		$ 952.29
(4)	Waterline charges		$ 250.50
(5)	Servicing, transportation		$ 504.36
(6)	Core splitter		$ 174.85

GEOLOGIC MAPPING

A large segment of the pluton was mapped on the scale 1 inch to 40 feet. This work began on June 3, and proceeded in conjunction with the drill programme. Drill-site survey stations were used as control points from whichkmapping was done with chain and Brunton compass.

The trench area, due to an excellent exposure, was mapped on the scale 1 inch to 20 feet. Special attention was paid to structure and mineralization.

Geologic mapping on the scale 1 inch to 1,000 feet was done with the aid of contoured maps and air photos made by Lockwood Surveys.

RECONNAISSANCE SOIL SAMPLING

Soils were collected west and south of the grid area sampled in 1965. The samples were taken every 200 feet along compass and pace traverses spaced approximately 400 feet apart. At the date of this report, the soil analysis have not been completed.

GEOLOGY OF THE OLD FORT PROPERTY
GENERAL STATEMENT

The claim area, and indeed most of the Babine Lake district is mantled by glacial till and glacio-fluvial material - particularly below the 3,000 foot level. Only the more resistant rocks, which either make up the highlands or else occur as isolated hills in the lower areas are available for study. Geologic work is continually frustrated by lack of suitable rock exposure.

GENERAL GEOLOGY

The Old Fort property is underlain principally by volcanic and sedimentary rocks tentatively included here with the Jurassic and Cretaceous Hazelton group. These rocks are altered to hornfels in a belt extending westward towards the summit of Old Fort Mountain. A small quartz-diorite stock outcrops on the eastern flank of the hornfels, and to date, contains the chief zones of mineralization. In the writer's opinion, a similar intrusive rock underlies the hornfels and likely forms the core of the mountain. Dykes of granitic rock occur throughout the area.

HAZELTON GROUP

Predominantly volcanic rocks form the southern boundary of the hornfels belt while a thick sequence of argillite and siltstone occurs to the north. The volcanics consist of chloritized amygdaloidal lavas and poorly bedded tuffs, interbedded with argillaceous sandstones and greywacke. A medium grain feldspar porphyry also occurs with the volcanics. Near the Bible Camp, a large body of this rock appears as a sill, or dyke, dipping gently to the south. The relative age and origin of the porphyry poses a problem - intrusive relations however, show that it is older than the plutonic rocks, and so, in this report it is included with the Hazelton rocks. No doubt, some of the volcanic rocks including the grey porphyry belong to the same metamorphic facies as the hornfels.

Most of the sedimentary rocks found were dark grey carbonaceous siltstones and argillite, commonly having fine, well-bedded textures with individual laminae 1/8 of an inch to 1 inch thick. Quartzose sediments were not common; no carbonate sediments were found. Chert occurs in a few outcrops east of the Bible Camp.

HORNFELS

The transformation of pelitic sedimentary rocks to hornfels appears to have been gradational with a cherty, or silicified, argillite as an intermediate product. In the field, the biotite hornfels was identified chiefly by a subtle brownish coloration, sub-conchoidal fracture and dense granoblastic texture. Thin sections of the rock indicate that quartz and biotite are the main mineral constituents; pyrrhotite was noted to be a persistant minor constituent. Some of the hornfels have a marked blastoporphyritic texture consisting of relic feldspar phenocrysts in a biotite - rich matrix; this rock may be of volcanic parentage. Along the southern side of the quartz-diorite stock, biotite hornfels development doesni't extend more than 300 feet from the steep intrusive contact. It would seem, then, that the large area of hornfels to the west was caused by an underlying body of intrusive rock very much larger than that presently exposed.

SUSTUT ? GROUP

A small area of coarse arenaceous sandstone and pebble conglomerate occurs in the lower areas east of the Bible Camp. These rocks are lithologically similar to the Upper Cretaceous, or Paleocene, Sustüt group reported to the northeast, and are quite distinct from the Hazelton sediments.

