3164

REPORT ON
AIRBORNE GEOPHYSICAL SURVEYS
PORT HARDY AREA, BRITISH COLUMBIA
ON BEHALF OF
GREEN EAGLE MINES LTD.

92L/5E

by

Richard O. Crosby, B.Sc., P.Eng.

June 10, 1970

CLAIMS:

Name

PAN 1 - 24 (inclusive)
GE 1 - 40 (inclusive)
GE 41 Fr.
GE 42

LOCATION:

About 20 miles south-southwest of
Port Hardy, British Columbia
Nanaimo Mining Division
50° 127° SW

DATES:

May 24 to May 29, 1970

TABLE OF CONTENTS

SUMMARY

Helicopter-borne electromagnetic and magnetometer surveys were executed over approximately 6 square miles in the Port Hardy area, British Columbia. No conductors were revealed by these surveys, however anomalous magnetic responses outlined areas warranting further field investigations. A dike or sill was located in the extreme northern portion of the survey grid and mineralized outcrop in the vicinity of the Yreka mine had correlating magnetic anomalies. Extensive northeast trending faults were also revealed by the survey.

REPORT ON AIRBORNE GEOPHYSICAL SURVEYS PORT HARDY AREA, BRITISH COLUMBIA ON BEHALF OF GREEN EAGLE MINES LTD.

INTRODUCTION

From May 24 through May 29, 1970, airborne geophysical surveys were executed on behalf of Green Eagles Mines Ltd., over the Yreka property, near Port Hardy, British Columbia, covering approximately 6 square miles (see Plate 1).

The airborne survey included electromagnetic and magnetometer measurements. The former employed a Scintrex HEM-701 electromagnetic unit and the latter a Scintrex NPM-1 nuclear resonance, total intensity magnetometer.

Appendix 'A', attached, gives full details of the airborne geophysical equipment and the ancillary equipment employed, as well as the treatment of data resulting from these surveys. In the case of the present surveys a Bell 206 helicopter, on charter from Okanagan Helicopters, was employed as the basic transport vehicle.

The survey lines were flown approximately east-west at a nominal 1/8 mile interval and a mean terrain clearance of 300'. The magnetometer sensor and the EM "bird" were towed separately by the helicopter, the former 50' below the helicopter and the latter 100' below the helicopter. Flight navigation and flight path recovery have been based upon a uncontrolled photo mosaic on the scale of approximately 1" = 1/8 mile.

Thirty-six flight lines measuring a total of 112 line miles were flown on the survey. Two control lines flown normal to the traverse direction were used for magnetic leveling. The intensity of the earth's total magnetic field in the survey area measures approximately 56,100 gammas and the inclination of the total field vector is approximately 70 degrees.

The purpose of the present programme was to map the distribution of the subsurface conductors in the survey area. In the survey area the targets of economic interest are metallic sulphide bodies. The electromagnetic data provide the basic information relating to the possible presence of such bodies. The purpose of the magnetometer survey results is primarily one of correlation with the electromagnetic conductors.

PRESENTATION OF DATA

The results of the geophysical surveys and their interpretation are presented on Plates 2 and 3, on the scale of 1" = 1/8 mile. Some topographic features and flight lines are shown on the plates. Plate 2 shows the magnetic contours. The contours are at an interval of 100 gammas or less, according to magnetic relief. Plate 3 shows the geophysical interpretation and claim location on the scale of 1" = 1/8 mile.

The EM and magnetometer data are presented together with altimeter and fiducial recording on a dual trace Moseley recorder. In order to record three traces on the dual trace recorder in-phase and out-of-phase utilize the same pen by alternately displaying one trace, then shifting the mean recording level and recording the other trace. The in-phase trace is displayed for a period twice that of the out-of-phase to distinguish between the traces.

The original geophysical traces are on the following scales:

EM	1" = 100 parts per million
MAGNETOMETER	1" = 100 gammas with automatic steps of 500 gammas. The magnetic base level is 57,000 gammas.

GEOLOGY

A description of the geology of the area including the present survey grid is found in Minister of Mines Province of British Columbia Annual Report, 1953 and is described as follows: "The rocks underlying the claims are andesites, agglomerates, tuffs, and limestones correlated with the Vancouver group of Triassic age. They comprise three principal units - a lower unit of andesitic lavas to an elevation of about 900 feet; a middle unit consisting of banded limestone to about 1,000 feet, overlain by tuffs and agglomerates with lenticular beds of limestone to about 2,000 feet; and an upper unit of tuffs and andesitic flows. They are intruded by dykes and sills of basalt, diabase, and quartz-feldspar porphyry. A diabase dyke cuts a basalt sill near the east boundary of the N. S. Fraction claim, but the age relationships between these and the quartz-feldspar porphyries is not known.

