

GEOLOGICAL REPORT

ON THE

FRAM CLAIM GROUP

ELEVEN MILES SOUTH OF TUCHODI LAKES

2875

LIARD MINING DIVISION

58°124°SW

BY

Department of Mines and Petroleum Resources	
ASSESSMENT REPORT	
NO. 2875	MAP.....

D. L. Cooke, Ph.D., P.Eng.

FOR

WINDERMERE EXPLORATION LTD. (N.P.L.)

August 21-26, 1970

GEOLOGICAL REPORT ON THE FRAM CLAIM GROUP

ELEVEN MILES SOUTH OF TUCHODI LAKES

LIARD MINING DIVISION

58°124°SW

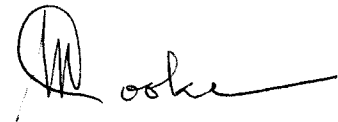
Located mineral claims on which assessment credits are requested:

<u>Name of Claim</u>	<u>Record Numbers</u>	<u>Credit Requested</u>
Fram #1-18 inclusive	48874-48891 incl.	1 year each
		TOTAL 18 years.

WORK WAS DONE ON THE FRAM CLAIM GROUP, BETWEEN August 21, 1970
AND August 26, 1970.

Report by:

D. L. Cooke, Ph.D., P.Eng.
Geologist



Date: February 22, 1971

TABLE OF CONTENTS

	PAGE
SUMMARY	1
INTRODUCTION	2
PROPERTY AND OWNERSHIP	3
LOCATION AND ACCESS	4
PHYSIOGRAPHY AND CLIMATE	4
GEOLOGY	
Regional Geology and Structure	6
Detailed Geology	9
Structure	9
Mineralization	10
CONCLUSIONS	12
REFERENCES	14

APPENDICES

Appendix A	Statement of Expenditures
Appendix B	Statutory Declaration in Support of Expenditures
Appendix C	Statement of Qualifications
Appendix D	Preliminary Geology and Assay Plan, Fram Group, 1" = 1,000'
	<i>Handwritten:</i> Fram #1-18 Claims, 1" = 1,500'.

SUMMARY

The Fram claim group covers a copper prospect near the headwaters of Gathto Creek in the Liard Mining Division, northeastern British Columbia. Access to the claims is by helicopter, 45 miles south from Mile 392 on the Alaska Highway. The claims lie above timberline in the north central ranges of the Rocky Mountains.

A programme of geological mapping, prospecting, and sampling of the mineralized veins was done during the period August 21 to August 26, 1970. During this period, access to the property was made by helicopter from a base camp established on the Bronson claims, approximately 28 miles to the northwest of the Fram claims.

The area is characterized mainly by a northwest trending belt of gently folded sedimentary rocks of Proterozoic age, which have been intruded by diabase and gabbro dikes. The Precambrian sequence and later Paleozoic rocks are marked by a series of sub-parallel thrust faults which dip to the west and southwest. Copper mineralization in the area occurs within the Proterozoic rocks in association with quartz-carbonte veins, generally located along dike margins and in fault zones. On the Fram claims, the

SUMMARY (CONT'D)

mineralization consists of bornite, with lesser amounts of chalcopyrite. Low values in silver and lead also occur.

INTRODUCTION

This report is based on a preliminary geological investigation of the Fram claims during the period August 21 to August 26, 1970. Geological mapping, prospecting, and local sampling of mineralized veins was done by D. Forgeron, B.Sc., Geology, St. Francis Xavier University, assisted by J. Smiley, Department of Geology, University of British Columbia, and L. P. Duquette, prospector. This investigation was supervised by D. L. Cooke, Ph.D., Geology, University of Toronto, Ontario.

Mapping was done at a scale of 1" = 1000' by compass and pace survey. Aerial photographs, at a scale of 1" = 1/2 mile, were used for general survey control, and traverse lines were tied in to the claim location lines where possible. Seven chip samples were taken across the main mineralized vein, and analyzed for copper, lead, and silver.

INTRODUCTION (CONT'D)

Analyses were done by Bondar-Clegg & Company Ltd. of North Vancouver, B.C.

