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EXPLORATION ASSESSMENT REPORT, LABRADOR CITY, NEWFOUNDLAND-LABRADOR

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IRON ORE COMPANY OF CANADA

RESOURCE ASSESSMENT PROGRAM
LABRADOR CITY, NEWFOUNDLAND-LABRADOR

EXPLORATION ASSESSMENT REPORT OF MAP DESIGNATED CLAIMS
CDC1020712, CDC1020713, CDC1020714, CDC1020715, CDC1020716,
CDC1020717, CDC1020718,

CANTON LISLOIS, PROVINCE OF QUEBEC.
NAD 27; ZONE 19; NTS: 23B/14

JANUARY-DECEMBER 2001

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Summary

Iron formations were first examined in the Wabush Lake region in 1933. In 1936 LM&E was formed to explore the iron ore potential of the Wabush Lake region. Recognition in 1949 of the value of coarse-grained metamorphosed iron-formations as a source for high quality iron-ore concentrates, led to extensive, rapid exploration and mine development in the Wabush Lake region. In 1949 IOCC was formed to develop the Carol Lake Project. In 1962 IOCC opened its first open pit mine (Smallwood), and by January 1996 IOCC had extracted more than one billion tonnes of crude iron ore from its open pit mining operations.

Following the acquisition of IOCC shares from North Limited by Rio Tinto in August 2000, (who became the principal shareholder), IOCC initiated the **R**esource **A**ssessment **P**rogram (**RAP**) in October 2000 with a mandate to define an additional 1.5 billion tonnes of iron ore reserves in the vicinity of its current mining operations.

The IOCC RAP project is centred near the Municipalities of Wabush and Labrador City. It covers a total area of approximately 135,746 hectares straddling the Quebec (claim # CDC1020712, CDC1020713, CDC1020714, CDC1020715, CDC1020716, DC1020717, CDC1020718) -Newfoundland-Labrador provincial boundary immediately north of the town of Fermont and extends to the northeast to Rannie Lake, Newfoundland-Labrador.

To evaluate IOCC holdings and meet objectives, the following activities were initiated in 2001: staking of prospective targets on open ground; geophysical surveys including aeromagnetics gradient and ground gravity surveys; geological and structural mapping; surface sampling, drilling, and computation of historical data.

The key results from the 2001 phase 1 RAP program are as follows:

- F1/ F2 interference folds played an important role in terms of the distribution and economic viability of iron ore bodies. The dominant structural trends between Polly Lake and Julienne Lake are controlled by northeast trending F2 folds and thrust faults, which cut, overturn, and repeat the MIF ore-bearing horizon. These structures are superimposed on earlier F1 structures, causing structural thickening of iron ore beds.

- Gravity surveys provide a quantitative evaluation of a prospect and allows a better selection of drill hole targets for prospect evaluation.

- Areas with positive magnetic and gravity signature, F1/F2 fold interference patterns, and favourable geology are prime exploration targets.

- The Polly Lake prospect area has the potential to host a sizeable (>100Mt) iron ore deposit.

The results from the 2001 Phase 1 RAP program are considered to be very encouraging and further work is recommended to fully evaluate the iron resources potential of the Polly Lake area. This work would include;

1) Re-assessment and integration of all geological, structural, aeromagnetic, gravity, and field mapping data, in order to generate a new geological map of the Wabush-Shabogamo Lake area. An attempt to differentiating the Sokoman Fm. into UIF, MIF and LIF should be made.

2) Follow-up drilling at Polly Lake to delineate the extent and geometry of the iron ore mineralisation. Ore characterization should be initiated during this phase of drilling.

3) Detailed structural mapping over the Polly Lake area is recommended.

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1. Introduction

IOCC initiated the **R**esource **A**ssessment **P**rogram (**RAP**) in October 2000 to evaluate its holdings, and ensure a long-term and sustainable resource base. The RAP mandate is to define an additional 1.5 billion tonnes of iron ore reserves in the vicinity of its current Labrador City mining operations, west of Wabush Lake.

To evaluate IOCC holdings and meet objectives, the following activities were initiated: staking of prospective targets on open ground, geophysical surveys including aeromagnetics gradient, ground gravity surveys, research and eventual implementation of test airborne gravity survey as systems develop, geological and structural mapping, surface sampling and drilling, and computation of historical data.

This report describes the work done on the Polly Lake area between January, 2001 and December 2001. During this period the exploration program within the Polly Lake area included:

- Data compilation and evaluation of the Polly Lake area.
- Aeromagnetic surveying data processing, geological and structural interpretation.
- Map staking of seven explorations claims surrounding Polly Lake.
- Field evaluation (*incl.* geological and structural mapping, and surface sampling)
- Detailed gravity surveys.
- Drill target definition.

2. *Background and Previous Work*

2.1 Background

Iron occurrences located between Hudson Bay and the Labrador coast were initially reported in 1870 by missionary and explorer Father Pierre Babel, but it was not until 1933 that iron formations in the Wabush Lake Region were first examined. Very little was known about the geology of the Wabush Lake Region prior to 1949, but recognition of the value of coarse-grained metamorphosed iron-formations as a source for high quality iron-ore concentrates led to extensive, rapid exploration and mine development. (Gross. G.A., 1968)

In 1936 Labrador Mining and Exploration Company (LM&E) was granted prospecting concession rights to an area of approximately 56,980 square kilometres in Western Labrador. By 1949 significant iron ore reserves had been identified within LM&E concessions. With the formation of IOCC in 1949 an agreement was made between LM&E and IOCC which granted IOCC the right to explore selected areas within the LM&E concessions. This agreement led to the development of IOCC's Carol Lake Project, located west of the Wabush Lake, with initial reserves of more than 200 million tonnes of iron ore grading approximately 38 % Fe (Tim Leriche, personal communication). IOCC's Smallwood open pit mine officially opened in July of 1962. Since then, several open pits surrounding the Smallwood mine have been put into production. At the end of January 1996 IOCC extracted more than one billion tonnes of crude iron ore from its open pit mining operations. IOCC's proven and probable current reserves stand at approximately 1.5 billion tonnes.

IOCC conducted intermittent reconnaissance exploration work from the early 1950's until 1979, to investigate the iron ore potential in the vicinity of its mining operations. This work included regional aeromagnetic surveys in 1951 and 1972, regional mapping and sampling at a scale of 1:12 000, limited reconnaissance ground magnetic (dip needle and magnetometer), gravity surveys, and drilling. Most of this work-focused on/or near nineteen sublicenced blocks (licences 24 to 42). A total of 1405 drill holes have been drilled in reconnaissance exploration. Many of these holes were designed to trace the iron formation units and not to test for tonnage or grade. The majority of the holes drilled on the sublicenced blocks were BX and AX core size, generally shallow (< 30 m) with core recoveries usually less than 50 percent.

The 1950 -1979 exploration campaign returned several significant drill holes intercepts and surface sample assay results on or near the sublicenced blocks, but little follow-up work was done, leaving several areas untested.

During the same period LM&E and Holannah Mines conducted limited reconnaissance ground magnetometer, gravity surveys and drilling, in the Huguette, Hermski, Jackson, North Wabush, Throne, Danek, Grace and Shabogamo Lake areas, and Polly Lake area. Work done by Canadian Javelin Limited from 1956 to1966 on the Julienne peninsula at the north end of the Wabush Lake, which included mapping, ground magnetometer and drilling (1059.8 metres in nine holes), outlined a potential indicated ore reserves of 416,663,000 tons of iron ore grading 34.2 % Fe.

Following the acquisition of IOCC shares from North Limited by Rio Tinto in August 2000, (who became the principal shareholder), IOCC initiated the RAP program with a mandate to define an additional 1.5 billion tonnes of iron ore resources in the vicinity of its current mining operations. The ore being sought is of a quality to satisfy IOCC's customers' stringent compositional requirements and of a quantity that will support a world class operation.

2.2 Previous Work

1949 : regional geological mapping (H.E. Neal, 1950)

1953 : geological mapping, sampling, dip needle survey (Crouse, R.A., 1954)

1956 : claims staked in Quebec (Holannah Mines)

1957 : mapping, dip needle survey (Sofanio, Holannah Mines)
: mapping, 20 ddh (Mathieson, 1957)

1958 : 12 ddh at Polly Lake - HH series holes – assay data not included with drill logs (R.Jury, 1958 – Holannah Mines)

1958 – 1971: Quebec ground withdrawn from staking

1971 : 30 claims staked in Quebec by IOC

1972 : aeromagnetic survey, geological mapping

1973 : geological mapping, geophysics (magnetics and gravity) (C.Hamilton, 1973)

1974 : gridding, geophysics (gravity and magnetics)

1979 : ground magnetic survey
: regional geological compilation (Muwais, W., 1979)

2000 : compilation report on sublicenced blocks (R. Hulstein, M. Flis. 2000)
: Landsat based regional structural synthesis (Watts, Griffis and McOuat, 2001)

3. *Location and Access*

The Polly Lake Prospect is a moderate to small property totalling 306.84 ha. The property is situated 12 km. SW of Labrador City and 9.0 km NNE of Fermont. It covers the Quebec portion of the main prospective area, which straddles the provincial boundary with Newfoundland-Labrador. Access requires the use of a four-wheel drive vehicle, is along a previously established drill road that strikes to the northeast off Highway 389-530 at a point located 17.1 km southwest of Labrador City, with the target area located 4.7km from Highway 389 (figure3.1).

