**NORTHWIND VENTURES LTD.**
GEOPHYSICAL REPORT ON AN
AIRBORNE MAGNETIC AND VLF-EM SURVEYS
**LINDA 1-18 CLAIMS**
SKEENA MINING DIVISION
NTS: 104B/8E & 9E
LATITUDE: 56° 28'-35'N LONGITUDE: 130° 01'-11'W

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DATE OF WORK: MARCH 8, 1990
DATE OF REPORT: JUNE 7, 1990



GEOLOGICAL BRANCH
ASSESSMENT REPORT

20,073

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**ILLUSTRATIONS**



* Written by Woods (1988)

**INTRODUCTION:**

On March 8, 1990 an airborne reconnaissance magnetic and VLF-EM survey was conducted over the **Linda 1-18 claims** (also referred to in this report as the **Linda property**) by Western Geophysical Aero Data Ltd. for **Northwind Ventures Ltd.**.

The intention of this survey is to direct further exploration to favorable target areas and to assist in the geological mapping of the property. Approximately 198.31 line kilometers of airborne magnetic and VLF-EM data has been collected, processed, and displayed in order to evaluate this property. In order to optimize the results from exploration dollars available the airborne geophysical data was collected only over the ridges which protrude through and radiate from the central icefield and glaciers.

**PROPERTY:**

The **Linda 1-18 claims** consists of 346 units in the Skeena Mining Division (Figure 2) and are summarized as follows.

| Claim Name | Record Number | Number of units | Expiry Date |
|---|---|---|---|
| Linda 1 | 7310 | 20 | Feb 14,1991 |
| Linda 2 | 7311 | 20 | Feb 14,1991 |
| Linda 3 | 7312 | 20 | Feb 14,1991 |
| Linda 4 | 7313 | 20 | Feb 14,1991 |
| Linda 5 | 7314 | 20 | Feb 14,1991 |
| Linda 6 | 7315 | 20 | Feb 14,1991 |
| Linda 7 | 7316 | 20 | Feb 14,1991 |
| Linda 8 | 7317 | 20 | Feb 14,1991 |
| Linda 9 | 7318 | 20 | Feb 14,1991 |
| Linda 10 | 7319 | 18 | Feb 14,1991 |
| Linda 11 | 7320 | 20 | Feb 14,1991 |
| Linda 12 | 7321 | 20 | Feb 14,1991 |
| Linda 13 | 7322 | 20 | Feb 14,1991 |
| Linda 14 | 7323 | 16 | Feb 14,1991 |
| Linda 15 | 7578 | 16 | Feb 14,1991 |
| Linda 16 | 7579 | 18 | Feb 14,1991 |
| Linda 17 | 7580 | 20 | Feb 14,1991 |
| Linda 18 | 7581 | 18 | Feb 14,1991 |


NORTHWIND VENTURES LTD.

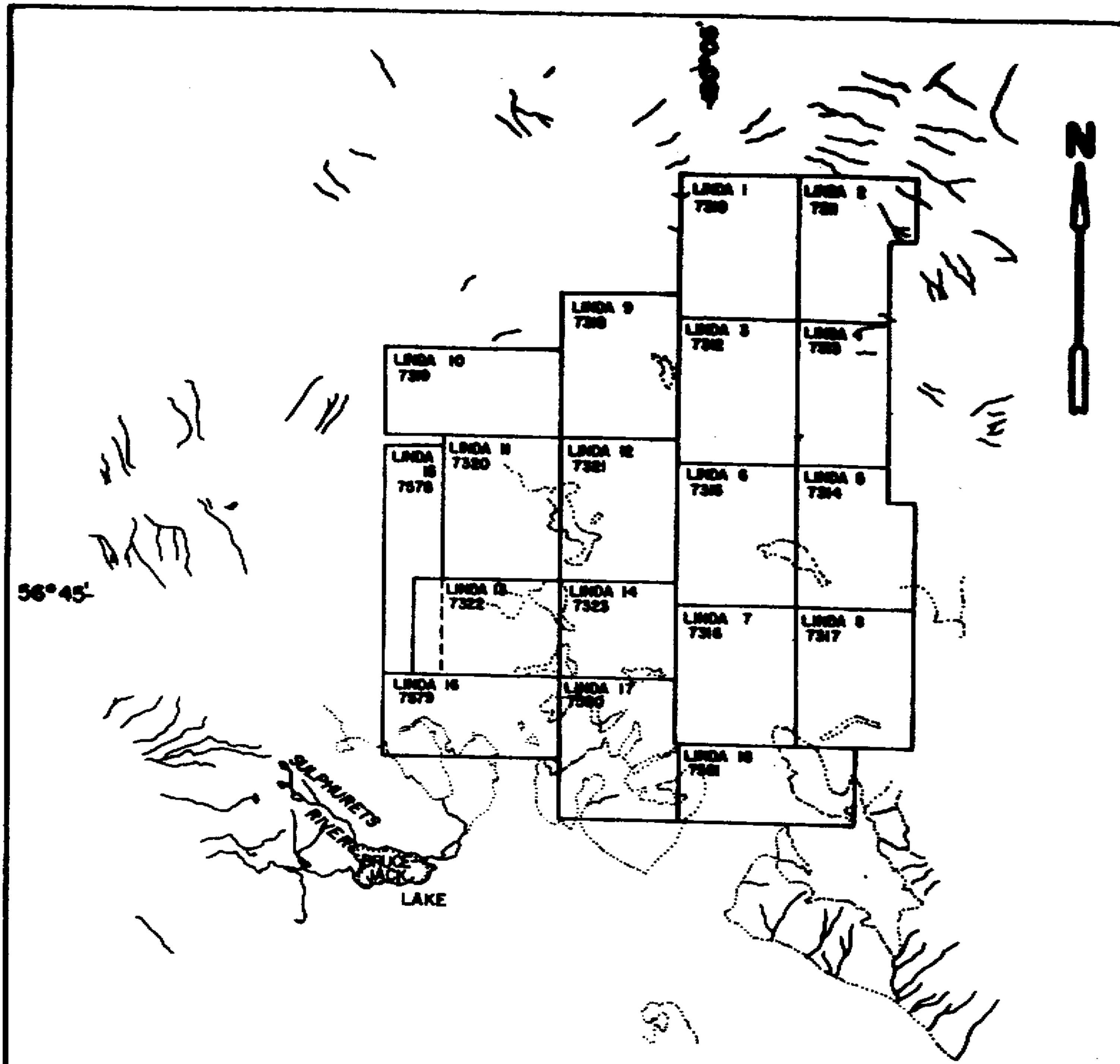
LINDA CLAIMS

LOCATION MAP

N.T.S. 104B/8E & 104B/9E

SCALE = 1:2 000 000

FIG. 1




# NORTHWIND VENTURES LTD.

## LINDA 1-18 CLAIMS

## CLAIMS MAP

N.T.S. 104B/8E & 104B/9E

SCALE = 1 : 100000

FIG.2

## LOCATION AND ACCESS

The **Linda claims** are located sixty-five kilometres north of Stewart, B.C.. There is year-round highway access to Stewart. Property access was gained by a thirty-five minute helicopter charter to the Tim Williams Glaciers. Geographically, the **Linda property** is located NE of Brucejack Lake, NW of Mt. Knipple, south of Treaty Glacier and Treaty Creek, and roughly centred around Triple Peak. The majority of the property area is covered by a large ice field which feeds many glaciers radiating out from the centre of the property. These glaciers (clockwise from north) include: Treaty Glacier, South Treaty Glacier, Drysdale Glacier, Tim Williams Glaciers, Knipple Glacier, Mt. John Walker Glacier, Freegold Glacier, and Mitchell Glacier.

## AREA HISTORY

Mineral exploration in the Stewart-Unuk River area began in the early 1890's when placer miners on their way out of the Cariboo prospected the Unuk River and its tributaries. In 1898, an expedition of placer miners landed at the head of Portland Canal and proceeded to explore the Bear River and Salmon River valleys. The discovery of mineralized float and vein material led to an influx of "hard-rock" prospectors. The townsite of Stewart was established (named after the prospecting family of "Pop", John and Bob Stewart), and by 1910 most of known mineral occurrences in the Stewart area, including the future Silbak Premier mine, had been discovered.

Mine development over the next three decades resulted in slow but steady growth of the Stewart area. In particular, the discovery of high-grade silver and gold ore at Premier in 1918 led to the development of one of the richest mineral deposits in British Columbia and the incentive for intensive exploration and development in the Salmon River basin.

Most of the small mines in the Stewart region were worked out by the 1940's except for the Silbak Premier mine which continued through to the 1970's. Total production of the Premier group consisted of 4 million ounces of gold, 41 million ounces of silver, 4 million pounds of copper, 52 million pounds of lead and 19 million pounds of zinc, making it the second largest silver producer (after Sullivan) and the third largest gold producer (after Bralorne-Pioneer and Rossland) in B.C. The development of the Granduc massive sulphide orebody in the Unuk River area northeast of Stewart and construction of the Cassiar-Stewart-Terrace highway maintained the growth and exploration activity of the Stewart area during the 1960's and 1970's. Significant discoveries in the Iskut River - Stikine River areas north of Stewart have led to an increased intensity of mineral exploration activity in recent years.