"The basalt intrusive bodies are green aphanitic rocks composed of plagioclase feldspar (andesine-labradorite) with interstitial pyroxene and magnetite. They range from a few inches to more than 20 feet thick.

"The diabase is dark grey and fine grained, and is composed of plagioclase feldspar (labradorite), augite, and magnetite. The texture is ophitic. The dykes and sills are 5 to 10 feet thick.

"The quartz-feldspar porphyry is a light-grey medium-grained porphyritic rock composed chiefly of quartz and feldspar phenocrysts in a fine-grained groundmass composed almost wholly of quartz and feldspar.

The feldspars are principally orthoclase and oligoclase. Augite is present as phenocrysts (about 10 per cent) and as a minor constituent of the groundmass. The bodies range up to nearly 30 feet thick.

"At an elevation of about 1,800 feet and near the New Comstock - N.S. Fraction-Asa Thor corner post a light-grey diorite-like rock is conformably in contact with overlying chloritic tuff. It is composed of phenocrysts of orthoclase, oligoclase, and hornblende in a groundmass made up of a matte of microlites showing a flow structure and apparently composed in the main of feldspar. Both feldspar and hornblende phenocrysts appear to be secondary, and the overlying chloritic tuff shows no sign of alteration at the contact".

Economic mineralization in the area consists of chalcopyrite, galena and zinc found in skarn zones in the vicinity of a limestone-tuff contact.

DISCUSSION OF RESULTS

The electromagnetic responses recorded during the survey are due only to noise and consequently are not plotted on Plate 3. The absence of geological conductors is due to the lack of metallic sulphides of sufficient grade and continuity and also probably due in part to the topographic relief along with excessive tree heights in the survey area.

The observed magnetic relief is a total of 3700 gammas and occurs primarily along the western half of the survey grid as an extremely distorted area. This portion of the map is interpreted as indicating basic intrusive and extrusive rocks which are probably highly faulted. A number of these faults are shown on Plate 3.

The northern portion of the area contains a linear anomalous area extending southeasterly, from the tip of the peninsula about 1/4 mile inland for a distance of 1 1/2 miles. Local disruptions of magnetic gradients along this trend indicate the regional northeasterly strike of the faulting previously mentioned. This magnetic feature is interpreted as arising from either a basic sill or dike located near surface, probably outcropping and oriented vertically.

The field as measured over the Yreka mine and a number of mineralized outcrops reaches about 80 gammas above the local background. This magnetically positive zone is also apparently cut by major north-eastern trending faults. The anomaly may be caused by either volcanic flows or else may be due to skarn type mineralization. The dikes reported to be located in this area are conspicuous by their lack of magnetic expression.

CONCLUSIONS AND RECOMMENDATIONS

The airborne magnetometer survey has revealed anomalous conditions which warrant further investigation.

The most important area to be checked is the anomalous magnetic area in the vicinity of the Yreka mine.

The total area to be field checked is outlined on Plate 3. It is recommended that an induced polarization survey be completed over the following claims: COPPER KING, COPPER QUEEN, NEW COMSTOCK, NS, READY CASH, QUATSINO CHIEF, 97, 98, MOUNTAIN KING, MOUNTAIN QUEEN, SUPERIOR, MOHICAN, ELVA, HIAWATHA, YREKA, POCHOHANTAS, EDISON, TUSCARORA, TUSCARORA Fr. and NORA BELL No. 1. For this survey, the three electrode array with electrode spacings of 200' and 400' should be used. Line should be cut every 500 feet oriented N 45° W.

The area including the interpreted dike or sill should also be field checked for evidence of sulphide mineralization. Particular attention should be given to the areas in the vicinity of interpreted faults. It is recommended that these zones be geochemically sampled for concentrations of base metal mineralization. Additional induced polarization surveys and drilling would be contingent upon the results of this sampling.

Respectfully submitted,

SEIGEL ASSOCIATES LIMITED

R.O. Crosby per [illegible]

Richard O. Crosby, B.Sc., P.Eng.
Geophysicist

Vancouver, B. C.
June 10, 1970

APPENDIX 'A'

DESCRIPTION OF AIRBORNE SYSTEMS

ELECTROMAGNETIC SYSTEM - SCINTREX HEM-701

Equipment

The Scintrex HEM-701 is a solid state, fixed-configuration, electromagnetic system especially designed for helicopter transport. It consists of two coaxial coils, one serving as transmitter and the other as receiver, which are mounted, 30 ft. apart, in a rigid "bird" with their axes horizontal and in the direction of flight. The bird is towed approximately 100 ft. below the helicopter, by means of a suitable cable which also carries electrical signals and power to and from the bird.