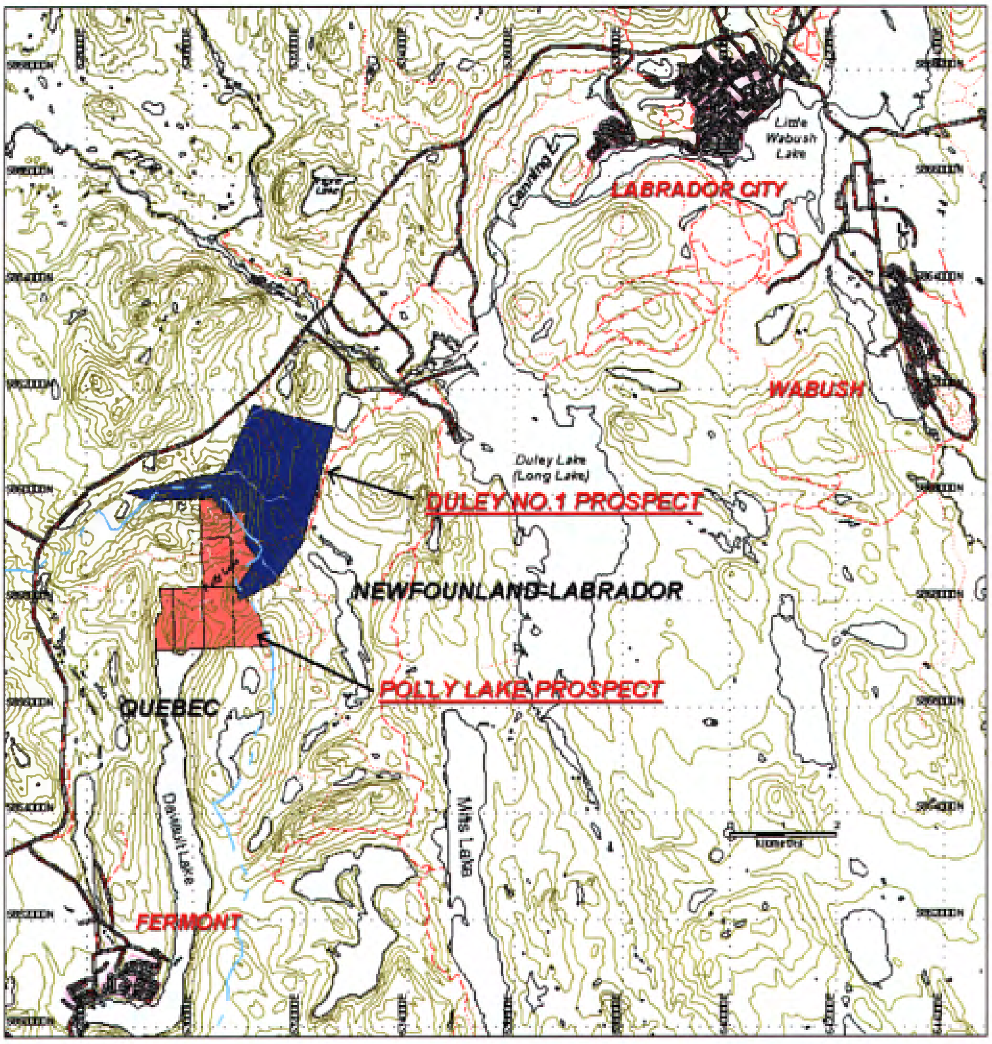

Figure 3.1 – Polly Lake Prospect, Location Map.

4. IOCC Land Holdings

IOCC's Quebec Polly Lake land holdings consists of seven (7) map designated exploration claims in the Province of Quebec, covering a total area of 306.84 hectares (table 4.1). IOCC claims are shown in figure 4.1.

Table 4.1 Quebec Map Staked Claim Status.

Claim #	Licence Name	Licence Type	Location	Area (Hectares)	Expiry Date
CDC 1020712	Polly Lake	Exploration	Quebec	25.50	06-11-2003
CDC 1020713	Polly Lake	Exploration	Quebec	52.04	06-11-2003
CDC 1020714	Polly Lake	Exploration	Quebec	52.04	06-11-2003
CDC 1020715	Polly Lake	Exploration	Quebec	36.27	06-11-2003
CDC 1020716	Polly Lake	Exploration	Quebec	52.03	06-11-2003
CDC 1020717	Polly Lake	Exploration	Quebec	39.88	06-11-2003
CDC 1020718	Polly Lake	Exploration	Quebec	49.08	06-11-2003

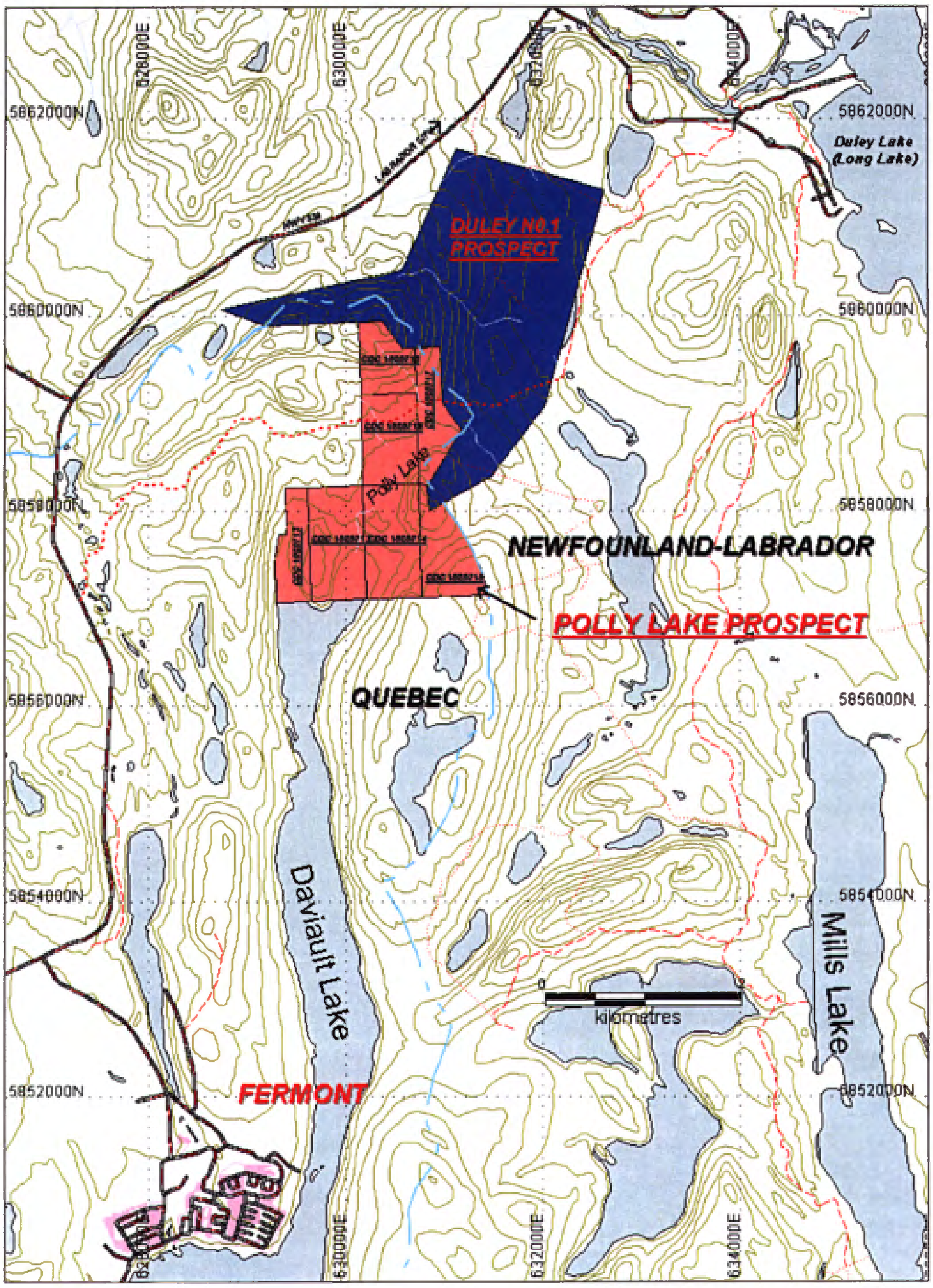

Figure 4.1 – Polly Lake Claim Location Map, Province of Quebec.

5. *Regional Geology*

IOCC's iron ore mining operations and exploration programs are centred on Lower Proterozoic (c.a. 2.0 Ga) iron formations of the Knob Lake Group, which lies within the lithotectonic Gagnon Terrane, in the Grenville Province of Western Labrador.

The Knob Lake Group is a continental-margin sedimentary sequence, consisting of pelitic schists, iron formations, quartzite, dolomitic marbles, semipelitic gneiss and subordinate local mafic volcanics. It unconformably overlies the Archean Ashuanipi Metamorphic Complex which is predominantly composed of granitic and granodioritic gneisses. The Knob Lake Group was deformed and subjected to greenschist to upper amphibolite facies metamorphism within a north-westerly verging ductile foreland fold and thrust belt, during the Grenville Orogeny (Lee. C., November 2001). It is best exposed in the region west of Wabush Lake, extending southeast into the province of Quebec, and northeast beyond the northend of Shabogamo Lake.

The Knob Lake Group is represented by six formations (in ascending order); the Attikamagen, the Denault, the Mackay River, the Wishart, the Sokoman and the Menihek Formation (Fm.) (table 5.1), which occur in varying proportions along the northeast trending belt (figure 5.1), and are briefly described below.

