

4499

92I/7E
GEOPHYSICAL REPORT

on a
VLF-EM SURVEY
KR & K CLAIMS
GREENSTONE CREEK, KAMLOOPS M.D., B.C.
MAY & JUNE, 1973

KR & K Claims : 25 miles N 10 E of Merritt, B.C.
: 50° 120° SW
NTS : 92I/7E

Report by: David G. Mark
Geophysicist
GEOTRONICS SURVEYS LTD.
514-602 West Hastings Street
Vancouver 2, B.C.

for : NICOLA COPPER MINES LTD. (NPL)
9897 - 137A Street
Surrey, B.C.

July 31, 1973

Department of
Mines and Geoscience Resources
ASSESSMENT REPORT
NO. 4499 REP



Geotronics Surveys Ltd.

Vancouver, Canada

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SUMMARY

A VLF-EM survey was completed over a portion of the 12-claim Greenstone Creek property of Nicola Copper Mines Ltd. The claims are located near the confluence of Greenstone Creek with Meadow Creek. Access is by the Lac Le Jeune road which leaves Highway No. 1 west of Kamloops. The terrain is fairly gentle, timber on the property is largely conifers, and much of it is covered with glacial drift.

All of the property is underlain by the Nicola group of rocks. Five miles to the west and nine miles to the east, this group has been intruded by acidic rocks of the Coast Intrusions. There are no known copper occurrences on the property but there are many in the general area.

A Geonics EM-16 was used to carry out the survey. The resulting in-phase data was Fraser-filtered, plotted, and contoured on a 5-degree interval. Also the in-phase, quadrature and Fraser-filtered in-phase were profiled.

The results produced 2 relatively strong anomalies that may be reflecting either one broad conductor or 2 narrow conductors. There were several other smaller anomalies.

CONCLUSIONS

1. The Anomalies A and B may be caused by one broad conductor that could be a sulphide body. The hill between the 2 anomalies introduces the possibility

of it being caused by an intrusive stock.

2. At least some of the anomalies, including A and B if reflecting 2 separate sources, are probably caused by fault, shear, and/or mineralized zones.
3. Additional work should be done on the property to give a more definite interpretation to the VLF-EM results.

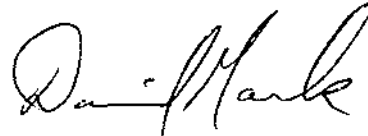
RECOMMENDATIONS

1. It is important that the property be thoroughly geologically mapped. Correlating any future geophysical or geochemistry with known geology enhances their interpretation.
2. The property should be soil sampled and the results tested for copper. It is recommended to sample at 100-foot intervals, and 50-foot intervals across all of the VLF-EM anomalies.
3. Consideration should be given to using seismic refraction for determining overburden depth on any anomalies. This usually helps in giving a better interpretation of geophysical or geochemical survey results. It also assists in determining the optimum position of any possible diamond drill holes.

(iii)

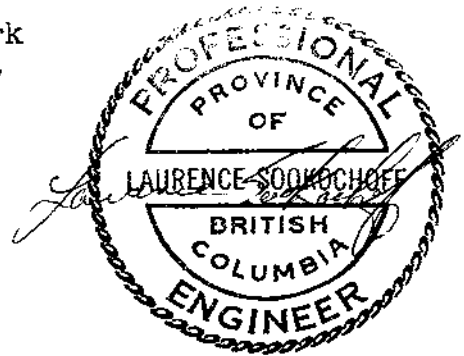
4. Diamond drilling may be warranted after the above recommendations are carried out but it is not recommended until they have been . If drilling is being contemplated at this stage, however, the writer has spotted 3 proposed holes shown on sheet 1 in order of priority. It is recommended to drill at least the first hole with a 45° dip towards the northeast. This takes into account the possible dip of the causitive source towards the southwest.

Respectfully submitted,
GEOTRONICS SURVEYS LTD.



David G. Mark
Geophysicist

July 31, 1973



GEOPHYSICAL REPORT
on a
VLF-EM SURVEY
KR & K CLAIMS
GREENSTONE CREEK, KAMLOOPS M.D., B.C.

INTRODUCTION AND GENERAL REMARKS

This report discusses the procedure, compilation and interpretation of a very low frequency electromagnetic (VLF-EM) survey carried out on the KR & K claims during May and June, 1973.

The field work was carried out by Richard Conte who was under supervision of the writer. The writer visited the property on July 10, 1973. The number of line miles completed was 9.25 and the area covered by the survey is as shown on figure 2.

The object of the VLF-EM survey was to outline any probable areas of copper sulphide mineralization. A secondary object was to delineate fault, shear, or contact zones that may be important to the control and deposition of any possible copper sulphides.

PROPERTY AND OWNERSHIP

The property is comprised of 12 contiguous mineral claims as shown on figure 2 and as described in the table below.