The system operates at 1600 Hertz. Changes in the alternating magnetic field at the receiver coil are observed and these changes are converted into two components, one whose phase is the same as that of the transmitted signal (the "In-Phase" component) and the other whose phase is 90° apart (the "Out-of-Phase" component). These changes are expressed in terms of the normal undistorted primary field. They are so small as to be expressed usually in parts-per million or p.p.m.

The In-Phase and Out-of-Phase variations are presented in graphic time-shared form on a single channel of a graphic recorder. The full scale chart width employed is commonly 1000 p.p.m., although in areas of low geologic noise levels 500 p.p.m. may be employed. At one or more points during each flight the scale sensitivity is checked by means of calibration signals, usually 100 p.p.m. on each trace.

The reference or "zero" level for each EM trace is an arbitrary one and is obtained empirically from the regional level of each trace. These levels may drift slowly during a flight because of temperature changes affecting the bird dimensions. These drifts are very gradual and are readily distinguishable from much quicker, local changes due to conductors of a geologic origin. Similarly, severe turbulence effects sometimes introduce low-order, primarily in-phase disturbances which are of such short period that they may also readily be distinguished from the effects of geologic conductors.

Man-made disturbances are often to be seen, including power lines, pipe lines, metal fences, railways, etc. The former are generally recognizable as such because they usually show through as cyclic noise of irregular shape and phase relationship. Non-energized, grounded power lines (e.g. 3 phase systems) may also give rise to proper conductor indications, however. Such indications, as well as those from pipe lines and metal fences, etc. are usually of short duration and can be distinguished from proper geologic sources except for very narrow, near-surface lenses. In some instances ground investigation may be necessary in order to resolve the ambiguity of possible source. Whereas the airborne geophysical crew attempts to note visible man-made conductors of the above types, the ground moves by so rapidly at the low flight elevation employed that 100% recognition of such sources cannot be expected from the air.

The normal terrain clearance of the bird is 100 ft. - 200 ft. depending on the surface topography and tree cover, etc., with the helicopter 100 ft. above. The established useful depth of detection of the system for moderate-to-large conducting bodies is about 350 ft. sub-bird under conditions of low extraneous geologic noise, i.e. where the general level of conductivity of the overburden and rock types of the area is low. The useful depth of detection of the system is therefore between 150 ft. and 250 ft. beneath the ground surface under these conditions.

Interpretation of Results

The EM records are interpreted to determine the presence of conducting bodies and to obtain some information relating to their character. The intervalometer time marks (see below) are synchronized with the positioning camera film strip (also see below) and thereby permit the relating of the conductors with appropriate ground locations. The altimeter data (see below) indicate, for each conductor, what the terrain clearance was at the time of detection.

A plan is prepared, either using a subdued photo-mosaic ("grayflex") or an overlay from a mosaic or topographic plan as base. The flight path of each survey line is obtained by means of "tie points", which are features on the mosaic or topographic plan which are also recognizable on the positioning camera film. The flight path is interpolated between these tie points.

For each conductor the following quantities are measured and recorded.

a) Half width. This is the distance between the points of half the maximum conductor disturbance. For a very thin, steeply dipping body or pipe line, etc., the half width will be about 1.6 times its depth below the bird. If the bird is at a mean conductor clearance of 150 ft. the half width would be about 250 ft. Larger half widths reflect either more deeply buried or, more likely, thicker conductors.

Flat-lying conductors (e.g.overburden) characteristically give large half widths.

The conductor half width is indicated on the plan by an open bar symbol along the flight line. In the event of very narrow conductors only the peak location may be shown (see below).

b) <u>Peak Location</u>. The in-phase conductor peak location is shown on the plan by a circle in the appropriate location. In the case of broad conductors or closely spaced multiple conductor zones there may be more than one peak, in which event all major peaks are shown. If a conductor is of short half width there may be no room for a half width bar and only the peak circle will be shown. A conductor which is likely man-made will be indicated by an X rather than by a circle.

c) <u>In-Phase and Out-of-Phase Amplitudes</u>. These amplitudes are scaled from the EM traces and noted in parts per million. On the flight plan, opposite each peak location (circle) will be given the peak in-phase amplitude and the ratio of peak in-phase to peak out-of-phase response (see below).

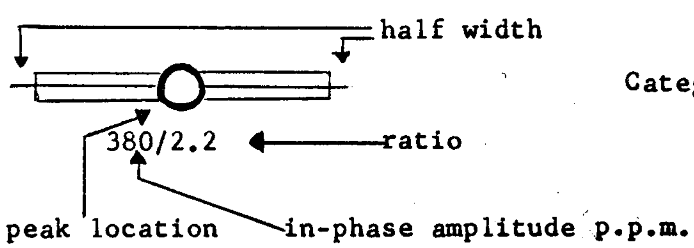
d) <u>Conductor Coding</u>. Conductor intersections are graded in electrical categories 1, 2 and 3, based on the in-phase amplitude but taking into account the terrain clearance. For tabular bodies such as sheet-like ore deposits, strata bound conductors and overburden, their response drops off almost in accordance with the inverse cube power of the elevation. Assuming an average 50 ft. of overburden, a category 1 conductor has a peak in-phase response equivalent to 350 p.p.m. or over at 100 ft. bird terrain clearance. A category 2 conductor has a peak in-phase response under similar conditions of between 100 p.p.m. and 350 p.p.m. A category 3 conductor has an equivalent peak in-phase response of less than 100 p.p.m.

