

REPORT ON
PETROGRAPHY AND GEOLOGY OF THE VOLCANIC SEQUENCE
KUTCHO 1-6 MINERAL CLAIMS

KUTCHO PROPERTY

58°12'N 128°30'W

1041 1W & 2E

LIARD MINING DIVISION

NORANDA EXPLORATION COMPANY, LIMITED

(NO PERSONAL LIABILITY)

by

DOUGLAS GRANT TROOP

Under The Direction of

R. MacArthur, District Geologist

and

G.E. Dirom, P. Eng.

April, 1981

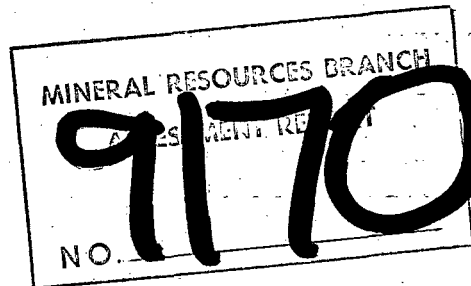


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1. GENERAL INTRODUCTION

The following report describes the work carried out on the Noranda "Kutcho Property" during 1980.

The work was performed by G. Troop and K. Lillie under the supervision of R. MacArthur and G. Dirom P.Eng. The geological report was prepared by G. Troop and is included here verbatim.

The property covers occurrences of Cu-Zn mineralization in schistose volcanic, volcanoclastic and sedimentary rocks.

i) Location and Access

The property is located approximately 95 km southeast of Dease Lake in northwestern B.C.

Access to the property has been by helicopter from Dease Lake or via the Kutcho Airstrip located approximately 3 km to the north. (For the 1980 programme a Bell 206B helicopter contracted by Noranda and based at Mayfield Lake 160 km southeast was used).

ii) Claims and Ownership

The Kutcho property consists of the following claims:

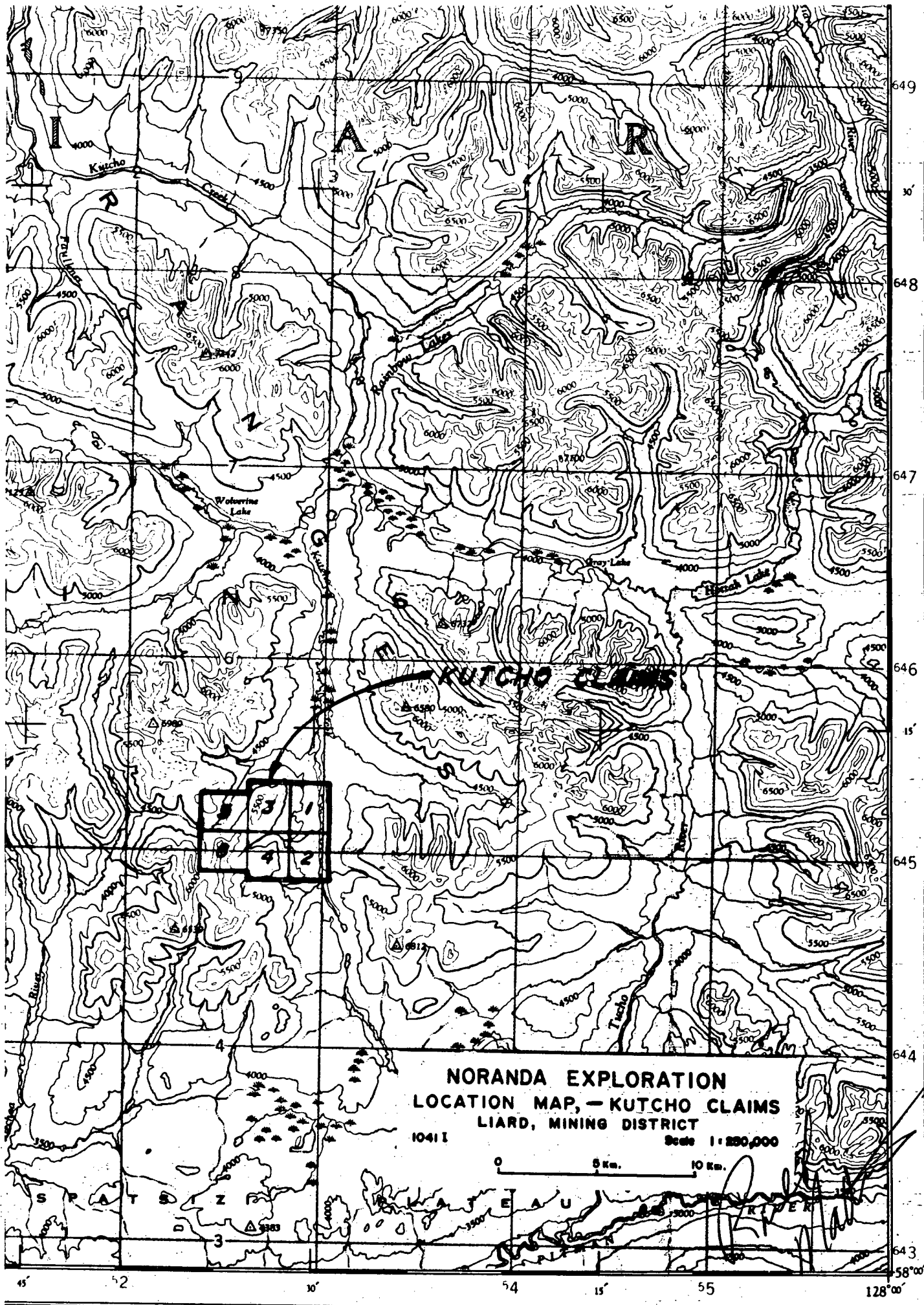
<u>CLAIM</u>	<u>UNITS</u>	<u>RECORD NO.</u>	<u>RECORD DATE</u>	<u>OWNER</u>
Kutcho 1	12	99	March 10, 1976	Noranda Exploration Company Limited (No Personal Liability)
Kutcho 2	20	100	" " "	" " "
Kutcho 3	12	101	" " "	" " "
Kutcho 4	20	102	" " "	" " "
Kutcho 5	8	103	" " "	" " "
Kutcho 6	8	104	" " "	" " "

iii) Topography and Vegetation

The area is characterized by mountainous terrain with elevations up to 2200 meters and local relief on the order of 800 meters.