<u>CLAIM NAME</u>	<u>RECORD NUMBER</u>	<u>EXPIRY DATE</u>
KR & K 200-211	97255 - 97266	June 2 , 1973

The expiry date does not take into account the assessment credits applied for the VLF-EM survey.

All claims are wholly owned by Nicola Copper Mines Ltd. of Surrey, B.C.

LOCATION AND ACCESS

The property is located 21 air miles S 50 W of the city of Kamloops and 25 air miles N 10 E of the town of Merritt.

The geographical coordinates are $50^{\circ} 28.5'$ N latitude and $120^{\circ} 42'$ W longitude.

Access to the claims is best by the Lac Le Jeune road which leaves Highway No.1 about 6 miles west of Kamloops. One travels 15 miles southerly on this road to an intersection with a road going westerly. The property is about 12 miles west of the intersection. Access can also be gained by travelling to the town of Logan Lake from either Savona, Ashcroft or Merritt. The property is 6 miles east of Logan Lake.

PHYSIOGRAPHY

The property is found within the physiographic unit known as the Thompson Plateau which is part of the Interior Plateau system. The terrain is quite gentle. The elevation varies from 3900 to 4100 feet asl giving a range of 200 feet.

The main water source for the property is Meadow Creek, which flows through the southern end of the property and Greenstone Creek which flows southerly off of its eastern edge into Meadow Creek. In addition there are 2 small lakes located on the claim group itself.

The timber on the property consists mainly of pine and poplar, with some spruce. Deadfall is minimal and underbrush is restricted to the creeks and lake edges.

Pleistocene ice occupied the Thompson Plateau and thus much of the claims area is covered by glacial drift which could become quite deep over the flatter areas.

HISTORY OF PREVIOUS WORK

Apparently, no previous physical, geological, geochemical, and/or geophysical work has been carried out on these claims.

GEOLOGY

The geology is largely taken from the G.S.C. map of the area by W.E. Cockfield.

The property is entirely underlain by the Nicola Group of rocks which is of Upper Triassic Age. It consists of greenstone, andesite, basalt, agglomerate, breccia, tuff, minor argillite, limestone and conglomerate.

Five miles to the west and nine miles to the east, the Nicola Group is in contact with the Guichon Creek Batholith and the Central Nicola Batholith respectively. These

batholiths consist of granodiorite and quartz diorite and are of the Coast Intrusions which is of Jurassic and (?) later age.

There is no known copper mineralization on the property. However, there are dozens of occurrences in the general area.

The closest 2 copper prospects are located 2 miles west of the property on the Lac Le Jeune road and less than 2 miles south of the property just west of Homfray Lake. (see figure 2). The one consists of disseminated copper minerals within a prophyry; and the other, cuprite within fractures (Cockfield, p.126).

The Guichon Creek Batholith is host to a number of disseminated copper sulphide mines and prospects and some massive copper sulphide prospects.

Sixteen miles northeast of the property are a number of copper mineral occurrences within both the Iron Mask Batholith and the older intruded Nicola rocks. Generally, they occur as veins, impregnations, stockworks, and mineralized shear zones with the principle copper minerals being chalcopyrite, bornite, and native copper.

INSTRUMENTATION AND THEORY

A VLF-EM receiver, model EM-16, manufactured by Geonics Limited (formerly Ronka) of Toronto, Ontario was used for the survey. This instrument is designed to measure the magnetic component of a very low frequency (VLF) electromagnetic field. The U.S. Navy submarine transmitter located at Seattle, Washington and transmitting at 18.6 KHz. was used.

In all electromagnetic prospecting, a transmitter produces an alternating magnetic field (primary) by a strong alternating current usually through a coil of wire. If a conductive mass such as a sulphide body is within this magnetic field, a secondary alternating current is induced within it which in turn induces a secondary magnetic field that distorts the primary magnetic field. It is this distortion that the EM receiver measures. The VLF-EM uses a frequency range from 16 to 24 KHz. whereas most EM instruments use frequencies ranging from a few hundred to a few thousand Hz. Because of its relatively high frequency, the VLF-EM can pick up bodies of a much lower conductivity and therefore is more susceptible to clay beds, electrolyte-filling fault or shear zones and porous horizons, graphite, carbonaceous sediments, lithological contacts as well as sulphide bodies of too low a conductivity for other EM methods to pick up. Consequently the VLF-EM has additional uses in mapping structure and in picking up sulphide bodies of too low a conductivity for conventional EM methods and too small for induced polarization (in places it can be used instead of IP). However, its susceptibility to lower conductive bodies results in a number of anomalies, many of them difficult to explain and, thus, VLF-EM preferably should not be interpreted without a good geological knowledge of the property and/or other geophysical and geochemical surveys.