The respective peak circles are shaded to reflect their electrical category, with category 1 fully shaded, category 2 half shaded and category 3 unshaded.

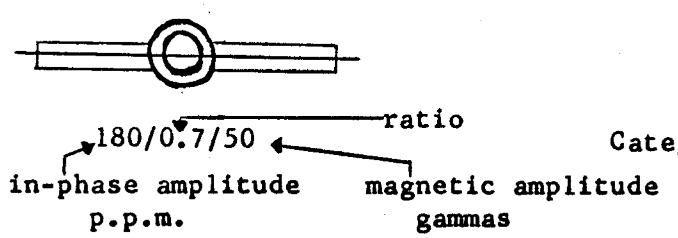
For each conductor peak the ratio of peak in-phase to peak out-phase amplitude is calculated and plotted on the plan. This ratio is indicative of a conductivity-size factor for the conductor. Large, high conducting bodies such as massive sulphides or graphite and seawater, etc., generally have ratios of 3 or over. Moderate conductivity-size bodies will have ratios between 1 and 3. Poor conductivity bodies (e.g. most overburden and some sulphide and graphitic zones) will have ratios of less than 1. In areas where there is a clear differentiation in conductivity between the targets of potential economic interest and other possible conductors, the ratio is a diagnostic feature. In some areas, however, there is an overlap of conductivity ranges and then the ratio cannot be too rigidly relied upon.

Where magnetic data is available, preferably from a coincident recording magnetometer, any correlating magnetic activity will be noted for the pertinent conductor peak. A conductor peak with apparently direct magnetic correlation will be indicated by a double concentric circle. Although a conducting body which is appreciably magnetic is more likely to be a sulphide body than one which is non-magnetic, there are many very important base metal ore bodies which are quite non-magnetic.

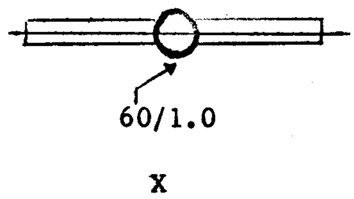
Examples of conductor coding are given below.



Category one, no magnetic correlation.



Category two, magnetic correlation.



Category three, no magnetic correlation.

Probably man-made conductor.

MAGNETOMETER - SCINTREX NPM-1

The Scintrex NPM-1 nuclear resonance airborne magnetometer is based on a Newmont modification of a Varian Associates magnetometer and is produced under license to both companies. It is a very light weight, solid state unit, especially designed for use in a helicopter or light fixed-wing aircraft where weight is an important consideration.

Its cycle period is 1.1 seconds. Each cycle it measures the total intensity of the earth's magnetic field and this quantity, in gammas, is recorded, in analogue form, on a suitable graphic recorder. The full scale sensitivity is usually 1000 gammas and the recorder automatically steps each 500 gammas. In very active areas a full scale sensitivity of 5000 gammas with steps of 2,500 gammas may be employed. Only the magnetic variations are actually recorded although the absolute base level may be established from the NPM-1 as well.

The magnetic sensing head may be on a cable as much as 100 ft. below the aircraft or, in some installations, may be rigidly attached to the aircraft on a suitable boom.

The intrinsic noise level of each reading is about 5 gammas.

Where it is intended to contour the NPM-1 information it is customary to fly tie lines across the survey grid. A fixed magnetic field monitor is often used as well, on the ground, primarily to indicate periods of magnetic storms during which the aeromagnetic data should be considered as unreliable.

The aeromagnetic data may be contoured if desired, using a contour interval of 25 gammas or up, depending on the amount of magnetic relief. Alternatively they may be used simply for purposes of correlation with simultaneously obtained electromagnetic data to determine which conductor zones are appreciably magnetic.

ANCILLARY EQUIPMENT

1. Altimeter

A Bonzer, high frequency solid state radio altimeter is employed to continuously indicate the mean terrain clearance of the helicopter or other transporting aircraft. The altimeter is installed in the aircraft (unless otherwise indicated) so that the elevation of the sensing birds (electromagnetic or magnetic) will be less by the usual vertical displacement of these birds below the aircraft.