QUARTZ-DIORITE

The only pluton found in the claim area is a quartz-diorite intrusive located at the eastern flank of the hornfelsic belt. Because of the mineralization found within it, this rock has been the main focal point for the exploration of this year and last year. The quartz-diorite forms a stock-like body about 2400 feet in diameter, regular in plan, and elongated in an east-west direction. Magnetometer work done in 1965 defines the boundaries of the pluton, and suggests steep-sided contacts. Thin sections suggest that the composition of the stock is close to that of a quartz-diorite with variations towards dioritic and granodioritic compositions. The rock was originally thought to be mainly dioritic and has been reported as such in the drill logs. Throughout the stock, the rock varies little in appearance, remaining as a medium grey, fine to medium grain equigranular rock. On an average, mafics form about 15% of the rock and generally hornblende exceeds biotite. Near the contacts a trachytoid alignment of the mafics is often evident; elsewhere, the fabric is essentially isotropic.

Dykes of quartz-diorite occur near the summit of Old Fort Mountain.

BIOTITE QUARTZ-MONZONITE

The principle occurrence of biotite quartz-monzonite is a small elongated body within, and intrusive to the quartz-diorite stock. Contacts between the two are sharp and well defined. The two rocks are very similar in physical characteristics and mineralogical composition. In the hand specimen, a seriate to porphyritic texture, and the presence of euhedral biotite prisms serve to distinguish the quartz-monzonite from the quartz-diorite. Thin sections reveal that the quartz-monzonite carries more potash feldspar. It is likely that the quartz-monzonite is a later intrusive phase of the quartz-diorite.

Outcrops of biotite quartz-monzonite were found near the northern boundary of the Indian Reserve; it could not be determined whether this was a large dyke or a small pluton.

BIOTITE FELDSPAR PORPHYRY

The biotite feldspar porphyry is genetically related to the biotite quartz-monzonite. Within the stock, dykes of the porphyry radiate outwards from the monzonite (see figure 4) and in places, a transition between the two can be traced out. Unlike the quartz-monzonite, the porphyry is distinctly porphyritic consisting of about 60% subhedral feldspar phenocrysts. Biotite occurs as fresh euhedral prisms, and locally is an important criteria in the identification of the rock. The matrix is generally dark grey, and often brownish in weathered specimens. A thin section of the porphyry taken from the trench area revealed the following composition:

Feldspar An 28 - 32	. . .70%	as corroded crystals
Primary ? Biotite	. . . 3%	as euhedral prisms
Secondary ? Biotite	. . .10%	Matrix
Quartz and Potash Feldspar?.	.15%	Matrix
Opaques	. . . 2%	Matrix

Anhedral quartz phenocrysts were noted in some dykes, but otherwise visible quartz was not common.

Dykes of biotite feldspar porphyry have been found near the summit of Old Fort Mountain and near the north boundary of the Indian Reserve.

It should be noted that the chief copper deposits of the Babine Lake district occur within, or near, dykes of biotite feldspar porphyry.

STRUCTURAL GEOLOGY

Only a rather sketchy outline of the geologic structure can be presented here due to a general lack of reliable outcrops and marker horizons.

Although strong northwest structures prevail throughout the region, no dominate structural trend could be determined locally. The long axes of the hornfels belt and the intrusive bodies including the porphyry are nearly east-west, possibly reflecting an earlier fault system or zone of weakness. Bedding appears to strike parallel to, and dip away from the hornfels-plutonic belt as if doming of the Hazelton rocks had taken place about a central intrusive body, at present only partially exposed. Moreover, high angle shearing, and steeply dipping relict bedding occurs sub-parallel to the actual hornfels - intrusive contacts. Faulting and jointing, obviously later than the above deformation, generally trends northwest and northeast throughout the area except in the eastern half of the quartz-diorite stock where northerly fracture deformation prevails. Jointing in sedimentary rocks often strikes approximately parallel to the bedding, and may, or may not, correspond with the general northwest and northeast trends. The majority of the faulting and jointing is steeply dipping, about 60° to 90°.

