4639

GEOPHYSICAL and GEOLOGICAL REPORT

on

MAGNETOMETER, VLF-EM, and GEOLOGICAL SURVEYS

on the

JOAN CLAIM GROUP

Racing River Area, Liard M.D., B.C.

94K/6W

JOAN CLAIM GROUP: 98 Miles S 75 W of Fort Nelson
58° 125° SE
N T S - 94K/6W

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

For : Yamoto Mining & Smelting Ltd (NPL)
515 - 602 West Hastings Street
Vancouver 2, B.C.

August 31, 1973

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SUMMARY:

Geological, magnetometer, and VLF-EM surveys were carried out over a portion of the Joan Claim Group in the Racing River area of the Liard mining division during July 1973. The purpose of the work in general was to determine the potential of finding copper sulphides similar to those of Consolidated Churchill Copper Mines Ltd.

The claims are located along Delano Creek, 98 miles S75 W of Fort Nelson and are accessible by the Churchill Copper access road which leaves the Alaska Highway at Mile 401. The terrain varies from gentle near the creek to precipitous. Much of the property is covered by a coniferous forest.

The Joan claims are underlain by a series of sedimentary rocks that range in age from Helikian to Cambrian. Basic dykes cut the Helikian sediments. Some copper sulphides are known to occurr on the property.

The magnetic survey was carried out using a portable, vertical-component, fluxgate magnetometer. The values were diurnally corrected, statistically analyzed, plotted, and contoured at a 40 - gamma interval. The VLF-EM survey used a receiver tuned in to the transmitter at Seattle (18.6 KHz). The results were Fraser-filtered, plotted, and contoured at a 5-degree interval.

All the outcrops, from which the geology was mapped, were found outside the survey area.

CONCLUSIONS:

1. Most of the claim group seems to be underlain by argillites, sandstones, and dolomites of the Aida Formation. Though no outcrops were mapped, the Tuchodi Fromation probably underlies an eastern portion of the claims. The Atan Group appears to underlie the northern quarter and the extreme western portion of the claim group.
2. Three diabase dykes were mapped.
3. A highly altered zone containing a diabase dyke, argillite, argillite-breccia, irregular quartz-ankerite veining, and copper mineralization was located.
4. The magnetic survey appeared to reflect 6 basic dykes varying in strike from N20E to N30E.
5. In the VLF-EM survey, there are 4 anomalous areas. Two of these seem to be related to the basic dykes as mapped by the magnetic survey and therefore could well be reflecting copper sulphides. At least one of the anomalies of area C appears to be reflecting a fault. Copper mineralization as the cause of the VLF-EM anomalies within areas C and D should not be precluded.
6. It is felt that the surveys were successful in their objectives and that there is a good potential of substantial copper sulphides occurring on the Joan Claims.

RECOMMENDATIONS:

To further determine the potential of the property, it is strongly recommended to carry out a soil geochemistry survey on the existing grid and to test these samples for copper.

This is especially important over the VLF-EM anomalous zones A and B.

Any further work should depend on the results of the soil geochemistry survey.

August 31, 1973

Sincerely yours,
GEOTRONICS SURVEYS LTD.

David G. Mark
Geophysicist

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
LAURENCE SOUKOCHOFF

GEOPHYSICAL - GEOLOGICAL REPORT

on

MAGNETOMETER, VLF-EM, AND GEOLOGICAL SURVEYS

JOAN CLAIM GROUP

Racing River Area, Liard M.D., B.C.

INTRODUCTION AND GENERAL REMARKS:

This report discusses the procedure, compilation, and interpretation of fluxgate magnetometer, very low frequency electromagnetic (VLF-EM), and geological surveys carried out over the Joan Claim Group in the Racing River area during July, 1973.

The field work was carried out by and under the direct supervision of Howard A. Larson, geophysicist. The number of line miles of the 2 geophysical surveys completed was 10.4 and the area covered by the survey is as shown on Figure 2.

The object of the surveys was to determine the possibility of the existence of copper mineralization similar to that at Consolidated Churchill Copper Mines Ltd. The Churchill Copper sulphides seem to be associated with andesite dykes.

For this reason, the magnetic survey was carried out to map any dykes that may occur on the Joan Claims. The VLF-EM survey was carried out to map structure and sulphide mineralization. It is not known, however, whether the VLF-EM is able to reflect sulphides in this area. The purpose of the geological mapping was to map petrology, structure and possibly any sulphides. In addition, its purpose was to assist in the interpretation of the 2 geophysical surveys.

PROPERTY AND OWNERSHIP:

The Joan Claim Group consists of 22 full-sized mineral claims as shown on Figure 2 and as described below. Fig. 2 shows how the claims sit as was found by the magnetic and VLF-EM surveys. Thr fractions have now since been staked.

CLAIM NAME	RECORD NO.	EXPIRY DATE
Joan 1 - 17	57053-'69	Oct. 13, 1973
Joan 19 - 20	57070-'71	Oct. 13, 1973
Joan 27 - 28	57072-'73	Oct. 13, 1973
Joan 36	57074	Oct. 13, 1973

All claims are fully owned by Yamoto Mining & Smelting Ltd. (NPL) of Vancouver, B.C.

LOCATION AND ACCESS:

The claims are located 98 miles S75 W of the town of Fort Nelson, B.C. They are found on the southern slope of Yedhe Mountain and on Delano Creek which is a tributary of Racing River.

The geographical co-ordinates are 58°28' N latitude and 125°17' W longtitude.

The Joan Claims are easily accessible by 2-wheel drive vehicle on the Churchill Copper mine access road. This road leaves the Alaska Highway at Mile 401 and eventually parallels the Racing River and Delano Creek, through the claim group. The property is centered about 6 miles past the Churchill Copper mill site.