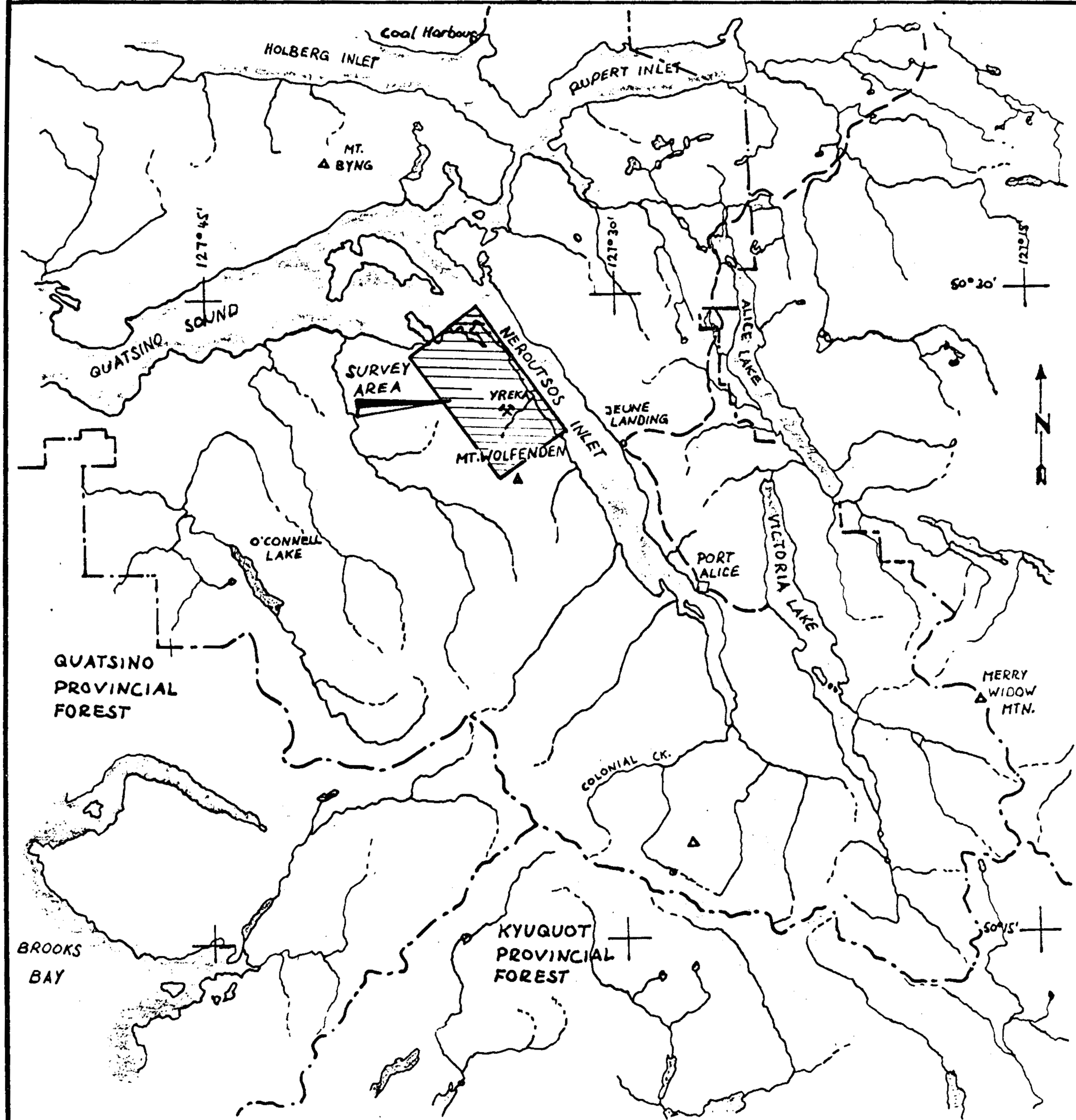
The output of the Bonzer may be expressed in analogue form on a suitable graphic recorder, or may be, for convenience, converted to a semi-digital form on a recorder side pen. In the latter event the altimeter record is a series of spaced pulses whose separation is proportional to the mean terrain clearance.

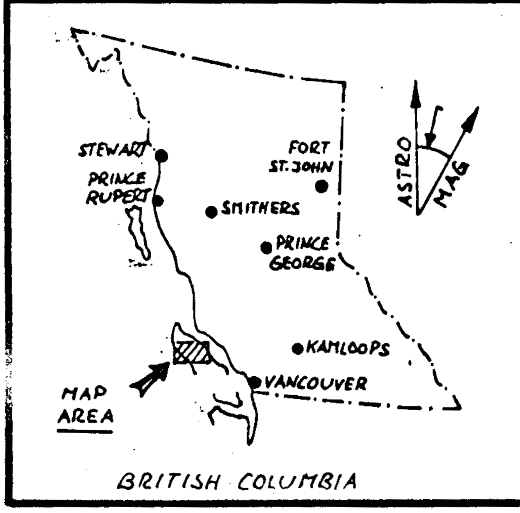
2. Positioning Camera

A Vinten Mark 3 16 mm positioning camera is employed with a wide angle lens. Photographs of the ground are taken with sufficient frequency to give a complete record of the flight path of the aircraft or helicopter. The frequency of exposure is controlled by the intervalometer referred to below.