SURVEY PROCEDURE

The base line was measured in from the initial post of KR and K 202 and 203 mineral claims and was marked by

pink and blue flagging tape. It runs in a north-south direction.

The survey lines are 200 feet apart and run in an east-west direction. The stations on these lines are 50 feet apart and are marked by pink flagging tape. Readings were taken by the instrument at these stations and were read facing west.

COMPILATION OF DATA

Since the in-phase readings were read in percent of slope, they were changed to read in degrees. They were then reduced by applying the Fraser Filter. Filtered data, as shown on sheet 1, are plotted between the reading stations. The positive filtered values were contoured at intervals of 5° .

In addition, the in-phase, quadrature, and Fraser-filtered in-phase values were profiled on sheet 2 at a horizontal scale of $1" = 200'$ and a vertical scale of $1" = 10^{\circ}$.

The Fraser filter is essentially a 4 point difference operator which transforms zero crossings into peaks, and a low pass smoothing operator which reduces the inherent high frequency noise in the data. Therefore, the noisy, non-contourable data are transformed into less noisy, contourable data. Another advantage of this filter is that a conductor that does not show up as a cross-over on the unfiltered data quite often will show up on the filtered data.

DISCUSSION OF RESULTS

The VLF-EM survey, as can be seen on sheet 1, has produced several anomalies (or conductive zones) some of which are definitely worthy of exploration interest. Six of these are discussed below and are labelled by the letters A to G respectively.

The writer would like to again point out that interpretation of a VLF-EM survey without correlating with other work such as geological, geochemical, and/or other geophysical surveys is very difficult. The possible causes of a VLF-EM anomaly can be many and therefore much of the following is conjectural.

Anomalies A and B are 2 anomalies of prime interest. The reasons for this is as follows:

- 1) Both have a good strike length, being about 2000 feet long.
- 2) Both have a relatively high intensity. Anomaly B reaches a maximum of 38° , by far the highest on the property.
- 3) Because of the shape and position of the anomalies, it is strongly possible that both anomalies are reflecting the edges of one broad, flat conductor rather than 2 long, narrow conductors. The reason for this conjecture is that any EM unit measuring the tilt angle will show up as anomalous any place where there is a change in conductivity. Therefore, if a broad flat conductor occurs in a medium (such as country rock) of relative non-conductivity, the

edges of the conductor will show up as anomalous, and not its center.

If A and B are outlining one conductor, then its dimensions are 1500 feet by up to 800 feet and its strike is northwesterly. Its causitive source may well be a low-grade sulphide body. Of particular interest is the hill between the two anomalies shown on lines 4S and 6S. The hill could be caused by an intrusion of more resistive rock into the Nicola rocks, possibly a stock of the Coast Intrusions. Whatever its cause, it definitely appears to be related to the 2 anomalies A & B.

If A and B do not reflect one conductor, then they reflect 2 separate conductors. The causitive sources of these may be a series of water-filled faults and/or shear zones. Sulphides may be deposited along these zones. As shown on sheet 1, much of anomaly A follows along swampy ground and therefore part of the cause of the anomaly may be clay sediments deposited in the swamp. However, the cause of the swamp itself is likely a zone of weakness within the underlying bedrock caused by a fault or shear zone.

The profiles were drawn in the hope of being able to ascertain the dip of any conductors. It is difficult to accurately ascertain that of A and B (whether one or two separate conductors) but it appears to be very close to vertical with possibly a small dip to the southwest.

Anomalies C and D are of similar intensity (about 20°). C strikes northwesterly, is at least 200 feet long and is

open on the north end. These anomalies, as well as E, may be caused by structure and/or sulphides.

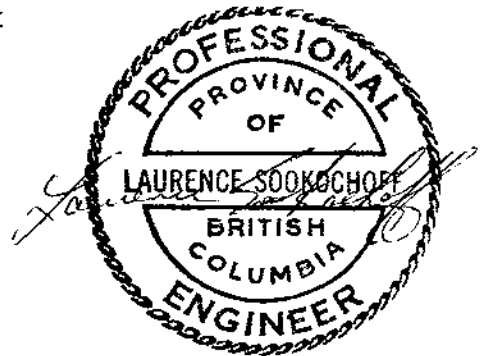
At F, the values on lines 14S, 16S, and 18S appear to be reflecting the negative component of an anomaly of fairly high intensity. The anomaly probably is over the lake and therefore the anomalies at G may be its northern extension. The cause of this anomaly could be lake sediments, but other causes should not be precluded.

Respectfully submitted,
GEOTRONICS SURVEYS LTD.



David G. Mark
Geophysicist

July 31, 1973



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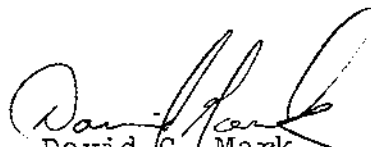
GEOPHYSICIST'S CERTIFICATE

I, DAVID G. MARK, of the City of Vancouver,
in the Province of British Columbia, do hereby certify:

That I am a Consulting Geophysicist of
Geotronics Surveys Ltd., with offices at 514-602 West
Hastings Street, Vancouver 2, B.C.