The area has been subjected to glaciation and most of the mountains are covered with a thin veneer of glacial debris while the lower valleys are filled with thick glacial deposits.

Vegetation in the area consists of a dense growth of spruce and fir below 1500 m merging into patches of mountain willow or "buckbrush" up to 1700 m. Above 1700 m there is only short grass and moss.



Many of the larger river valleys in the area are covered only with dense "buckbrush".

iv) Regional Geology

The area has been mapped regionally by the Geological Survey of Canada and their results are available as Open File Map #610 at a scale of 1:125,000.

Regional mapping indicates the area is underlain by a sequence of volcanic, volcanoclastic and sedimentary rocks ranging from Upper Triassic to Lower Jurassic in age. The sequence has been tightly folded with axes trending west northwest often plunging to the west.

v) Previous Work

The property was staked by Imperial shortly after the discovery of the Sumac - Imperial deposit on the nearby "Jeff" and "SMRB" claims. The property was dropped after a limited amount of work.

The property was staked by Noranda in 1976 and the following table outlines the work done prior to the 1980 programme.

<u>YEAR</u>		<u>CLAIMS</u>	
1976	February	Staking Kutcho 1 to 6	
1976	June, July		Geological Mapping Line Cutting Soil Survey CEM Survey Vertical Loop EM Partial IP Survey Partial VLF Survey
1976	August	Taking Kutcho 7,8,9 & 10	Airborne VLF & Mag Survey
1977	June, July	Kutcho 1 to 6	Grid Extension Additional Mapping CEM, IP, and Soil Sampling Drill Holes NK-1, NK-2 & NK-3 = Total 229m.
		Kutcho 7,8,9,& 10	Grid Preparation Soil Survey CEM Survey Geological Mapping
1978	August	Kutcho 8	Geological Mapping and CEM Survey

11. PETROGRAPHY AND GEOLOGY REPORT

i) Introduction

This report describes the conclusions of field work carried out on the Kutcho 1-6 mineral claims, Liard Mining Division, B.C. Field work was carried out between the dates of June 28 and July 9, 1980 by

Grant Troop and Kevin Lillie, both employed by Noranda Exploration.

The programme was designed to provide a re-evaluation of the property in terms of the volcanogenic massive sulphide bearing potential of the local volcanic sequence. Although geophysical, geochemical and prospecting techniques have not been successful in locating ore grade/tonnage mineralization, encouragement has been obtained from minor chalcopyrite-pyrrhotite-pyrite stringer zone type mineralization and overall similarity to the Esso/Sumac volcanic stratigraphy to the east. The latter point is of particular importance as extensive diamond drilling has outlined an estimated 6 million tonne orebody at 4.33% Zn and 2.38% Cu on the Esso/Sumac property - the Kutcho Creek deposit.

The objectives of the programme were as follows:

- (1) remapping the property and reinterpretation of geology.
- (2) preliminary petrography of the volcanic stratigraphy.
- (3) litho-geochemistry of selected volcanic intervals, for the purpose of noting any metal haloes and/or oxide component enrichments or depletions.

Only the first two objectives are herein reported.

ii) Field Geology

The regional geology of the King Salmon Assemblage is well documented by Thorstad (1979) and others as a Triassic to Jurassic volcano-sedimentary sequence emplaced as a thrust plate slice. The Kutcho formation is observed as a sequence of basic to acidic volcanic flow and pyroclastic rocks, overlain by limestones and phyllites. Complex folding and faulting have somewhat complicated the local structure while subgreen-schist to greenschist regional metamorphism is super-imposed.

The Kutcho property has been remapped with the aims of:

- (1) developing a local volcanic stratigraphy with rock identifications which are applicable in the field.
- (2) obtaining a better understanding of the local structure.

Mapping on the property was accomplished with the aid of the old Noranda grid. As well, several traverses were run over the ridge and cirque areas at the west end of the property. The geological plan is shown on Dwg. 1 (in pocket) at a scale of 1:5,000.

Previous mapping and structural interpretation of the local geology has been essentially correct. Lithologic patterns indicate an anticline-syncline series of folds whose axes are plunging west to northwest and foliations steeply dipping to the north. Obviously, the axial planes of these large folds have been tilted to the north, to account for the lack of south dipping foliations.

Mapping at the head of the cirque (west end of the property) has shown the flexure point of the most northerly syncline and in just observing the scarp at the head of the west cirque, several large folded structures can be identified. These have been correlated with field evidence. It is also in this area that the volcanic sequence dips down underneath the younger sediments of the Sinwa and Inklin formations, and thus a large section of volcanics cannot be observed. However, repeated folding exposes the volcanics on the south flank of the west ridge, where they have been mapped.

The volcanic sequence has been mapped into a number of sub-units which are readily identifiable in the field. An excellent mappable section is noted along the north side of the main valley, where all units are observed. Transition units, such as the Maroon Tuff (3a) between the basic volcanics (1b/1c) and the agglomerate (3) or the Limy agglomerate (4a) between the agglomerate (3) and the Sinwa limestone (4), are persistent albeit thin units which are mappable over large distances. These provide good markers, and have been found on the south side of the main valley, where the agglomerates are absent.