PHYSIOGRAPHY:

The property is found in the Muskwa Range which forms part of the physiographic unit known as the Rocky Mountains. The terrain in the area is typical of the Muskwa Range which is broad U-shaped river valleys and precipitous, rugged mountains. The elevation ranges from 2 to 3,000 feet in the valleys to 9 to 10,000 feet on the mountain peaks. The relief on the Joan claims is about 3500 feet which is from about 3,000 feet in Delano Creek to about 6,500 feet on the southern slope of Yedhe Mountain.

On each side of Delano Creek, as well as its tributaries, are talus slides with an incline from 30° to 45° . These slides are interspersed with rock bluffs and extend for approximately 1,500 to 3,000 horizontal feet to larger, often impassable bluffs.

The main water source of the area is Delano Creek which flows easterly through the southern part of the claims. Also a tributary of Delano Creek flows southerly through the western part of the claim group.

Longitudinal valleys of considerable length and width are common in the Muskwa Ranges. They are generally eroded parallel to the structural trend along lines of faulting or along belts of softer, more easily eroded rock. These valleys produce a pronounced trellis pattern.

Glaciation in the northern areas was uneven in intensity with some areas within the Muskwa Ranges showing little or no evidence of glacial erosion. However, the presence of an ice cover is revealed by an almost universal veneer of drift.

The major vegetation in the area is a light coniferous forest found mainly in the valleys and on the lower slope of the mountains. The higher peaks are devoid of vegetation other than some grasses and small bushes.

The climate of the area could be termed sub-artic. Temperatures can thus dip to a minimum of -60° F in January to a maximum of about 90° F in July. Freeze-up starts approximately mid-October and break-up around April or May. There are thus only four or five months of exploration season and snow can fall any time during these months (as was the writer's experience).

HISTORY OF PREVIOUS WORK:

An airborne magnetic survey was carried out September 3, 1970 by GEOTRONICS SURVEYS LTD.

GEOLOGY (GENERAL)

The geology is largely taken from Taylor & Stott, Vail, and Carr.

The whole Racing River area is generally underlain by an unmetamorphosed succession of sedimentary rocks of every type ranging in age from Late Precambrian to Upper Cretaceous. The only igneous rocks present are Precambrian diabase dykes. These sedimentary rocks possess a regional northwesterly strike and a dip towards the southwest at moderate angles.

Figure 3 shows the geology in the region of the Joan Claim Group. The following is a description of the geology as seen on this map.

The oldest rock-types within this area are those of the Tuchodi Formation and are Helikian in age. It occurs on the eastern part of the claims area. This formation contains brown weathering feldspathic quartzites, orange-brown weathering silty and argillaceous dolomites, and dolomitic siltstones.

Overlying the Tuchodi Fromation and also of Helikian age is the Aida Formation. It underlies the southern two-thirds of the claims area. It is within this formation that many of the copper prospects of the area occur. Taylor and Stott say this formation is comprised of calcareous and dolomitic mudstones and siltstones with minor sandstone; green chamositic mudstone and black carbonaceous mudstone; dolomite and limestone.

However, Carr says that around the Churchill Mine, the rock-types are grey and black limestone, limy argillite, and limy shale. The writer, when in the area in the fall of 1969,noted the same rock-types as Carr.

Cutting the above formations are steeply dipping diabase dykes, also of Helikian age. These dykes are anywhere from 20 to 250 feet thick and contain 4 to 8% magnetite. They seem to be associated with the sulphide mineralization of the area. None so far have been mapped within the area shown by Figure 3.

Of Cambrian age are rocks of the Atan group which cover the northern third of the claim group. This is largely composed of fanglomerates which are sheared, polymictic, very coarse, with boulders as much as ten feet in diameter, and grey in color. They are deposited next to active faults. The size of the clusts reduce in size the further from the fault trace. Sandstone, shale, and minor limestone are also found within this group.

Overlying the Atan group is the Ordivician Kechika group. In this area the group is composed of limestone and minor sandstone.

The Silurian Nonda Formation overlies the Kechika group and contains dark grey dolomite; basal sandstones, and minor limestone.

Dolomite of the Muncho-McConnell Formation overlies the Nonda Formation. It is Devonian in age.

Striking northwesterly on the southwest corner of the claim group is a major thrust fault. Carr notes that folding becomes intense near faults and locally elsewhere, and is largely asymmetric with steep eastern limbs.

The sulphide mineralization of the area is chalcopyrite - pyrite that seems to occur mainly within the Aida Formation. The Magnum vein system of Churchill Copper Mines is the best known and is probably fairly representative. The system comprises a number of quartz-ankerite veins, mineralized with chalcopyrite and lesser pyrite, occurring in a steep northeasterly zone of deformation and subsequent dyke intrusion within otherwise little-deformed sedimentary rocks.

The writer located chalcopyrite mineralization near the initial post of the Joan 13 and 14 claims, when the claims were first staked in the fall of 1969.

INSTRUMENTATION AND THEORY:

a) Magnetometer

The magnetic survey was carried out using a portable vertical component, Model G-110 fluxgate magnetometer manufactured by Sabre Electronic Instruments Ltd. of Burnaby, B.C. This is a visual-null type instrument using digital dial readout with a range of 100,000 gammas and a reading accuracy of 10 gammas.

The G-110 has a temperature coefficient of 2 gammas per degree centigrade.

Only two commonly occurring minerals are strongly magnetic; magnetite and pyrrhotite. Hence, magnetic surveys are used to detect the present of these minerals in varying concentrations. Magnetic data are also useful as a reconnaissance tool for mapping geologic lithology and structure since different rock types have different back-ground amounts of magnetite and/or pyrrhotite.

b) VLF-EM

A VLF-EM receiver, Model G-28, manufactured by Sabre Electronic Instruments Ltd. of Burnaby, B.C. was used for the VLF-EM survey. This instrument is designed to measure the electromagnetic component of the very low frequency field (VLF), transmitted at 18.6 KHz, from Seattle, Washington.