I further certify that:

1. I am a graduate of the University of British Columbia (1968) and hold a B.Sc. degree in Geophysics.
2. I have been practising in my profession for the past five years and have been active in the mining industry for the past eight years.
3. I am an associate member of the Society of Exploration Geophysicists and a member of the European Association of Exploration Geophysicists.
4. This report is compiled from data obtained from a VLF-EM survey carried out by Richard Conte under the supervision of myself, during May and June, 1973 on the KR & K claims and from a personal visit to the property on July 10, 1973.
5. I have no direct or indirect interest in the properties or securities of Nicola Copper Mines Ltd. (NPL), Surrey, B.C. nor do I expect to receive any interest therein.


David G. Mark
Geophysicist

July 31, 1973

ENGINEER'S CERTIFICATE

I, LAURENCE SOOKOCHOFF, of the City of Vancouver, in the Province of British Columbia, do hereby certify:

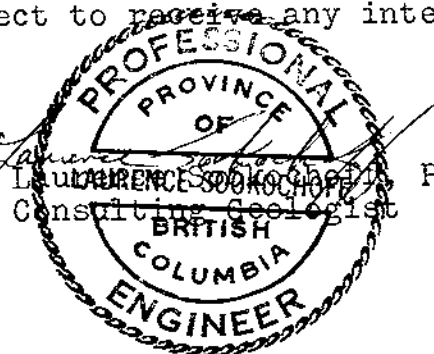
That I am a Consulting Geologist and an associate with T.R. Tough & Associates Ltd., with offices at 519-602 West Hastings Street, Vancouver 2, B.C.

I further certify that:

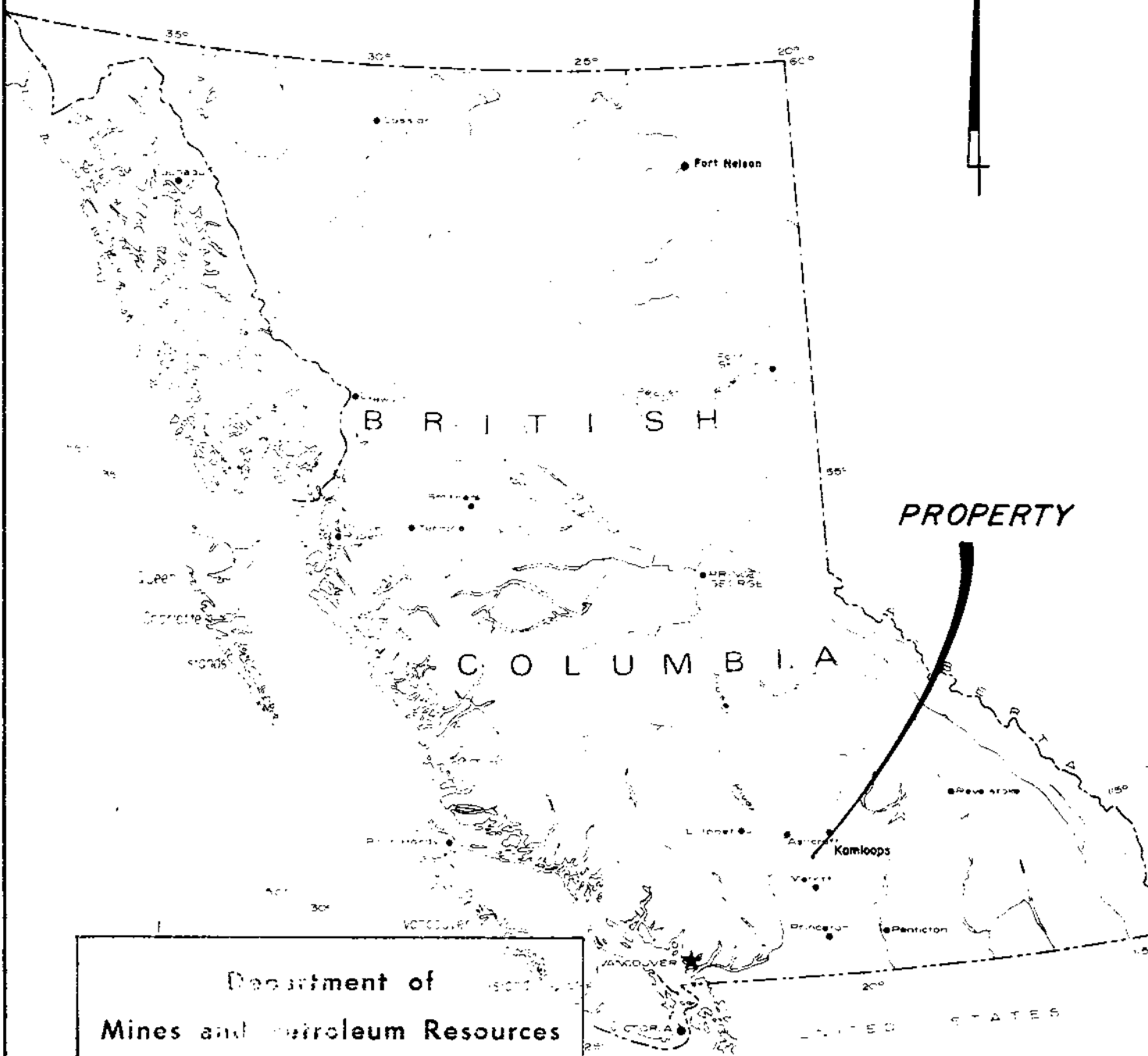
1. I am a graduate of the University of British Columbia (1966) and hold a B.Sc. degree in Geology.
2. I have been practising in my profession for the past six years.
3. I am registered with the Association of Professional Engineers of British Columbia.
4. I have studied the accompanying report dated July 31, 1973 on a VLF-EM survey submitted by Geotronics Surveys Ltd., written by David G. Mark, Geophysicist, and concur with findings therein.
5. I have no direct or indirect interest whatsoever in the property described herein, nor in the securities of Nicola Copper Mines Ltd. (NPL)., and do not expect to receive any interest therein.