3. Intervalometer

A Scintrex IA-2 intervalometer provides regularly spaced timing pulses which drive the positioning camera exposure mechanism and produces synchronous "fiducial marks" on the side pen of the geophysical graphic recorder or recorders. Because of the synchronization of the geophysical traces and the positioning camera it is then possible to relate the geophysical events of interest to their proper ground location. The timing pulse frequency may be adjusted in accordance with the ground speed of the aircraft so that an adequate flight path record is obtained.





GREEN EAGLE MINES LTD.

LOCATION MAP

AIRBORNE GEOPHYSICAL SURVEY

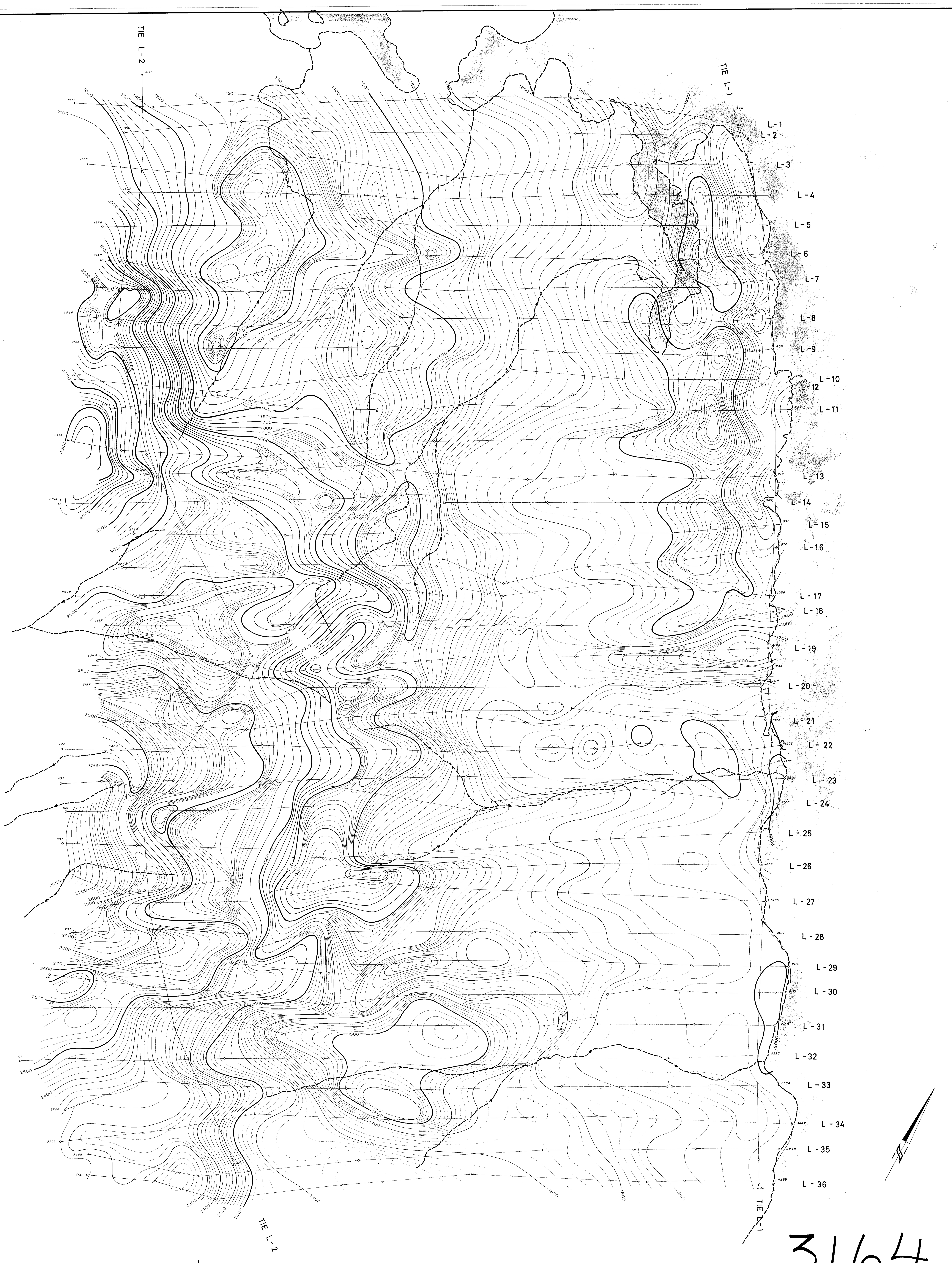
NEROUTSOS INLET, VANCOUVER ISLAND B.C.