The ***Attikamagen Fm.*** also known as the Katsao Fm. is the oldest stratigraphic meta-sedimentary rock sequence within the Knob Lake Group. The formation which can reached up to 300 metres in thickness, unconformably overlies the Archean Ashuanipi Metamorphic Complex, and predominantly consists of brownish to creamy coloured banded, medium to coarse grained quartz-feldspar-biotite-muscovite schists and lesser gneisses. Accessory minerals include chlorite, garnet, kyanite and calcite. The Attikamagen Fm. appears to be best preserved in the deeper portions of the continental shelf, east of Wabush and Shabogamo Lakes, where the formation thickness is the greatest. Towards the foreland, in the northwest, the formation tapers out and disappears, leaving upper units of the Knob Lake stratigraphy in contact with the Archean basement (Lee. C., 2001).

Conformably overlying the Attikamagen Fm. is the ***Denault Fm.*** also known as the Duley Fm. This formation consists of coarse grained, banded, dolomitic and calcitic marble up to 75m thick with minor tremolite, quartz, diopside and phlogopite as accessory minerals. In the Wabush Lake area the Denault Fm. has only been identified east and south of the lake, and represents a transition between the shallow and deeper parts of the continental shelf.

Overlying the Denault Fm. is the ***Mackay River Fm.*** It consists of volcanogenic water-laid metatuffaceous sediments and conglomerate units. This sequence is not present in the general mine area and occurs mainly northeast of Shabogamo Lake.

The ***Wishart Fm.*** also known as the Carol Fm. conformably overlies the Denault Fm. (where present) or unconformably overlies the Attikamagen Formation. It consists of a 60 - 90 m thick sequence of white, massive to foliated quartzite, that is typically resistant to weathering and erosion, forming prominent hills in the Wabush Lake Region. Several areas with prominent exposures of especially pure quartzite have been staked as silica prospects and one area held by Shabogamo Mining is under sporadic development. This formation appears to pinch out to the north and has not been mapped north Shabogamo Lake. The Wishart Fm. can be subdivided into the Lower, Middle and the Upper Members based on variation in composition and texture.

The *Lower Member* consists of white to reddish brown coloured quartz-muscovite schists with varying percentage of garnet and kyanite.

The *Middle Member* is a coarsely crystalline quartzite, often an orthoquartzite, which is generally massive to banded. Accessory minerals include carbonates, amphiboles (varying from tremolite and/or anthophyllite to grunerite and/or cummingtonite), garnets, micas (muscovite, sericite and biotite) and chlorite. Intervals of iron-rich carbonates or their weathered products, limonite and goethite may also occur.

The *Upper Member,* who exhibits a gradational contact with the overlying Sokoman Fm., generally consists of bands of carbonate alternating with bands of quartzite. The presence of thin layers of muscovite and biotite schist (pelitic layers) is common. Accessory minerals include grunerite, garnets, kyanite and staurolite.

The ***Sokoman Fm.*** also known as the Wabush Iron Fm. is the ore-bearing formation in the Wabush Lake-Mount Wright area. The formation conformably overlies the Wishart Fm., where it is present, but also locally shares its basal contact with the Denault, Mackay Lake, Attikamagen Formations, and the Ashuanipi Metamorphic Complex. The Sokoman Fm. is also subdivided into Lower, Middle and Upper Members.

The *Lower Member* **(LIF)** consists of a 0 - 75 m thick sequence of fine to coarse grained banded quartz - carbonate, and/or quartz - carbonate - magnetite, and/or quartz-carbonate (i.e siderite, ankerite and ferroan-dolomite) - silicate (i.e. grunerite, cummingtonite, actinolite, garnets), and/or quartz - carbonate - silicate - magnetite, and/or quartz - magnetite - specularite units. Mixtures of these units can occur both vertically and laterally. This member may contain iron ore locally.

The *Middle Member* **(MIF)** which forms the principal iron ore unit, consists of a 45 - 110 m thick sequence of quartz-magnetite, and/or quartz-specularite-magnetite, and/or quartz-specularite-magnetite-carbonate, and/or quartz – specularite – magnetite - anthophyllite gneiss and schist units. Actinolite and grunerite rich bands can be present in this member. Martite can also occur in weathered zones by alteration of magnetite.

The *Upper Member* (**UIF**) consists of a 45 – 75 m thick sequence similar in composition to the Lower Member and can generally only be differentiated through their contact relationships with the overlying and underlying formations supported by detailed structural interpretations.

The hydrous iron oxides, limonite and/or goethite have been observed in all members of the Sokoman Fm. Limonite and/or goethite are present in weathered and fractured zones and are derived primarily from alteration of carbonates (Muwais, 1974). Pyrolusite (MnO_2) was also observed in all members of the Sokoman Fm. and is typically associated with surficial or supergene enrichment, extending to depth along and adjacent to fault and fractured zones.

The ***Menihek Fm.*** also known as the Nault Fm. is the youngest formation of the Knob Lake Group. It consists of a 15 - 75 m thick sequence of pelitic sediments. The Formation is commonly fine grained, foliated and variably comprised of quartz-feldspar-mica (biotite-muscovite)-graphite schist units. Garnets, epidote, chlorite, and carbonates are accessory minerals. This unit is well preserved adjacent to the craton in the southern region, and within broad synclinal regions in the north. A number of properties have recently been staked over areas of high graphite content. Mazarin and its manufacturing partner Graphtech are currently carrying out a feasibility study of the Lac Knife graphite deposit in the Province of Quebec.

The ***Shabogamo Intrusive Fm.*** is the youngest Precambrian rock formation in the Wabush Lake area. It consists of massive, medium to coarse-grained basic intrusive (gabbro, olivine gabbro and amphibolites) non-magnetic sill-like bodies with ophitic to subophitic textures. These sills may be locally discordant and have a tendency to become schistose near the contact with other rock formations. Most of the gabbro sills are composed of plagioclase, pyroxene, olivine and minor amounts of magnetite and ilmenite. The amphibolite equivalents are commonly made of hornblende, biotite, garnets, quartz and chlorite. Pyrite, muscovite, and feldspar are accessory minerals. The gabbro sills are most abundant east and southwest of the Wabush Lake.

Table 5.1 Stratigraphic Units of the Knob Lake Group	
Formation	**Lithological Description**
Menihek Fm.	• Pelitic Schist; quartz - feldspar - mica (biotite-muscovite) - graphite schist
Sokoman Fm.	• ***Upper Member*** - banded silicate - carbonate - oxide facies iron formation • ***Middle Member*** - (**iron ore unit**) - banded oxide (specularite - magnetite) facies iron formation. Carbonate, anthophyllite, grunerite and actinolite can be present. • ***Lower Member*** - banded silicate - carbonate - oxide facies iron formation. May contain ore locally.
Wishart Fm.	• ***Upper Member*** - Predominantly quartzite. Alternating bands of quartzite and carbonate as well as thin layers of muscovite and biotite (pelitic schist) can be present. Accessory minerals - grunerite - garnets - kyanite - staurolite. • ***Middle Member*** - Massive to banded quartzite and orthoquartzite. Accessory minerals - carbonates - amphiboles - garnets - micas - chlorite. • ***Lower Member*** - Quartz - muscovite (+/- garnet, kyanite) schist.
Mackay River Fm.	• Volcanogenic water-laid tuffaceous and conglomerate units.
Denault Fm.	• Banded dolomitic and calcitic marble with minor tremolite, quartz, diopside and phlogopite.
Attikamagen Fm.	• Banded quartz - feldspar - biotite – muscovite schist and gneiss. Accessory minerals - chlorite - garnets - kyanite - calcite.

