REPORT

ON AN

AIRBORNE GEOPHYSICAL SURVEY

OF THE

NATION 8 - 18,28 and 19 - 27, 29,30 MINERAL CLAIMS

Nation Lakes Area
Omineca Mining Division
British Columbia

NTS 93N/6E,7W

Latitude: 55°20' North
Longitude: 125°02' West

OWNER: GRAND AMERICA MINERALS LTD.

AUTHOR: N.C. CARTER, Ph.D. P.Eng.

DATE: August 6,1991

21551

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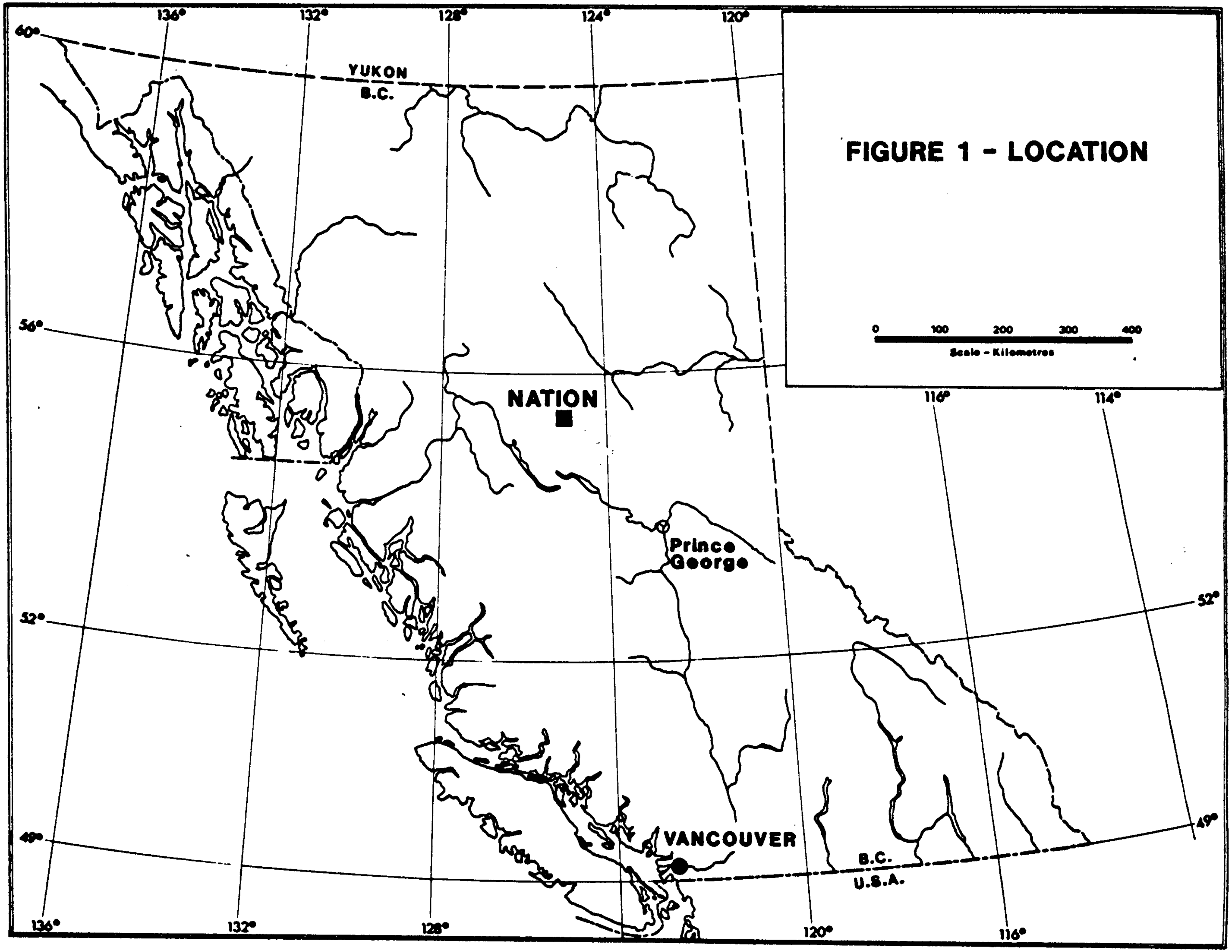

FIGURE 1 - LOCATION

INTRODUCTION

Airborne magnetic and VLF-EM surveys of the NATION mineral claims were undertaken by Aerodat Limited on behalf of Grand America Minerals Ltd. in August of 1990.

This report describes the airborne geophysical survey and includes copies of maps showing the survey results and a report by Aerodat Limited as an appendix.

LOCATION AND ACCESS

The NATION mineral claims are situated 120 km northwest of Fort St. James in north-central British Columbia (Figure 1).

The NATION property is north of Tchentlo Lake (Figure 2), and the geographic centre of the claims area is at latitude 55°20' North and longitude 125°02' West in NTS map-areas 93N/6E and 7W. Access to all parts of the claims is most convenient by helicopter. Logging roads from Fort St. James access the west end of Tchentlo Lake.

MINERAL PROPERTY

The NATION property includes 23 four post or Modified Grid mineral claims comprising 455 mineral claim units in the Omineca Mining Division. The mineral claims are shown on Figure 3 and include the NATION 1 - 3 claims which were