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:

Both the magnetic and VLF-EM surveys were carried out on survey lines as shown on sheets 2 and 3. The survey lines were spaced 400 feet apart and run in an east-west direction.

Readings by both instruments were taken every 100 feet on the survey lines. These reading stations were marked by flagging tape with the appropriate grid coordinates. The magnetometer was read facing towards magnetic north and the VLF-EM was read facing southwards towards the transmitter station near Seattle.

The magnetic diurnal drift was monitored by closing loops on base stations. All loops were closed within 2 hours.

COMPILATION OF DATA:

a) Magnetic

The magnetic data were corrected for diurnal drift and a cumulative frequency curve, Figure 3, was plotted.

From the cumulative frequency curve, the mean background value of approximately 58,040 gammas was determined. For ease of drafting, 50,000 gammas were subtracted from all values and the data was then plotted on Sheet 2 at a scale of 1" = 400 feet, and contoured at a 40-gamma interval. The 58,020-and 58,060-gamma contours were omitted since these are close to the mean background value and would therefore only hinder the interpretability of the magnetic data.

b) VLF-EM

Sheet 3 shows the VLF-EM results after they have been reduced by applying the Fraser filter. Filtered data is plotted between actual reading stations. The positive dip angle readings were contoured at intervals of 5^{o}.

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

a) Geological Mapping

The rock-types with structural relations were described by Larson and verified with some modifications by L. Sookochoff, geological engineer. A table of the outcrop (or sample) numbers with the accompanying rock description is given below. In addition the outcrops are mapped and labelled on sheet 1.

Outcrops (or sample) No.	Description
1)	Reddish-brown siltstone with quartz stringers and veins making up to 50% of the rock.
2)	Reddish medium-grained sandstone with obscure bedding planes. It contains quartz-ankerite stringers and minor amounts of sericite indicating minor metamorphism.
3)	Slightly reddish quartzite. Some of the quartz grains are pebble-size and there is no apparent bedding. It contians epidote on the fractures and randum quartz stringers.
11)	Dark grey siliceous dolomite weathering to a buff clour. It contains irregular veins of ankerite. Major fracturing is vertical striking N40E. There is also surrounding flat-lying beds of black argillite mineralized with minor pyrite and malachite staining.
12)	Argillite-breccia occurring within a black, flat-lying fissile argillite. The argillite-breccia is comprised of argillite

fragments within irregular quartz-ankerite veins. There was also noted some minor pyrite, chalcopyrite blebs, and malachite staining.

13) Calcareous quartzite with heavy disseminated pyrite. It's flat-lying with the major fractures along the bedding. Two other fractures are vertical with one striking N15E ad and the other SE.

14) Medium-to fine-grained arkose with predominant grains of quartz and feldspar. There is no apparent bedding.

14A) Dark green meta-argillite with fine disseminated pyrite. Near contact with basic dyke striking N80E.

15) Dark medium-grained basic intrusive, probably a diabase or micro-gabbro. It contains epidote and minor pyrite within some fractures. Three sets of fractures were noted: a) dipping 20° towards N65E; b) dipping near-vertical with a strike towards N40E; c) dipping 50° towards the southwest.

16) 18) Alternating bands of white quartzite and green silliceous argillite. The beds dip 30° towards the south.

17) Dark grey bedded argillite with a dip of 30° towards the south.

19 & 20) Highly fractured and weathered arkose with disseminated pyrite. No bedding or distinct fracture patterns could be seen . Sample 20 is slightly darker, more ferruginous, and more competent than 19. Outcrops 19 and 20 were very crumbly and weathered which was probably caused by the fault action nearby. The gorge to the immediate east of 19 and 20 is surmised to be a fault. There are different rock types on each side of the gorge. Opposite 19 and 20 are rocks similar to 16 to 18.

21) Grey, coarse-grained arenite. Same as 19 and 20.
This is adjacent to a vertical east-west striking fault that is uplifted 75 feet on the north side.

22) Vertical diabase or micro-gabbro dyke similar to sample 15. Strike is N to N20E.

23) Vertical diabase or micro-gabbro dyke similar to sample 15. Strike was difficult to determine.

24-26) Alternating bands of phyllite, chloritic schist and boulder conglomerate with the conglomerate being highly predominant. Some malachite staining was noted on some of the schists. The beds dip 60 to 75° to the SW.

28) Light grey quartzite weathering to a buff colour with minor pyrite and chalcopyrite.

29) Slaty black fissile argillite dipping approximately 30° to SW.

29A) Light brown argillite dipping 30° to SW

30) Interbedded black argillite and grey sandstone with quartz veins perpendicular to bedding which dips 30° to the SE.
This unit is overlain by pebble conglomerate.

31) Grey and black slaty argillite with a slight cleavage. Beds dip 55° to the SW.

32) Grey quartzite with quartz-arkerite stringers. The bedding dip could not be determined.

33) Red shales dipping 30° to the SW.

34) Conglomerate.

The above rock descriptions more conclusively indicate that the greater part of the property is underlain by the Helikian Aida Formation and that this formation is cut by the favourable basic intrusive dykes. On this property, the Aida Group is composed of limy argillite, various types of sandstone, and some dolomite.

Outcrops of the underlying Helikian Tuchodi Formation were not mapped but an assumed contact, taken from Stott and Taylor, was sketched on sheet 1.