PROPERTY AND OWNERSHIP

The Fram claims were staked in 1970 to cover quartz-carbonate-bornite mineralization discovered by Windermere Exploration Ltd. during the course of a regional exploration programme in the area. As a result of the geological work completed in 1970 it is requested that one year's assessment credits be applied to each of the following 18 located mineral claims, owned by Windermere Exploration Ltd. (N.P.L.), 1418 - 355 Burrard Street, Vancouver 1, B.C.:

<u>Name of Claim</u>	<u>Record Number</u>	<u>Date Recorded</u>
Fram #1-18 inclusive	48874-48891 incl.	August 11, 1970

The total value of assessment credits requested on the Fram claim group is \$1,800.00. The total expenditures on the geological survey is \$2,015.00.

LOCATION AND ACCESS

The Fram claims are located at Latitude $58^{\circ}00'N$, and Longitude $124^{\circ}36'W$, eleven miles south of the west end of Tuchodi Lakes, in the Liard Mining-Division, northeastern British Columbia. The claims lie between elevations of 6,000' and 8,000', and are drained to the east and south by tributaries of Gathto Creek.

The nearest accessible road to the property occurs at the confluence of Delano and Churchill Creeks, approximately 40 air miles to the northwest. This road runs from the Churchill Copper Corp. concentrator some 25 miles north to Mile 401 on the Alaska Highway. A four-wheel drive road extends another 12 miles south of Delano Creek along the bed of the Racing River and Churchill Creek, but this road is flooded during most of the summer months.

PHYSIOGRAPHY AND CLIMATE

The area lies east of the Trench in the northern part of the Rocky Mountains. The terrain is rugged and consists

PHYSIOGRAPHY AND CLIMATE (CONT'D)

of a series of northwest trending mountain ranges. Elevations range from 2,500' to 10,900' above sea level. Timber line occurs at about 4,700', but only a small part of the area lies below this elevation. Glaciers are common above 6,000'. The region forms part of the MacKenzie drainage, being drained locally to the north and east by the Gataga, Toad, Racing, Tetsa, Chischa, Tuchodi and Muskwa Rivers.

The area is one of low precipitation, which annually amounts to less than 20 inches. Winter temperatures fall to as low as -50°F in January and February. The summer season is short, extending from June to September. The summers are cool with light but frequent rainfall. Snowfall may occur in every month of the year at the higher elevations.

The area covered by the claims lie entirely above timberline. Soil cover is very poorly developed, and extensive areas of rock are obscured by a cover of talus and by debris from glacial ice.

GEOLOGY

REGIONAL GEOLOGY

The area of interest encompasses a northwest trending belt of Proterozoic rocks in the central Rocky Mountains of northeastern British Columbia. The Proterozoic rocks are exposed from the Muskwa River in the southeast to Toad River Lodge on the Alaska Highway in the northwest.

The Precambrian rocks have undergone only a minor degree of regional metamorphism. These units are characterized by gentle open folds and by a series of sub-parallel thrust faults which dip to the west and southwest, particularly in the western part of the area. A broad, north-northwest plunging anticlinal dome constitutes the main fold structure ^{which} runs from Tuchodi Lakes towards the Alaska Highway in the vicinity of Mile 397 (Bell, 1970, Personal communication).

The Proterozoic sedimentary rocks have been divided into more than four formations by previous workers (Bell, 1968, p. 3). These formations are generally conformable to each other, with gentle to moderate dips. The uppermost

GEOLOGY

REGIONAL GEOLOGY (CONT'D)

or Gataga formation occurs along the western margin of the belt and consists of laminated, slaty-cleaved, dark grey argillites, mudstones and siltstones. The underlying Aida formation consists of interbanded light grey to brown, slaty-cleaved argillites, mudstones, siltstones, and massive dolomites and limestones. This formation occurs in the western and central parts of the region. The Gataga and Aida formations lie stratigraphically above the Tuchodi and pre-Tuchodi formations which occur in the central and eastern part of the Precambrian belt. The sedimentary rocks comprising the Tuchodi and pre-Tuchodi formations are quartzites, sandstones, dolomites, limestones, shales, mudstones and siltstones.