4 0 4 8

SCALE IN MILES

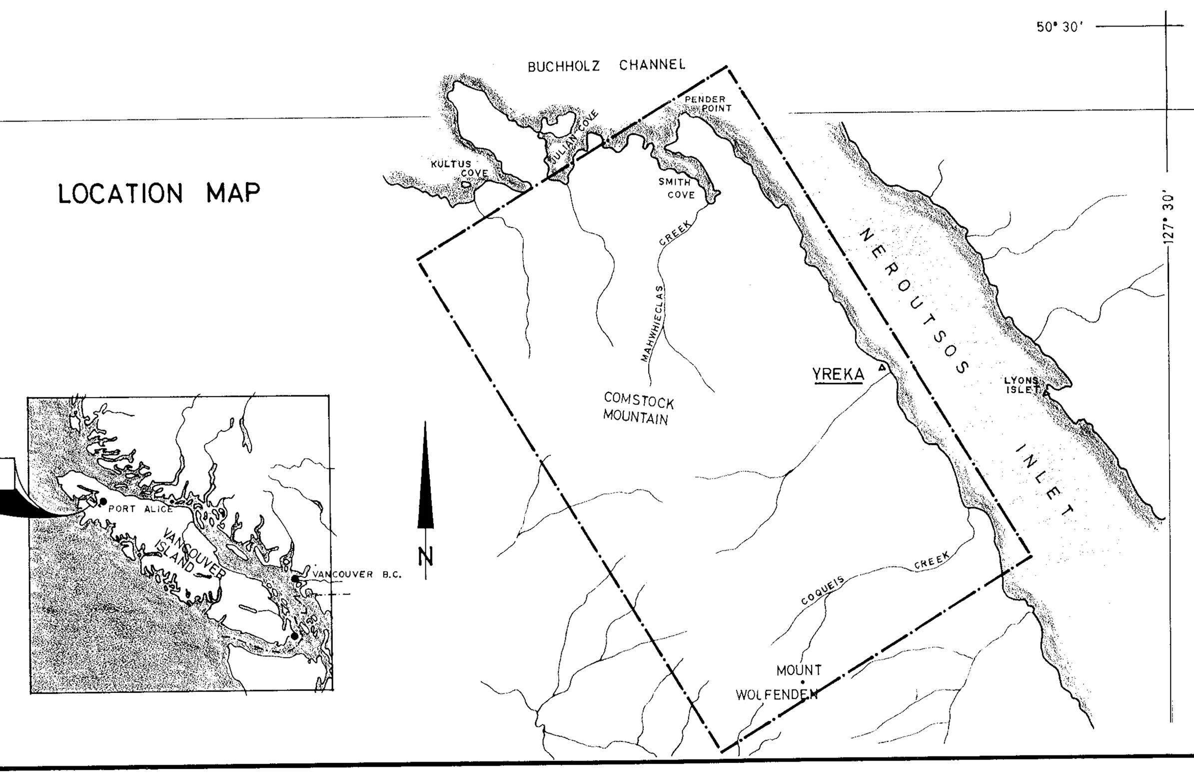
SURVEY BY
SEIGEL ASSOCIATES LIMITED
MAY 1970

PLATE 1



3164 M-2

LOCATION MAP



LEGEND

L-2 — FLIGHT LINE, FLIGHT LINE NUMBER AND NUMBERED FIDUCIAL POINTS

500 GAMMA ISOMAGNETIC CONTOUR INTERVAL

100 GAMMA ISOMAGNETIC CONTOUR INTERVAL

20 GAMMA ISOMAGNETIC CONTOUR INTERVAL

MAGNETIC LOW

AIRCRAFT TERRAIN CLEARANCE - 300'

FLIGHT LINE SPACING 1/8 MILE

BASE INTENSITY ARBITRARY

DRAINAGE

TO ACCOMPANY A GEOPHYSICAL REPORT
BY R.Q. CROSBY DATED JUNE 10, 1970

PLATE 2

GREEN EAGLE MINES LTD.

YREKA AREA, VANCOUVER ISLAND B.C.