Almost all of the early mineral discoveries in the Stewart-Unuk River area have been found by prospecting gossans sighted from accessible stream or river valleys in areas of negligible vegetation. Recent discoveries have results from prospecting mineralized showings revealed by ablating glaciers (i.e. Granduc Mine). Exploration is hampered by dense vegetation at low elevations and snow cover at high elevations. Soil geochemistry is impractical in most areas due to a lack of suitable soil cover. Hence, the best approach to mineral exploration in the stewart-Unuk River area is a combination of geological and geophysical surveying to discover unknown hidden deposits, and detailed reappraisal of known showings using geophysical and geochemical techniques together with modern geological concepts of ore genesis.

**REGIONAL GEOLOGY**

The Stewart-Unuk River area is composed of three distinct tectonic zones of Mesozoic to Cenozoic age along the western margin of the Cordilleran (Figure 3). From west to east they are: the Coast Plutonic Complex or Crystalline Belt, the Stewart Complex and the Bowser Basin. The Stewart Complex is a deformed belt of volcanic, volcaniclastic and sedimentary rocks of Upper Triassic to Middle Jurassic age which extend from Alice Arm in the south to the Iskut River in the north. These rocks are in intruded contact with Middle Jurassic to Eocene felsic plutonic rocks of the Coast Plutonic Complex to the west, and unconformably underlay the Upper Jurassic to Cretaceous marine clastic sedimentary rocks of the Bowser Basin to the east. The Stewart Complex is one of the most important metallogenic regions in British Columbia.

Stratigraphic nomenclature of the Stewart Complex and Bowser Basin has been adopted from Grove (1986) following modifications from Grove (1971). The oldest rocks of the Stewart-Unuk River area are the Upper Triassic volcanic conglomerates, sandstones and siltstones comprising the Takla Group near Unuk River. In the absence of correlatable fossil evidence, the distinction between these Takla Group volcaniclastics and the overlying Hazelton Group volcaniclastics in not conclusive.

The lowest member of the Jurassic Hazelton Group is the Lower Jurassic Unuk River Formation consisting of green, red and purple volcanic breccia, conglomerate, sandstone and siltstone, pillowed lava and volcanic flows, and minor crystal tuff, limestone and chert. The Unuk River Formation is uncomfortably overlain by the Middle Jurassic Betty Creek Formation of predominantly volcanic breccia, conglomerate, sandstone and siltstone, which, in turn, is unconformably overlain by siltstone, greywacke, sandstone and argillite of the Salmon River Formation. Grove (1971) referred to the Unuk River Formation as the Hazelton assemblage, and the Betty Creek and Salmon River Formation as the Bowser assemblage.

The Upper Jurassic Nass Formation overlies the Salmon River Formation to form the uppermost constituent of the Bowser basin. The Nass Formation consists of a thick sequence of marine clastic sedimentary rocks (siltstones, greywackes, sandstones).

In addition to the volcanic epiclastic and sedimentary rocks of the Unuk River, Betty Creek and Salmon River Formations, the Stewart Complex is also partially composed of their cataclastic and metamorphic equivalents. Cataclasite and mylonite are found near the intruded contract of the Late Jurassic Texas Creek granodiorite. Phyllites, schists and gneisses are confined to the intruded contact areas with the Tertiary Hyder quartz monzonite and Boundary granodiorite.

The Coast Plutonic Complex is composed of multiple phases of intrusion from Upper Triassic quartz diorite in the Unuk river area to Middle Jurassic granodiorites and Tertiary quartz monzonites in the Stewart area. Plutonic satellites of quartz monzonite, quartz diorite and granodiorite are also found toward the centre of the Stewart Complex. Dykes and sills of similar composition are found throughout the Stewart Complex but particularly in well defined zones cutting across the regional geologic trends.

Mineralization in the Stewart area is confined primarily to the Lower and Middle Jurassic Stewart Complex: Unuk River, Betty Creek and Salmon River Formations. Grove (1986) recognizes four classes of mineral deposits such as the Silbak Premier Mines, stratiform massive sulphide deposits such as the Hidden Creek Mine in the Anyox area, discordant massive sulphide deposits such as the Granduc Mine, and Tertiary porphyry copper-molybdenum deposits such as the Mitchell-Sulphurets property. The most important of these, in terms of number of deposits and quantity of ore, are the fissure and replacement vein deposits. However, in terms of exploration potential, all types of deposits have equal importance.

**PROPERTY GEOLOGY**

The **Linda property** is located in an area where there four areas within seven kilometres of the western property border that have significant published reserves or geologic potential. Six kilometres east of **Linda 16** is the Sulphurets Gold Zone where there are 20,000,000 tons of 0.08 oz/ton of Au indicated. Two kilometres east of **Linda 16** and north of Brucejack Lake is the Gold Wedge deposit (Minfile No. 104B-105) where drilling and under ground workings have indicated 375,000 tons of 0.75 oz/ton of Au and 1.0 oz of Ag. South of Brucejack Lake the Brucejack Gold Deposit has proven and probable reserves of 854,072 tons of 0.354 oz/ton of Au and 22.94 oz/ton of Ag.

The following geological information has been taken from the BCMEMPR Open File Map 1988-4 (Alldrick, 1988). Within 1500 metres west and southwest of Brucejack Lake there are eleven BCMEMPR Minfile occurrences: Red River (104B-118), Kruchowski (104B-187), Shore (104B-189), Gossan Hill (104B-190), Discovery (104B-022), West (104B-193), 367 (104B-195), Galena Stockworth (104B-196), 5.7 (104B-197), Spine (104B-199), and Electrum (104B-200). Gold, silver, arsenopyrite, copper, lead, zinc, and barite, have been recognized in various combinations in this mineral rich area between Sulphurets Glacier and the **Linda property**.

Geologically these mineral occurrences are located on either side of a major, nearly north striking fault. This fault cuts or defines the boundary of the Lower Jurassic Upper Unuk River Formation andesite sequence, the Betty Creek Formation pyroclastic-epiclastic sequence, and, to a lesser extent, concurrent-aged to latter-aged, small porphyritic volcanic intrusions. Within both the Upper Unuk River and the Betty Creek rocks there are many gossanous alteration zones comprised of foliated to schistose pyrite-quartz-sericite with or without carbonate and clay.

# LEGEND

## INTRUSIVE ROCKS

### TERTIARY

**10** POST TECTONIC DYKES: *Keratophyre, lamprophyre, microdiorite, diabase (narrow, not shown)*

### JURASSIC

**9** POST-VOLCANIC INTRUSIONS: *Subporphyritic to porphyritic rocks with phaneritic groundmass. Texturally dissimilar to their volcanic host rocks*

MITCHELL–SULPHURETS SUITE

- 9a Alkali-feldspar Granite: *dark red, holofelsic, medium-grained, equigranular, hypersolvus granite*
- 9b Monzonite, Quartz Monzonite: *grey-green, pink and red, medium to coarse-grained, subporphyritic (K-feldspar, plagioclase) subsolvus rock. With increasing quartz locally grades into a texturally identical granite*
- 9c Monzodiorite: *greenish grey, plagioclase-hornblende prophyritic, medium-grained rock; locally grades into light grey equigranular biotite monzodiorite or monzonite*

**8** SYN TO POST-VOLCANIC INTRUSIONS: *Porphyritic, hypabyssal rocks with aphanitic groundmass. Texturally similar to extrusive rocks; intrusive relationships not always apparent*

- 8a Walker Porphyry: *light grey, homogeneous, plagioclase porphyritic dacite with fine-grained cognate xenoliths*
- 8b Rounsefell Porphyry: *light grey, coarse biotite and feldspar phenocrysts in dacitic groundmass*
- 8c Two-feldspar Porphyry: *medium to dark green, coarse K-feldspar and fine plagioclase ± hornblende phenocrysts in andesitic groundmass. (Hypabyssal equivalent of Unit 2a)*
- 8d Wedge Lake Porphyry: *light green, plagioclase ± quartz phenocrysts in dacitic groundmass*

**7** SUBVOLCANIC INTRUSIONS: *Porphyritic hypabyssal rocks with phaneritic groundmass. Composition and phenocrysts similar to extrusive rocks*

- 7 Lee Brant Stock: *Light grey, K-feldspar porphyritic, hornblende-biotite quartz monzonite*

## GOSSANOUS ALTERATION ZONES

- (stippled pattern) Pyrite-quartz-sericite ± carbonate ± clay; locally foliated to schistose
- (/////) Disseminated pyrite

## VOLCANIC AND SEDIMENTARY ROCKS
(Note: No stratigraphic order is implied within units)

### QUATERNARY

**6** UNCONSOLIDATED SEDIMENTS: *Alluvium, glaciofluvial deposits, landslide debris (not shown)*

### TRIASSIC TO JURASSIC

### HAZELTON GROUP

#### MIDDLE JURASSIC (TOARCIAN TO BAJOCIAN)

**5** SILTSTONE SEQUENCE (Salmon River Formation): *Dark grey, well bedded siltstone and fine sandstone*

- 5a *Basal, fossiliferous, pyritic wacke*
- 5b *Rhythmically bedded siltstone*
- 5c *Thickly bedded sandstone*
- 5d *Limestone lenses*

#### LOWER JURASSIC (TOARCIAN)

**4** FELSIC VOLCANIC SEQUENCE (Mount Dilworth Formation): *Light weathered intermediate to felsic pyroclastic rocks, including dust tuff, crystal and lithic tuff, and lapilli tuff. Locally pyritiferous (5 to 15%) and gossanous. Minor chalcedonic quartz veins locally*

- 4a *Massive to bedded airfall tuffs*
- 4b *Variably welded ash flow tuffs*
- 4c Krippie Porphyry: *coarse white glomeroporphyritic plagioclase phenocrysts set in grey dacitic-andesitic groundmass*