Steeply-dipping diabase and gabbro dikes have intruded the Proterozoic rocks prior to Lower Cambrian time. These dikes range in thicknesses from a few feet to a few hundreds of feet. In general the dikes trend to the northwest and dip to the southwest. They occur as single intrusions or in swarms. Dikes which trend to the north and northeast do occur, but are less common. Throughout the Proterozoic sequence the dikes exhibit a tendency to branch and coalesce where they occur in dense swarms.

GEOLOGY

REGIONAL GEOLOGY (CONT'D)

Thermal effects of dike intrusion extend outward from their margins for distances not exceeding a few feet. Chlorite, actinolite and epidote are the most common secondary minerals developed by the alteration of the dikes, often occupying shear zones which characterize the margins of most dikes.

Sedimentary rocks of Lower Cambrian age unconformably overlie the late Precambrian rocks in the western and southern parts of the area. These early Paleozoic rocks consist of grey-weathering limestones and dolomites, interlayered with brown-weathering pebbly mudstones, conglomerates, sandstones, quartzites, and dark grey shales. The Lower Cambrian units follow the general strike and dip of the Proterozoic formations, but they are tilted at shallower angles to the southwest.

Along the northeast and east margins of the belt, the Proterozoic rocks are overlain by dolomites, limestones, quartzites, shales and cherts of Silurian and Devonian age (Taylor, 1963), which in turn are in contact

GEOLOGY

REGIONAL GEOLOGY (CONT'D)

with Late Paleozoic and Mesozoic sedimentary rocks of the Foothills.

DETAILED GEOLOGY

Interbanded, brown-weathering argillaceous dolomites and argillites belonging to the Aida Formation outcrop on the Fram claims. This formation strikes to the northwest and dips 10° - 30° to the southwest. Dolomites of Lower Cambrian age unconformably overlie the Aida Formation. A narrow basal conglomerate and quartzite band marks the contact with the underlying Proterozoic rocks.

The Proterozoic units are intruded by gabbro and diabase dikes which strike generally to the northeast.

STRUCTURE

Fault and shear zones occur along the margins of many of the dikes in the area. The major fault structure on the property strikes to the northeast and dips to the northwest. The block on the southeast side of this structure appears to have moved downward, bringing the Lower Cambrian

GEOLOGY
STRUCTURE (CONT'D)

rocks into contact with the Proterozoic rocks on the north-west side. Subsidiary faults also occur parallel to this major structure or transverse to it.

MINERALIZATION

Vein-type copper mineralization occurs within the Proterozoic rocks throughout the area. Numerous occurrences of copper are associated with quartz-carbonate veins occupying faults, fractures and shear zones within the sedimentary rocks and along the margins of dikes. Although copper is localized in all formations comprising the Proterozoic sequence, there appears to be a higher proportion of occurrence within the Aida formation.

Bornite occurs less commonly than chalcopyrite, with which it is associated in several locations. Minor amounts of lead are not an uncommon association of the copper occurrences, some of which also carry low values in silver and gold. Chalcocite commonly occurs in association with chalcopyrite in the Tuchodi and pre-Tuchodi formations along the eastern and lower portion of the Proterozoic section.

GEOLOGY
MINERALIZATION (CONT'D)

The main accessory sulphide is pyrite. It occurs sparsely within quartz-carbonate veins, as minor disseminations within the margins of dikes, and as conformable streaks and lenses within the more argillaceous sedimentary units.

The main zone of copper mineralization on the Fram claims occupies a subsidiary north-south fault structure which is terminated at its northern end by the major northeast fault and an associated dike mass. Bornite and chalcopyrite occur together with quartz and minor carbonate as vein material. The vein dips variably from vertically to moderately east and west. It has been traced for 3,000 ft. along strike, but only the northern 1,000 ft. of it is well mineralized. This zone averages 7% copper across an average width of 6 ft., through a vertical distance of 500 ft. Values in silver range from 0.1 to 1.9 ounces per ton.

Other zones with minor galena and/or chalcopyrite occur along dike margins or in veins and fractures trending to the northeast. These others appear to have little economic potential.