AIRBORNE GEOPHYSICAL SURVEY

MAGNETOMETER CONTOUR PLAN

APPROX. SCALE 1" = 1/8 MILE

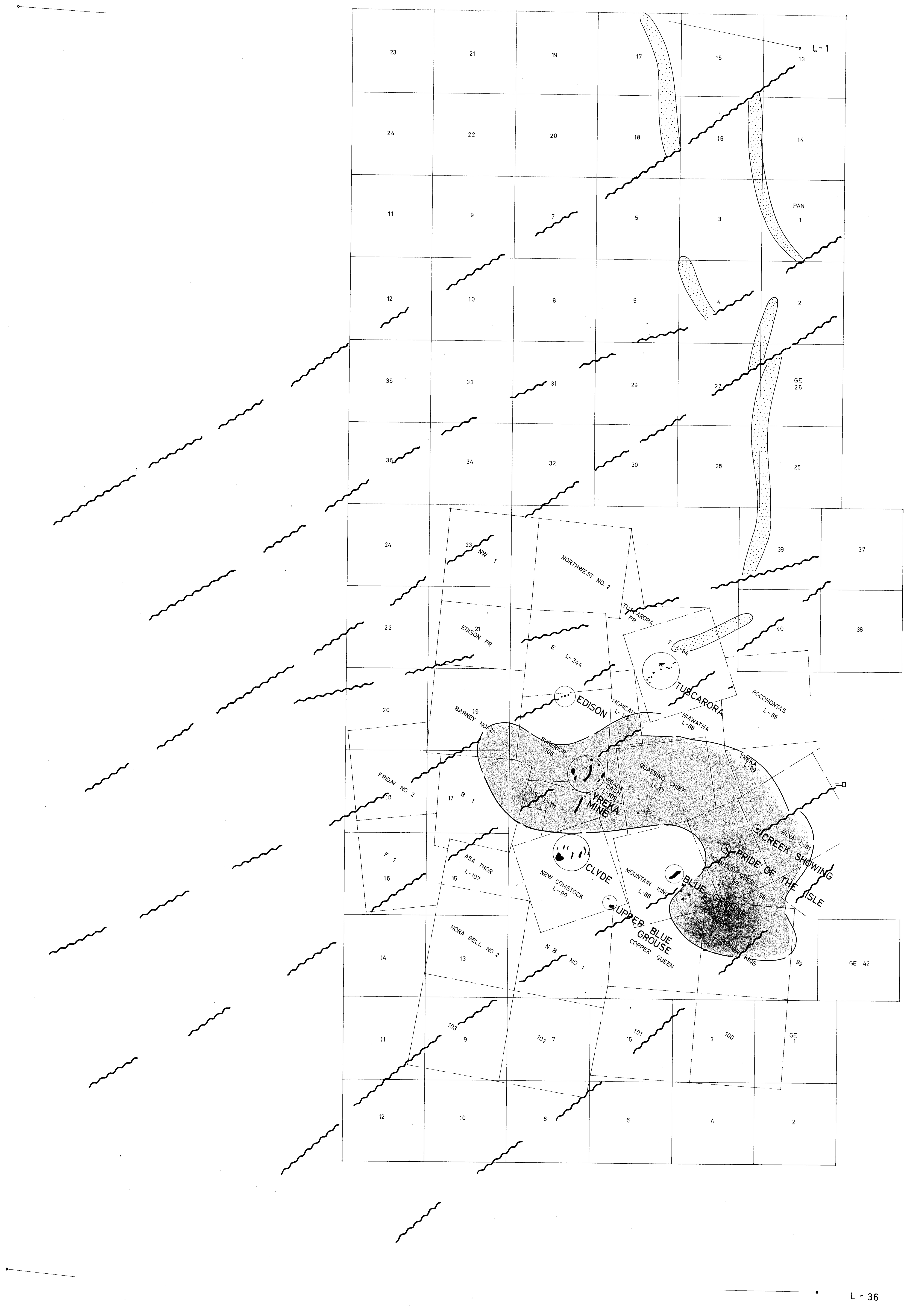
0 — 1/2 MILE

Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 3164 MAP #2

SURVEY BY SEIGEL ASSOCIATES LIMITED

FLOWN AND COMPILED MAY - JUNE 1970

SHEET 1 OF 1



LEGEND

PROBABLE FAULT

MINERALIZED OUTCROP OR FLOAT

BASIC DIKE OR SILL

ANOMALOUS ZONE OF INTEREST

PLATE 3

GREEN EAGLE MINES LTD.

YREKA AREA, VANCOUVER ISLAND B.C.

CLAIM LOCATION

GEOPHYSICAL INTERPRETATION

APPROX. SCALE 1" = 1/8 MILE

0 1/2 MILE

Department of Mines and Petroleum Resources ASSESSMENT REPORT 3164 MAP #3

SURVEY BY SEIGEL ASSOCIATES LIMITED

FLOWN AND COMPILED MAY–JUNE 1970

TO ACCOMPANY A GEOPHYSICAL REPORT BY R.O. CROSBY DATED JUNE 10, 1970

SHEET 1 OF 1