Overlying the Aida Formation are supposedly conglomerates of the Atan group. The northern contact was not mapped but was assumed to be the east-striking cliff and therefore was sketched in as such. On the western part of the property samples 24 to 26 are felt to belong to the Atan group, largely because of the boulder conglomerate. Therefore, the western boundary between the Aida Formation and the Atan group was sketched in midway between the 2 respective outcroppings. Outcroppings 34 (conglomerate) may be remnants of the Atan group. As noted above, 2 almost-orthoganol faults were mapped on the Joan 15 claim. Small amounts of copper mineralization are found in several places within the outcrop part of the claim group. The best mineralization is found north of the Joan 12 mineral claim. Here is mapped a diabase dyke, the rocks are highly altered, and irregular veins of quartz-ankerite occur.

b) Magnetic Survey

The cumulative frequency graph shows 2 distinct segments divided by the 58,100-gamma interval at the 15% level (there is a third small segment at the 0.6% level but it is considered part of the 2nd segment). This shows that there are 2 main distributions of magnetic values within the survey area.

The part of the graph labelled AB is likely a reflection of the sedimentary rocks. Sediments almost always have a very low magnetite content. In addition, the range of the magnetic field over sedimentary rocks is quite narrow. This is shown by the steep slope of segment AB and its geometric deviation which is 1.0074 (see Lepeltier).

Segment BC, which contains the higher magnetic values, in all probability is a result of underlying basic intrusive dykes. Basic rocks almost always contain magnetite and the magnetite content of the dykes in this area are reported to be as high as 15%. Also the magnetic field range is much broader over basic rocks and this is shown by the smaller slope of BC and its higher geometric deviation which is 1.0228.

The writer feels the above interpretation is more strongly confirmed by the shape of the anomalous highs on sheet 2 which are labelled by the letter A to F. (The anomalous highs are described as those areas containing values greater than 58,100 gammas). These highs are somewhat long and linear-looking and therefore strongly suggestive of dykes. Part of the shape, of course, is caused by the bias of the grid size.

The causitive source of anomaly A has a vertical dip and a N10E strike.

The dip of B's causitive source is difficult to say but is probably close to vertical. The strike could be anything from N20E to N30E. Anomaly C is small and narrow with relatively high intensity and therefore is probably caused by a narrow basic dyke with its top close to the surface. It appears to have a vertical dip and a N28E strike.

Anomalies D, E and F appear as one anomaly but are felt to be caused by 3 different sources. This is especially

seen on the profiles of figure 5. The dip of all 3 sources appears to be close to vertical. D strikes N20E; E, N30E; and F, N20E.

The anomalies not lettered are small and isolated but still possibly could be due to basic intrusives.

The magnetic lows are of low intensity and therefore doubtlessly only reflect minor magnetic variations within the sedimentary rocks. It is also possible the variations are in actuality reflecting the basement rock.

c) VLF-EM SURVEY

Sheet 2 shows several anomalies varying in intensity from 6^{o} to 28^{o}. The anomalies appear to occur in 4 distinct areas and these are labelled A to D, respectively.

The VLF-EM anomalies of area A are close to the magnetic anomalies A, B, and C, and the VLF-EM anomalies of area C are close to the magnetic anomalies D, E and F. As mentioned previously, in all possibility, the magnetic anomalies are caused by basic dykes. As a result, there is a good possibility that the VLF-EM anomalies are caused by copper sulphides. Other possibilities are shear zones, shear zones with copper sulphides, and/or contacts between altered and unaltered sediments. North of zone A about 1500 feet and northeast of zone B about 3000 feet is a zone containing highly altered argillite, argillite-breccia, quartz-ankerite veining, a basic dyke, and

chalcopyrite.

VLF-EM zones D and E are not related to any major magnetic highs. This does not preclude that there are no basic dykes as the writer found that some in the area were not magnetic. Consequently, it should not be precluded that these VLF-EM anomalies are caused by copper sulphides. West of area D, for example, was noted malachite staining on some schists. These schists may belong to the Atan Group, however. A few of these anomalies are somewhat lineal and therefore suggests that they could be caused by faults and/or shear zones. Within area C, there is a north-striking fault shown on the geology map (sheet 1).

Respectfully submitted,

GEOTRONICS SURVEYS LTD.

David G. Mark
Geophysicist

August 31, 1973

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
LAURENCE SOOKOCHOFF

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Resume of
Professional and Technical Experience
of
Howard Larson, Geophysicist

Education:

1971 Graduate of the University of British Columbia with a Bachelor's degree in Science (B.sc.) in geophysics.

Experience:

August 1971 to Present	Geotronics Surveys Ltd. geophysicist in both mining and engineering geophysics
May 1970 to September 1970	Tri-Con Exploration Survey Ltd. Field Supervisor in geophysics.
May 1969 to September 1969	Atlas Explorations Ltd. geochemical analyst and geophysical operator.
May 1968 to September 1968	Coast Eldridge Engineers and Chemists chemist's assistant on geochemical rock assays and soil samples.

Location of experience is British Columbia, Yukon, and the Northwest Territories.

Types of geophysical surveys experience are single and multi-channel seismic, induced poloarization, resistivity, self-potential, magnetometer (air and ground), various types of electromagnetic, radiometric and soil sampling.

GEOPHYSICIST'S CERTIFICATE

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

That I an 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 geological, magnetometer, and VLF-EM surveys carried out by Howard A. Larson, geophysicist, under my supervision during July, 1973, on the Joan Claim Group, from references as mentioned under Selected Bibliography, and from a personal visit to the property and the area over a period of a month during the fall of 1969.

5. I have no direct or indirect interest in the properties or securities of Yamoto Mining & Smelting Ltd. (NPL), Vancouver, B.C. nor do I expect to receive any interest therein.