An important point which the petrography has shown is that the 1a and 2b units are essentially the same and that chlorite content simply increases stratigraphically downwards. Initially, a distinction was made on the basis of colour. The 1a/2b unit is termed a Quartz eye sericite-chlorite schist and is the most persistent unit of the sequence. It shows facies transitions to the Quartz sericite schist (2a) and the basic chlorite and epidote-chlorite schists (1b and 1c). The 1a/2b unit may well represent the equivalent of Esso's Quartz feldspar crystal tuff (QFCT) with which the sulphide zones are intimately associated.

It is noted that the volcanic sequence ends with basic volcanic units (1b and 1c) and the tuff/agglomerate unit (3a and 3) on the north limb of the north syncline, while these units appear to be absent to the south. This suggests radically different environments of volcanicity between the two areas. In fact, the agglomerate unit is well-developed only on the north limb margin, in contact with limestone indicating a more sub-aerial environment here probably closer to volcanic source.

After a period of quiescence, renewed volcanic activity produced the sequence of rhyolite porphyry (unit 2a) which is in direct contact with the north contact of the Inklin slate. It is felt that this unit is not suitable for massive sulphide development and is genetically different from the rhyolitic sericite schists (2a) associated with the Quartz eye schists (1a/2b). These latter 2a volcanics may correspond to Esso's rhyolite lapilli tuff and lapilli crystal tuff (LCT) of the ore horizon.

iii) Petrography of the Volcanic Rocks

A total of ninety rock samples were collected from the property and shipped to the University of Toronto for petrographic work. Twenty of these samples were chosen to be sectioned as a representative suite of the lithologies present, in order to make more definite determinations of mineralogy and rock fabric. The rock specimens and the unit from which they were chosen are shown in Table 1. The follow-

ing unit descriptions are summarized from petrographic descriptions of each slide.

A. Unit 1a/2b - Quartz eye Sericite-Chlorite Schist

Large crystal fragments (up to 5 mm) of both quartz and twinned plagioclase (An₄₈, andesine) are observed in this unit, which is almost certainly a tuffaceous pyroclastic. In general, the quartz occurs as fractured, clean "eyes" while plagioclase laths are heavily sericitized. Also, a number of the smaller plagioclase crystals have been substantially altered to a fine grained epidote-clinozoisite mixture, making them almost opaque. Epidote-clinozoisite-zoisite crystals as alteration of plagioclase are scattered throughout the matrix.

The groundmass is well foliated and shows a bending of chlorite-sericite bands around crystal fragments. These schistose bands are often interbanded with equigranular quartz and sericite - the quartz showing effects of recrystallization and probable silicification. Sericitization of the matrix is more prominent than chloritization, which is concentrated mainly in the foliated bands particularly around plagioclase laths. The chlorites show both anomalous brown and blue interference colours, but are of green colour, indicating that they are iron rich.

Carbonate alteration of plagioclase rather than epidote alteration was noted in section 06-5. A dolomite alteration halo is documented at the Kutcho deposit.

B. Unit 2a - Quartz Sericite Schist

The fabric shows a fine grained recrystallized quartz groundmass (with numerous 120° equilibrium textures) with strongly foliated sericite bands traversing through the matrix. These bands are seen to deflect around the few quartz eyes present. There also appears to be a random sericitization of the groundmass, possibly a relict of hydrothermal alteration, as some of the sericite is included in the recrystallized quartz. Silicification of this unit has occurred as most plagioclase and alkali feldspar has been destroyed.

An interesting feature and characteristic texture of this unit is noted a radial quartz equilibration of flame-like quartz laths around the ends of pyrite grains (and sometimes quartz eyes). This is a pressure-resolution phenomenon in which primary large crystals of pyrite and quartz have provided pressure shadows for recrystallizing quartz to equilibrate parallel to foliation direction (ie. perpendicular to direction of principal stress). This is good evidence that the pyrite is primary (ie. pre-deformational) and may be the result of hydrothermal solution passage. Sample 03-1 is highly pyritic and resembles massive sulphide stockwork or stringer zone ore.

C. Unit 1b - Chlorite Schist

Minor quartz and plagioclase phenocrysts are noted in a fine grained well foliated groundmass of chlorite and minor sericite. Fine grained recrystallized quartz stringers and blebs are probably the result of silicification. Plagioclase phenocrysts (An₅₅, Labradorite)

are heavily sericitized or show complete carbonate-epidote alteration. Epidote is not common, however and would not be observed in hand specimen. There seems to be a good deal of carbonate associated with this unit, sometimes as replacement bands, parallel to foliation. Chlorite is predominant over sericite and is green in colour indicating high iron content.

D. Unit 1c - Epidote-Chlorite Schist

A very schistose or foliated groundmass is noted as fine grained bands of chlorite and sericite with interlayered recrystallized bands of elongate quartz blebs and sericite. These bands curve around large quartz and plagioclase phenocrysts. In places, the epidote is very fine grained and almost opaque, but coarse fresh crystals are common in the larger relict plagioclase laths.

In section 30-2, this unit is in contact with the iron chert tuffaceous exhalite unit which may be similar to the "tetsusekiei" of Kuroko deposits. This is composed of equigranular quartz, carbonate, hematite and pyrite plus tuffaceous rock fragments and would seem to be a chemical precipitate formed in an active sedimentary environment. Chlorites in direct contact with this exhalite show anomalous brown interference colours and are a yellowish-green colour indicating a higher magnesium content - indicative of a hydrothermal assemblage.

E. Units 3, 3a, and 4a - Agglomerate, Maroon Tuff and Limy Agglomerate

These units are important only in that they mark the waning stage of volcanic activity and are characterized by an increasingly sedimentary nature. Large volcanic rock fragments are noted in these, as well as an increasing percentage of calcite, much of which appears to be primary rather than a replacement of plagioclase phenocrysts. Filling in the matrix around these large clasts (in which primary pyroclastic textures are often visible) are fine recrystallized quartz plus bands of sericite and chlorite. Hematite is a common constituent in the maroon tuffs - imparting the characteristic colour. The calcite occurs in large crystals, often with quartz and sericite inclusions.