#### LOWER JURASSIC (PLIENSBACHIAN TO TOARCIAN)

**3** PYROCLASTIC–EPICLASTIC SEQUENCE (Betty Creek Formation): *Heterogeneous, red, green, purple and grey, bedded to massive pyroclastic and sedimentary rocks*

- 3a *Massive, green and grey andesitic to dacitic tuff, lapilli tuff, tuff breccia and minor flows;*
- 3ah *Hematitic mudstone seams within 3a*
- 3b *Bedded, heterogeneous, red, green, and grey volcanic breccia, lapilli tuff, crystal and lithic tuff, commonly hematitic*
- 3c *Basaltic to andesitic pillow lavas*
- 3d Atkins Porphyry: *hornblende and feldspar porphyritic andesite*
- 3e *Massive grey arkosic rocks and greywacke*
- 3f *Bedded, hematitic siltstone, sandstone and conglomerate; locally fossiliferous*

#### LOWER JURASSIC (HETTANGIAN–PLIENSBACHIAN)

**2** ANDESITE SEQUENCE (Upper Unuk River Formation): *Green and grey, rare purple, intermediate to mafic pyroclastics and flows with minor interbeds of siltstone and wacke*

- 2a *Medium to dark green, K-feldspar and plagioclase ± hornblende porphyritic trachyandesite tuffs and flows*
- 2b *Grey and green plagioclase porphyritic andesite*
- 2c *Dark green, hornblende ± augite porphyritic basalt-andesite*
- 2d *Dark grey rhythmically bedded siltstone (turbidites)*
- 2e *Grey well-sorted arkosic wacke, greywacke and conglomerate*

#### UPPER TRIASSIC TO LOWER JURASSIC (NORIAN TO HETTANGIAN)

**1** LOWER SEDIMENTARY SEQUENCE (Lower Unuk River Formation): *Brown and grey mixed sedimentary rocks with tuffaceous interbeds*

- 1a *Immature arkosic and lithic wacke*
- 1b *Siltstone*
- 1c *Polymictic conglomerate*
- 1d *Tuffite*
- 1e *Andesitic pyroclastics*


# NORTHWIND VENTURES LTD.
# LINDA 1–18 CLAIMS
# PROPERTY GEOLOGY
**N.T.S. 104B/8E & 104B/9E**

SCALE 1:100,000

FIG. 3

The **Linda property** encompasses a large ice field under lain by two Hazelton Group strata; one, the Middle Jurassic Salmon River Formation siltstone sequence, and two, the Lower Jurassic Betty Creek Formation pyroclastic-epiclastic sequence. Dividing the Salmon River and the Betty Creek lithologies is a narrow, approximately 250 metre wide, felsic volcanic sequence which corresponds to the Lower Jurassic Mount Dillworth Formation. The Mount Dillworth rocks are characterized by intermediate to felsic pyroclastic rocks, including dust tuff, crystal and lithic tuff, and lapilli tuff. Locally the pyroclastic rocks may be pyritiferous (from 5 to 15 per cent) and gossanous. Also of note, locally present are minor chalcedonic quartz veins. Massive to bedded airfall tuffs and variably welded ashfall tuffs have been mapped as the Mount Dillworth Formation along the west border of **Linda 10**.

The Salmon River Formation rocks correspond to the area staked as **Linda 1-9** and the east side of **Linda 10, 12, and 18 claims**. To the SW of these claims the dominant lithologic type is Betty Creek pyroclastic-epiclastic sequence. On the NW corner of **Linda 15** and crescent-shaped contact of the Salmon River Formation with a local, kilometre-wide, Lower Jurassic, Upper Unuk River Formation andesite sequence. In this area, the andesite sequence has been classified as containing two types: first, medium to dark green, K-feldspar and plagioclase with or without hornblende trachyandesite tuffs and flows; and second, grey and green plagioclase porphyritic andesite.

Further south, the area corresponding to the SW corner of **Linda 15** and the western border of **Linda 16** (over part of Freegold and John Walker Glaciers), have been mapped as the NE corner and eastern border of Jurassic intrusive stock. This local stock corresponds to the Walker Porphyry - a light grey, homogeneous, plagioclase porphyritic dacite with fine-grained, dacitic cognate xenoliths.

**AIRBORNE MAGNETIC AND VLF-EM SURVEY:**

This geophysical survey simultaneously monitors and records the output signals from a Barringer Research proton precession magnetometer and a Herz dual-frequency VLF-EM receiver. The sensors are installed in an aerodynamically stable "bird" which is towed thirty metres below a helicopter. Fixed to the helicopter skid is a shock and gimbal-mounted, downward-facing video camera. A video signal is recorded and later reviewed and correlated with a recent air photograph in order determine the precise locations of the flight paths. The elevation of the helicopter above the ground is recorded by a radar altimeter and monitored by the pilot and navigator in order to maintain a constant ground clearance.

A computer records readings of the magnitude of the earth's magnetic field and of the fields induced by two powerful VLF-EM transmitters (located in Cutler, Maine and Hawaii). This data, the time and date it was observed, radar altimeter values, and survey fiducial points are all superimposed on the video image and recorded on both video cassettes and 3.5 inch computer diskettes.

Data quality is assured by the survey operator monitoring a real-time display of direct and unfiltered recordings of all the geophysical output signals while a navigator directs the helicopter pilot from an air photograph.

Magnetic (Figures 5 & 6) data is useful for mapping the position and extent of regional and local geological structures which have varying concentrations of magnetically susceptible minerals. Many lithological changes correlate with a change in magnetic signature.

VLF-EM data is useful for mapping conductive zones. These zones usually consist of argillaceous graphitic horizons, conductive clays, water-saturated fault and shear zones, or conductive mineralized bodies. The VLF-EM data is presented as contoured total field data overlain by quadrature (out-of-phase component) profiles. Conductors are located at inflection points or a change in sign (cross-over) of the quadrature component over a local total field VLF-EM high.

In a typical VLF-EM survey, satisfactory conductor coupling and imaging occurs only within 45° of the primary field selected (in the direction of the transmitter). For maximum coupling, and in turn, imaging, a transmitter should be selected in the same direction as geologic strike.

**DATA PROCESSING:**

The video image, with superimposed line and fiducial identification, recording times, and the recorded data, is correlated with both the navigator's and operator's field notes and topographic features observed from an air photograph. The "recovered" flight paths are digitized to obtain relative x and y positions which are then combined with the data. Subsequently, all geophysical data is filtered to remove spurious noise bursts and chatter, and then plotted as flight path profiles and contour maps for each of the sensors. Note that the VLF-EM data corresponding to Lines 1a to 4a and Lines 17 to 25 on Figure 9 were not contoured on Figure 10. The Cutler transmitter had shut-down before those lines were flown and data from the weaker Annapolis transmitter were collected. The lower level of the Annapolis data would give a false contour display if the Annapolis and Cutler total field data were gridded and contoured together.

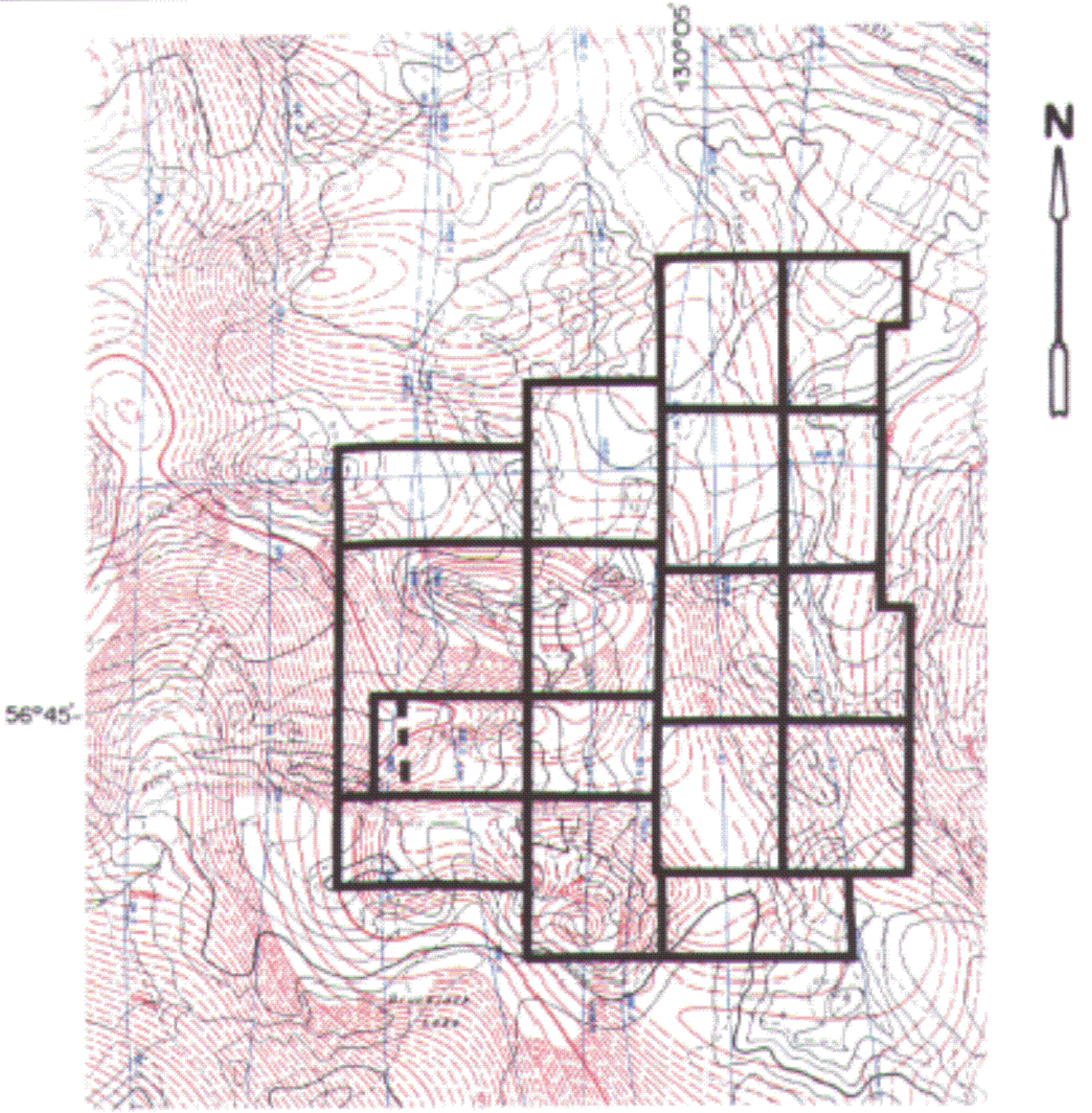
Both the total field magnetometer signal and the total field and quadrature components of VLF-EM signal are sensitive to topographic changes and bird oscillations. Short wavelength (less than 200 meters) oscillations, are attenuated by filtering the VLF-EM data with a digital low-pass filter. Long wavelength effects (anomalies greater than 2000 metres), attributed to broad topographic features, are also removed from both the VLF-EM channels by high-pass filtering.