David G. Mark
Geophysicist

August 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:

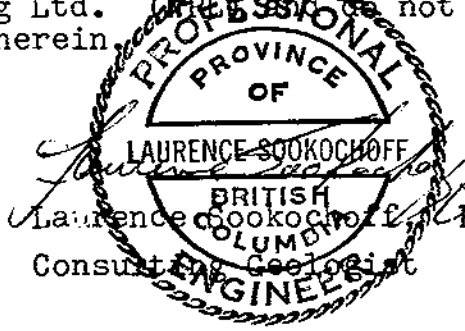
1. I am a graduate of the University of British Columbia (1966) and hold a B.Sc. degree in Geology.

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 August 31, 1973 on geological, magnetometer, and VLF-EM surveys 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 Yamoto Mining and Smelting Ltd. (NPL), and do not expect to receive any interest therein.



Laurence Sookochoff, P. Eng.
Consulting Geologist

September 11, 1973

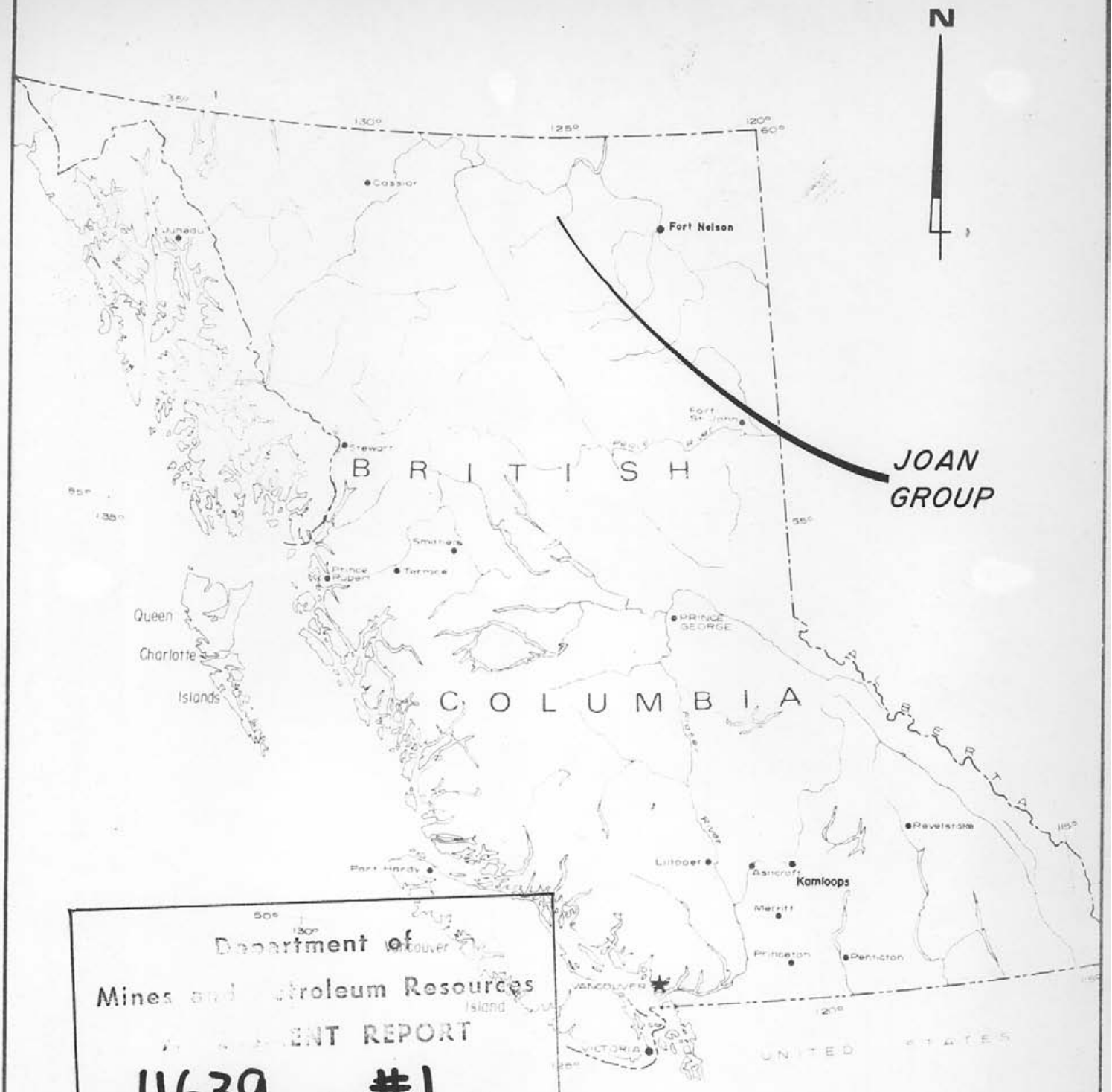


FIG. 1

GEOTRONICS SURVEYS LTD.

YAMOTO MINING & SMELTING LTD.