Laurence Sookochoff
LAURENCE SOOKOCHOFF P.Eng.
Consulting Geologist

July 31, 1973

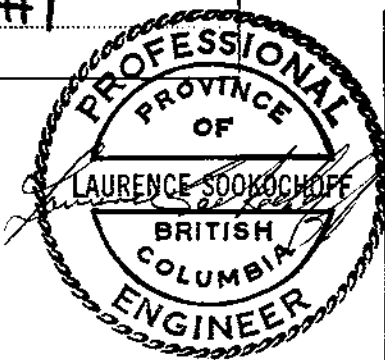


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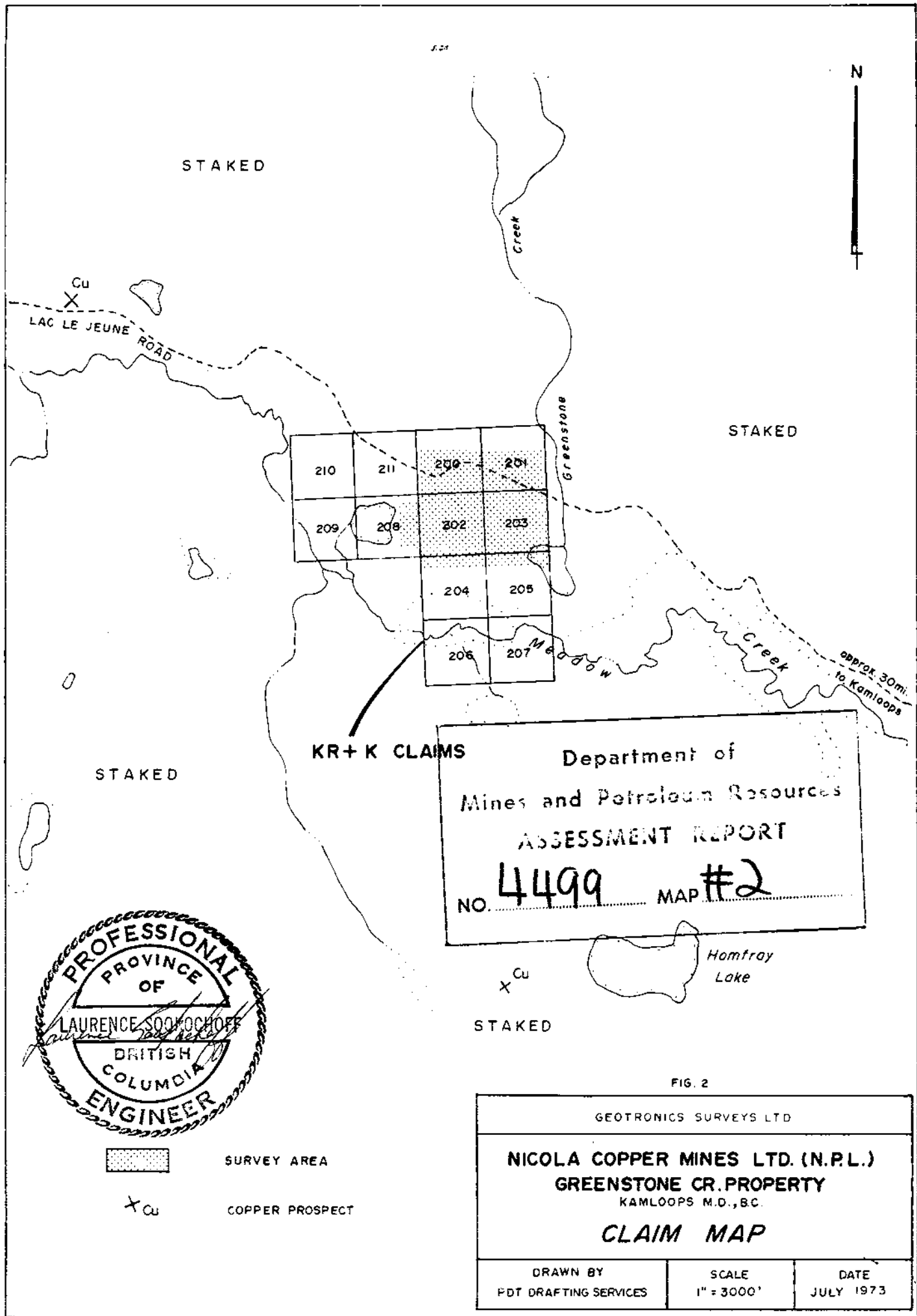