**DISCUSSION OF RESULTS:**

The **Linda 1-18 claims** were surveyed on March 8, 1990 for **Northwind Ventures Ltd.**. Over 198.31 line kilometers of airborne magnetic and VLF-EM survey data have been recorded and evaluated for this property. Survey lines were flown along ridge lines or areas of reduced glacial cover in a Hughes 500D helicopter with an average spacing of 125 metres. The geophysical survey data were recorded on average three times per second for an effective sample interval of 15 metres. The sensors were towed below the helicopter with an average terrain clearance of 30 metres where possible. The survey covered contains many areas where terrain clearance of over 190 metres was encountered. Above 190 metres the radar altimeter data collected has been "pegged" or gives a fixed value and has not been profiled (Figure 11).

In any airborne geophysical survey an increase in the ground-to-sensor distance by five metres is noteworthy and by ten metres is significant. The effect of separation increases of this magnitude upon the magnetic and VLF-EM responses is a marked reduction in measured intensity. Increased sensor-ground separation attenuates the geophysical response and results in the appearance of a mappable magnetic or VLF-EM low. In many geological settings the location of creeks and rivers correspond to the surface expression of fault and shear zones, or lithological contacts and are likely areas to observe significant VLF-EM conductors. In part, both the VLF-EM response and the magnetic response may have been "over-printed" or attenuated in these areas by increased separation effects thus masking conductors that might be observed on a ground survey.

The GSC magnetic data (Figure 4) shows the area associated with the Middle Jurassic Salmon River Formation siltstone sequence on the **Linda property** (see the area described in the "Property Geology" section of this report) as an area of very little magnetic expression; the local magnetic field increases only 40 nanoTeslas, over four kilometres, from the west to the east of the property. The magnetic data collected for this area of the survey, Lines 17 through 48 (over **Linda 1-8, and 18 claims**), show a poor magnetic response even over areas of abrupt topographic change. This poor magnetic response is relative to the highly variable magnetic response on the SW part of the property. The magnetic response for the area covering **Linda 11 - 17 claims** is highly variable and contains both the magnetic minimum and maximum for the entire survey area. The higher magnetic response in this area is probably due the volcanic and more mafic nature of the Betty Creek pyroclastic-epiclastic sequence than the contrasting shallow marine nature of the Salmon River Formation silts on the east half of the property. Overall, in this SW part of the survey, magnetic lows are associated with areas of thick glacial ice. Magnetic highs correlate with the topographic highs and ridges protruding from the glaciers and icefields. The reduced magnetic level encountered in areas of thick ice cover is more probably due to an increase in the effective sensor to ground separation rather than a change in the underlying lithology. A number of faults have been interpreted from the magnetic data where steep magnetic gradients are encountered. Some of these areas correspond to ridge lines and are coincident with an interpreted magnetic/geologic contact (for example the fault interpreted along the border of **Linda 13 and 16** and from Line 11 to 13). This combination of an interpreted fault and a magnetic/geologic contact may be due to a block of volcanic rocks thrust over less magnetic and less mafic sediments. The magnetic response associated with the magnetic/geologic contacts interpreted and drafted on Figure 12 show some topographic "over-printing". However, the magnetic response is more-likely due to either lithological or mineralogical differences in the source




NORTHWIND VENTURES LTD.

LINDA 1-18 CLAIMS

AEROMAGNETIC MAP

N.T.S. 104B/8E & 104B/9E

SCALE = 1:100 000

FIG. 4

rocks rather than a topographic effect or a geophysical sensor separation effect. Note, that along the SE border of **Linda 13** a minor magnetic anomaly is observed corresponding to two intersecting, approximately-perpendicular ridges, from Line 1b to 6. In this area the magnetic response has been evaluated and interpreted as primarily a topographic effect.

VLF-EM conductors corresponding to Cutler and Hawaii transmitters have been interpreted and numbered on the Geophysical Interpretation Map (Figure 12). The intensity of the conductive responses induced by the Hawaii transmitter (Figures 7 & 8) are greater than those induced by the Cutler transmitter (Figure 9 & 10). The Hawaii and Cutler total field contour maps (Figure 8, 10) are both contoured at a of 2.0 per cent interval.

Good conductors typically exhibit strong in-phase crossovers, the quadrature usually lags by up to 90 degrees or mirrors the in-phase response, and the total field is a local high. Conversely, for poor conductors, the quadrature response nearly mimics the in-phase and there are no strong in-phase crossovers and, in some cases, no associated total field anomalies. Poor conductors may be associated with conductive overburden, weathered bedrock or ground to VLF-EM sensor separation effects over the survey area.

The VLF-EM responses resulting from abrupt topographic changes on the **Linda property**, are as expected. The resulting relatively narrow conductors are primarily sourced in topographic effects. This correlation is apparent when the conductors and the airphoto features are compared. Areas of low measured VLF-EM total field correspond to areas covered by ice. The ice cover results in an increased ground-sensor separation and thus lower VLF-EM total field intensities. There are a few weak conductors which cut across ice fields. These usually correlate to crevassed areas and may reflect a subglacial topographic change and reduced thickness of glacial ice and are therefore a probable topographic effect.

Conductors which intersect topographic features obliquely or correlate with steep magnetic gradients are of primary exploration importance on the **Linda property**. These "cross-cutting" conductors may be due to fault structures, mineralized zones, or lithological differences on the property. On **Linda 1 claim**, over flight Lines 45a to 48, conductor pairs C12-H19 and C13-H20 occur oblique to the topographic trend. Conductors C10, C11, perpendicularly oriented H16, H17, and H18 all are oblique to or "cross-cut" the NE trending ridge on the **Linda 2 claim** (over flight Lines 40 to 45b). These very local conductors appear to correspond to ravines or drainages - these are likely short fault structures. Likewise on **Linda 4**, conductors H14 and H15 are short and perpendicular to a ridge. Elsewhere on **Linda 3 to 8 and 18 claims**, all the conductors correlate with ridgelines or crevassed areas.

Conductors C25 to C28 and H46, H47, and H48, associated with Lines 56 to 61 and which intersect **Linda 9, 10, and 12 claims**, are cross-cutting or are oblique to the NW trending ridge. Conductors H22 to H27 on the northern part of Lines 1a to 4a which correspond to area over the **Linda 9, 12, and 14 claims** all appear to be attributed to topographic effects.

The southwest portion of the surveyed area, corresponding to the **Linda claims** 13 to 17, is the most promising area from both a geological and a geophysical standpoint. On **Linda 14** the north-south trending portion of H35 is coincident with a fault interpreted from the magnetic data. Along the north and south borders of **Linda 16**, conductor pair C22-H39 and conductor H37 should be evaluated as they are both coincident with fault and magnetic/geologic contacts. Conductor C17 is particularly noteworthy; trending roughly east-west it spans the entire width of **Linda 16 and 17**, crossing over five kilometres over ridgelines and areas of glacial cover. On **Linda 17** conductors H29 and H31 are coincident with C17.

## CONCLUSIONS AND RECOMMENDATIONS

The **Linda 1-18 claims** are located adjacent to an area where significant gold and silver reserves have been discovered. Within seven kilometres of the SW border of the property, in similar geologic settings to the property geology, are four auriferous deposits that have either indicated potential or proven and probable reserves. These gold-rich and silver-rich deposits are: the Sulphurets Gold Zone, the Snowfield Gold Zone, the Gold Wedge Deposit, and the Brucejack Gold Deposit. Within four kilometres SW of the **Linda 16 claim** and west of Brucejack Lake there are eleven mineral occurrences listed as B.C. Minfile numbers. Many of these mineral occurrences correspond to gossans in the Betty Creek pyroclastics and epiclastics.

The predominant lithology on the eastern half of the survey area is the Middle Jurassic, Salmon River Formation siltstone sequence. Underlying the marine silts and at surface on the western half of the property are the Lower Jurassic, Betty Creek Formation pyroclastic-epiclastic sequence, and a small, similar-aged, volcanic stock mapped as a Walker porphyry. South and west of the property there are many gossanous alteration zones.