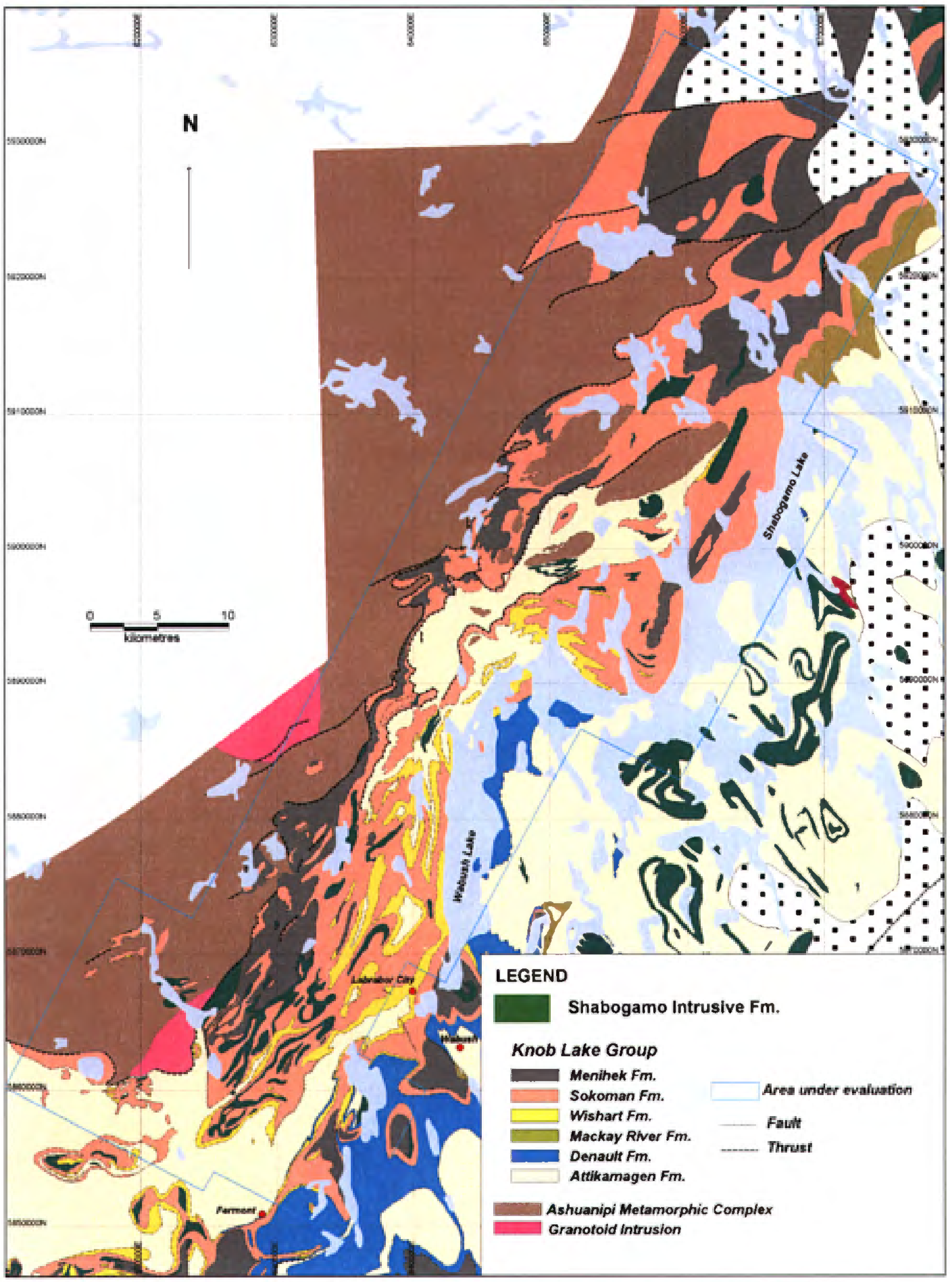

Figure 5.1 - Regional Geology of the Wabush Lake Region, Quebec-Newfoundland

6.0 Exploration Program

6.1 Objectives.

The primary objective of the 2001 RAP exploration program was to evaluate and integrate all pre-existing geotechnical data with recently acquired geophysical and geological data, for follow – up work directed toward drill target identification and potential enhancement of the sublicenced blocks and surrounding areas. The exploration program also aimed to secure iron ore resources that have chemical and physical characteristics similar to or better than those mined today. Table 6.1 shows the typical chemical and physical components of the crude ore that is currently mined at IOCC operations. New discoveries with sufficient tonnage would have to meet or exceed this criteria to be considered economically viable under current market conditions.

Table 6.1: IOCC's chemical and physical crude ore characteristics.

	Fe	WR	CaO	MgO	Mn	Al2O3	SiO2	TiO2	Mag	m200	RMI	L/G
Average	38.9	46.9	2.07	1.42	0.33	0.20	36.9	0.024	19.0	17.0	17.5	1.83
Minimum	37.8	42.0	0.83	0.51	0.29	0.16	36.9	0.024	11.9	14.4	16.0	0.62
Maximum	43.0	48.8	2.41	1.64	0.47	0.56	36.9	0.024	22.8	24.9	20.8	5.70

Data extracted from Flis, M. 2001 internal report. **WR** (weight recovery), **Mag** (Magnetite content), **m200** (-200 mesh fraction), **RMI** (Rod Mill Index), **L/G** (Limonite-Goethite content). All of the above values are in percent.

6.2 Work carried out between January 1st and December 31st, 2001.

- Between January 1st, 2001 and June 1st, 2001 a review and compilation of historical work done within the Duley#1-Polly Lake prospect area was completed.

- Between January and May, 2001 an aeromagnetic survey was flown over the Duley No.1-Polly Lake prospect region.

- Between June and October, 2001 a field evaluation of Duley#1- Polly Lake prospect area was completed.

- Between June and November 2001 a detailed gravity survey was conducted over the Duley#1 - Polly Lake prospect and surrounding area.

6.3 Aeromagnetic Geological and Structural Interpretation.

Following the completion of the 2001 regional aeromagnetic survey covering the current IOCC land holding in the Labrador City area, Chris Lee, structural geologist with SRK Consulting, was retained to conduct a regional interpretation of the structural geology of the Wabush-Shabogamo lakes region, with an emphasis on its controls on the location and development of economically viable iron ore deposits pertaining to the structural geology of the area were also reviewed.

The primary objectives of the 2001 structural interpretation were:

- to acquire an understanding of the tectonic setting of the Sokoman Fm., its deformation and metamorphism at a regional scale, and integrate this understanding into on-going field investigations and geophysical modelling. Of particular interest is the differentiation of the Sokoman Fm. into its three principal component: Lower Iron Fm. (LIF), Middle Iron Fm. (MIF) and Upper Iron Fm. (UIF).
- to identify the key structural controls on current and past producing iron ore bodies, at a local scale, in order to help delimit targets within the exploration property.
- to develop criteria to help in the recognition of favourable geological and structural settings for targeting and prioritisation of potential anomalies.

Conclusions generated by SRK's (Lee.,C. 2001) recent work are that:

- The effects of the Grenvillian Orogeny and the architecture of its Archean basement rocks govern the structure of the Knob Lake Group.
- Three distinct episodes of deformation (D_1, D_2, and D3) have been recognised. D_1 and D_2 structures are the most important in terms of distribution of existing iron ore bodies, and these controls should guide future exploration work and target definition.
- Economic ore bodies are coincident with the superposition of F1 and F2 synclines.
- Thickening of the MIF horizon during the F1 folding event is considered the most important factor in the development of an economic ore body. F1 folds are isoclinal, recumbent folds with west to southwest vergence, and characterised by a high degree of flow thickening in the fold hinges relative to typical F2 folds. F2 folds are more upright and open than F1, but still have a strong westward vergence.
- The dominant structural trends in the area around the mine, west of Wabush Lake, Newfoundland-Labrador and North of Daviault Lake, Province of Quebec, are controlled by NE-trending F2 folds and thrust faults, which cut, overturn, and repeat the MIF ore-bearing horizon. These structures are superimposed on earlier F1 structures, and the resulting interference patterns are largely responsible for the geometry of the Knob Lake stratigraphy, and thick accumulations of iron ore.

- More viscous flow of hematite, relative to magnetite, may serve to upgrade ore quality by preferentially thickening hematite rich horizons during deformation.

6.4 Geophysics

Gravity and magnetics are the principle geophysical tools used in iron ore exploration. Geophysical work conducted in 2001 includes the compilation of old geophysical surveys, the execution of a regional aeromagnetic survey and ground gravity surveys on selected exploration targets.

Geophysical surveys compilation

The purpose of this work was to compile all geophysical surveys within Wabush-Labrador City area. Oldest geophysical surveys include ground magnetic, airborne magnetic, airborne electromagnetic and gravity surveys. These surveys have been reviewed to extract all pertinent and reliable data. An evaluation of these old surveys showed that only the gravity data is relevant.

The only compilation done in the province of Quebec is a gravity survey conducted by IOCC in 1975, around Polly Lake, Lislois Township. This survey is now superseded by the 2001 IOCC gravity survey.

6.4.1 Aeromagnetic Survey

An aeromagnetic survey was completed in 2001 to further define the extension of the Sokoman Fm. between Fermont and Rannie Lake (figure 6.4a). Iron formations are the only magnetic rocks within this area; therefore a magnetic survey is the most effective tool to delineate these formations.

The purpose of this survey was to provide high-resolution magnetic data with such high precision that further ground surveys would be unnecessary. The magnetic expression of the exploration area provides definitive support to structural and geological interpretation. This contributes to the delineation of exploration targets and their sequential investigation through prospecting and drilling.

The company Terraquest under the supervision of the firm Paterson, Grant & Watson conducted the aeromagnetic survey. Cowen Geodata Services processed the data and delivered the final map image.

Specifications of the survey

The survey, which totals 24,065 km of flight lines, consisted of 932 100m-spaced traverse lines totalling 21,782 km at azimuth 120° - 300°, and 41 1km-apart tie lines totalling 2,283 km at an azimuth of 30° - 210°. Measurements are collected every 6m along the lines. Flight lines are shown on figure 6.4b. Survey specifications are detailed in the Terraquest's report, which is attached to this report in appendix A. The survey covers 2148.2 km^2, of which 73.2 km^2 are located in the Lislois township, Quebec.