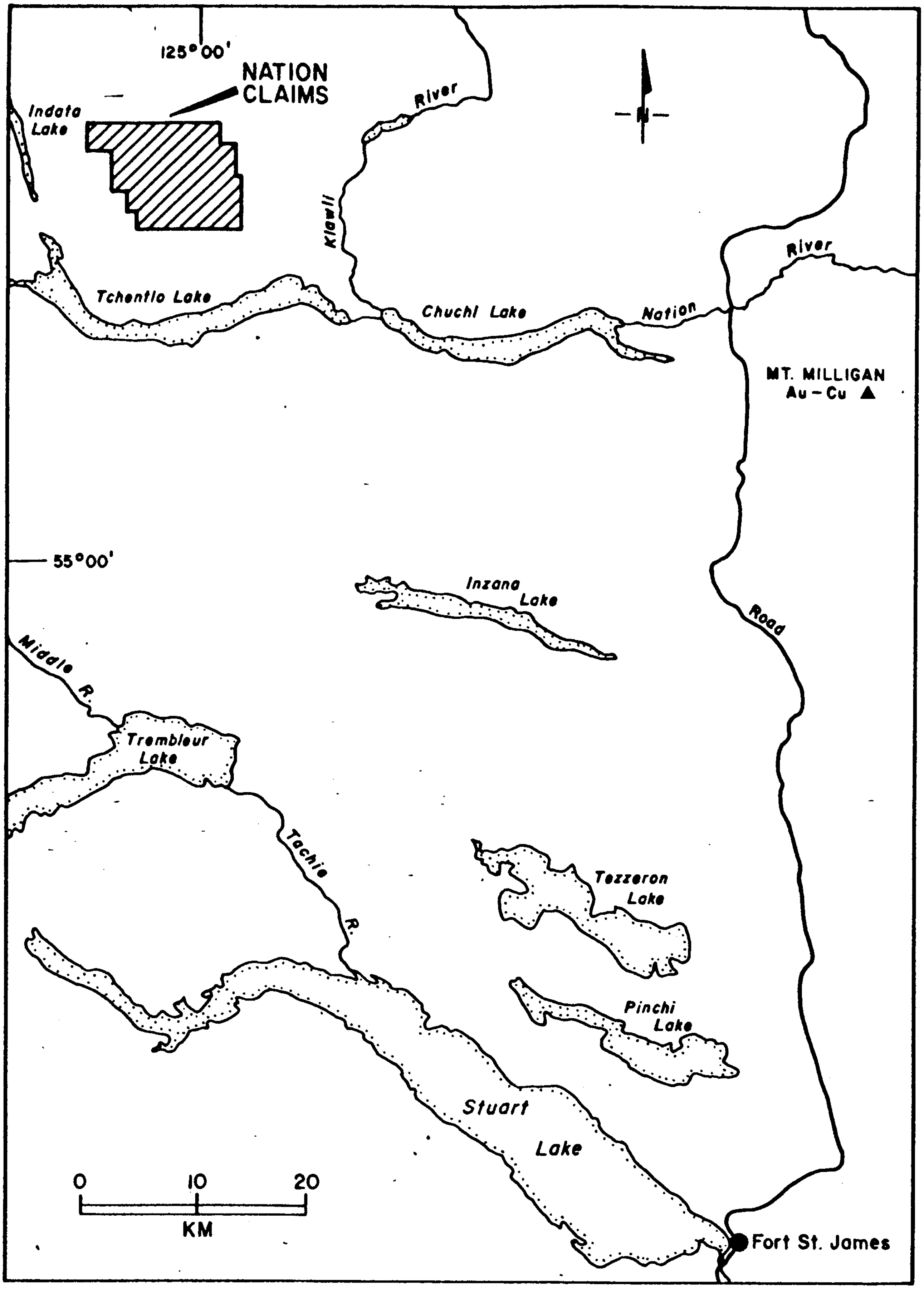

FIGURE 2 - LOCATION - NATION MINERAL CLAIMS

allowed to lapse in early May of 1991. Details of the current claims are as follows:

Claim Name	Record No.	Units	Record Date
NATION 8	11849	20	May 10,1990
NATION 9	11850	20	" "
NATION 10	11851	20	May 11,1990
NATION 11	11852	20	" "
NATION 12	11853	20	May 10,1990
NATION 13	11854	20	" "
NATION 14	11855	20	" "
NATION 15	11856	20	" "
NATION 16	11857	20	" "
NATION 17	11858	20	" "
NATION 18	11859	20	" "
NATION 19	11860	20	" "
NATION 20	11861	20	" "
NATION 21	11862	20	May 12,1990
NATION 22	11863	20	" "
NATION 23	11864	20	May 11,1990
NATION 24	11865	20	May 10,1990
NATION 25	11866	20	May 12,1990
NATION 26	11867	20	" "
NATION 27	11868	20	May 11,1990
NATION 28	11869	15	May 13,1990
NATION 29	11870	20	May 14,1990
NATION 30	11871	20	" "

Grand America Minerals Ltd., owner of the mineral claims, entered into an option/joint venture agreement with Harvard Capital Corporation in August of 1990 whereby Harvard can earn an undivided 51% interest in the NATION mineral claims by incurring certain exploration and development expenditures over a specified time period.

PHYSICAL FEATURES

The NATION claims, north of Tchentlo Lake (the westernmost of the two Nation Lakes), cover an area near the