The profiled and contoured magnetic data (Figures 5 and 6) shows laterally variable, elevated magnetic levels on the area corresponding to **Linda 11-17 claims**. Fault and magnetic/geologic contacts have been interpreted where steep magnetic gradients occur. Some of these defined magnetic features correspond to cross-cutting or oblique-to-topography VLF-EM conductors. The geophysical signatures may sourced either in whole, or in part: fault structures, contacts within the volcanic and sedimentary rocks, zones of fissure or replacement mineralization, topographic "over-printing", or increased ground to geophysical sensor separation effects.

Elsewhere, on the northwest portion and the eastern side of the

**Linda property**, the magnetic response shows little influence from topographical features. This poor magnetic response is likely due to marine sediments rather than volcanic rocks. Usually volcanic rocks have a higher mafic mineral content than marine sediments resulting in an elevated magnetic response. Airborne magnetic data on the **Linda 1 - 8 and 18 claims** are marginally useful for geologic mapping purposes due to the absence of sufficient concentrations of magnetic minerals in the Salmon River siltstone sequence.

Overall, the VLF-EM conductors recorded on the survey are correspond to topographical highs. VLF-EM lows typically correlate to glaciated areas. Significantly there are a number of conductors which trend at oblique angles to topographic features. The topographic, structural, or lithological characteristics of these "cross-cutting" conductors should be evaluated.

A ground examination must be made to verify the geophysical interpretations presented in this report. A more complete picture of the local geology is necessary to interpret the geophysical data further. It is recommended that a follow-up search of all sources for additional geological information and any descriptions of past work on these and adjacent claims be undertaken. Subsequent to this search effort, a program of geological mapping should be undertaken in two phases. The first phase, conducted on the **Linda 11 to 17 claims**, should verify the position and presence of the postulated faults, geological contacts, and/or mineralization with the interpreted oblique-to-topography conductors. The second phase, on the **Linda 1-10, and 18 claims**, is to map those "cross-cutting" conductors which occur in the area associated with Salmon River siltstone sequence.

A follow-up program of ground geophysical surveying should be completed over those airborne geophysical anomalies which are found to be located in a promising geological setting.

Respectfully submitted,

Jeffrey C. Murton, B.Sc., P.Geoph.(APEGGA)

**REFERENCES**

Alldrick, D.J., and Britton, J.M., 1988, Geology and Mineral Deposits of the Sulphurets Area, Open File Map 1988-4, BCMEMPR

Grove, E.W., 1971, Geology and Mineral Deposits of the Stewart Area, Northwestern B.C., Bulletin 58, BCMEMPR

Grove, E.W., 1986, Geology and Mineral Deposits of the Unuk River - Salmon River - Anyox Area, B.C., Bulletin 63, BCMEMPR

Woods, D.V., and Hermary, R.G., 1988, Geophysical Report on the Chris 1-4 Claims, Skeena Mining Division, 15 July, 1988

**STATEMENT OF QUALIFICATIONS**

| | |
|---|---|
| **NAME:** | MURTON, Jeff C. |
| **PROFESSION:** | Geophysicist |
| **EDUCATION:** | B.Sc - Geophysics Major<br>University of British Columbia |
| **PROFESSIONAL ASSOCIATIONS:** | Society of Exploration Geophysicists<br><br>Association of Professional Engineers, Geologists, and Geophysicists of Alberta |
| **EXPERIENCE:** | 1984-88 - Geophysicist, Interactive Graphics with Western Geophysical Company of Canada Ltd. in Calgary, Alberta.<br><br>1988 - Geophysicist with White Geophysical Inc. |

## INSTRUMENT SPECIFICATIONS

### BARRINGER AIRBORNE MAGNETOMETER

| | |
|---|---|
| Model: | M 1041 |
| Type: | Proton Precession |
| Range: | 20,000 to 100,000 gammas |
| Accuracy: | + 1 gamma at 24 V d.c. |
| Sensitivity: | 1 gamma throughout range |
| Cycle Rates: | Manual: Pushbutton single cycle |
| | External: Actuated by a contact closure (short) longer than 10 microseconds |
| | Continuous: 1.114 seconds with external pins shorted |
| | Internal: 1 second to 3 minutes in 1 second steps |
| Outputs: | Analogue: 2 channels, 0 to 99 gammas or 0 to 990 gammas at 1 m.a. or 100 mV full scale deflection |
| | Digital: Parallel output 5 figure 1248 BCD, TTL compatible |
| | Visual: 5 digit numeric display directly in gammas |
| Size: | Instrument set in console |
| | 19" x 3.5" x 10" |
| Weight: | 10.6 lbs. |
| Power Requirements: | 28 ± 5 volts dc, @ 1.5 amps - polarizing 4 amps |
| Detector: | Noise cancelling torroidal coil installed in air foil |

## INSTRUMENT SPECIFICATIONS

### HERZ TOTEM - 2A VLF-EM SYSTEM

| | |
|---|---|
| Primary Source: | Magnetic field component radiated from VLF radio transmitters (one or two simultaneously) |
| Parameters Measured: | Total field, vertical quadrature, horizontal quadrature and gradient |
| Frequency Range: | 15 kHz to 25 kHz; front panel selectable for each channel in 100 Hz steps |
| Sensitivity Range: | 130 µV m to 100 mV at 20 kHz, 3 dB down at 14 kHz and 24 kHz |
| VLF Signal Bandpass: | -3 dB at +/- 80 Hz; < 4% variation at ±50 Hz |
| Adjacent Channel Rejection: | 300 to 800 Hz = 20 to 32 dB; 800 to 1500 Hz = 32 to 40 dB; > 1500 Hz > 40 dB (for < 2% noise envelope) |
| Out of Band Rejection: | 10 kHz to 2.5 Hz = 5 x $10^{-4}$ Am to 5 x $10^{-1}$ Am < 2.5 kHz rising at 12 dB octave 30 kHz to 60 kHz = 5 x $10^{-4}$ Am to 8 x $10^{-3}$ Am > 60 kHz rising at 6 dB octave (for no overload condition) |
| Output Span: | ±100% = ±1.0 V |
| Output Filter: | Time constant 1 sec. for 0% to 50% or 10% to 90% noise bandwidth 0.3 Hz (second order LP) |
| Internal Noise: | 1.3 µV m rms (ambient noise will exceed this) |
| Sferics Filter: | Reduces noise contribution of impulse filter |
| Electric Field Rejection: | <0.5% error for 20 m tow cable |
| Controls: | Power switch, frequency selector switches (Line and Ortho), meter switch (Total Quad), and sferics filter switch |
| Displays: | Meters (Line and Ortho), sferics light, overhead light |

**HERZ TOTEM - 2A VLF-EM SYSTEM - PAGE 2**

| | |
|---|---|
| Inputs: | Power: 23 to 32 V DC; fused 0.5 Amps |
| | Signal: Sensor upper; sensor lower |
| Outputs | Total, quad, gradient, multiplexed (line and ortho) |
| | Audio monitor, stereo line and ortho |
| Dimensions and Weight: | Console: 480 mm wide x 45 mm high x 340 mm deep, 3.8 kg |
| | Sensor and Preamplifier Assembly: 150 mm diameter x 460 mm long, 1.5 kg |

## INSTRUMENT SPECIFICATIONS

### DATA ACQUIISITION UNIT

| | |
|---|---|
| Model: | HP-3852A |
| Mainframe Supports: | Eight function module slots |
| | Data acquisition operating system |
| | System timer |
| | Measurement pacer |
| | Full alphanumeric keyboard, command and result displays |
| Number of Channels: | 20 channel relay multiplexer HP44708A/H |
| Voltmeter: | 5½ to 3½ digit intergrating voltmeter HP44701A measures: |

DC voltage

resistance

AC voltage

Range ±30V, ±0.008%, +300uV

Intergration Time 16.7 msec

Number of converted digits 6½

| | |
|---|---|
| Reading rate (readings/ sec) | 57 |
| Min-Noise rejection (dB) Normal Mode Rejection at 60 Hz ±0.09% | 60 |
| DC Common Mode Rejection with 1 KΩ in low lead | 120 |
| Effective Common Mode Rejection at 60 Hz ±0.09% with 1 KΩ in low lead | 150 |

| | |
|---|---|
| Communication: | HPIB interface with Compaq |
| Power Requirements: | 110/220 Volts AC at 60/50 Hz |
| Dimensions: | 45.7 cm x 25.4 cm x 61.0 cm |
| Weight: | 9.5 kg. |

## INSTRUMENT SPECIFICATIONS

## CONTROLLER AND RECORDING SYSTEM - SPECIFICATIONS

| | |
|---|---|
| Type: | Compaq Portable II |
| | An 80286 microprocessor |
| | 640 Kbytes of RAM |
| | 2 three and a half inch 720 Kbyte drives one 20-Megabyte fixed disk drive |
| | Monochrome, dual-mode, 9-inch internal monitor |
| | Asynchronous communications interface |
| | Parallel interface |
| | Composite-video monitor interface |
| | RGB monitor interface |
| | RF modulator interface |
| | Two expansion slots |
| | Real-time clock |
| | An 80287 coprocessor |
| | A HPIB Interface Card |
| Data Storage: | 3 1/2 inch diskettes in ASCII |
| | Roland 1012 printer for printed output |
| | Beta I video cassettes |
| Power Requirements: | 115 Volt AC at 60 Hz |
| Weight: | 11 kg |
| Dimensions: | 45 cm x 25 cm x 30 cm |