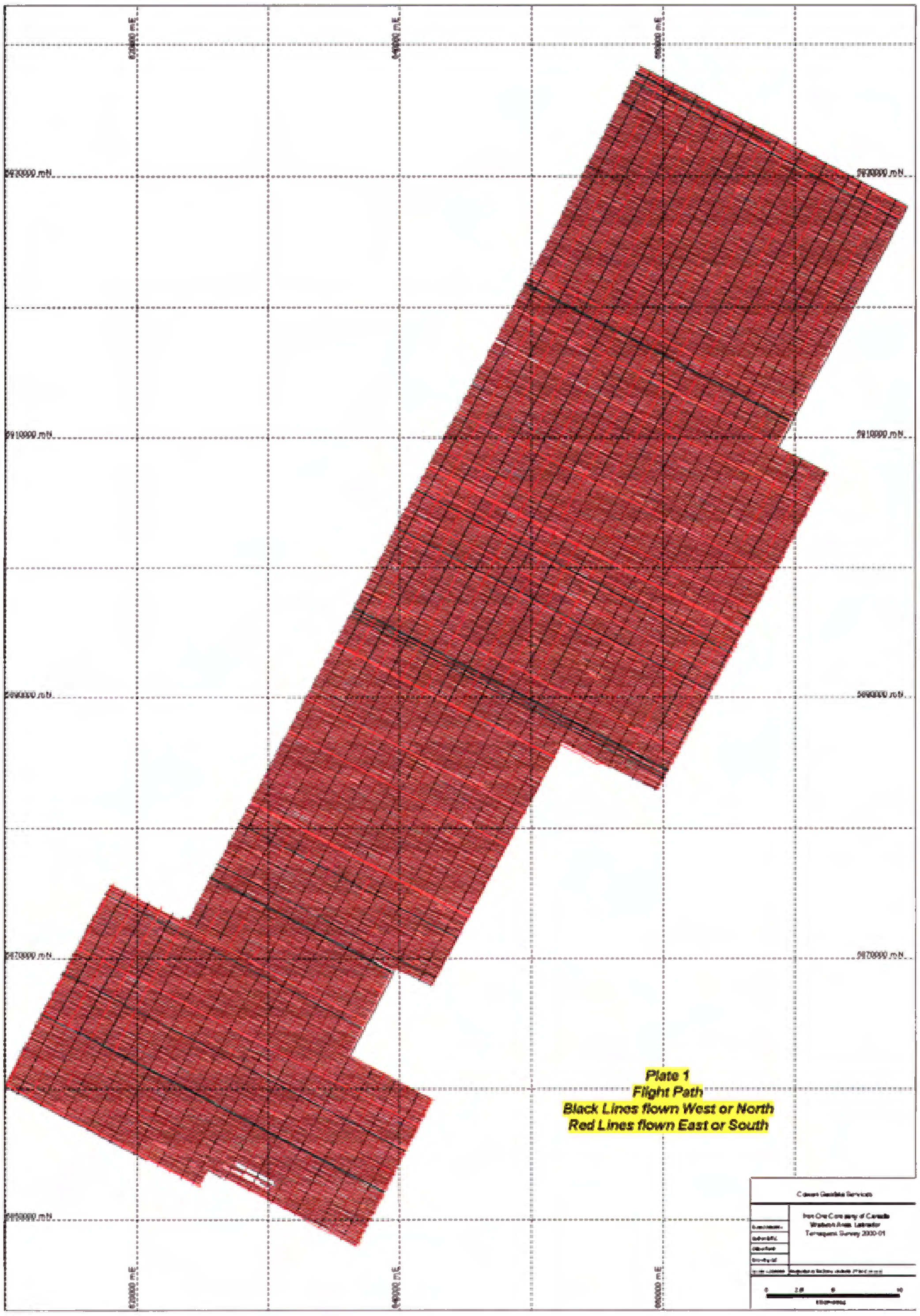

Figure 6.4b – Flight lines of the 2001 aeromagnetic survey.

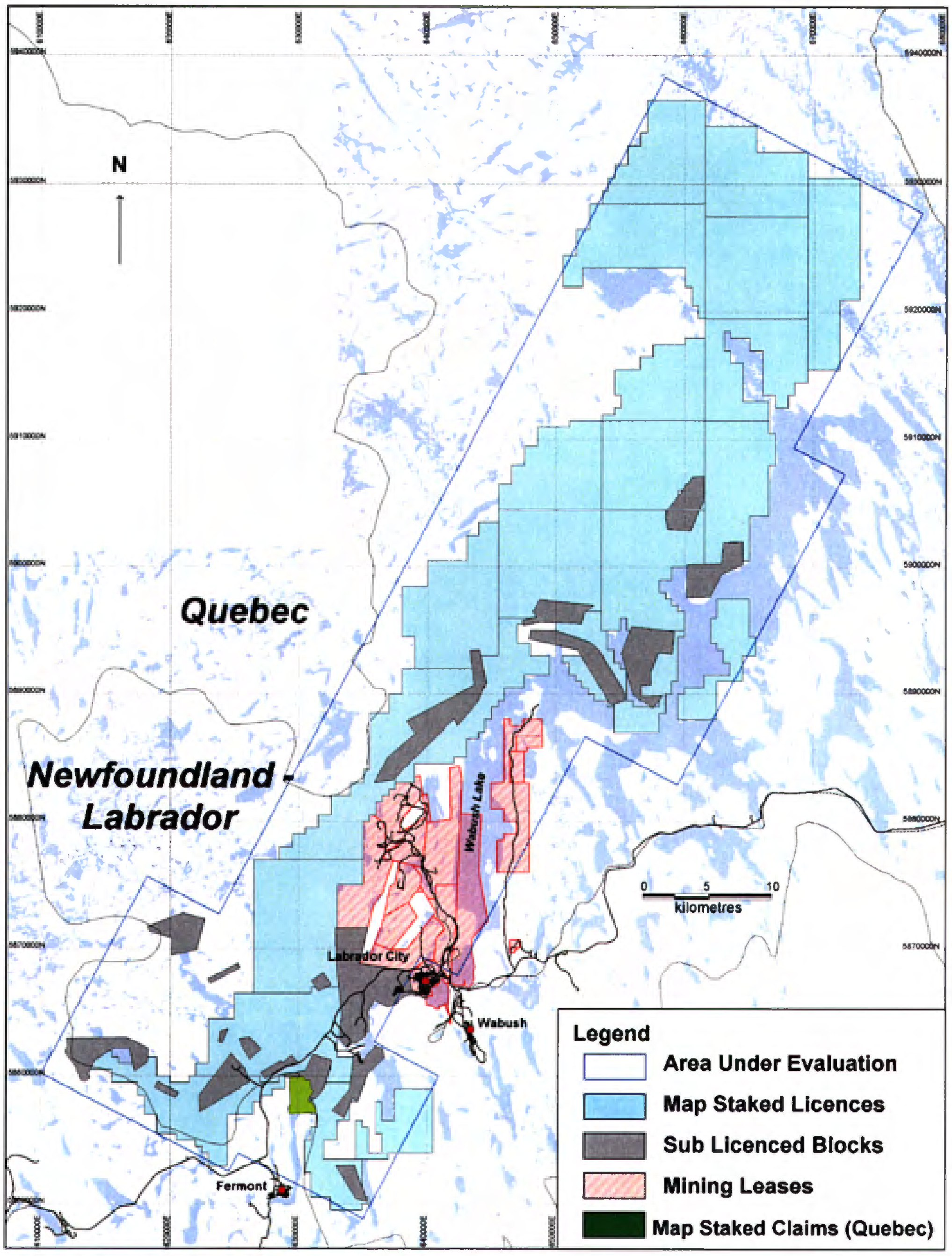

Figure 6.4a – 2001 Aeromagnetic Survey (blue) and IOCC Tenements Location Map.

The data was acquired between January 5, 2001 and May 1, 2001. Due to irregularities and inconsistencies in the data, Terraquest was contacted to solve the problem. In September 2001 wishing to achieve final results, IOCC sent Terraquest's partially corrected data to Cowan Geodata Services. Cowan Geodata carried out quality control and reprocessed the data in order to get the best possible results. The final products were delivered in mid-October, 2001.

Quality Control and Data Processing

Problems that affect the data are numerous. They are observed in GPS data, radar altimeter and magnetic base station. They are well described in Cowan's report in appendix B. The description of the data processing and the products delivered are also included.

Despite inconsistencies in the survey, it is still a valuable tool for selecting and evaluating exploration targets, and guiding geological interpretation. However, care should be exercised when evaluating the data on detailed prospect scale. Particular care should be taken in inversion and modelling of magnetic and gravimetric data. If a shift of the model is required to best-fit magnetic and gravimetric data, localisation of the data should be double-checked. Ground surveys could be required.

Presentation of data

Data processing can be divided in two groups. The first group consists of corrections that should be applied to raw geophysical data to remove the effects of changing conditions under which the data were collected. Raw data must be corrected to represent only the effects of the physical properties of the geological environment. Corrections that should be applied to an airborne magnetic survey include diurnal variation of the earth magnetic field, aircraft heading, instrumental drift, lag error between location of the GPS antenna and the magnetic sensor, difference of elevation between contiguous flight lines, etc.

The second group of data processing aims at the enhancement of geophysical signals revealing some geological features. They include gridding, filtering, derivatives, 3D-analytic signal, upward and downward continuation, reduction to the pole, automatic gain compensation, texture, terrace, Euler 3D-deconvolution, etc.

Cowan Geodata Services processed the data and produced the following grids:

- **Enhanced Total Magnetic Field**: The original TMI map shows numerous flaws in localisation and levelling. The enhanced total magnetic intensity grid was levelled using the Geosoft method of calculating pseudo-line using transverse gradient. All other products are derived from this grid.

- **Automatic Gain Compensation** Filter of Enhanced TMI: This filter enhances the signal from the shallow sources. The filter operates on a moving window of data and normalises amplitudes to enhance small amplitude anomalies while attenuating large amplitude anomalies. The AGC enhancement has no directional bias. This is a spatial filter so it does not suffer from the edge effects seen in the FFT methods. The AGC filter had less tonal information content than the separation filter greyscale images so it was only used as worksheet to highlight local detail.

- **1st Vertical Derivative**: This is the vertical variation rate of the magnetic field vertical component. This enhancement sharpens up anomalies over bodies and tends to reduce anomaly complexity, allowing a clearer imaging of the causative structures. The transformation can be noisy since short wavelength noise is amplified.

- **2nd Vertical Derivative**: This is the vertical variation rate of the magnetic field first vertical derivative. This enhancement accentuates the edges of structures thus sharpening anomalies and exaggerating discontinuities, facilitating location of faults and structures within upper geological section. It emphasises the expressions of local features, and removes the effects of large anomalies or regional influences. Zero values indicate the outlines of individual blocks or the edges of disturbances or faults.