JOAN GROUP

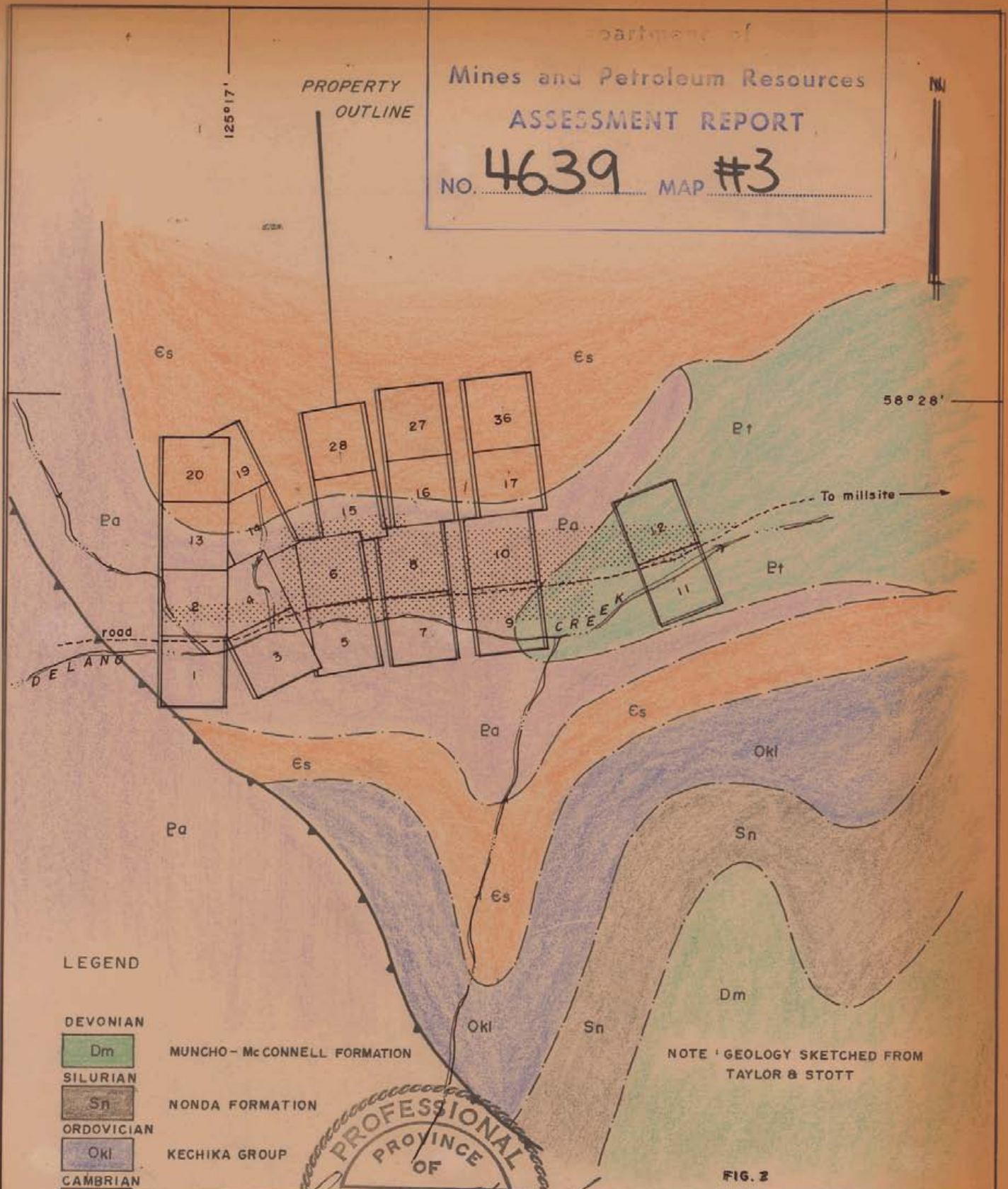
LIARD M.D., B.C.

LOCATION MAP

SCALE 1" = 134 mi

DRAWN. PDT		DATE JULY '73

PDT



LEGEND

DEVONIAN
- Dm — MUNCHO – McCONNELL FORMATION

SILURIAN
- Sn — NONDA FORMATION

ORDOVICIAN
- Okl — KECHIKA GROUP

CAMBRIAN
- Es — ATAN GROUP

HELIKIAN
- Pa — AIDA FORMATION
- Pt — TUCHODI FORMATION

THRUST FAULT

CONTACT

SURVEY AREA

NOTE : GEOLOGY SKETCHED FROM TAYLOR & STOTT

FIG. 2

GEOTRONICS SURVEYS LTD.

YAMOTO MINING & SMELTING LTD.

JOAN CLAIM GROUP

LIARD M.D., B.C.

GEOLOGY MAP

DRAWN BY	SCALE	DATE
PDT DRAFTING SERVICES	1" = 3000'	JULY 1973

YAMOTO MINING & SMELTING LTD.
JOAN CLAIM GROUP
LIARD M.D., B.C.