## INSTRUMENT SPECIFICATIONS

### FLIGHT PATH RECOVERY SYSTEM

| | |
|---|---|
| T.V. Camera: | Model: RCA TC2055 Vidicon |
| | Power Supply: 12 volt DC |
| | Lens: Variable, selected on basis of expected terrain clearance |
| | Mounting: Gimbal and shock mounted in housing, mounted on helicopter skid |
| Video Recorder: | Model: Sony SLO-340 |
| | Power Supply: 12 volt DC / 120 volt AC (60Hz) |
| | Tape: Betamax ½" video cassette - optional length |
| | Dimensions: 30 cm X 13 cm X 35 cm |
| | Weight: 8.8 Kg |
| | Audio Input: Microphone in - 60 db low impedance microphone |
| | Video Input: 1.0 volt P-P, 75 unbalanced, sync negative from camera |
| Altimeter: | Model: King KRA-10A Radar Altimeter |
| | Power Supply: 0-25 volt (1 volt/1000 feet) DC signal to analogue meter, 0-10 v (4mv/ft) analogue signal to data acquisition unit |
| | Mounting: Fixed to T.V. camera housing, attached to helicopter skid |

**COST BREAKDOWN:**

| DESCRIPTION | TOTAL |
|---|---|
| **Linda 1-18 claims survey totals** | |
| Mobilization and demobilization, 2 men, Brent Robertson and Gerald MacKenzie...................... | $ N/C |
| Data Acquisition: | |
| -Total daily charges for vehicle rental, instrument rental, labour, and room and board ....... | $10,360.00 |
| -Survey charges (198.31 km @ $43.72/km on March 8, 1990) ............ | $ 8,670.00 |
| Data processing, interpretation, and report charges . | $ 8,650.00 |
| **Total** | **$27,680.00** |

Allocation of Charges To Groups

**Linda-A Group: Linda 1, 2, 3, & 4 claims, NTS: 104B/9E**

| | |
|---|---|
| Data acquisition ..................................... | $ 4396.00 |
| Data processing, interpretation, and report charges . | $ 2004.00 |
| **Linda-A Subtotal** ..................................... | **$ 6400.00** |

**Linda-B Group: Linda 5, 6, 7, 8, & 18 claims, NTS: 104B/8E & 9E**

| | |
|---|---|
| Data acquisition ..................................... | $ 5385.00 |
| Data processing, interpretation, and report charges . | $ 2455.00 |
| **Linda-B Subtotal** ..................................... | **$ 7840.00** |

**Linda-C Group: Linda 9, 10, 11, & 12 claims, NTS: 104B/9E**

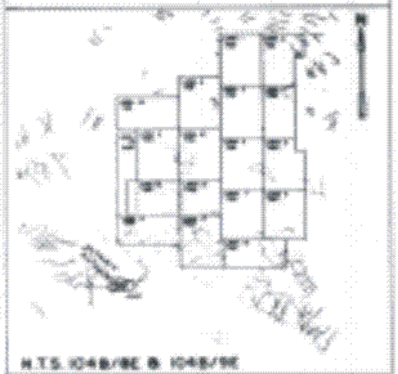
| | |
|---|---|
| Data acquisition ..................................... | $ 4282.00 |
| Data processing, interpretation, and report charges . | $ 1958.00 |
| **Linda-C Subtotal** ..................................... | **$ 6240.00** |

**Linda-D Group: Linda 13 - 17 claims, NTS: 104B/8E & 9E**

| | |
|---|---|
| Data acquisition ..................................... | $ 4967.00 |
| Data processing, interpretation, and report charges . | $ 2233.00 |
| **Linda-D Subtotal** ..................................... | **$ 7200.00** |

GEOLOGICAL BRANCH
ASSESSMENT REPORT

# 20,073



N.T.S. 104B/8E & 104B/9E

NORTHWIND VENTURES LTD.

LINDA 1-18 CLAIMS

MAGNETOMETER: TOTAL FIELD PROFILES

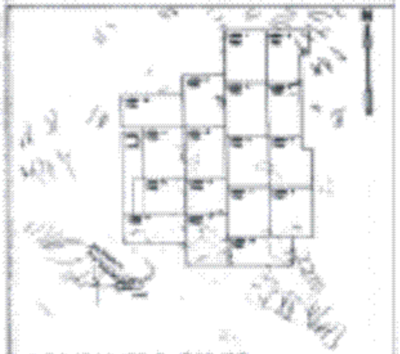
BASE LEVEL = 57 500 nT. SCALE = 100 nT/cm

Scale 1: 20000.0

WESTERN GEOPHYSICAL AERO DATA LTD.

GEOLOGICAL BRANCH
ASSESSMENT REPORT

# 20,073



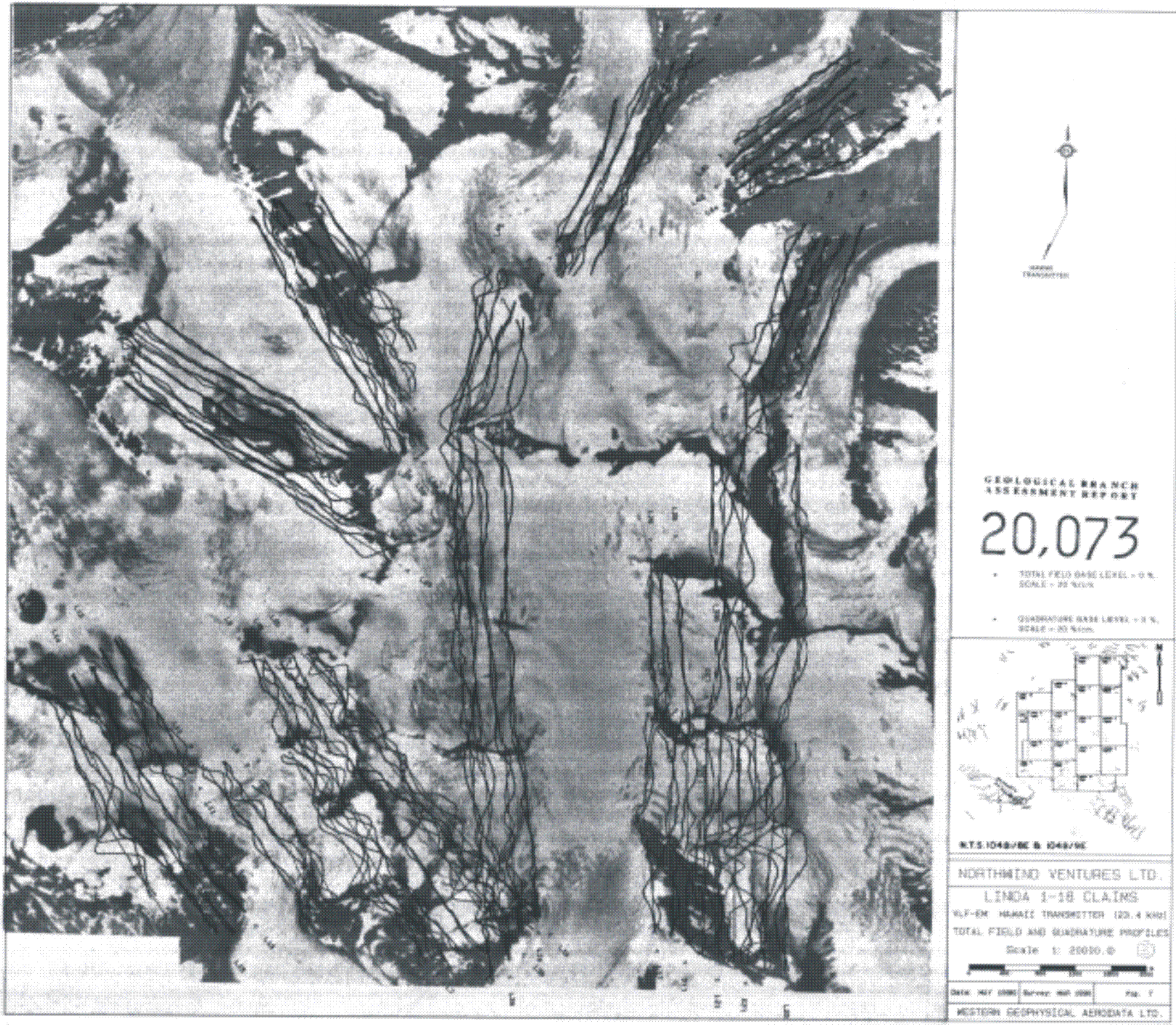
N.T.S. 104B/8E & 104B/9E

NORTHWIND VENTURES LTD.

LINDA 1-18 CLAIMS

Contour Interval: 10 nT

WESTERN GEOPHYSICAL AERO DATA LTD.

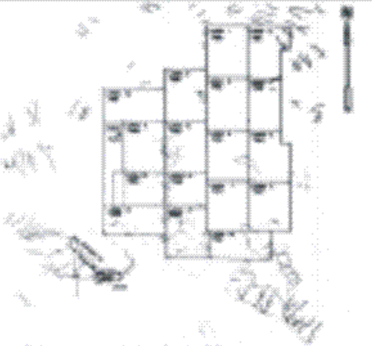


GEOLOGICAL BRANCH
ASSESSMENT REPORT
20,073
N.T.S. 104B/8E & 104B/9E
NORTHWIND VENTURES LTD.
LINDA 1-18 CLAIMS
VLF-EM: HAWAII TRANSMITTER (23.4 kHz)
TOTAL FIELD AND QUADRATURE PROFILES
Scale 1: 20000.0
WESTERN GEOPHYSICAL AERODATA LTD.

GEOLOGICAL BRANCH
ASSESSMENT REPORT

20,073

QUADRATURE BASE LEVEL = 0 %.
SCALE = 20 %/cm.