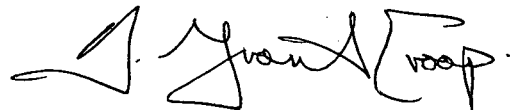
DISCUSSION

In general, the volcanic stratigraphy observed on the Kutcho property appears to be a rough equivalent of that observed by Esso on the east side of Kutcho Creek. Naturally, differences are noted with Esso's described type section, but variability of units is noted on the Noranda property alone and this is intrinsic to most volcanic terraines. The fact that massive sulphide deposits usually occur in clusters (ie. Noranda, Matagami, Bathurst) makes this property potentially valuable in light of Esso's sulphide discovery. There is also no reason to assume that all mineralization must come from only one exhalative centre - there may be several.

The presence of several discontinuous but traceable hematitic chert exhalite zones is encouraging (a feature not documented on the Esso property) as is the carbonitization, silicification and sericitization of the quartz eye sericite chlorite schist and quartz sericite schist units. The latter are indicative that at least some hydrothermal

activity by leaching brines has occurred although the centre of this 'plumbing system' is ill-defined. Geochemical studies would be of more use in this respect.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Douglas Grant Troop". The signature is stylized and cursive, with the word "Troop" written in a larger, more prominent font at the end.

Douglas Grant Troop

STATEMENT OF QUALIFICATIONS

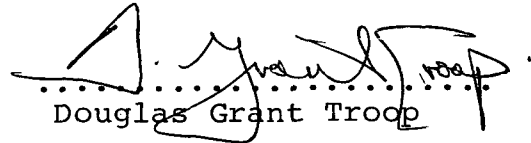
I, Douglas Grant Troop, of the City of Toronto, Ontario, do hereby certify that:

(1) I am a graduate of the University of Toronto with a Bachelor of Science Specialist degree in geology.

(2) I am a candidate for the degree of Master of Science, also at the University of Toronto.

(3) I have a total of six field seasons of geological experience, and have worked intermittantly with Noranda Exploration for four of these.

(4) I am a Student Member of the Canadian Institute of Mining and Metallurgy.


.....
Douglas Grant Troop

STATEMENT OF QUALIFICATIONS

I, Ronald G. MacArthur of the City of Vancouver, Province of British Columbia, do certify that:

- 1) I have been an employee of Noranda Exploration Company, Limited since May 1972.
- 2) I am a graduate of Dalhousie University with a Bachelor of Science Degree in Geology.
- 3) I am a member of the Canadian Institute of Mining and Metallurgy.
- 4) I am a member of the Geological Association of Canada.



R.G. MacArthur

Geologist

Noranda Exploration Company, Limited
(No Personal Liability)

Table 1. Thin Sections Examined From The Kutcho Property

<u>Rock Specimen and Section #</u>	<u>Stratigraphic Unit</u>
(T806) 30-2	1c/iron chert
(T807) 01-1	1b
01-5	1c
01-16	4a
02-1	1a
02-3	1a
02-4	1b
02-5	3a
02-6	3
03-1	2a
04-3	1c
06-5	2b
06-6	2a
07-3	2b
07-4	2a
08-3	2a
08-4	2b
08-8	2b
08-9	1a
10-4	1b

The rock specimen locations are noted on Dwg. 2 (in pocket).

NORANDA EXPLORATION COMPANY, LIMITED

STATEMENT OF COST

PROJECT KUTCHO

DATE March 1981

TYPE OF REPORT GEOLOGY

a) Wages:

No. of Days 74

Rate per Day \$59.94337

Dates From: June 23 1980 to March 9, 1981

Total Wages 74 x \$59.94337

4,435.81

b) Food and Accomodation:

No of days 74

Rate per day \$18.0135

Dates From: June 23, 1980 to March 9, 1981

Total Cost 74 x \$18.0135

1,333.00

c) Transportation:

No of days 74

Rate per day \$52.13905

Dates From: June 23, 1980 to March 9, 1981

Total Cost 74 X \$52.13905

3,858.29

d) Instrument Rental:

Type of Instrument

No of days

Rate per day \$

Dates From:

Total Cost X \$

Type of Instrument

No of days

Rate per day \$

Dates From:

Total Cost X \$

f) Analysis
(See attached schedule)

g) Cost of preparation of Report

Author	2 Days @ 59.94337	119.89
Drafting	1 Day @ 150.00	150.00
Typing	1 Day @ 100.00	100.00

h) Other:

FIELD SUPPLIES

7.85

Supervision: D.E. Cross P. Eng.
G.E. Dirom P. Eng.
2 Days @ 230.00

460.00

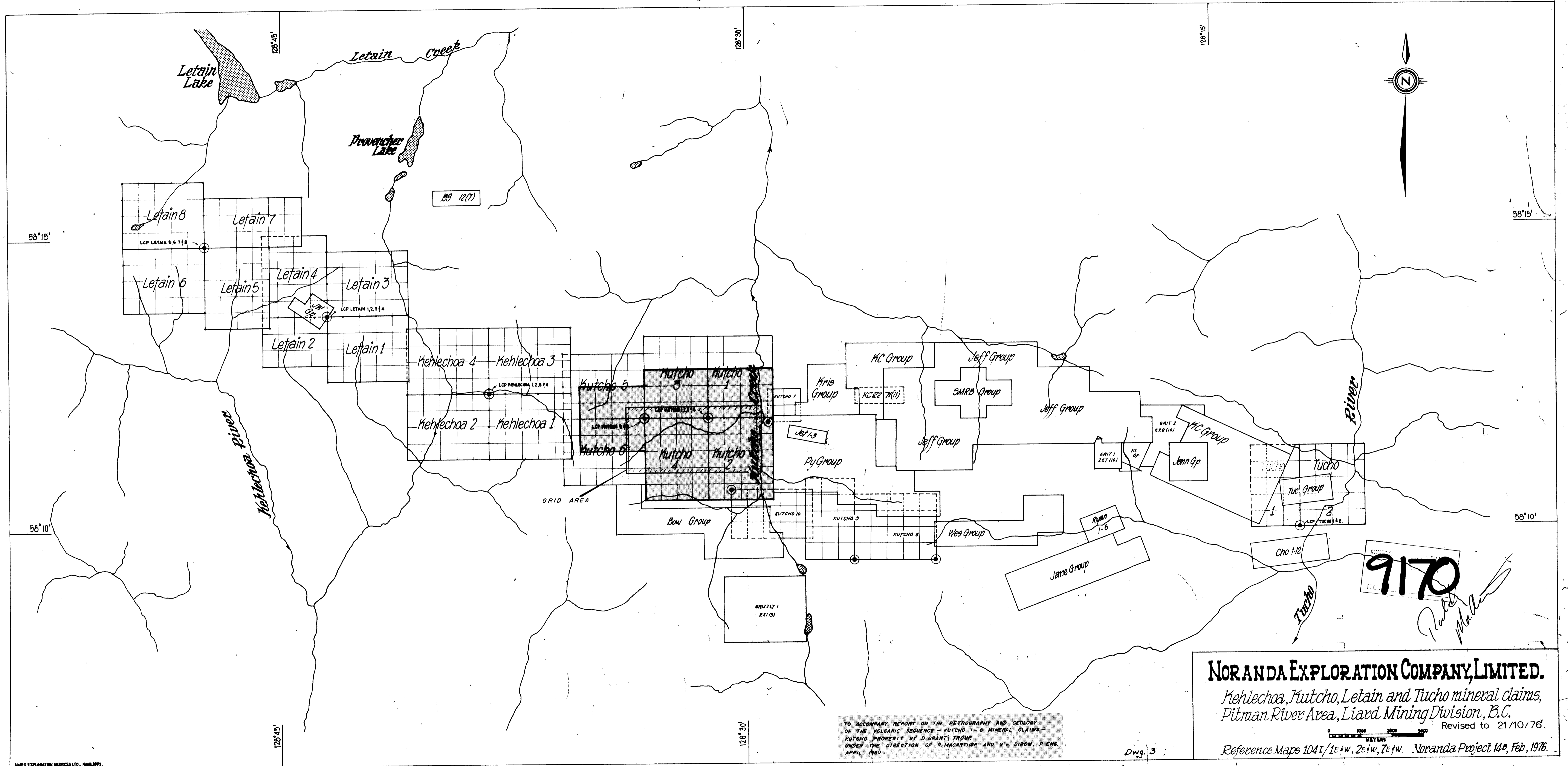
Total Cost

10,464.84

e) Unit costs for

No of days	74	
No of units	74	
Unit costs	141.41675	/ Day
Total Cost	74	x 141.41675

\$10,464.84



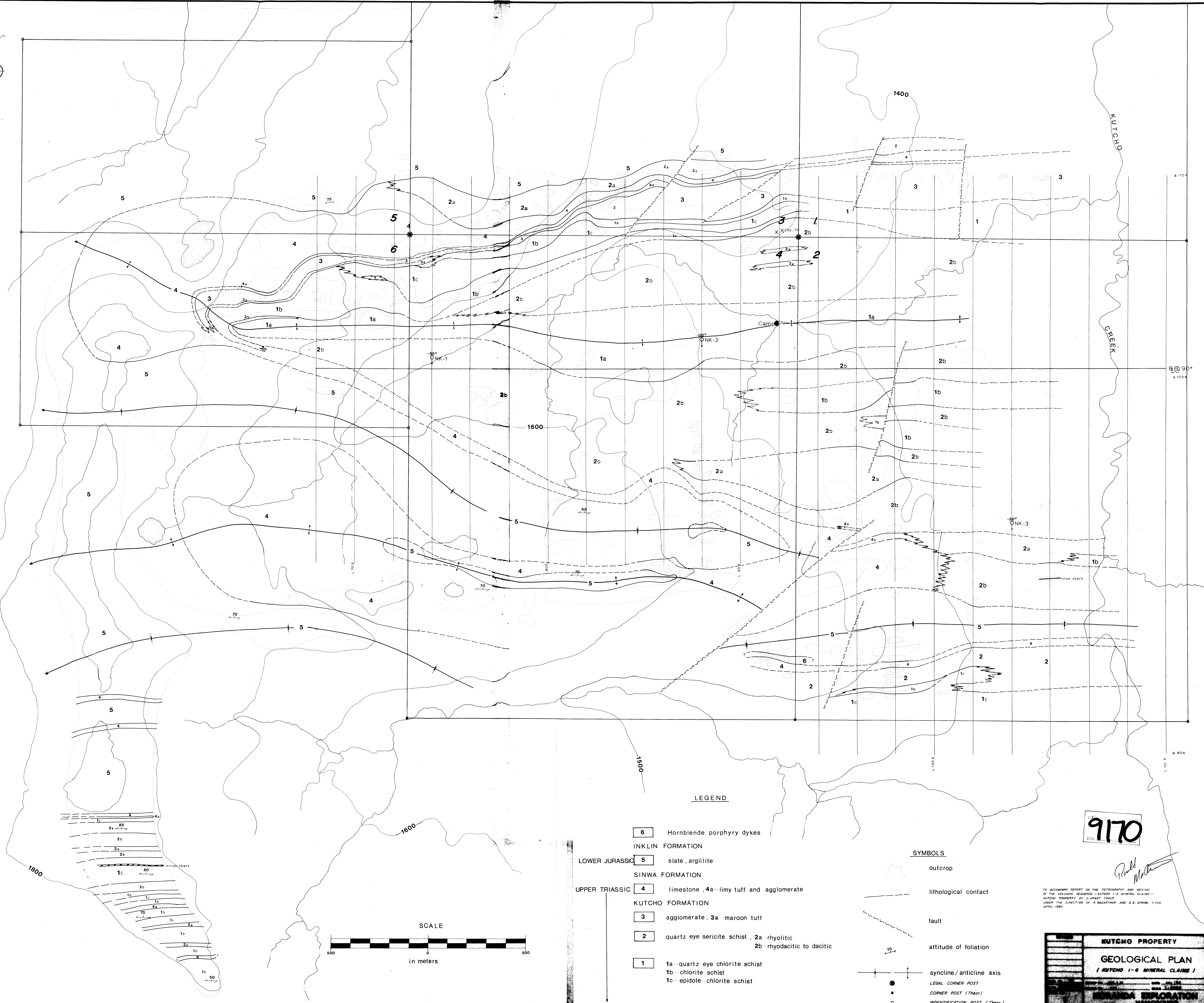
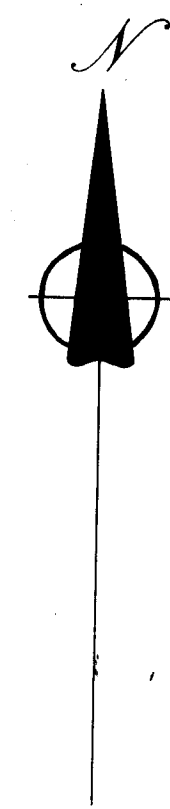
AMEX EXPLORATION SERVICES LTD. - VANCOUVER