- **3D Analytic Signal Amplitude**: The analytic signal is the vectorial addition of the three orthogonal derivatives. It generates a maximum directly over discrete bodies as well as their edges. The width of a maximum, or ridge, is an indicator of depth of the contact, as long as the signal arising from a single contact can be resolved. It is used in 3D Euler deconvolution for the determination of the position, depth and nature of any sources present.

- **Separation Filter:** Long wavelength anomalies, which are associated with regional field or background, are removed. The remaining residual field consists of shorter wavelength anomalies associated with sources in the uppermost level of the ground.

- **Terraced Separation Filter**: Apparent magnetic susceptibilities were calculated with the USGS terracing operator. This method is used to delineate areas of crust with similar magnetic properties.

- **GLCM Texture Filter**: Texture is an innate property of any image. In the literature describing image processing and analysis it is common to find an image described in terms of its tone and texture. Tone is basically equivalent to amplitude in geophysical terms and corresponds to the varying shades of colour assigned to individual pixels. In contrast texture refers to the spatial/statistical distribution of the tones. Thus it is fundamentally different from tone, which is defined at one location (pixel) since texture occurs over some finite area and hence requires some finite number of pixels to represent it. 'Texture filters' analyse the textural characteristics of a window which is progressively moved over the dataset to be filtered. At each location the data within the window are analysed and a parameter calculated which represents the amount that a particular textural characteristic presents. The spatial variation in this parameter is used to generate a new image. Thus, the resulting 'texturally filtered' image is a map of the variation in texture within the data. This project used a 7 x 7 windows and difference variance parameter F10.

- **Gradient Tilt Angle**: The gradient tilt angle is defined as the ratio of the vertical gradient to the total horizontal gradient of the potential field. The gradient tilt angle has some interesting properties. As a dimensionless ratio it responds equally well to shallow and deep sources and to a large range of amplitudes from sources at the same level. The tilt angle is positive over a source and negative elsewhere and has a range of –90° to +90°, so it is much simpler than the analytic signal phase angle.
  Gradient tilt = $\tan^{-1}$ (vertical gradient / absolute total horizontal gradient)

- **Altimetric Digital Topographic Map**: Produced from the GPS height and radar altimeter data. Data was not been levelled and the grid shows severe corrugation.

Maps showing the Quebec part of these products are presented at the scale of 1:50000 in appendix C. Figures of the whole survey presenting these products or a combination of products at the scale 1:250000 can be found in the Cowan's report in appendix B.

Conclusion

Terraquest has carried out an airborne magnetic survey in 2001 on the behalf of IOCC. The survey covers a surface about 2148 square km in the Wabush-Labrador City area, of which 73,2 square km are located in the province of Quebec.

The survey contains numerous inherent flaws and cannot be qualified as highly sensitive or highly precise. Ground verifications could be necessary to confirm some observations at local scale. The quality of the survey is superior to previous surveys and it is a useful tool for selecting and evaluating exploration targets and as a guide for geological interpretation.

6.4.2 Gravity

Gravity surveys were conducted by the firm Geosig Inc. of Quebec to investigate selected exploration targets in Labrador City area. Gravity data and GPS co-ordinates were collected along a total of 100.5 line-km.

One of these targets is the Duley #1 – Polly Lake prospect. It is located 18km southwest of Labrador City and straddled the Newfoundland-Labrador – Quebec boundary. A total of 522 stations were measured on this prospect, of which 156 are located in the Province of Quebec, Polly Lake area, Lislois Township.

Table 6.4: Characteristics of the gravity surveys

Grid	Km	Line spacing	Station spacing	Number of stations	Date	Properties
Polly Lake	7.8	400 m.	50 m.	156	11/2001	Quebec claims CDC1020712 CDC1020713 CDC1020714 CDC1020715 CDC1020716 CDC1020717 CDC1020718

A Lacoste & Romberg Model D gravity meter was used to measure gravity. Co-ordinates were determined using a GPS system Trimble 4700. A GDD chain-level was also used to measure elevations in areas where GPS system failed or during periods of magnetic activities. Reading elevation with GPS is often very difficult and sometimes impossible. The dense vegetation blocks GPS signals. Signals are also disturbed by the solar wind that scrambles the radio waves in auroral zones. In such cases, only Northing and Easting were kept from GPS data and elevations were measured with a chain-level.

Gravity corrections

Gravity data were corrected for drift, tides, latitude, free-air, altitude and Bouguer. Results of these corrections are Bouguer values or Simple Bouguer. Terrain corrections should be applied to Simple Bouguer values to obtain the Complete Bouguer Values. Removing the effect of these known features homogenises the data and isolates spurious 'anomalous' values, which result from density inhomogeneities due to local geology.

Simple Bouguer = G_{Measured} +Tides +Drift + Latitude + Free-air +Bouguer
Complete Bouguer = Simple Bouguer + Terrain

Drift correction: Drift is a small variation due to the change of sensor properties with temperature or time. This is a characteristic of the instrument. Drift is evaluated by taking frequent readings at a same location and distributing the tie error along the loop. Linear interpolation as a function of time (relative to time) determines the correction value at each station.

Tidal correction: The gravitational attraction of the sun and moon, and the resulting distortion of the earth introduce variation in gravity values. A complete tidal cycle is accompanied by gravity change of 0.2 to 0.3 mgal. The corrections can be calculated for a selected area and selected time with appropriate software. The tidal effect can also be considered as part of the drift correction. Combining tidal and drift corrections requires more frequent returns to the base station, at least every 2 hours. As a standalone correction, tidal correction should be the first applied.

Latitude correction: This correction compensates for the gravitational effect due to the shape and the rotation of the earth. The earth has an elliptical shape. Gravity is higher at the poles, which are 22 km nearer the centre of the earth than the equator. Also the rotation of the earth produces a centrifugal acceleration that changes the gravity measurements. This acceleration, higher at the equator, reduces the gravity. The combined effect produces a difference of 5.2 Gals between the equator and the pole. The correction formula is derived from the equation of the reference ellipsoid. The equation of the ellipsoid was established in 1901, then modified in 1930, 1967 and 1980.

Correction using 1967's ellipsoid is:
$978031.85\ (0.005278895 \sin^2 \Phi + 0.000023462 \sin^4 \Phi)$.
Correction using 1980's ellipsoid is:
$978032.67715\ (0.0052790414 \sin^2 \Phi + 0.0000232718 \sin^4 \Phi + 0.0000001262 \sin^6 \Phi + 0.0000000007 \sin^8 \Phi)$ where Φ is the latitude of the station.

Either formula provides the required accuracy for exploration purposes.
Accuracy of 0.01 mgal requires a precision of 12 metres in north-south location.

Altitude or **free-air** correction: This correction takes into account the gravitational variations caused by elevation differences in the observation locations. The free-air correction value is 0.3086 h where h is the elevation. Accuracy of 0.01 mgal requires a precision of 3 cm in elevation.

Elevation or **Bouguer** correction: Free-air correction eliminates the effect due to the variation of the distance between the stations and the geoid. Bouguer correction takes into account the influence of the various thickness of material under different stations.
The value of elevation or Bouguer correction is 0.04191 d h where d is the density and h the elevation. Usually, a density value of 2.67 g/cm^2 is used but the contribution of overburden or water, with their proper density, can be part of this correction if their thickness is known.

Bouguer values are the result of the application of drift, tidal, free-air and Bouguer corrections to the observed gravity. These values were used to produce the actual maps in appendix D.

Terrain correction: Influence of nearby hills or valleys is not included in the Bouguer correction. A complete terrain correction is a tedious operation often neglected in mineral exploration.

Traditionally, the effect of lack and excess of mass near the observation points is evaluated by hand with the help of tables, diagrams and topographic maps. When applied to old gravity surveys, terrain correction was often limited to the innermost area.

Automated procedures, using digital topography databases and a proper algorithm to evaluate the terrain corrections, are more efficient. The best method is the one that best approximates the topography, mainly in the inner zone.

The terrain correction is applied to Bouguer values to give the Complete Bouguer.

Interpretation and processing

Densities and magnetic susceptibilities used in interpretation are extracted from " Uses of Geophysical-Statistical Methods in determining Dimensions, Shapes, Tonnage's and Grades of Metamorphic Iron Formations of the Carol Lake District, Labrador, Newfoundland" by M.K. Séguin, 1971 and "Physical Rock Property Study, Labrador City" by Morris Magnetics Inc., 2001.

Formation	Density (g/cc)	Susceptibility (cgs unit)
Attikamagen Schist	2.72	7×10^{-6}
Duley Marble	2.83	7×10^{-7}
Wishart Quartzite	2.65	4×10^{-6}
Lower Iron Formation	3.05	$6 \times 10^{-5} - 4 \times 10^{-2}$
Middle Iron Formation	3.65	$1 \times 10^{-3} - 4 \times 10^{-1}$
Upper Iron Formation	3.05	$6 \times 10^{-5} - 4 \times 10^{-2}$
Menihek Schist	3.05	$1 \times 10^{-4} - 4 \times 10^{-3}$
Shabogamo Gabbro	3.06	$6 \times 10^{-4} - 1 \times 10^{-3}$

Regional and Residual Gravity Anomalies

This operation aims to remove the gravimetric contribution of all bodies that are not part of the target, leaving only the effect of the mineralised zones. The actual technique involves the separating of small-scale and large-scale geological features contribution. Many processes have been developed to do this: frequency filtering, least square fit to a low order polynomial, upward continuation. These techniques could be efficient for simple models but actual exploration targets are mid-scale structures, high-density iron mineralised layers folded and interbedded with poor mineralised ones. Therefore, no technique is very satisfying. The regional contribution is easily underestimated or overestimated resulting in a large distortion of the size of the targets.