N.T.S. 104B/8E & 104B/9E

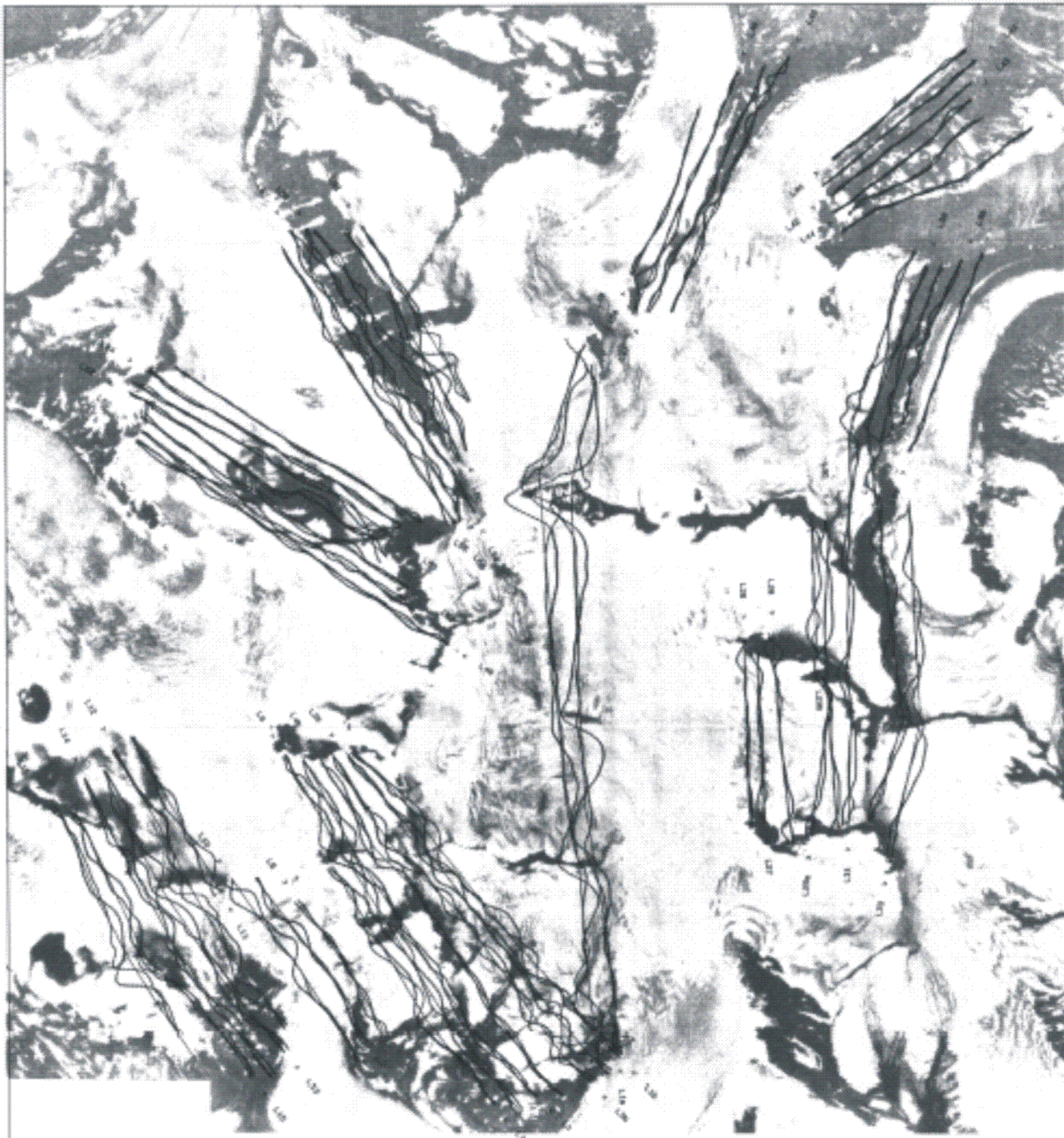
NORTHWIND VENTURES LTD.

LINDA 1-18 CLAIMS

Contoured Total Field with Quadrature Overlay

Scale 1: 20000.0

WESTERN GEOPHYSICAL AERO DATA LTD.



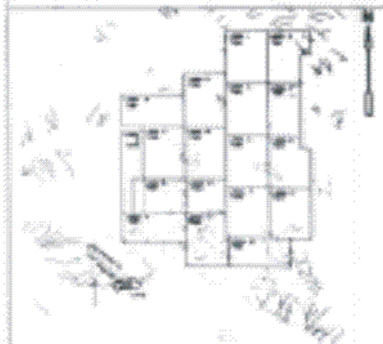
CUTLER TRANSMITTER

GEOLOGICAL BRANCH
ASSESSMENT REPORT

# 20,073

TOTAL FIELD BASE LEVEL = 0 %
SCALE = 20 %/cm

QUADRATURE BASE LEVEL = 0 %
SCALE = 20 %/cm



N.T.S. 104B/8E & 104B/9E

NORTHWIND VENTURES LTD.

LINDA 1-18 CLAIMS

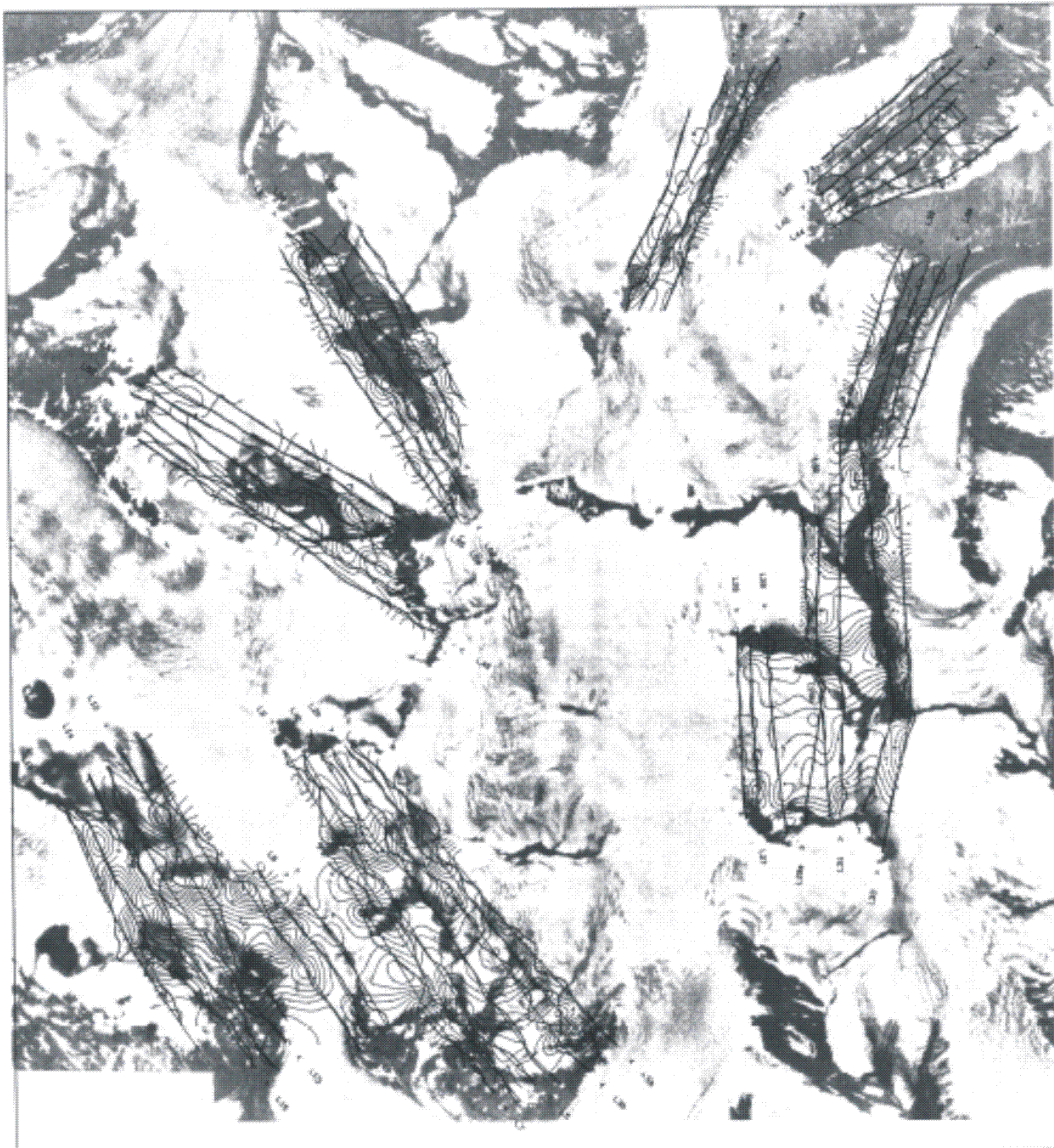
VLF-EM: CUTLER TRANSMITTER (24.0 KHZ)

TOTAL FIELD AND QUADRATURE PROFILES

SCALE 1: 20000.0

| Date: MAY 1990 | Survey: MAR 1990 | FIG. 9 |
|---|---|---|

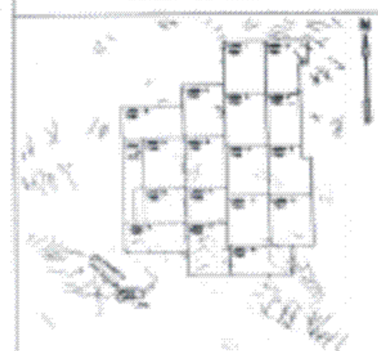
WESTERN GEOPHYSICAL AERODATA LTD.