TO ACCOMPANY REPORT ON THE PETROGRAPHY AND GEOLOGY OF THE VOLCANIC SEQUENCE - KUTCHO 1-6 MINERAL CLAIMS - KUTCHO PROPERTY BY D. GRANT TROUP UNDER THE DIRECTION OF R. MACARTHUR AND G.E. DIROM, P. ENG. APRIL, 1980

Dwg. 3

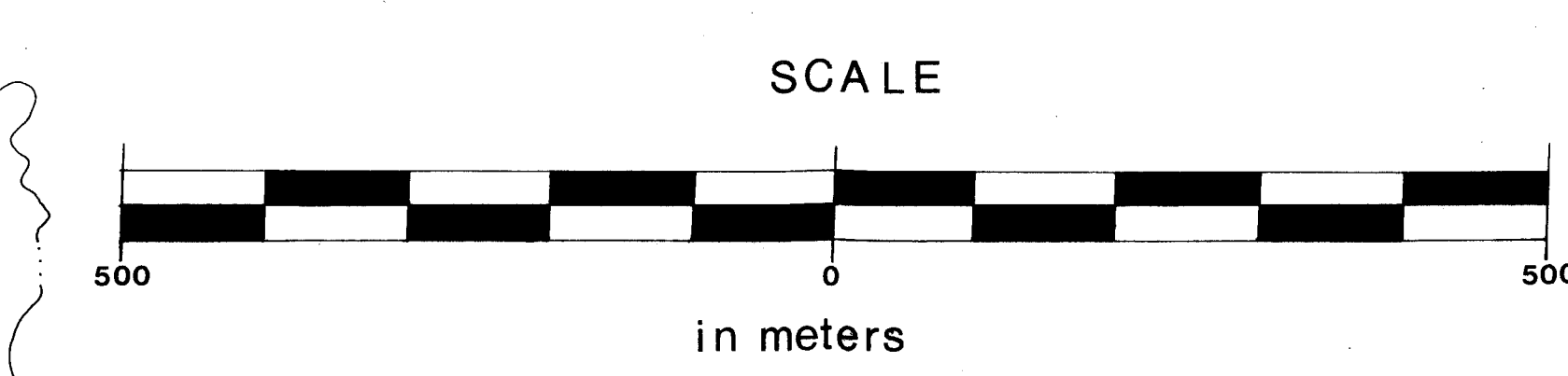
NORANDA EXPLORATION COMPANY, LIMITED.
Mehlechoa, Kutcho, Letain and Tucho mineral claims, Pitman River Area, Liard Mining Division, B.C.
 Revised to 21/10/76.
 Reference Maps 1041/1E+W, 2E+W, 7E+W. Noranda Project 148, Feb, 1976.

9170
Paul M. ...



- LEGEND**
- 6 Hornblende porphyry dykes
 - INKLIN FORMATION
 - LOWER JURASSIC 5 slate, argillite
 - SINWA FORMATION
 - UPPER TRIASSIC 4 limestone, 4a - limy tuff and agglomerate
 - KUTCHO FORMATION
 - 3 agglomerate, 3a maroon tuff
 - 2 quartz eye sericite schist, 2a rhyolitic
2b rhyodacitic to dacitic
 - 1 1a - quartz eye chlorite schist
1b - chlorite schist
1c - epidote-chlorite schist

- SYMBOLS**
- outcrop
 - lithological contact
 - fault
 - attitude of foliation
 - syncline/anticline axis
 - LEGAL CORNER POST
 - CORNER POST (Theor.)
 - INDENTIFICATION POST (Theor.)