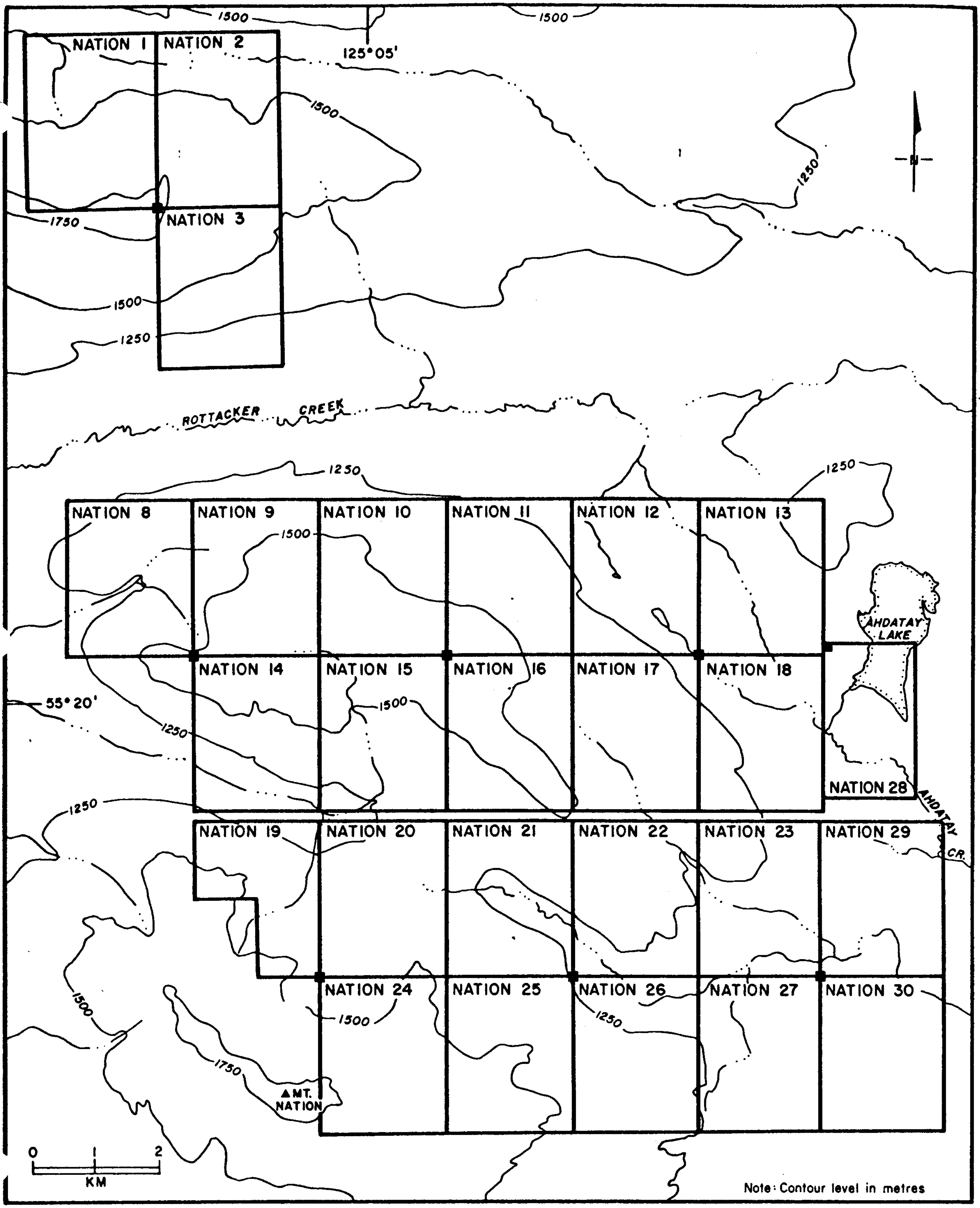

FIGURE 3 - NATION MINERAL CLAIMS

southern limits of the Swannell Ranges, a subdivision of the Omineca Mountains. Elevations within the claims area range from 350 metres south of Ahdatay Lake in the east to more than 1500 metres on rounded summits in the northwestern claims (Figure 4). Mt. Nation, adjacent to the southwestern margin of the claim block, is the highest point in the area at 1876 metres.

Tree line extends to about 1500 metres and according to available geological mapping (Garnett,1978), bedrock is reasonably well exposed throughout the NATION claims area with the exception of the lower, eastern claims.

HISTORY

Earliest documented prospecting activity north of Fort St. James took place in the 1920's and resulted in the discovery of the Pinchi Lake mercury mine in the late 1930's.

The Nation Lakes area was investigated for porphyry style mineralization in the late 1960's - early 1970's and several airborne geophysical surveys were carried out in the area north of Fort St. James in the early 1980's.

The area has attracted renewed attention over the past few years in response to the discovery of large copper-gold deposits at Mt. Milligan.

Other than Federal-Provincial regional aeromagnetic surveys, there is no public record of previous work within the boundaries of the current NATION claim block. The potential for porphyry style copper-gold mineralization is under investigation at Mt. Nation immediately southwest of the NATION claims and diamond drilling programs are currently underway south of Tchentlo Lake and north of Chuchi Lake.

1990 AIRBORNE GEOPHYSICAL SURVEY

719 line km of helicopter-borne magnetic and VLF-EM surveys were completed on the NATION mineral claims August 9,1990. The survey was commissioned by Nicholson and Associates Natural Resource Development Inc. on behalf of Grand America Minerals Ltd. Harvard Capital Corporation defrayed the costs of the survey pursuant to their agreement with Grand America.

East-west flight lines, 100 metres apart, are shown relative to claim boundaries on Figure 2A. An Aerospatiale A-Star helicopter was used for the survey and mean terrain clearance for the bird containing the geophysical instruments was 60 metres.

A Scintrex Model V1W 2321 H8 high sensitivity cesium vapour magnetometer was used to measure relative magnetic intensity in nanoTeslas (nT). Diurnal variations were recorded at a field base station and later correlated with the survey results. Total field magnetic data are presented in contoured form at 1:10000 scale on Figure 3A. The vertical magnetic gradient was calculated from total field magnetic data and these results are also shown in contoured form on Figure 4A.

VLF-EM total field was measured using three transmitting stations - Annapolis(21.4 kHz), Cutler (24.0 kHz) and Seattle (24.8 kHz). Total field intensity in percent is presented in contoured form on Figure 5A.

A report on the airborne geophysical program, prepared by Aerodat Limited (Carbone,1990), is included with this report as Appendix I.

REGIONAL GEOLOGY AND MINERALIZATION

The Fort St. James - Nation Lakes area, near the eastern margin of the Intermontane tectonic belt, is underlain principally by early Mesozoic Takla Group volcanic and lesser sedimentary rocks which occupy the northern part of the Quesnel Trough. The layered rocks are intruded by coeval or comagmatic alkaline plutons, the largest of which is the composite Hogem batholith which extends from Nation Lakes 180 km northwesterly to Mesilinka River.

Several km north of Fort St. James, late Triassic-Early Jurassic Takla Group rocks are separated from older, Paleozoic Cache Creek Group assemblages by the regional north-northwest trending Pinchi fault zone. Erosional remnants of Tertiary volcanic rocks locally overlie older rocks north of Fort St. James.

The most significant mineral deposit types within the Fort St. James - Nation Lakes area are porphyry copper (gold) deposits and prospects associated with late Triassic - early Jurassic alkaline (quartz deficient) plutons and enclosing volcanic rocks of similar age and petrochemistry. Common intrusive rock types include gabbros, diorites, monzonites and syenites.

Alkalic porphyry copper-gold deposits, ranging in age from 175-198 Ma (Christopher and Carter,1976) are well documented throughout the Intermontane tectonic belt of British Columbia (Barr et al,1976). Deposits of this type include the currently producing Similco and Afton-Ajax mines in south-central British Columbia and the Mt. Polley deposit (53.7 million tons grading 0.38% copper, 0.016 oz/ton gold) east of Williams Lake which is scheduled for production. The Galore Creek deposits in the Stikine River area of northwestern British Columbia have estimated reserves of 125 million tons grading 1.06% copper and 0.014 oz/ton gold.

Reported in situ reserves at the Mt. Milligan deposits, southeast of Nation Lakes (Figure 2) total 6.3 million ounces of gold and 820,000 tonnes copper.

In addition to significant copper reserves, developed and undeveloped alkaline suite porphyry deposits contain more than one-third of identified British Columbia gold reserves.

Typically, alkaline suite porphyry deposits are developed in zones of intense faulting, fracturing and hydrothermal alteration. Pyrite, chalcopyrite, bornite, chalcocite and pyrrhotite occur in stockworks and in fractures. Potassic alteration (secondary K-feldspar, biotite), coincident with the copper sulphide mineralization, grades outward to propylitically altered rocks with fracture filling and disseminated pyrite (Barr et al,1976).