Automatic Gain Compensation filter

Automatic Gain Compensation filter is another way to isolate the residual component. Regional and residual values are calculated for each grid cell by using a selected moving window. A plane, which minimizes root mean square misfit on the window, determined the background component while the difference between actual value and the background is the residual signal.

Derivatives

The first derivative of Bouguer enhances the geological structures at shallow depth. The second derivative emphasises regions of rapid change in gravity. It is useful to precisely determine contacts of geological structures. Derivatives also amplify the noise.

Modelling

Bouguer should reflect the variation of densities within the subsurface. Gravity modelling aims to reconstitute this density distribution. Modelling is an indirect method of interpretation. Taking into account all available geological data, a model is first constructed and the associated gravity anomaly is calculated. Then, the model is altered to improve the correlation between calculated and observed anomalies. The best-fit model is not unique. Different models could produce the same anomaly. Modelling is useful to confirm a geological hypothesis or to suggest a new one.

Duley #1-Polly Lake Prospect

The gravity survey over Duley #1-Polly Lake prospect delineated a Bouguer anomaly of 15 milligals at the boundary between Newfoundland-Labrador and Quebec (figures 6.4c-d). This anomaly coincides with the strongest magnetic anomaly of the 2001 airborne survey, about 40000 nanoTeslas (figures 6.4g-h). Two models have been drawn to explain these anomalies. Figure 6.4e shows a 40 % Fe-oxide with a depth extension of 700 metres. Figure 6.4f shows a more realistic 60 % Fe-oxide iron formation with a thickness of about 400 metres.

A smaller anomaly of about 5-8 milligals also coincides with the magnetic anomaly surrounding Polly Lake (figures 6.4c-d). The depth extension of the iron formation producing this anomaly could reach 150-200 metres (left end profiles on figures 6.4e and 6.4f).