CONCLUSIONS

1. The interbanded argillites and argillaceous dolomites of the Aida Formation which underlie the claims were deformed, faulted and intruded by gabbro dikes during late Proterozoic times.
2. The emplacement of the dikes and the localization of quartz-carbonate-bornite veins appear to have been controlled by the development of faults and fractures along zones of weaknesses within the sedimentary rocks.
3. Shearing and faulting, which followed both the intrusion of dikes and the deposition of copper-bearing veins, make it difficult to determine the relative ages of the dikes and the veins. These dikes and veins are bordered by narrow fault gouges, shears & slickenside markings.
4. Chip samples from the main bornite-quartz vein structure averages 7% copper over an average width of 6 ft. This zone has good potential of being developed into a small high-grade deposit. To determine whether or not an economic deposit exists, further detailed surface sampling

CONCLUSIONS (CONT'D)

and mapping, followed by diamond drilling or tunnelling will be necessary.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'D. L. Cooke'. The signature starts with a large, stylized 'D' that has several vertical lines inside it, followed by 'L.', 'Cooke', and a long horizontal flourish.

D. L. Cooke, Ph.D., P.Eng.
CORDILLERAN ENGINEERING LIMITED

REFERENCES

1. Forgeron, D., 1970 Field notes and map,
Fram Claim Group.

2. Bell, R. T., 1968 Proterozoic Stratigraphy of
Northeastern British Columbia.
Geol. Surv. Can., Paper 67-68,
pp. 75.

3. Taylor, G. C., 1963 MacDonald Creek, British
Columbia, Geol. Surv. Can.,
Prelim. Series, Map 28-1963.

APPENDIX A

STATEMENT OF EXPENDITURES

STATEMENT OF EXPENDITURES

ON THE FRAM 1-18, MINERAL CLAIMS, ELEVEN MILES SOUTH
OF TUCHODI LAKES, LIARD MINING DIVISION, 58°124°SW

SALARIES AND FEES

D. Forgeron, Geologist		
August 21-26, 1970; 6 days @\$30/day	\$180.00	
J. Smiley, Geological Assistant		
August 21-26, 1970; 6 days @\$20/day	120.00	
L. P. Duquette, Prospector		
August 21-26, 1970; 6 days @\$30/day	180.00	
D. L. Cooke, Geologist, Supervision		
August 22-24, 1970; 3 days @\$75/day	225.00	
Drafting Service	50.00	
Stenographic Service	40.00	\$ 795.00

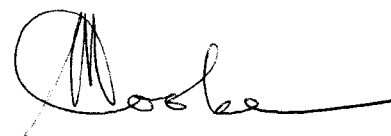
SUPPLIES AND MISCELLANEOUS

Printing and Office Supplies	\$ 50.00	
Assays: 7 chip samples (Cu,Pb,Ag) @\$10/sample	70.00	
Freight on 7 samples	15.00	
Food: 21 man days @\$10/day	210.00	
Tents and Field Equipment	200.00	545.00

TRANSPORTATION

Bell 47G3B Helicopter: 5 hrs. @\$135/hr.	\$675.00	<u>675.00</u>
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TOTAL EXPENDITURES		<u>\$2,015.00</u>
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Date: February 22, 1971

APPENDIX B

STATUTORY DECLARATION IN
SUPPORT OF EXPENDITURES

STATUTORY DECLARATION IN
SUPPORT OF EXPENDITURES

CANADA
Province of British Columbia
TO WIT

) IN THE MATTER OF the Statement
) of Expenditures for geological
) work on the Fram Mineral Claims
) in the Liard Mining Division.

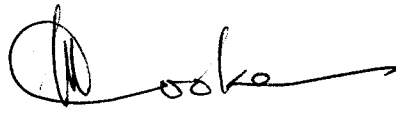
I, DAVID LAWRENCE COOKE, Geologist of
1418 - 355 Burrard Street, in the City of Vancouver, in the
Province of British Columbia, DO SOLEMNLY DECLARE:-

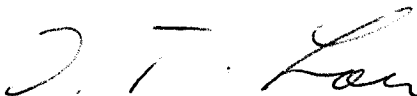
1. THAT the Geological Investigation of the Fram Claim Group was carried out under my supervision.
2. THAT the Statement of Expenditures set out in Appendix "A" of my report "Geological Report on the Fram Claim Group" dated August 21 to August 26, 1970, truly represents the amounts expended on geological work on the said claim group.