Examples of alkaline suite porphyry mineralization in the Fort St. James - Nation Lakes area include several prospects associated with basic intrusive rocks (gabbros, diorites, monzonites, syenites) near Nation Lakes at the southern limits of the Hogem batholith. At the BAL prospect, north of the west end of Tchentlo Lake, pyrite and chalcopyrite occur in fractures in weakly magnetic diorites and as disseminations in gabbroic phases (Carter,1970). Copper mineralization on the HEATH property on the western slope of Mt. Nation includes chalcopyrite in fractures in diorites and gabbros which are intruded by syenites. Some massive sulphide lenses containing good copper grades plus gold and silver values have also been reported (Campbell,1988).

Copper and gold values on the COL property, north of the west end of Chuchi Lake, are associated with chalcopyrite and bornite mineralization in syenite dykes which cut older monzonites (Garnett,1978).

The TAS prospect, 50 km north of Fort St. James, was discovered in the mid-1980's. Here, gold values are associated with pyrite, magnetite and lesser chalcopyrite in shear zones developed in Takla Group pyroxene porphyry flows and cherty sediments marginal to a diorite stock (Faulkner,1990).

The identification of large tonnages of gold-copper mineralization at Mt. Milligan, 10 km south of Nation River (Figure 2), has generated renewed interest in the Fort St. James - Nation Lakes area.

Like many of the deposits and prospects in the general area, Mt. Milligan is an alkaline intrusive related porphyry deposit (Rebagliati,1989) which features three principal styles of mineralization. Chalcopyrite and lesser pyrite occur as fracture fillings and as disseminations in K-feldspar altered Takla Group volcanic rocks marginal to a comagmatic, porphyritic monzonite stock. An intrusive breccia, developed along the perimeter of the southern half of the stock which is 450 metres in diameter, also features intense K-feldspar alteration and chalcopyrite as disseminations and in fractures.

A slightly younger, 45 metres wide, porphyritic monzonite dyke occupies an easterly dipping reverse fault east of the monzonite stock. Sulphide concentrations are highest in this area as are copper grades. Gold values are modest but several hundred metres to the southeast, along the projection of the reverse fault and porphyritic monzonite dyke, higher gold grades occur in propyliticallly altered volcanics cut by veinlets of pyrite with minor chalcopyrite.

West of the monzonite stock, polymetallic gold and silver bearing veins occupy northeast trending faults.

PROPERTY GEOLOGY AND MINERALIZATION

The NATION claims were located to cover aeromagnetic features north of Tchentlo Lake indicated by previous Federal - Provincial Government surveys. The two blocks of claims comprising the NATION property are immediately south of Rottacker Creek (Figures 3,4).

The claims cover a part of the southern end of the composite Hogem batholith and principal geological features are illustrated on Figure 4. Both the east and west contacts of the north-northwest trending batholith are exposed in the

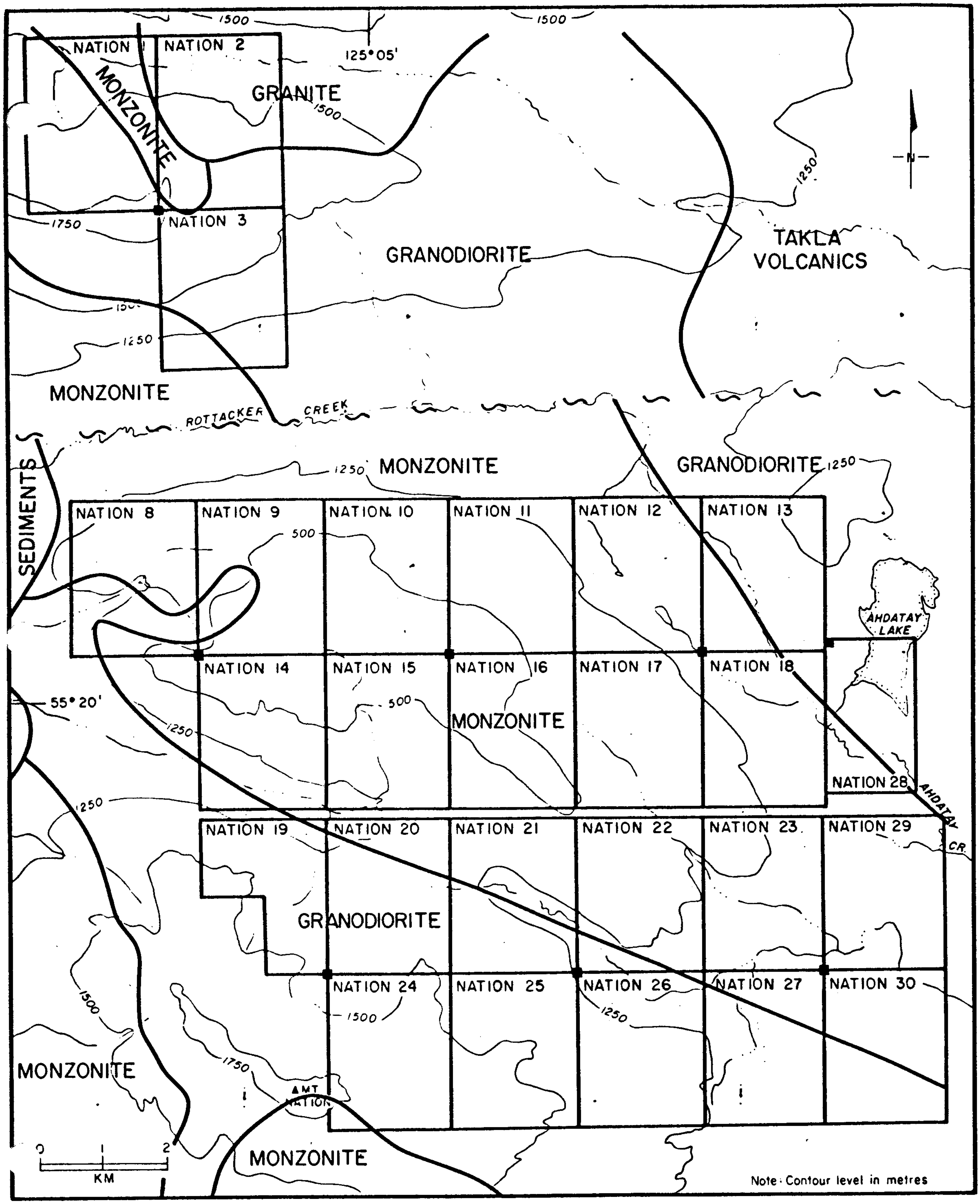

FIGURE 4 - NATION MINERAL CLAIMS - GEOLOGY (After MEMPR Bulletin 70)

area of the claims. Granodiorite is in contact with Takla Group volcanic rocks north of Ahdatay Lake and younger, lower Cretaceous, Uslika Formation sandstones and conglomerates flank a part of the batholith on the west (Figure 4).