CUMULATIVE FREQUENCY CURVE
MAGNETIC DATA RESULTS

fig. 4

COST BREAKDOWN

on

MAGNETOMETER, VLF-EM AND GEOLOGICAL SURVEYS

on the

JOAN CLAIM GROUP

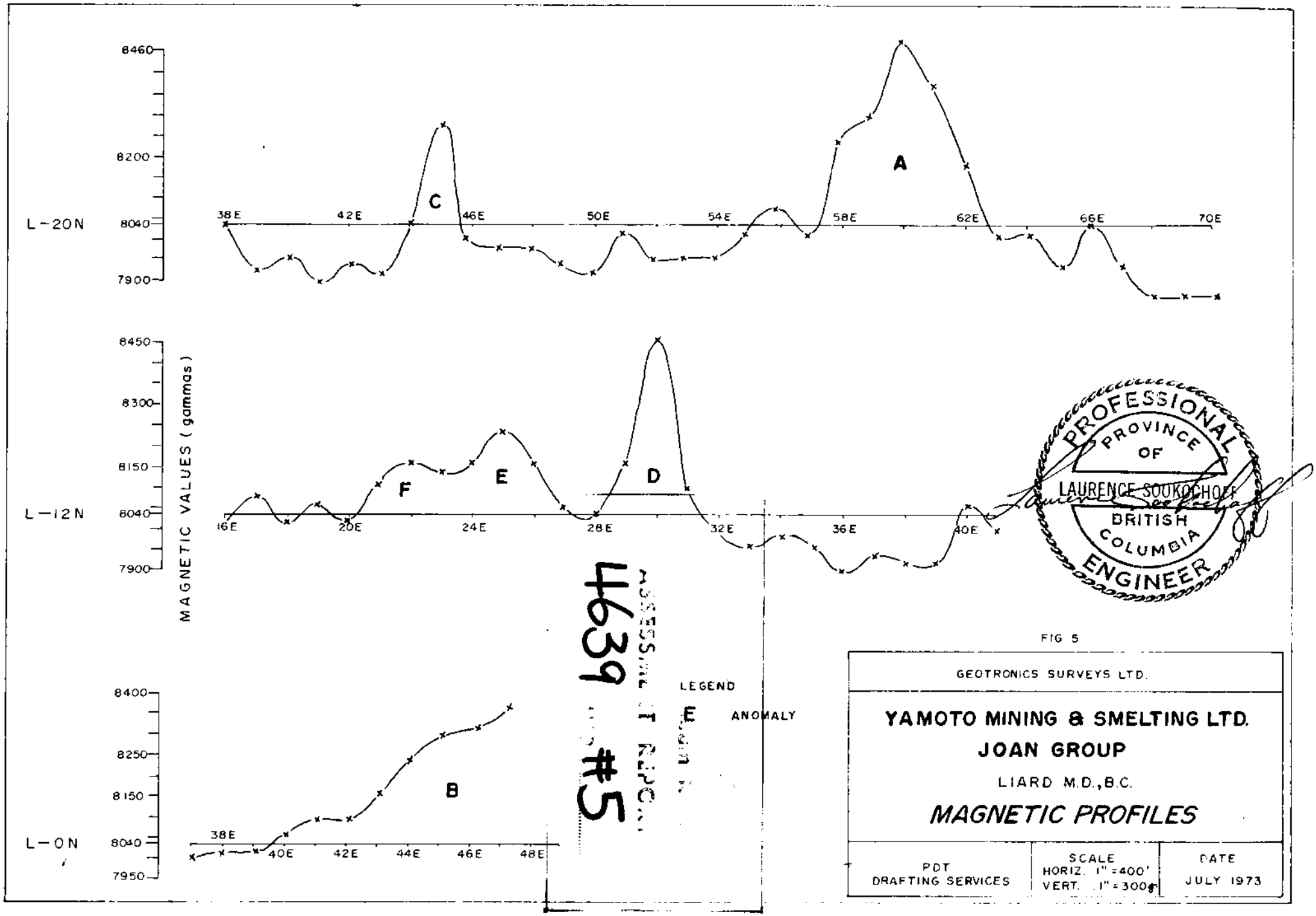
RACING RIVER AREA, LIARD M.D., B.C.

Wages	
H.A. Larson, geophysicist & crew chief, 19 days @ $130/day	$ 2470.00
R. MacGregor, instrument operator, 19 days @ $80/day	1520.00
	$ 3990.00
1 G-110 Magnetometer - 19 days @ $20/day	380.00
1 G-28 VLF-EM - 19 days @ $15/day	285.00
1 2-wheel drive rental - 19 days @ $25/day	475.00
Survey supplies	100.00
Mapping and Geophysical-Geological Report	800.00
Engineering fee	350.00
	$ 6380.00

Declared before me at the City
of [illegible], in the
Province of British Columbia, this 4th
day of Dec. 1973. A.D.

[illegible]

A Notary Public in and for the Province of British Columbia.



11639 #5

FIG 5

GEOTRONICS SURVEYS LTD.

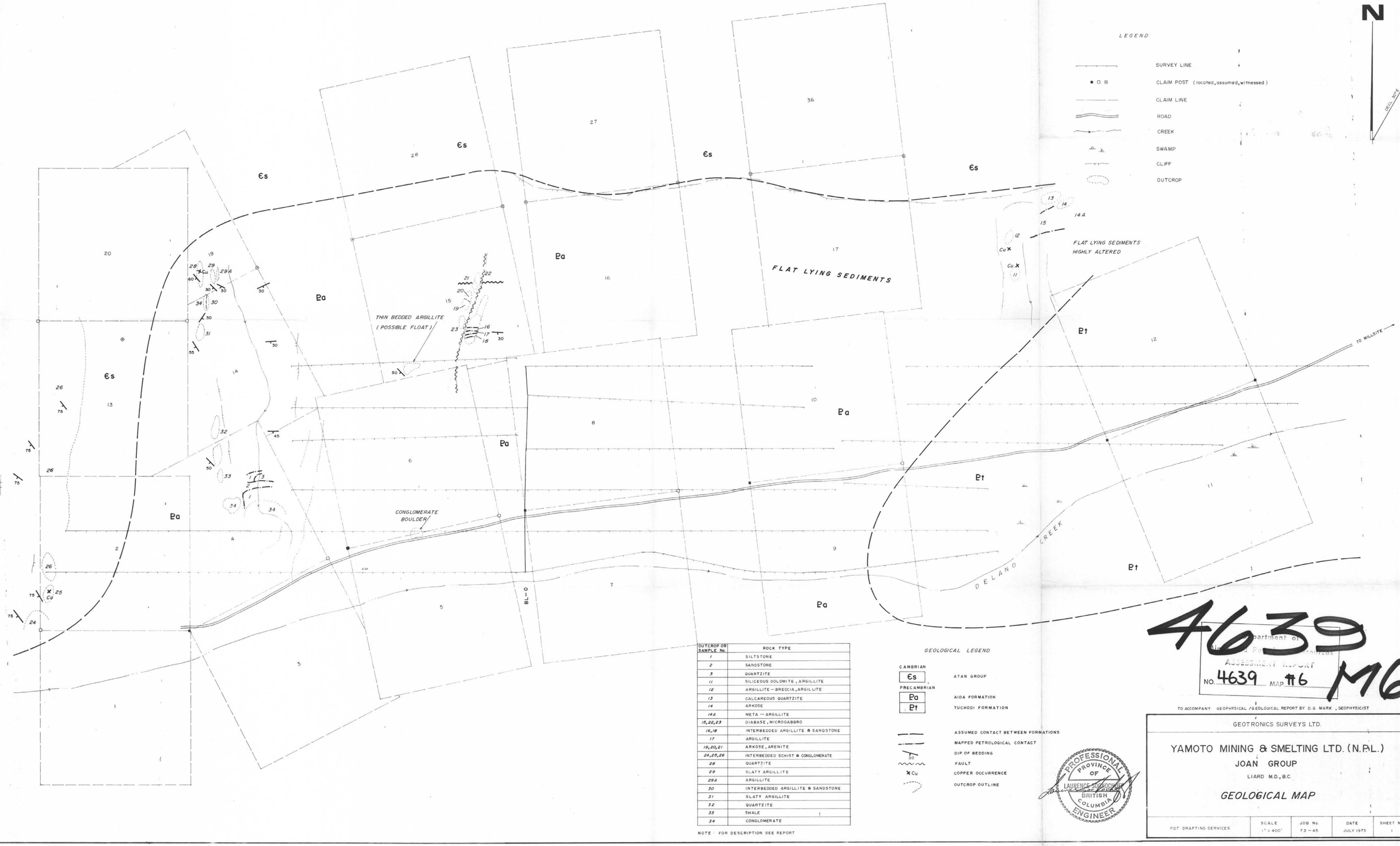
YAMOTO MINING & SMELTING LTD.