AND

I make this solemn Declaration conscientiously believing it to be true, and knowing that it is of the same force and effect as if made under oath, and by virtue of the Canada Evidence Act.

DECLARED before me at the
City of Vancouver, in the
Province of British Columbia
this 25th day of February
A.D. 1971.

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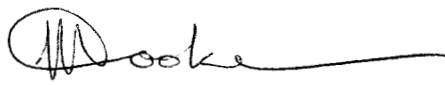

A Commissioner for taking
Affidavits for British Columbia.

APPENDIX C

STATEMENT OF QUALIFICATIONS

STATEMENT OF QUALIFICATIONS

1. I am a geologist residing at 334 Francis Road, Richmond, B.C., with an office at 1418 - 355 Burrard Street, Vancouver, B.C.
2. I graduated with a B.Sc. degree in Geology from the University of New Brunswick in 1959; and received M.A. and Ph.D. degrees in Geology from the University of Toronto in 1961 and 1966 respectively.
3. I have practised my profession as a geologist in Canada, Jamaica and Mexico.
4. I am a certified member of the Association of Professional Engineers in the Province of British Columbia.
5. I am the author of this report.
6. I supervised the geological work performed on the Fram Claim Group which is described herein.

Signed: 
D. L. Cooke, Ph.D., P.Eng.

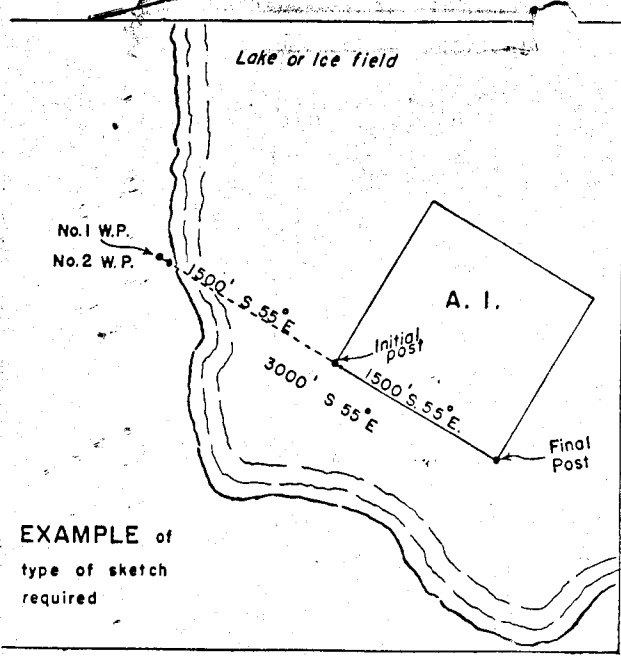
February 22, 1971
Vancouver, B.C.

APPENDIX D

PRELIMINARY GEOLOGY AND ASSAY PLAN

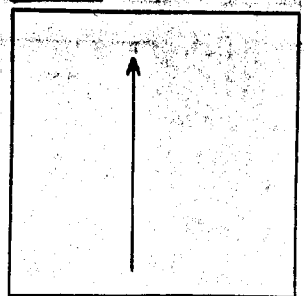
FRAM GROUP, 1" = 1,000'

FRAM #1-18 CLAIMS, 1" = 1,500'