A variety of intrusive rock types including two principal phases of the Hogem batholith are exposed within the area of the claims. The intrusive units have been offset by an east-west fault along Rottacker Creek (Figure 4).

Phase I intrusive rocks of the Hogem batholith underlie most of the NATION property. The most prevalent include monzonites and diorites of the Hogem basic suite (Garnett,1978) which have radiometric ages of between 176 and 212 Ma (late Triassic - early Jurassic) and are distinctly alkaline in composition. These quartz deficient rocks, in which magnetite is a common constituent, are intruded by granodiorites of similar age.

Copper mineralization is associated with monzonites and diorites of the Hogem basic suite at various localities within the batholith including the HEATH and BAL prospects west and south of Mt. Nation and referred to earlier.

A 4-6 metres wide north trending shear zone in dioritic rocks, exposed in a tributary of Rottacker Creek 1 km west of the NATION claim block, contains chalcopyrite, pyrite and magnetite (Gatenby,1971). Chalcopyrite in closely spaced fractures in dioritic rocks 2.5 km northwest of Mt. Nation (B.C. Minfile 173) is apparently close to the southwest boundary of the claim block.

According to Garnett(1978), copper mineralization is associated with basic suite Hogem rocks but similar age granodiorites are essentially barren of economic mineralization. Monzonites and diorites of the Hogem basic suite underlie much of the NATION claim block and in view of the 2-5% magnetite content of these rocks, they are thought to be the cause of the regional aeromagnetic high features in and adjacent to the claims area.

SURVEY RESULTS

Areas of higher total field magnetic intensity occur as northwest - southeast linear zones in the central claims area (Figure 3A). These are crudely coincident with the central and southwestern margins of monzonites and diorites of the Hogem basic intrusive suite (Garnett,1978; Figure 4). An area of lesser magnetic intensity, partly defined in the southwestern property area (Figure 3A), is within an area underlain by granodiorite but close to the monzonite - diorite contact. The foregoing magnetic features are further accentuated on the vertical magnetic gradient map (Figure 4A).

Strongest VLF-EM total field intensity (10-20%) is coincident with the eastern flank of the magnetic anomaly (Figure 5A). A weaker (5-10%) linear zone parallel to, and 1200 - 1400 metres east of the strongest zone, may be reflecting a fault as expressed by a prominent northwest-southeast drainage. More restricted VLF-EM features are situated south and west of Ahdatay Lake, in the northwestern claims area and along the southern property boundary.

CONCLUSIONS

The airborne survey of the NATION property has identified several areas which warrant ground follow-up. The principal area is the northwest trending magnetic high and coincident VLF-EM anomaly in the central property area where bedrock is believed to be reasonably well exposed in the topographically higher areas. The higher magnetic intensities may be simply due to the presence of magnetite in the monzonites and diorites of the Hogem basic intrusive suite but the cause of the VLF-EM anomaly is unknown.

A program of geological mapping, prospecting and stream sediment geochemistry is recommended for the central and northern parts of the NATION property.

COST STATEMENT

Geophysical Survey - Aerodat Limited August 9,1990 - 719 line km, plus preparation of a report dated October 3,1991	$50,330.00
Consulting, interpretation, N.C. Carter September 7 - 10, 1990	$2,073.16
Report Preparation:	
N.C. Carter, July 23,31,August 1,2,1991	$1,750.00
Drafting	$150.00
Miscellaneous stationery supplies	$18.76
Duplicating	$78.08
Secretarial	$100.00
	$2,096.84
Total	$54,500.00

To be apportioned as follows:

NATION 8-18,28 mineral claims	$23,500.00
NATION 19-27,29,30 mineral claims	$22,000.00
PAC Account - Harvard Capital Corporation	$9,000.00

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Rebagliati,C.M.(1989): Mt. Milligan - An Alkaline Intrusive Related Porphyry Gold-Copper Deposit - abstract-NWMA 95th Annual Convention, Spokane,Dec.6-8,1989

AUTHOR'S QUALIFICATIONS

I, NICHOLAS C. CARTER, of 1410 Wende Road, Victoria,British Columbia, do hereby certify that:

1. I am a Consulting Geologist, and have been registered with the Association of Professional Engineers of British Columbia since 1966.

2. I am a graduate of the University of New Brunswick with B.Sc.(1960), Michigan Technological University with M.S.(1962) and the University of British Columbia with Ph.D.(1974).

3. I have practised my profession in eastern and western Canada and in parts of the United States for more than 25 years.

4. The foregoing report on the NATION mineral claims is based on personal examinations of adjacent or nearby properties and on published and unpublished reports and maps pertaining to the geological setting of these claims, and on the results of the airborne geophysical program carried out by Aerodat Limited.

Dated at Victoria, British Columbia this 6th day of August,1991

PROFESSIONAL
PROVINCE OF
N. C. CARTER
BRITISH COLUMBIA
ENGINEER

N.C. Carter, Ph.D. P.Eng.

APPENDIX I

Aerodat Limited Report

REPORT ON
COMBINED HELICOPTER-BORNE
MAGNETIC AND VLF SURVEY
FORT ST. JAMES
BRITISH COLUMBIA

FOR
NICHOLSON & ASSOCIATES NATURAL RESOURCE DEVELOPMENT INC.
BY
AERODAT LIMITED
October 3, 1990

J9043

Adriana Carbone
Geologist

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<u>**List of Maps**</u>
(Scale 1:10,000)

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   Prepared from available air photos and photographically enlarged to 1:10,000 scale.

2. **FLIGHT LINE MAP;**
   Showing all flight lines and fiducials with the base map.

3. **TOTAL FIELD MAGNETIC CONTOURS;**
   Showing magnetic values corrected of all diurnal variation with flight lines, fiducials, and base map.

4. **VERTICAL MAGNETIC GRADIENT CONTOURS;**
   Showing magnetic gradient values calculated from the total field magnetics with flight lines, fiducials and base map.

5. **VLF-EM TOTAL FIELD CONTOURS;**
   Showing VLF total field response from the line transmitter with flight lines, fiducials, and base map.