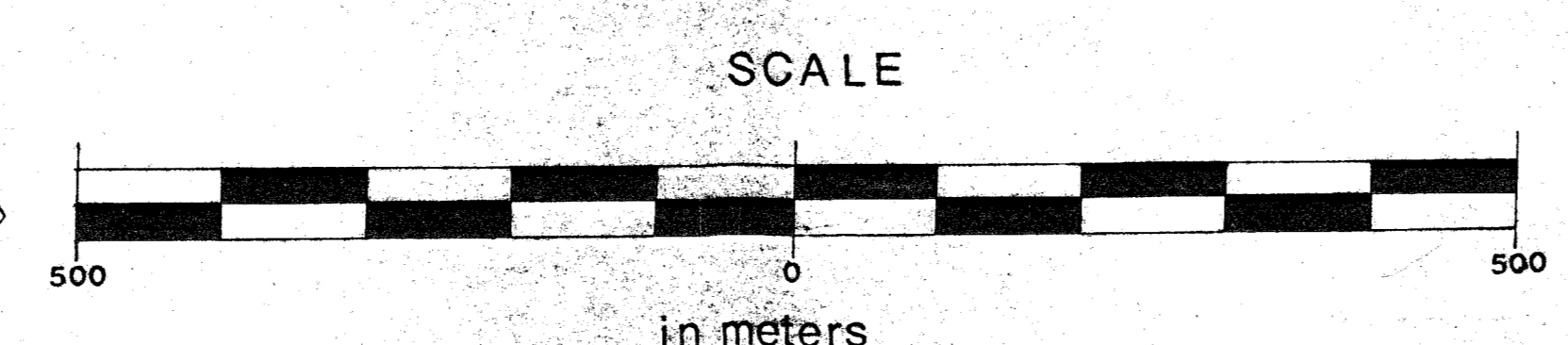
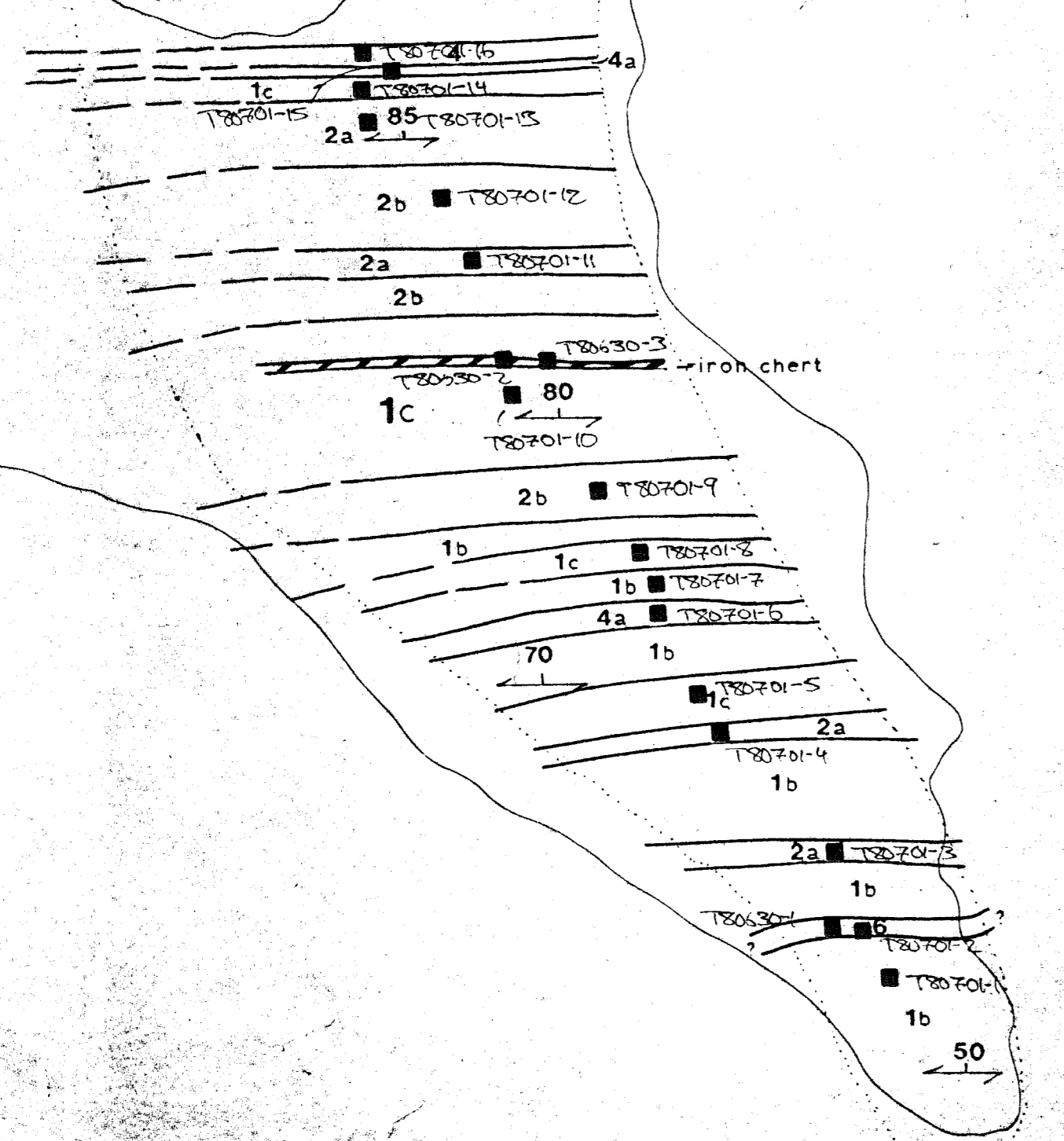
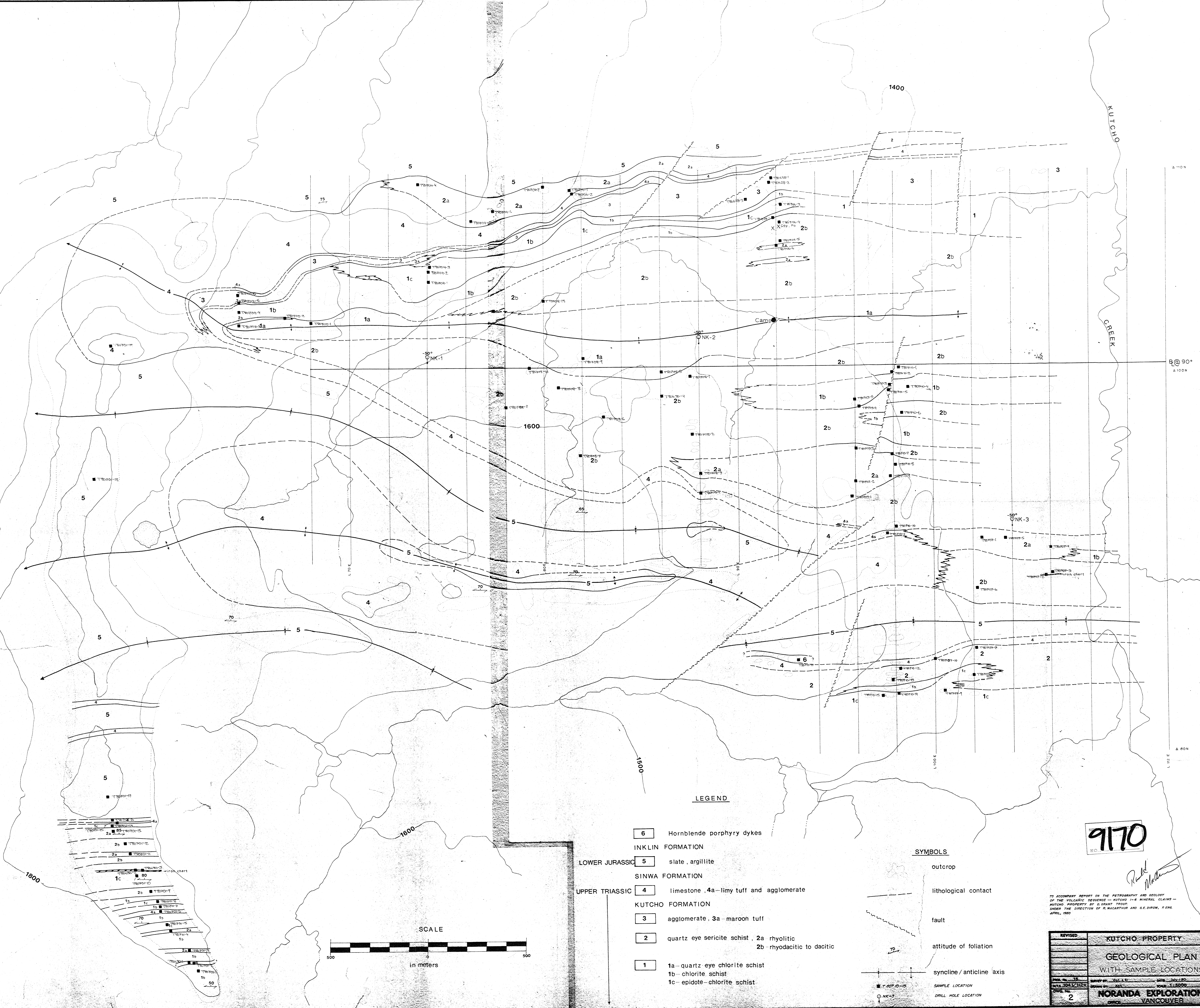
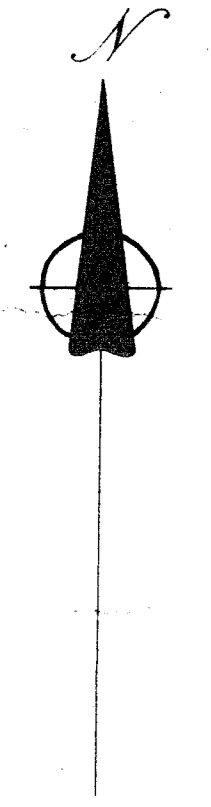
TO ACCOMPANY REPORT ON THE PETROGRAPHY AND GEOLOGY OF THE VOLCANIC SEQUENCE - KUTCHO 1-6 MINERAL CLAIMS - KUTCHO PROPERTY BY G. SMITH FROM UNDER THE DIRECTION OF R. MACARTHUR AND G.E. DIBON, P. ENG. APRIL, 1980