Diamond drilling has revealed considerable faulting and fracturing within the intrusive rocks. Much of this deformation forms topographic and magnetic lows. Due to overburden most of it is not available for surface inspection, although some of the northerly joints and faults have a marked effect upon the topography. Westerly fracture deformation appears less common than either the northwest, northeast or northerly fracture trends.

Lineaments and anomalous drainage patterns are common throughout the district. But, these may be largely the result of glacial activity and post glacial stream adjustment, and need not reflect bedrock conditions. A strong lineament to the north is important though, since a number of small sub-parallel faults and shear zones occur within it; that is, this lineament may be the topographic expression of a large northwest fault zone. (see figure 3)

COPPER MINERALIZATION

The economically significant minerals found within the property are chalcopyrite, molybdenite, and bornite. In terms of abundance, chalcopyrite far exceeds molybdenite (about 10:1) and bornite is rare. At the present, both diamond drilling and surface exploration have failed to reveal any sizeable area of persistant mineralization. Known occurrences of the ore minerals are small, discontinuous and low grade. The distribution of these low grade zones forms a crude semi-circle sub-parallel to, and less than 300 feet from the contact between the quartz-diorite and intrusive quartz-monzonite. An enrichment of actinolite and magnetite accompanied by varying degrees of silicification and potash feldspar development occurs near and within the actual intrusive contact. These minerals are also intimately associated with the sulfides occurring at a greater distance around the contact. The richer, and better exposed zones of copper mineralization occurring to the west and north of the contact are described below.

North Zone

The north zone has been explored by means of a 200 foot trench along which sampling has indicated an average grade of .21% copper and .04% MoS_2. Chalcopyrite occurs as disseminations within fault breccia and as minute veinlets filling joints and irregular fractures. Molybdenite occurs chiefly as scattered grains on fracture planes. The minerals magnetite, potash feldspar actinolite, and to a lesser extent, pyrite, quartz and hematite, are common, but not invariable, associates of the copper and molybdenum mineralization. "Bleaching" of the mafic rock-forming minerals sometimes occurs in the immediate vicinity of sulfide mineralization.

Strong northerly fracturing and faulting form the chief host structures for the sulfides and associated minerals. At the east end of the trench, such deformation and mineralization is clearly truncated by northeasterly faulting. (see figure 5 and 6) Since the mineralized zone is also elongated in a northeast direction, the combingation of northerly fracturing blocked by northeasterly faulting forms a likely structural control.

West Zone

Most of the chalcopyrite mineralization in the west zone occurs as disseminated replacements of mafics. Visual estimates of grade vary from 1% to .1% copper; the average grade of the zone is about .2% copper. Bornite occurs at the extreme northern tip of the zone. Pyrite, also as disseminated replacements of mafics, is widespread to the west. Molybdenite remains a common associate of chalcopyrite. Magnetite and actinolite occur with the sulfides, but are considerably enriched to the east near the quartz-monzonite contact.

DRILLING RESULTS

Possible extensions of known mineralization have been checked by diamond drilling; the results have been disappointing. Minor zones of low grade mineralization have been found in drill holes 1, 2, 3, 5, 9 and 11. (see Appendix)

THE GEOCHEMICAL SOIL ANOMALIES

Only about 15% of the total anomaly overlies the intrusive rocks and associated mineralization. Most of the anomalous areas occur below the outcrops where the bedrock is thickly covered by boulder clay, overlain in places by talus and sandy outwash. Since the majority of the copper-rich soils occur in seepage areas, small stream valleys, and various flats and hollows - all close to the local water table, it seems likely that the dispersion is largely hydromorphic. Waters draining the intrusive rocks carry about .1 - 2 ppm. copper and have a pH range of 4.5 - 5.0. As the area is underlain by impervious boulder clay, such copper-bearing run-off would be confined to the upper clay layers. Chemical and physical-chemical processes (i.e. evaporation, absorption on clays, precipitation) would likely localize, or "fix", the copper at favourable sites, such as seepage areas. That is, copper rich anomalies would occur wherever these clays are close to the surface. Such a hypothesis explains the anomalies southwest and south of the west mineralized zone.