1. INTRODUCTION

This report describes an airborne geophysical survey carried out on behalf of Nicholson & Associates by Aerodat Limited. Equipment operated during the survey included a high sensitivity cesium vapour magnetometer, a two frequency VLF-EM system, a video tracking camera, radar altimeter, and an electronic positioning system. Magnetic and altimeter data were recorded both in digital and analog forms. Positioning data was stored in digital form, encoded on VHS format video tape and recorded at regular intervals in local UTM coordinates, as well as being marked on the flight path mosaic by the operator while in flight.

The survey area is located north of Fort St. James, British Columbia, and is referred to as the Nation Claim Group. The survey was flown on August 09, 1990. Data from four flights were used to compile the survey results. The flight lines were oriented at an angle of 90 degrees, with a nominal line spacing of 100 metres (according to Appendix "A" of the contract). Geophysical information is provided in the form of maps at 1:10,000. Coverage and data quality were considered to be well within the specifications described in the service contract.

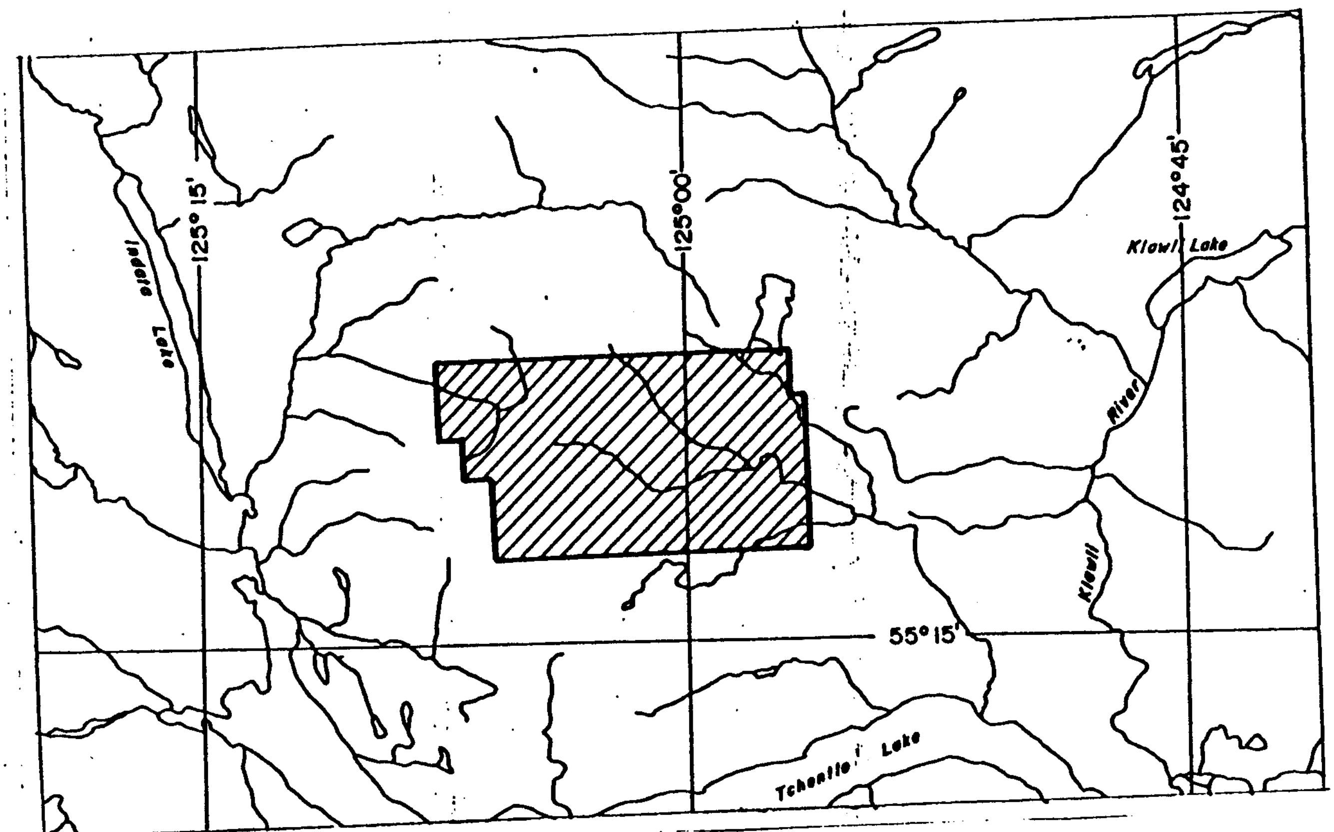
The purpose of the survey was to record airborne geophysical data over ground that is of interest to Nicholson & Associates.

The Nation claim consisted of 719 line kilometres of the recorded data that were compiled in a map form at a scale of 1:10,000. The maps are presented as part of this report according to specifications laid out by Nicholson & Associates.

2. SURVEY AREA LOCATION

The survey area is depicted on the following index map.

The Nation claim is centred at approximate geographic latitude 55 degrees 18 minutes North, longitude 125 degrees 00 minutes West.



NATION CLAIM GROUP

3. AIRCRAFT AND EQUIPMENT

3.1 Aircraft

An Aerospatiale A-Star 350 B helicopter, (C-GYHT), piloted by R. Mitchinson, owned and operated by Peace Helicopters Limited, was used for the survey. J. Moisan of Aerodat acted as navigator and equipment operator. Installation of the geophysical and ancillary equipment was carried out by Aerodat. The survey equipment was flown at a mean terrain clearance of 60 metres.

3.2 Equipment

3.2.1 VLF-EM System

The VLF-EM System was a Herz Totem 2 A. This instrument measures the total field and quadrature component of the selected frequency. The sensor was towed in a bird 30 metres below the helicopter.

3.2.2 Magnetometer System

The magnetometer employed a Scintrex Model VIW 2321 H8 cesium, optically pumped magnetometer sensor. The sensitivity of this instrument was 0.1 nanoTeslas. The sensor was towed in a bird 30 metres below the helicopter.

3.2.3 Magnetic Base Station

An IFG proton precession magnetometer was operated at the base of operations to record diurnal variations of the earth's magnetic field. The clock of the base station was synchronized with that of the airborne system to facilitate later correlation.

3.2.4 Altimeter System

A King KRA 10 radar altimeter was used to record terrain clearance. The output from the instrument is a linear function of altitude for maximum accuracy.

3.2.5 Tracking Camera

A Panasonic video flight path recording system was used to record the flight path on standard VHS format video tapes. The system was operated in continuous mode and the flight number, real time and manual fiducials were registered on the picture frame for cross-reference to the analog and digital data.