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FIG. 1



GEOTRONICS SURVEYS LTD.
 NICOLA COPPER MINES LTD. (N.P.L.)
 GREENSTONE CREEK PROPERTY
 KAMLOOPS M.D., B.C.
LOCATION MAP
 SCALE 1" = 134 mi



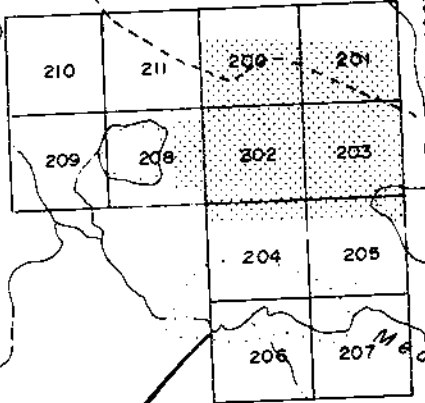
S.21



STAKED

Cu
X
LAC LE JEUNE ROAD

STAKED



KR+K CLAIMS

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 4499 MAP #2


STAKED



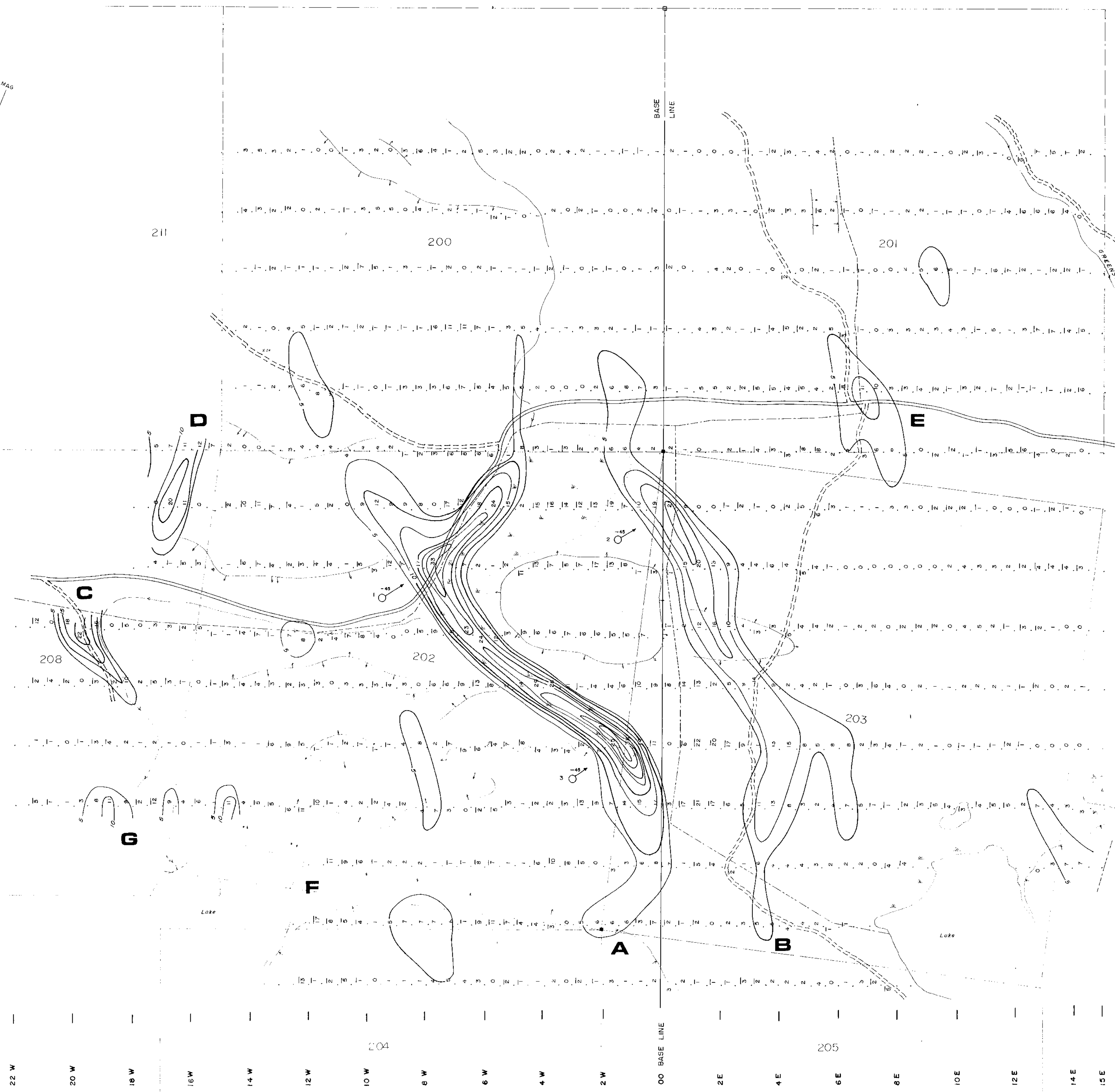
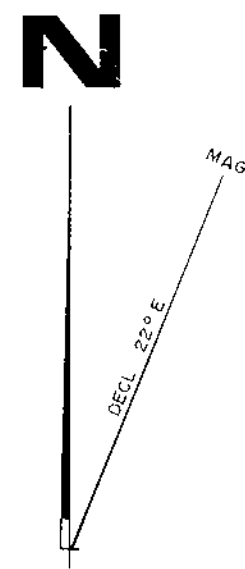
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Hamtray Lake