A predominately clastic dispersion pattern is evident in the anomalies southwest of the trench area. Here a thin layer of mineralized talus overlies the till, and podzolic-like soils have developed from the talus material; the "B" horizons of these soils are rich in copper.

This study suggests that the chief factors to be considered in the evaluation of a geochemical anomaly in this area are:

(1) the surficial geology
(2) the topography
(3) water table relations

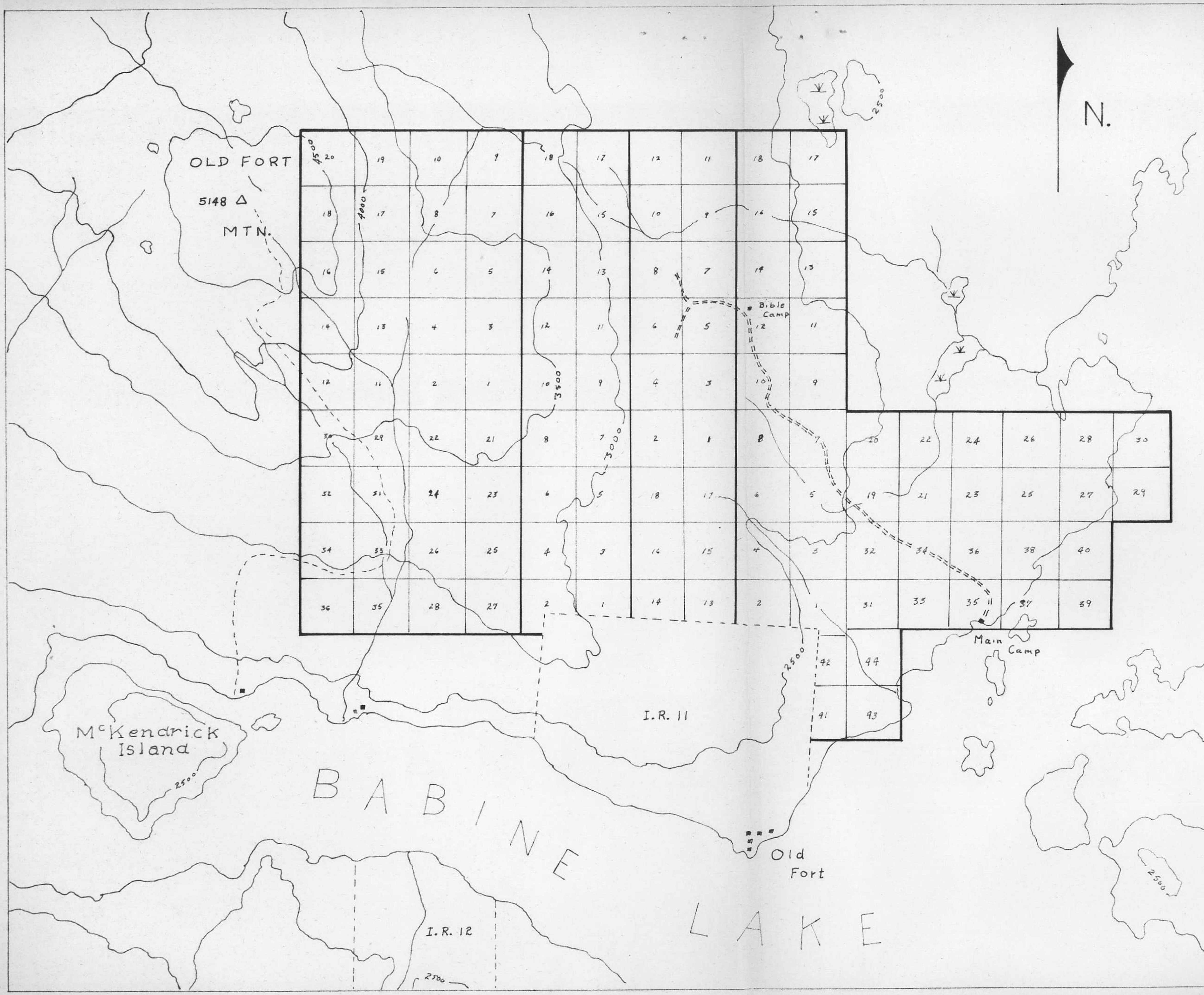


FIGURE 2

FALCONBRIDGE NICKEL MINES LTD.

OLD FORT PROPERTY

BABINE LAKE 93-M1

Scale 1" = 2500' NOV. 4, 1966

Claim Groups:

Itch

Raid

Off

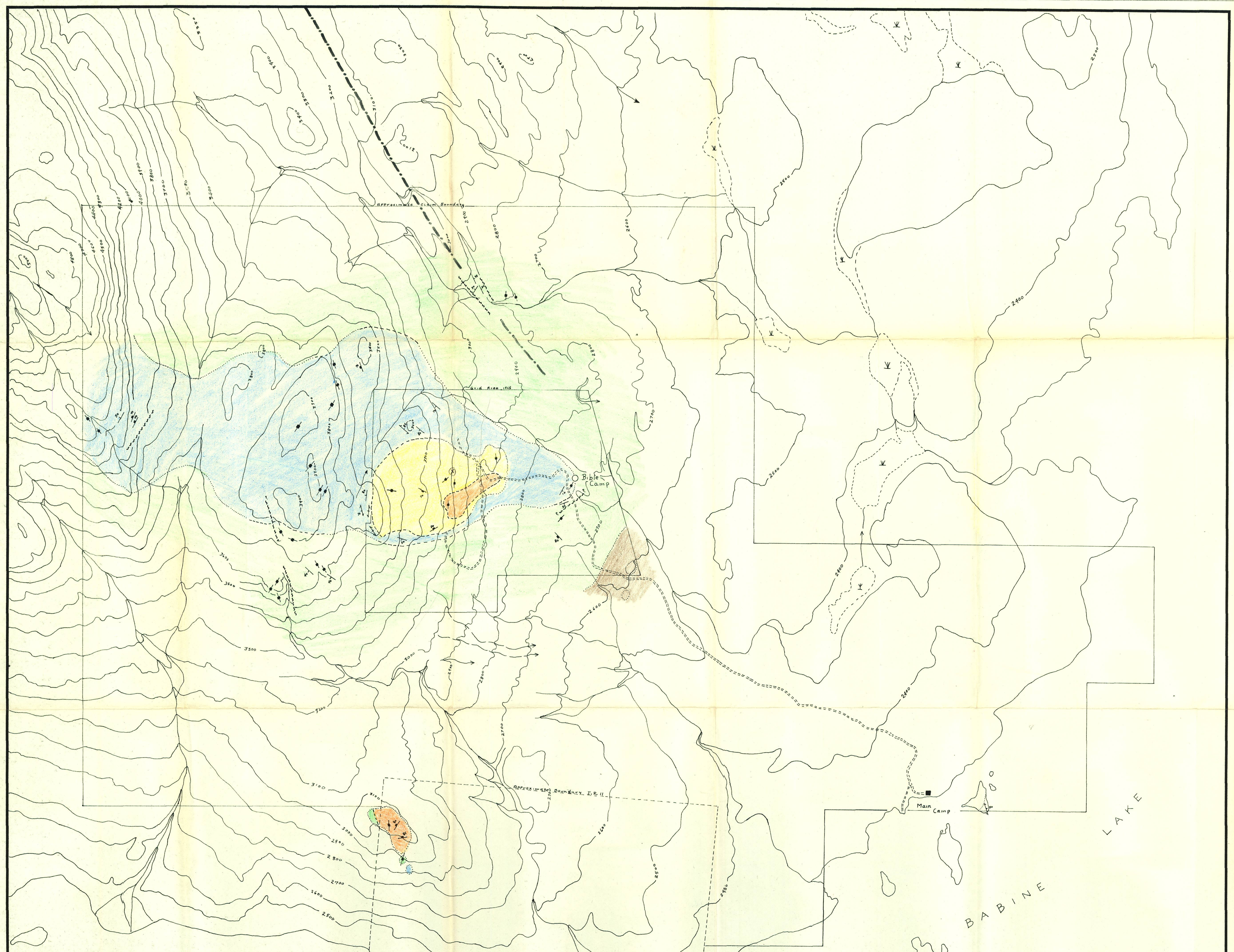
DDT

G.D.B.

Map Ref. No.: 93-M1

FIGURE 3

N.



LEGEND

- Biotite quartz-monzonite
- Quartz-diorite, diorite and granodiorite
- Biotite hornfels
- Hazelton grp?, mainly argillite, siltstone and andesitic volcanics
- Sustut grp? sandstone and conglomerate
- Approx. boundary
- Assumed boundary
- Fault
- Shear zone (vertical)
- Vertical joint
- Inclined joint
- Bedding
- Topographic lineament