3.2.6 Analog Recorder

An RMS dot-Matrix recorder was used to display the data during the survey. In addition to manual and time fiducials, the following data was recorded:

Channel	Input	Scale
VLT	VLF-EM Total Field, Line	25 %/cm
VLQ	VLF-EM Quadrature, Line	25 %/cm
VOT	VLF-EM Total Field, Ortho	25 %/cm
VOQ	VLF-EM Quadrature, Ortho	25 %/cm
RALT	Radar Altimeter	100 ft./cm
MAGF	Magnetometer, fine	25 nT/cm
MAGC	Magnetometer, coarse	250 nT/cm

3.2.7 Digital Recorder

A DGR 33:16 data system recorded the survey on magnetic tape. Information recorded was as follows:

Equipment	Recording Interval
VLF-EM	0.20 seconds
Magnetometer	0.20 seconds
Altimeter	0.20 seconds
Nav System	0.20 seconds

3.2.8 Radar Positioning System

A Mini-Ranger MRS-III radar navigation system was used for both navigation and flight path recovery. Transponders sited at fixed locations were interrogated several times per second and the ranges from these points to the helicopter were measured to a high degree of accuracy. A navigational computer triangulated the position of the helicopter and provided the pilot with navigation information. The range/range data was recorded on magnetic tape for subsequent flight path determination.

4. DATA PRESENTATION

4.1 Base Map

A photomosaic base at a scale of 1:10,000 was prepared from available air photos and enlarged to the required scale.

4.2 Flight Path Map

The flight path was derived from the Mini-Ranger radar positioning system. The distance from the helicopter to two established reference locations was measured several times per second and the position of the helicopter was calculated by triangulation. It is estimated that the flight path is generally accurate to about 10 metres with respect to the topographic detail on the base map.

The flight lines have the time and the navigator's manual fiducials for cross reference to both analog and digital data.

4.3 Magnetics

4.3.1 Total Field Magnetic Contours Map

The magnetic data from the high sensitivity cesium magnetometer provided virtually a continuous magnetic reading when recording at 0.2 second intervals. The system is also noise free for all practical purposes.

A sensitivity of 0.1 nanoTesla (nT) allows for the mapping of very small inflections in the magnetic field, resulting in a contour map that is equal to or exceeds ground data in quality and accuracy.

The aeromagnetic data was corrected for diurnal variations by adjustment with the digitally recorded base station magnetic values. No correction for regional variation was applied. The corrected data was interpolated onto a regular grid at a 25 metre true scale interval using an Akima spline technique. This grid provided the basis for threading the presented contours at a 2 nT interval.

The contoured aeromagnetic data has been presented on a Cronaflex copy of the base map with flight lines.

4.3.2 Vertical Gradient Contour Map

The vertical magnetic gradient was calculated from the total field magnetic data. Contoured at a 0.2 nT/m interval, the data was presented on a cronaflex copy of the base map with flight lines.

4.4 VLF-EM Total Field Contours

The VLF data was interpolated onto a regular grid at a 25 metre true scale interval using an Akima spline technique. This grid provided the basis for threading the contours at a 2% interval.

The VLF-EM signal from the line transmitting station was compiled as contours in map form on cronaflex copies of the base map with flight lines.

The VLF stations used were NSS, Annapolis, Maryland, U.S.A. broadcasting at 21.4 kHz., NAA, Cutler Maine, broadcasting at 24.0 kHz., and NLK, Seattle, Washington, U.S.A. broadcasting at 24.8 kHz.

The following were used as the line transmitting stations, NSS was used for flights 1 and 3, NAA was used for flight 2 and NLK was used for Flight 4. NAA was used as the orthogonal station for flights 1-4 inclusive.

Respectfully submitted,

Adriana Carbone

October 3, 1990

Adriana Carbone
Geologist

APPENDIX I

PERSONNEL

FIELD

Flown	August, 1990
Pilot	Ron Mitchinson
Operator	JEP Moisan

OFFICE

Processing	A. Carbone G. McDonald
Report	A. Carbone

APPENDIX II

GENERAL INTERPRETIVE CONSIDERATIONS

Magnetics

A digital base station magnetometer was used to detect fluctuations in the magnetic field during flight times. The airborne magnetic data was levelled by removing these diurnal changes. The Total Field Magnetic map shows the levelled magnetic contours, uncorrected for regional variation.

The Calculated Vertical Gradient map shows contours of the magnetic gradient as calculated from the total field magnetic data. The zero contour shows changes in the magnetic lithologies and will coincide closely with geologic contacts assuming a steeply dipping interface. Thus this data may be used as a pseudo-geologic map.

VLF Electromagnetics

The VLF-EM method employs the radiation from powerful military radio transmitters as the primary signals. The magnetic field associated with the primary field is elliptically polarized in the vicinity of electrical conductors. The Herz Totem uses three coils in the X, Y, Z configuration to measure the total field and vertical quadrature component of the polarization ellipse.

The relatively high frequency of VLF (15-25) kHz provides high response factors for bodies of low conductance. Relatively "disconnected" sulphide ores have been found to produce measurable VLF signals. For the same reason, poor conductors such as sheared contacts, breccia zones, narrow faults, alteration zones and porous flow tops normally produce VLF anomalies. The method can therefore be used effectively for geological mapping. The only relative disadvantage of the method lies in its sensitivity to conductive overburden. In conductive ground to depth of exploration is severely limited.

The effect of strike direction is important in the sense of the relation of the conductor axis relative to the energizing electromagnetic field. A conductor aligned along a radius drawn from a transmitting station will be in a maximum coupled orientation and thereby produce a stronger response than a similar conductor at a different strike angle. Theoretically, it would be possible for a conductor, oriented tangentially to the transmitter to produce no signal. The most obvious effect of the strike angle consideration is that conductors

favourably oriented with respect to the transmitter location and also near perpendicular to the flight direction are most clearly rendered and usually dominate the map presentation.

The total field response is an indicator of the existence and position of a conductivity anomaly. The response will be a maximum over the conductor, without any special filtering, and strongly favour the upper edge of the conductor even in the case of a relatively shallow dip.

The vertical quadrature component over steeply dipping sheet-like conductor will be a cross-over type response with the cross-over closely associated with the upper edge of the conductor.

The response is a cross-over type due to the fact that it is the vertical rather than total field quadrature component that is measured. The response shape is due largely to geometrical rather than conductivity considerations and the distance between the maximum and minimum on either side of the cross-over is related to target depth. For a given target geometry, the larger this distance the greater the depth.