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MUTCHO PROPERTY

GEOLOGICAL PLAN
(KUTCHO 1-6 MINERAL CLAIMS)

MINERAL EXPLORATION



- LEGEND**
- 6 Hornblende porphyry dykes
 - INKLIN FORMATION
 - LOWER JURASSIC 5 slate, argillite
 - SINWA FORMATION
 - UPPER TRIASSIC 4 limestone, 4a-limy tuff and agglomerate
 - KUTCHO FORMATION
 - 3 agglomerate, 3a-maroon tuff
 - 2 quartz eye sericite schist, 2a rhyolitic, 2b rhyodacitic to dacitic
 - 1 1a-quartz eye chlorite schist, 1b-chlorite schist, 1c-epidote-chlorite schist

- SYMBOLS**
- outcrop
 - lithological contact
 - fault
 - attitude of foliation
 - syncline/anticline axis
 - SAMPLE LOCATION
 - DRILL HOLE LOCATION

9170

Red Miller

TO ACCOMPANY REPORT ON THE PETROGRAPHY AND GEOLOGY OF THE VOLCANIC SEQUENCE - KUTCHO 1-8 MINERAL CLAIMS - KUTCHO PROPERTY BY G. HART TRUMP UNDER THE DIRECTION OF R. MACARTHUR AND G.E. DIFON, P. ENG. APRIL, 1960

REVISED	KUTCHO PROPERTY
	GEOLOGICAL PLAN
	WITH SAMPLE LOCATIONS
DATE: 1960	SCALE: 1:50,000
NO. 2	NORANDA EXPLORATION
	VANCOUVER