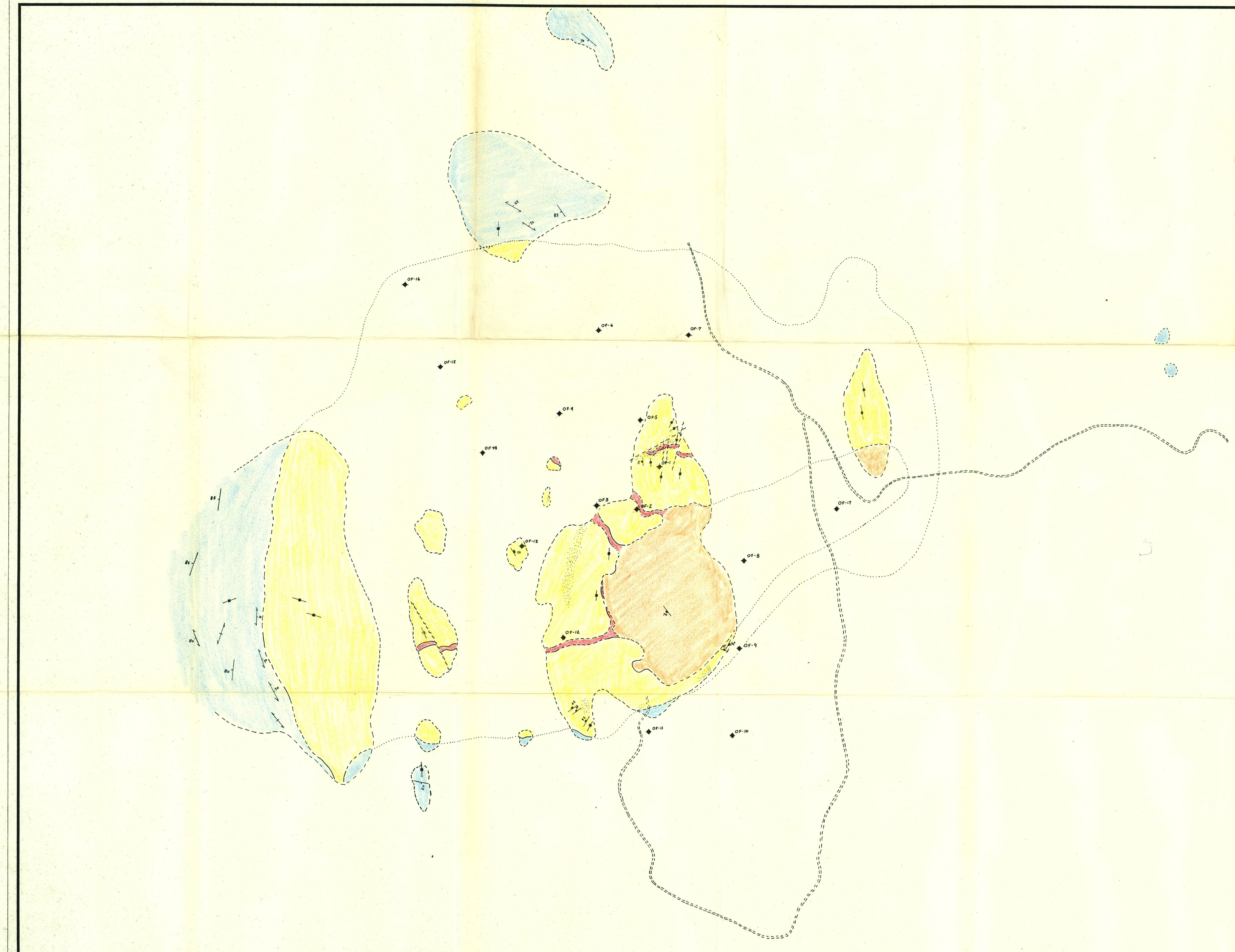
Scale: 1 inch to 1000 feet

Company . . Falconbridge Nickel Mines Ltd.	Working Place . .	Date . . Nov. 9, 1966
Property . . Old Fort	Type of Map . . General Geology	Drawn by . . G.D. Bysouth
Location . . Babine Lake B.C.	Based on . . Mapping by G.D. Bysouth	Date of Work . . Sept, 1966

MAP REF. NO.: 93 M1

FIGURE 4

N.



LEGEND

Biotite quartz-monzonite

Biotite feldspar porphyry

Quartz diorite diorite and granodiorite

Biotite hornfels

Chalcopyrite mineralization approx. .2 % copper

Geologic boundaries

Exact

Approximate

Assumed

Symbols

Fault

Shear zone (vertical)

Vertical joint

Inclined joint

Bedding

Diamond drill hole

SCALE: 1 INCH TO 200 Feet

COMPANY . . FALCONBRIDGE NICKEL MINES LTD.

PROPERTY . . OLD FORT

LOCATION . . BABINE LAKE, B.C.

WORKING PLACE . .

TYPE OF MAP . . GENERAL GEOLOGY

BASED ON . . MAPPING BY G.D. BYSOUTH

DATE . . NOV. 9, 1966

DRAWN BY . . G.D. BYSOUTH

DATE OF WORK . .