JOAN GROUP

LIARD M.D., B.C.

MAGNETIC PROFILES

PDT DRAFTING SERVICES	SCALE HORIZ. 1" = 400' VERT. 1" = 300'	DATE JULY 1973



OUTCROP OR SAMPLE No.	ROCK TYPE
1	SILTSTONE
2	SANDSTONE
3	QUARTZITE
11	SILICEOUS DOLOMITE, ARGILLITE
12	ARGILLITE — BRECCIA, ARGILLITE
13	CALCAREOUS QUARTZITE
14	ARKOSE
14A	META — ARGILLITE
15,22,23	DIABASE, MICROGABBRO
16,18	INTERBEDDED ARGILLITE & SANDSTONE
17	ARGILLITE
19,20,21	ARKOSE, ARENITE
24,25,26	INTERBEDDED SCHIST & CONGLOMERATE
28	QUARTZITE
29	SLATY ARGILLITE
29A	ARGILLITE
30	INTERBEDDED ARGILLITE & SANDSTONE
31	SLATY ARGILLITE
32	QUARTZITE
33	SHALE
34	CONGLOMERATE

NOTE : FOR DESCRIPTION SEE REPORT

GEOLOGICAL LEGEND

CAMBRIAN
Es — ATAN GROUP

PRECAMBRIAN
Pa — AIDA FORMATION
Pt — TUCHODI FORMATION

ASSUMED CONTACT BETWEEN FORMATIONS
MAPPED PETROLOGICAL CONTACT
30 — DIP OF BEDDING
FAULT
×Cu — COPPER OCCURRENCE
OUTCROP OUTLINE

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — LAWRENCE SUMMERHAYES

4639 M6

Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 4639 MAP 116

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

GEOTRONICS SURVEYS LTD.

YAMOTO MINING & SMELTING LTD. (N.P.L.)

JOAN GROUP

LIARD M.D., B.C.

GEOLOGICAL MAP

PDT DRAFTING SERVICES	SCALE 1" = 400'	JOB No. 73-45	DATE JULY 1973	SHEET No. 1

NOTE : READINGS ARE IN GAMMAS.
50,000 GAMMAS HAS BEEN SUBTRACTED FROM ALL READINGS.
CONTOUR INTERVAL IS 40 GAMMAS.
8100 GAMMAS AND ABOVE
7980 " " LESS
8020, 8060 CONTOUR IS NOT DRAWN IN.

4639

Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 4639 MAP #7

M7

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

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
LAURENCE SCHOOLCRAFT

GEOTRONICS SURVEYS LTD.

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JOAN GROUP

LIARD M.D., B.C.

MAGNETOMETER SURVEY
DATA & CONTOURS

PDT DRAFTING SERVICES	SCALE 1" = 400'	JOB No. 73-45	DATE JULY 1973	SHEET No. 2

N

MAG.
DECL. 30°E.

LEGEND

- SURVEY LINE
- CLAIM POST (located, assumed, witnessed)
- CLAIM LINE
- ROAD
- CREEK
- SWAMP
- CLIFF
- OUTCROP

A

B

C

D

L-20N

L-16N

L-12N

L-8N

L-4N

L-0

TO MILLSITE

DELANO CREEK

SEATTLE TRANSMITTER 18.6 KHz

44W | 36W | 28W | 20W | 12W | 4W | BL.00 | 4E | 12E | 20E | 28E | 36E | 44E | 52E | 60E | 68E | 76E | 80E

NOTE: READINGS ARE IN DEGREES.

CONTOUR INTERVAL IS 5°.

4639

Mines

ASSESSMENT REPORT

NO. 4639 MAP #8

M8

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

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
LAURENCE SOUMBOUDES

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JOAN GROUP

LIARD M.D., B.C.

VLF — EM SURVEY — FRASER FILTER DATA & CONTOURS

PDT DRAFTING SERVICES	SCALE 1" = 400'	JOB No. 73-45	DATE JULY 1973	SHEET No. 3