FIG. 2

 SURVEY AREA
x Cu COPPER PROSPECT

GEOTRONICS SURVEYS LTD		
NICOLA COPPER MINES LTD. (N.P.L.) GREENSTONE CR. PROPERTY KAMLOOPS M.D., B.C.		
CLAIM MAP		
DRAWN BY PDT DRAFTING SERVICES	SCALE 1" = 3000'	DATE JULY 1973



- L-10N
- L-8N
- L-6N
- L-4N
- L-2N
- L-0
- L-2S
- L-4S
- L-6S
- L-8S
- L-10S
- L-12S
- L-14S
- L-16S
- L-18S

LEGEND

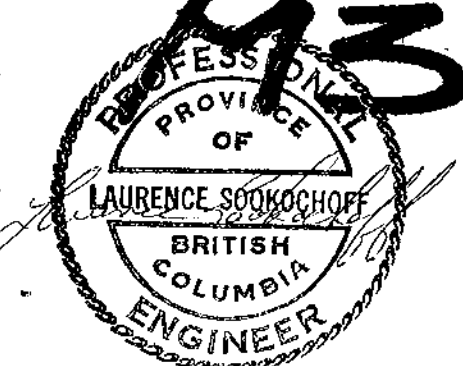
- SURVEY LINE
- CLAIM LINE
- CLAIM POST (LOCATED, ASSUMED)
- ROAD
- FENCE
- SWAMP
- CREEK
- SLOPE (medium, steep)
- PROPOSED DRILL HOLE (NUMBERED IN ORDER OF PRIORITY)