The amplitude of the quadrature response, as opposed to shape is function of target conductance and depth as well as the conductivity of the overburden and host rock. As the primary field travels down to the conductor through conductive material it is both attenuated and phase shifted in a negative sense. The secondary field produced by thisaltered field at the target also has an associated phase shift. This phase shift is positive and is larger for relatively poor conductors. This secondary field is attenuated and phase

shifted in a negative sense during return travel to the surface. The net effect of these 3 phase shifts determine the phase of the secondary field sensed at the receiver.

A relatively poor conductor in resistive ground will yield a net positive phase shift. A relatively good conductor in more conductive ground will yield a net negative phase shift. A combination is possible whereby the net phase shift is zero and the response is purely in-phase with no quadrature component.

A net positive phase shift combined with the geometrical cross-over shape will lead to a positive quadrature response on the side of approach and a negative on the side of departure. A net negative phase shift would produce the reverse. A further sign reversal occurs with a 180 degree change in instrument orientation as occurs on reciprocal line headings. During digital processing of the quadrature data for map presentation this is corrected for by normalizing the sign to one of the flight line headings.

GEOLOGICAL BRANCH
ASSESSMENT REPORT

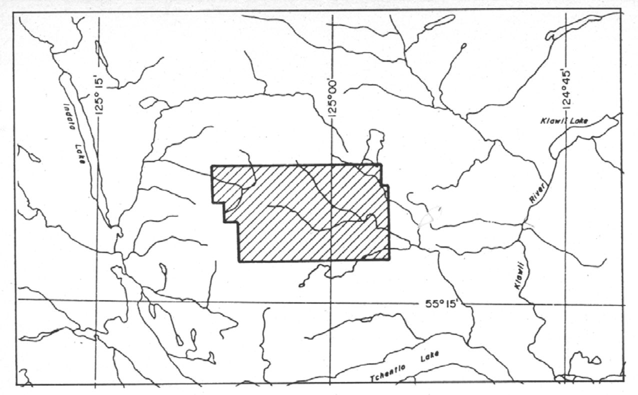
21,551

N

Flight Path

Navigation and recovery using a Motorola Mini-Ranger (MRS III) navigation system.

Average terrain clearance 60m
Average line spacing 100m



NICHOLSON AND ASSOCIATES

FLIGHT PATH

NATION CLAIM GROUP

BRITISH COLUMBIA

SCALE 1:10,000

0 330 660 1320 2640 Feet

0 100 200 500 1000 Metres

AERODAT LIMITED

DATE:	AUGUST 1990
NTS No:	93 N/6,7
MAP No:	2 A J9043 - 1

GEOLOGICAL BRANCH
ASSESSMENT REPORT

GEOLOGICAL BRANCH
ASSESSMENT REPORT

21,551

N

Flight Path

Navigation and recovery using a Motorola Mini-Ranger (MRS III) navigation system.

Average terrain clearance 60m
Average line spacing 100m

Vertical Gradient

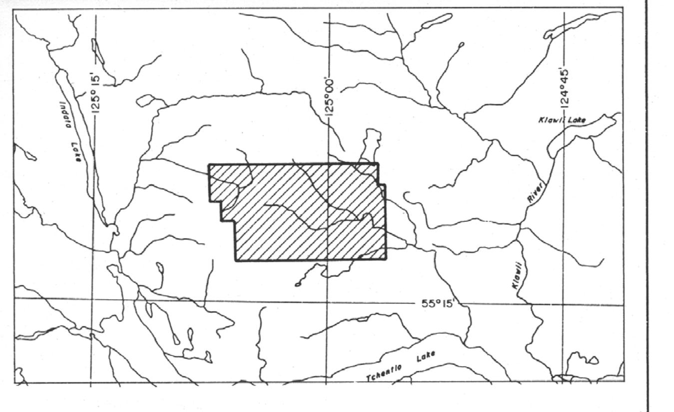
Vertical Magnetic Gradient calculated from the total field magnetic intensity in nT/m.

Cesium high sensitivity magnetometer.

Sensor elevation 45m

Map contours are multiples of those listed below

0.2 nT
1.00 nT
5.00 nT
10.00 nT
50.00 nT



NICHOLSON AND ASSOCIATES

CALCULATED VERTICAL MAGNETIC GRADIENT

NATION CLAIM GROUP
BRITISH COLUMBIA

SCALE 1:10,000

0 330 660 1320 2640 Feet

0 100 200 500 1000 Metres

AERODAT LIMITED

DATE:	AUGUST 1990
NTS No:	93 N/6,7
MAP No:	4A J9043 - 1

GEOLOGICAL BRANCH
ASSESSMENT REPORT

21,551

N

Flight Path

Navigation and recovery using a Motorola Mini-Ranger (MRS III) navigation system.

Average terrain clearance 60m
Average line spacing 100m

VLF-EM

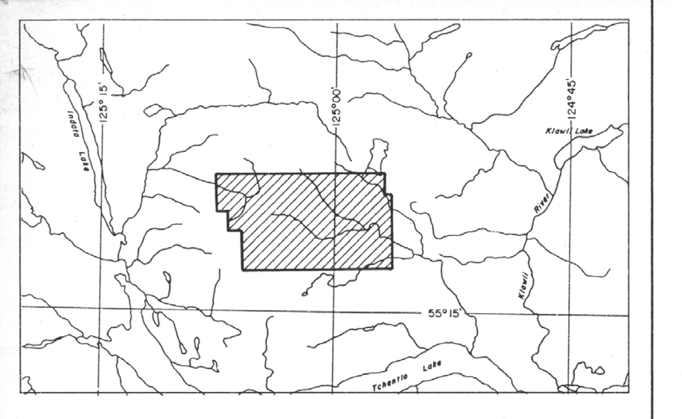
VLF-EM Total Field intensity in percent.

Station: NSS Flight(s) 1.3
Annapolis, Maryland
21.4 kHz
Station: NAA Flight(s) 2-2
Cutler, Maine
24.0 kHz

Sensor elevation 45m

Map contours are multiples of those listed below

1 %
5 %
25 %
100 %



NICHOLSON AND ASSOCIATES

VLF-EM TOTAL FIELD CONTOURS (LINE CHANNEL)

NATION CLAIM GROUP

BRITISH COLUMBIA

SCALE 1:10,000

0 330 660 1320 2640 Feet

0 100 200 500 1000 Metres

AERODAT LIMITED

DATE: AUGUST 1990
NTS No: 93 N/6,7
MAP No: 5A J9043 - 1