EXAMPLE of type of sketch required

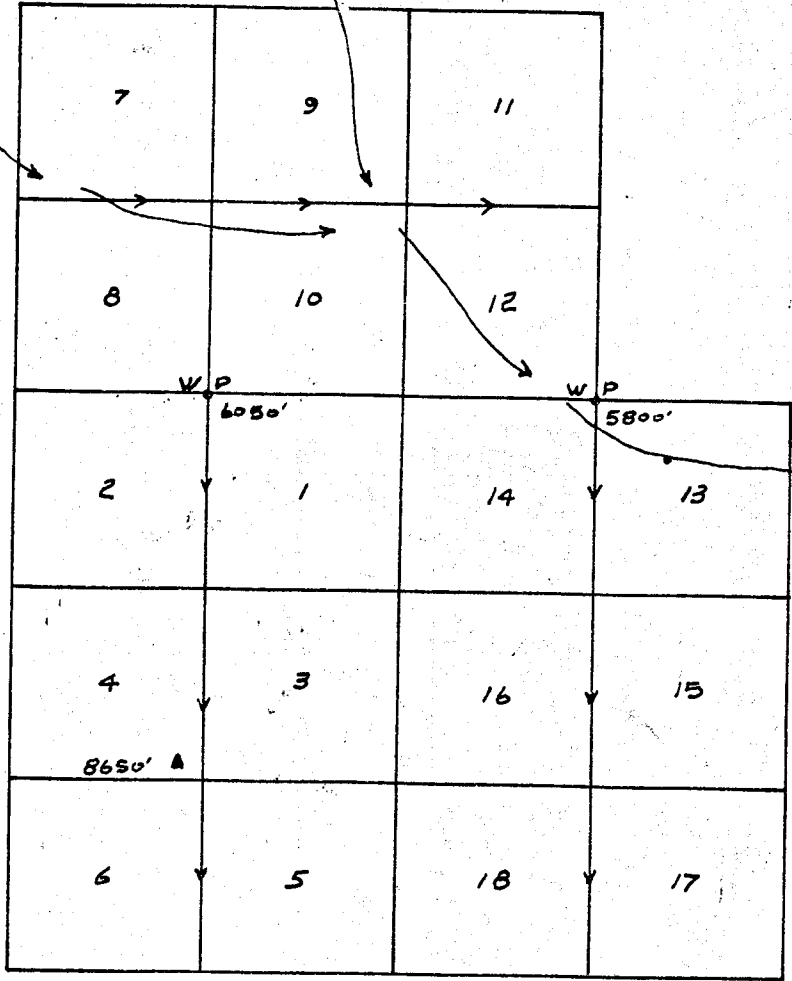
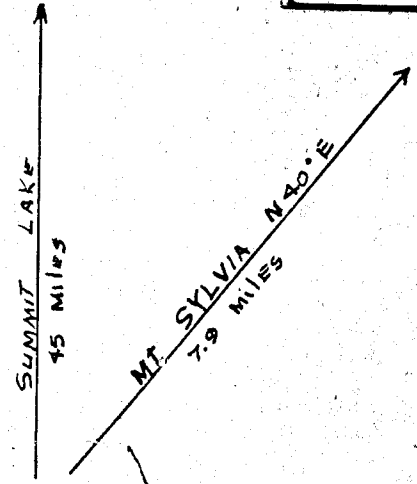
Claims must be tied by direction and distance to at least one, preferably more than one, topographical feature, or to a land lot, section, township, or other recognizable point on printed maps of the district. Relationship of previously located claims should also be shown.
 N.B. — The sketch for a group of claims may be placed on one affidavit.