NOTE: READINGS ARE IN DEGREES.
 CONTOUR INTERVAL IS 5°.
 INSTRUMENT — GEONICS EM-16
 ALL READINGS READ FACING WEST

SEATTLE TRANSMITTER 146 MHz
 S 30° W

4499
M3

Department of
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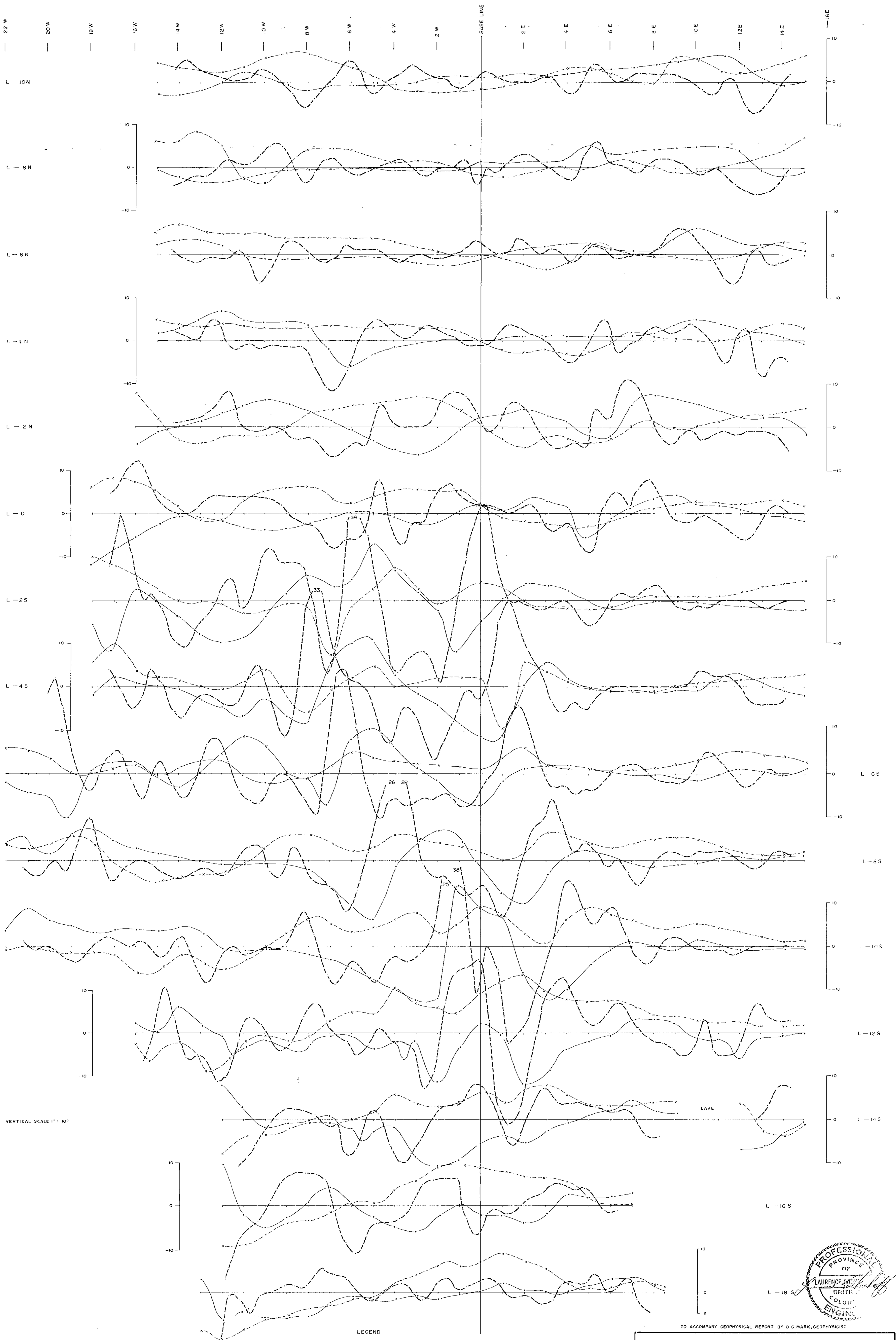
TO ACCOMPANY GEOPHYSICAL REPORT BY D.G. MARK, GEOPHYSICIST

GEOTRONICS SURVEYS LTD.


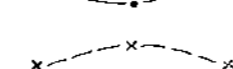
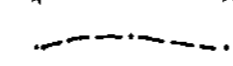
NICOLA COPPER MINES LTD. (N.P.L.)
 GREENSTONE CR. PROPERTY
 KAMLOOPS M.D., B.C.

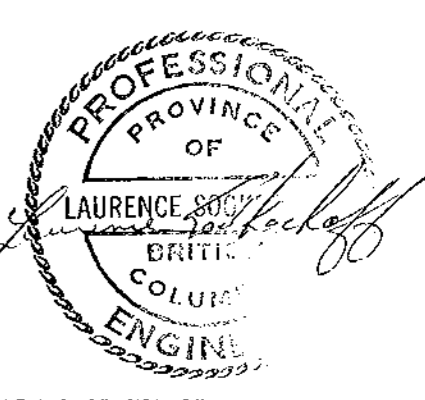
VLF-EM SURVEY-FRASER FILTER
 DATA & CONTOURS

PDT DRAFTING SERVICES	SCALE 1" = 200'	JOB No. 73-68	DATE JULY 1973	SHEET No. 1
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LEGEND

-  INPHASE
-  QUADRATURE
-  FRASER FILTER



TO ACCOMPANY GEOPHYSICAL REPORT BY D.G. MARK, GEOPHYSICIST

Department of Mines and Petroleum Resources ASSESSMENT REPORT NO. 4499 MAP #4		GEOTRONICS SURVEYS LTD. NICOLA COPPER MINES LTD. (N.P.L) GREENSTONE CREEK PROPERTY KAMLOOPS M.D., B.C. VLF - EM SURVEY PROFILES	
POT DRAFTING SERVICES SCALE 1" = 200'	JOB No. 73-68	DATE JULY 1973	SHEET 2

4499 M4