GEOLOGICAL BRANCH
ASSESSMENT REPORT

# 20,073

QUADRATURE BASE LEVEL = 0 %
SCALE = 20 %/cm



N.T.S. 104B/8E & 104B/9E

NORTHKIND VENTURES LTD.

LINDA 1-18 CLAIMS

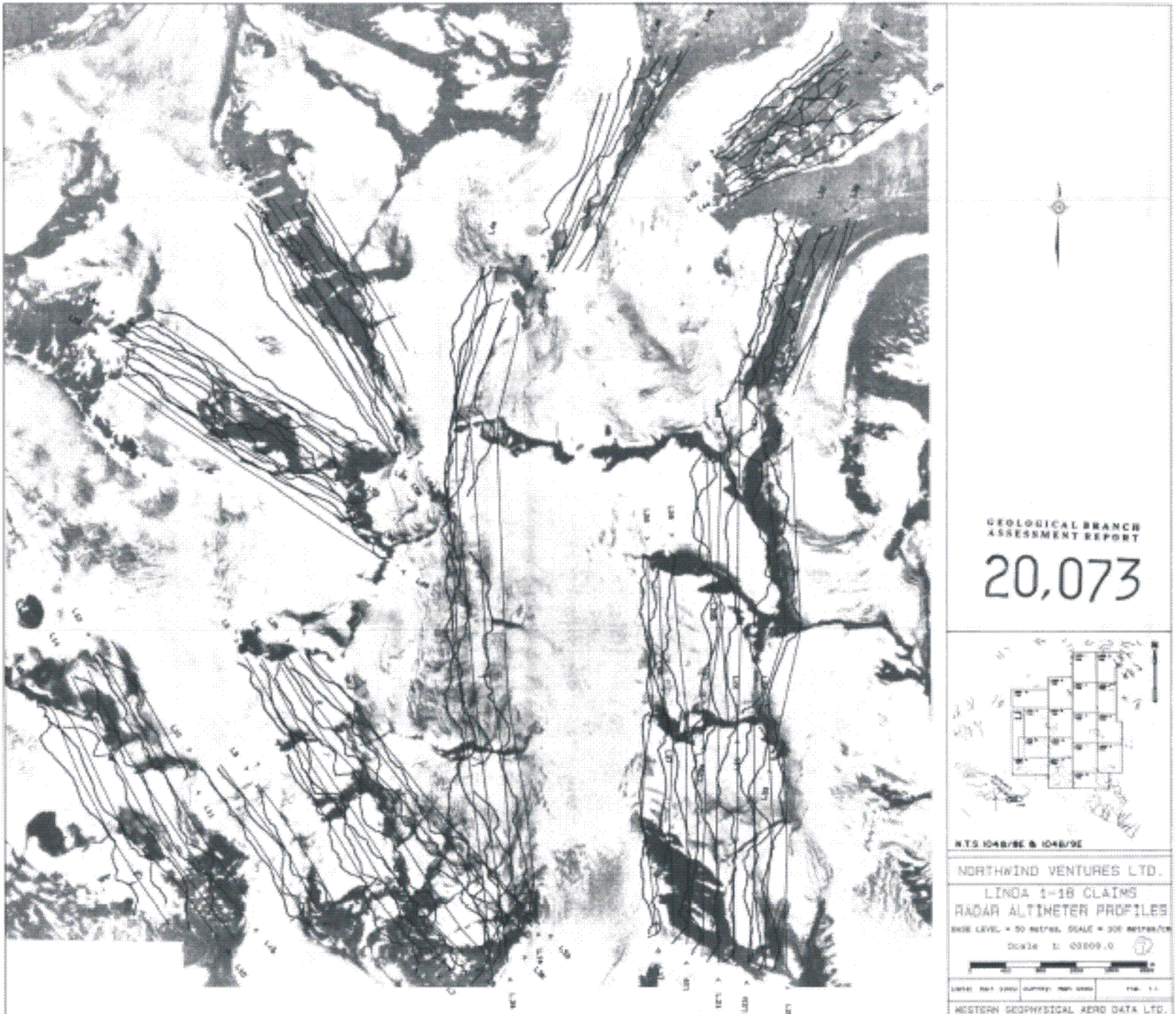
VLF-EM. Cutler Transmitter (24.8 kHz)

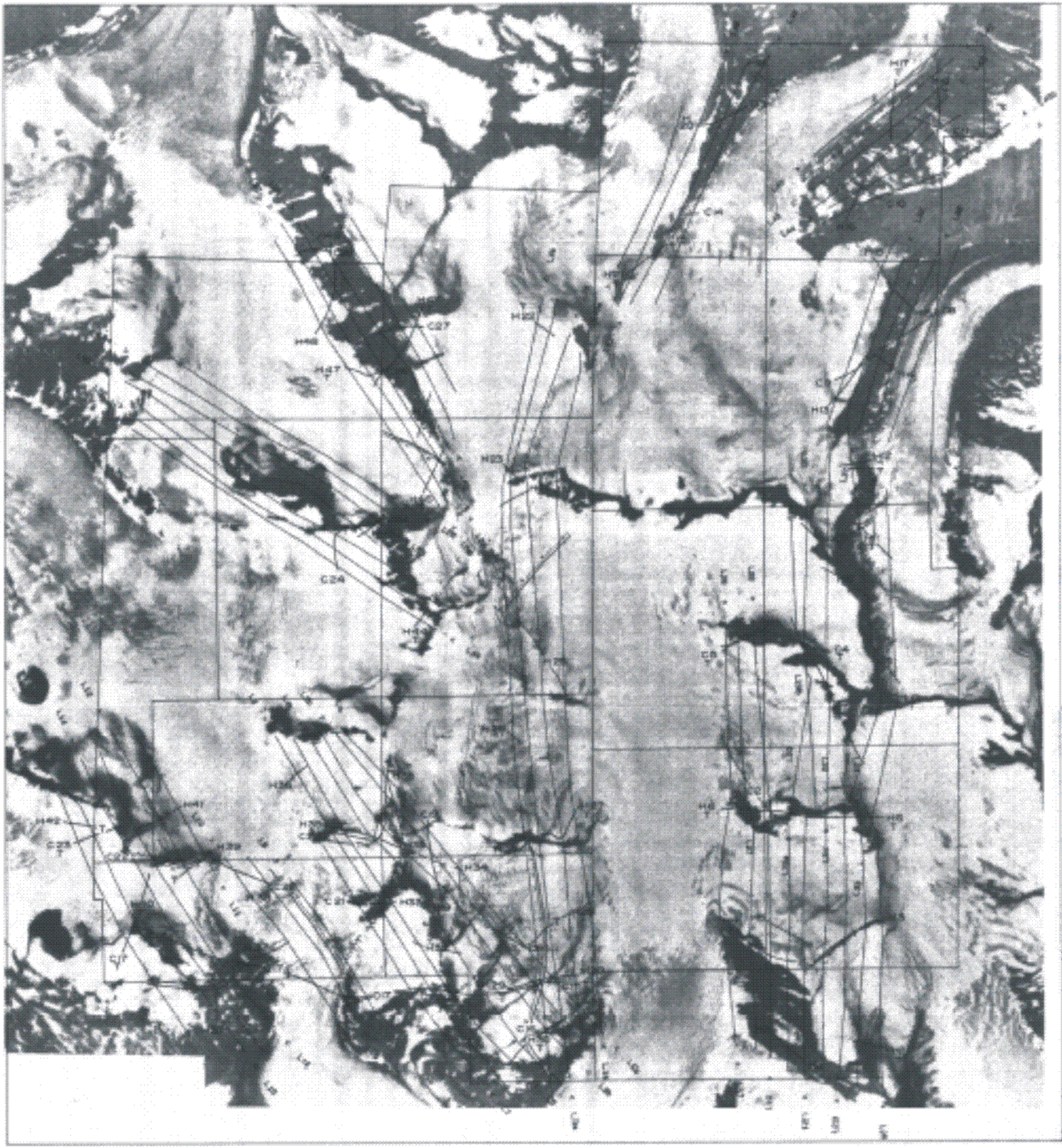
Contoured Total Field with Quadrature Overlay

Scale 1: 20000.0

Date: MAY 1990 | Survey: MAR 1990 | Fig. 10

WESTERN GEOPHYSICAL AERO DATA LTD.


GEOLOGICAL BRANCH
ASSESSMENT REPORT
20,073
N.T.S 104B/8E & 104B/9E
NORTHWIND VENTURES LTD.
LINDA 1-18 CLAIMS
RADAR ALTIMETER PROFILES
BASE LEVEL = 50 metres, SCALE = 100 metres/cm
WESTERN GEOPHYSICAL AERO DATA LTD.



CUTLER TRANSMITTER

HAWAII TRANSMITTER

—CN— CUTLER CONDUCTOR

—HN— HAWAII CONDUCTOR

—T— TOPOGRAPHIC/INCREASED GROUND TO SENSOR EFFECT

INTERPRETED FAULT

MAGNETIC/GEOLOGIC CONTACT

GEOLOGICAL BRANCH
ASSESSMENT REPORT

# 20,073

N.T.S. 104B/8E & 104B/9E

NORTHWIND VENTURES LTD.

LINDA 1-18 CLAIMS

GEOPHYSICAL INTERPRETATION MAP

With Flight-Line and Claim Boundary Overlay

Scale 1: 20000.0

WESTERN GEOPHYSICAL AERO DATA LTD.