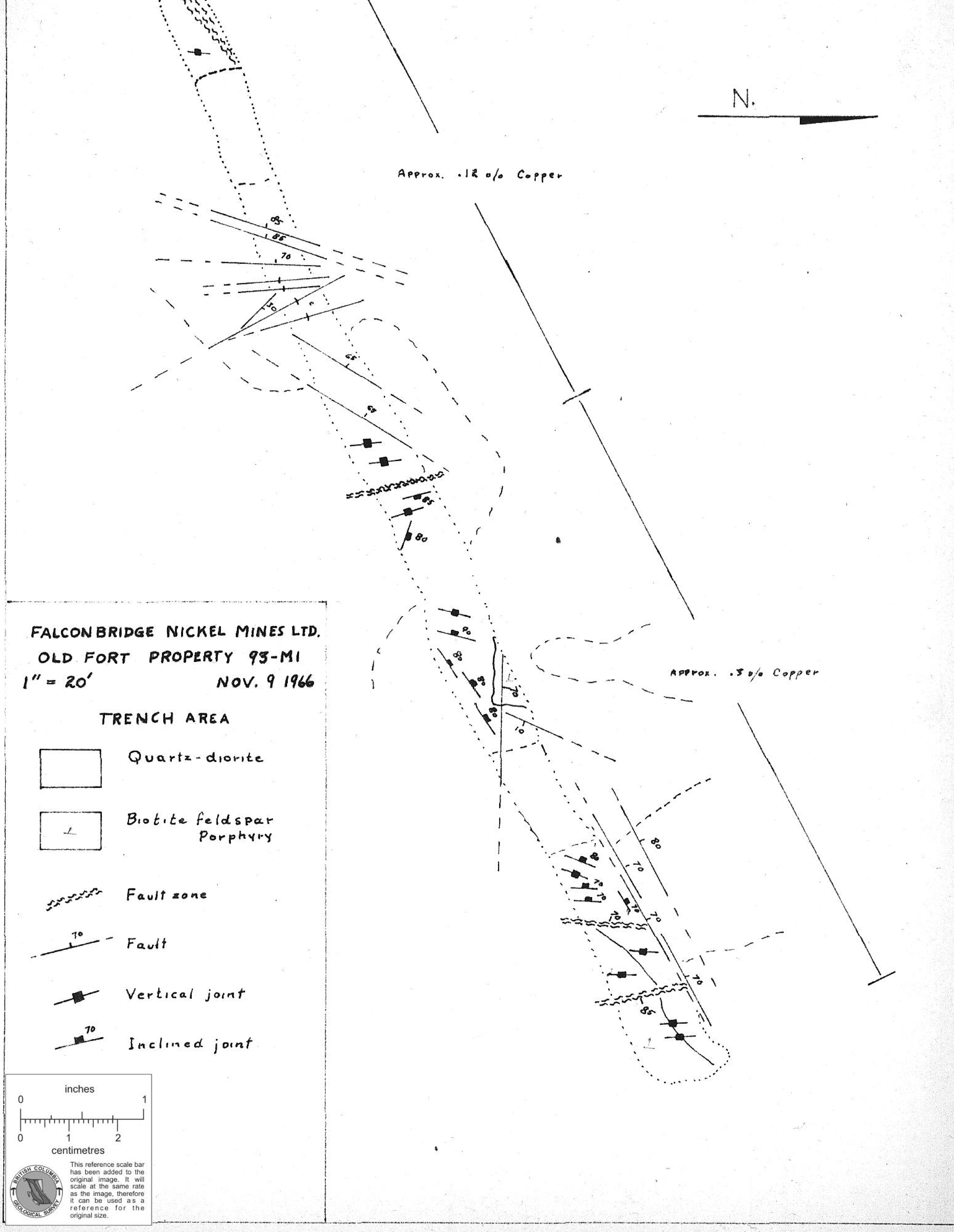
SCALE: 1 INCH TO 40 FEET

COMPANY . . FALCONBRIDGE NICKEL MINES LTD.
PROPERTY . . OLD FORT
LOCATION . . BABINE LAKE, B.C.

WORKING PLACE . .
TYPE OF MAP . . DETAILED GEOLOGY
BASED ON . . WORK BY G.D.BYSOUTH

DATE . . NOV. 11 1966
DRAWN BY . . G.D. BYSOUTH
DATE OF WORK . . JUNE-AUG. 1966

FIGURE 6



N.
Approx. .12 o/o Copper
Approx. .30/o Copper
FALCONBRIDGE NICKEL MINES LTD.
OLD FORT PROPERTY 93-M1
1" = 20'
NOV. 9 1966
TRENCH AREA
Quartz-diorite
Biotite feldspar Porphyry
Fault zone
Fault
Vertical joint
Inclined joint