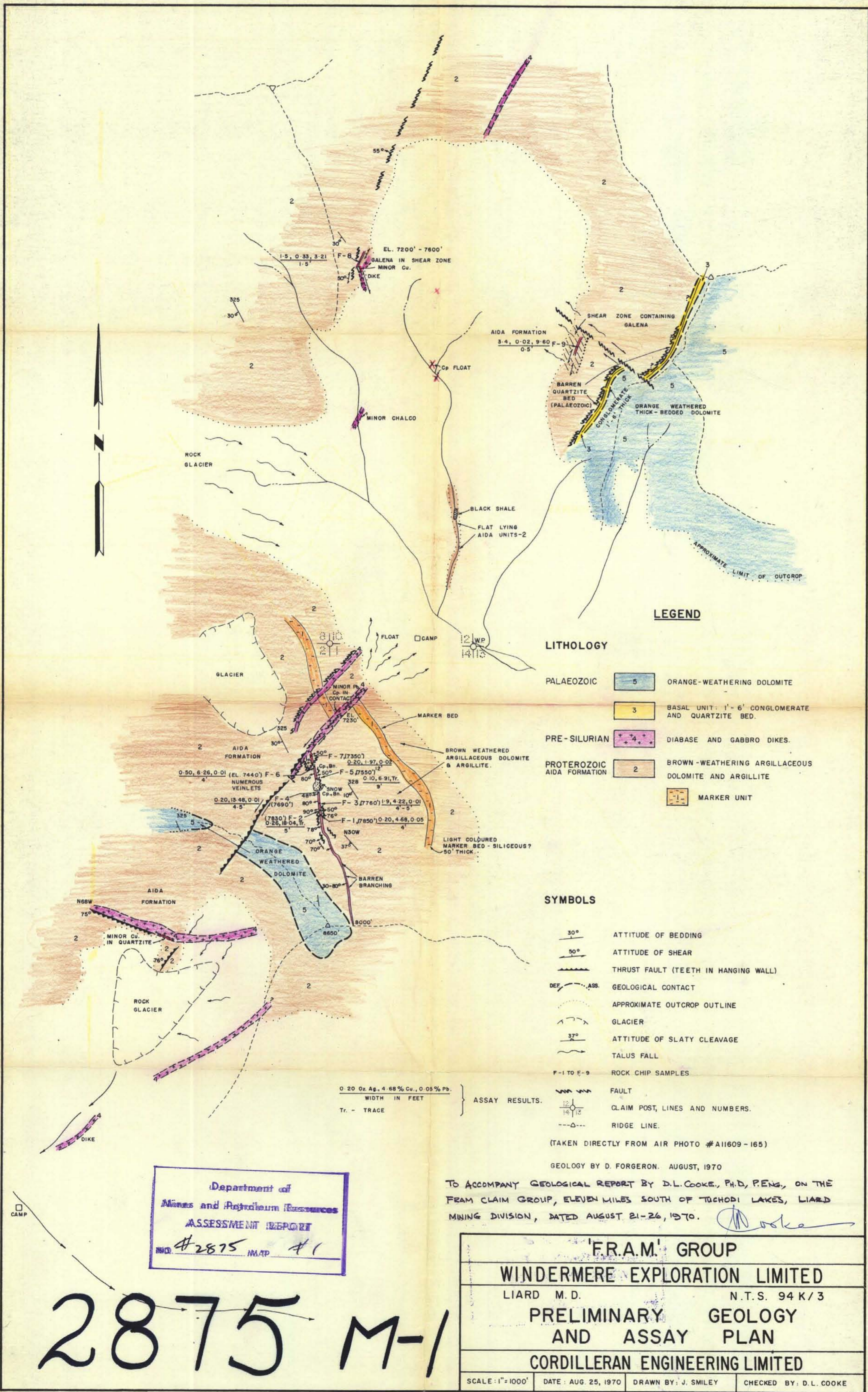
INDICATE NORTH (True or Magnetic.)

**Department of
 Mines and Petroleum Resources
 ASSESSMENT REPORT**

NO. 2875 MAP #2



FRAM # 1-18
 RECORDED SEPT 11/70
 1" = 1500'



LEGEND

LITHOLOGY

- PALAEOZOIC
 - 5 ORANGE-WEATHERING DOLOMITE
 - 3 BASAL UNIT: 1'-6' CONGLOMERATE AND QUARTZITE BED.
- PRE-SILURIAN
 - 4+ DIABASE AND GABBRO DIKES.
- PROTEROZOIC
 - 2 BROWN-WEATHERING ARGILLACEOUS DOLOMITE AND ARGILLITE
 - 1 MARKER UNIT

SYMBOLS

- 30° ATTITUDE OF BEDDING
- 50° ATTITUDE OF SHEAR
- THRUST FAULT (TEETH IN HANGING WALL)
- DEF. ASS. GEOLOGICAL CONTACT
- APPROXIMATE OUTCROP OUTLINE
- GLACIER
- 37° ATTITUDE OF SLATY CLEAVAGE
- TALUS FALL
- F-1 TO F-9 ROCK CHIP SAMPLES
- FAULT
- CLAIM POST, LINES AND NUMBERS.
- △--- RIDGE LINE.

(TAKEN DIRECTLY FROM AIR PHOTO #A11609-165)

GEOLOGY BY D. FORGERON. AUGUST, 1970

TO ACCOMPANY GEOLOGICAL REPORT BY D.L. COOKE, PH.D., P.ENG., ON THE FRAM CLAIM GROUP, ELEVEN MILES SOUTH OF TUCHODI LAKES, LIARD MINING DIVISION, DATED AUGUST 21-26, 1970.

D.L. Cooke