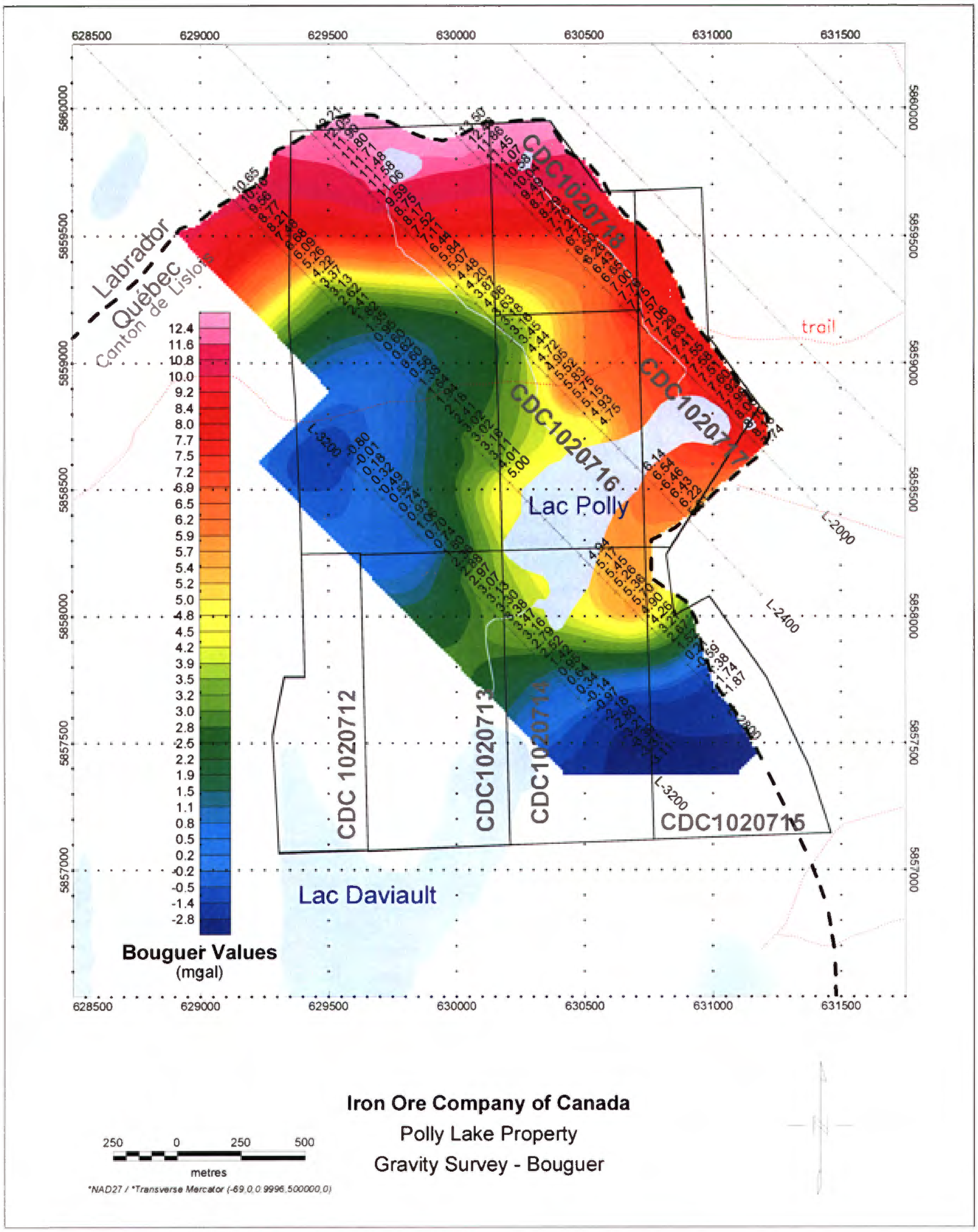

Figure 6.4c – Bouguer on Polly Lake Property

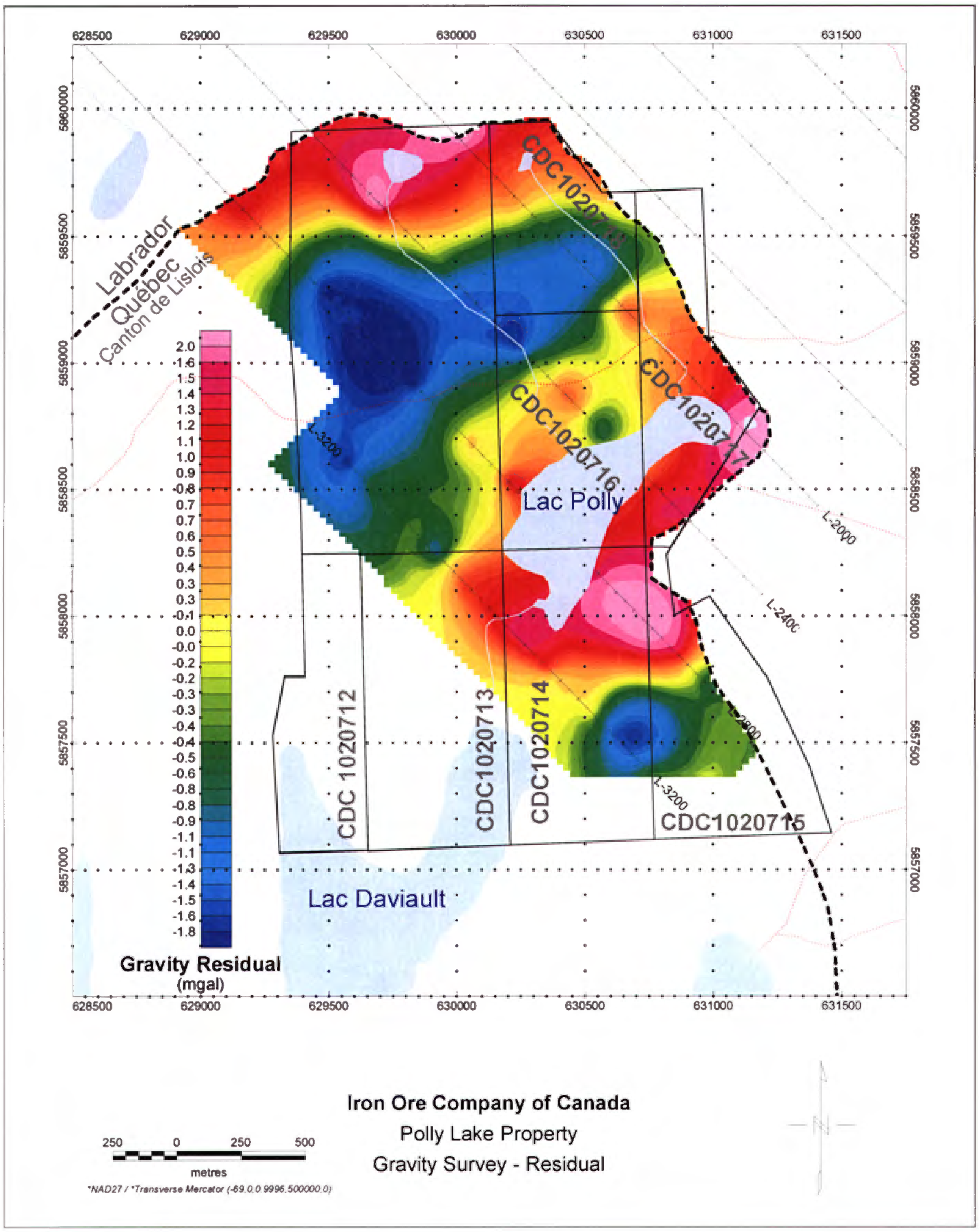

Figure 6.4d – Residual of Bouguer on Polly Lake Property

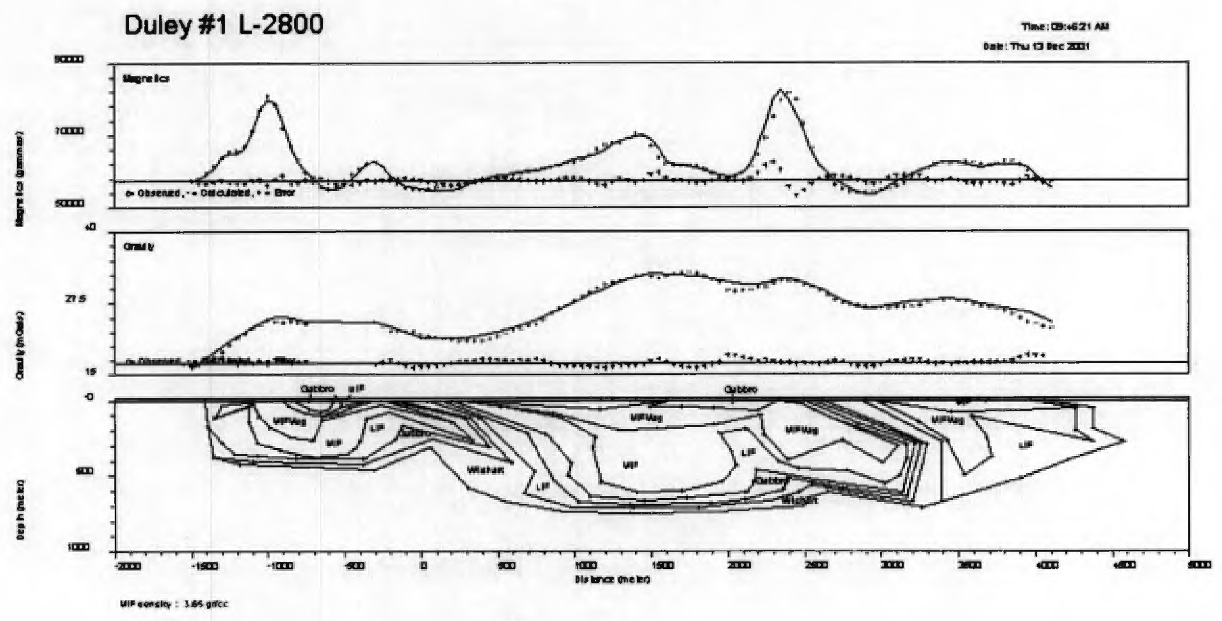

Figure 6.4e: Interpreted section on Duley#1 (Polly Lake) with Middle Iron Formation (MIF) density of 3.65 (40% Fe oxide).

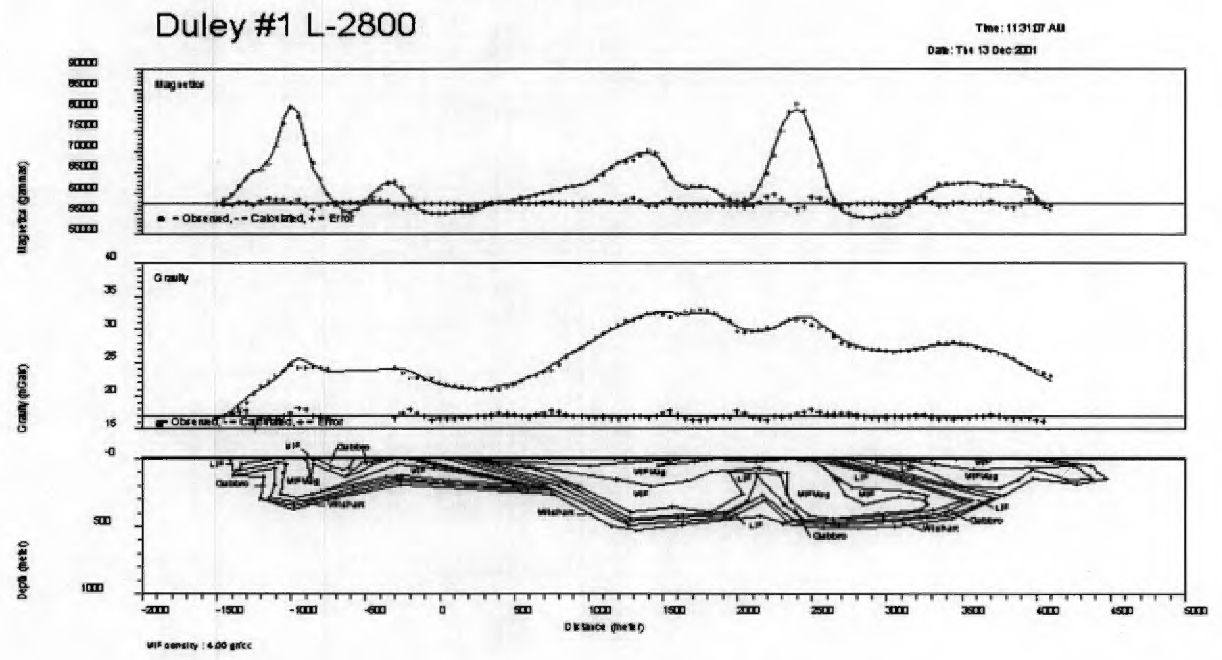

Figure 6.4f: Interpreted section on Duley #1 with Middle Iron Formation (MIF) density of 4.00 (60% Fe oxide).

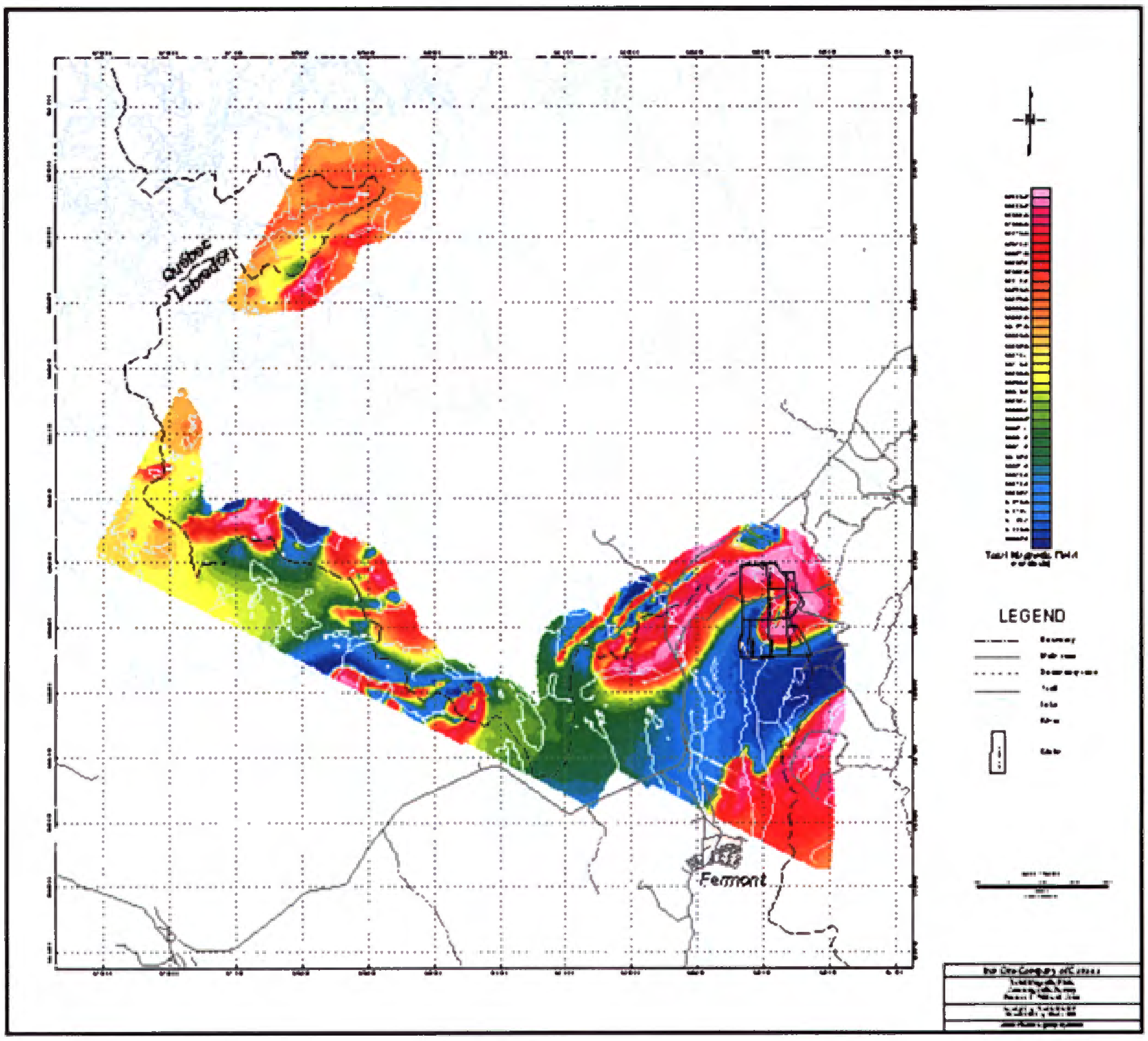

Figure 6.4g. Airborne magnetic survey - Total magnetic field intensity.

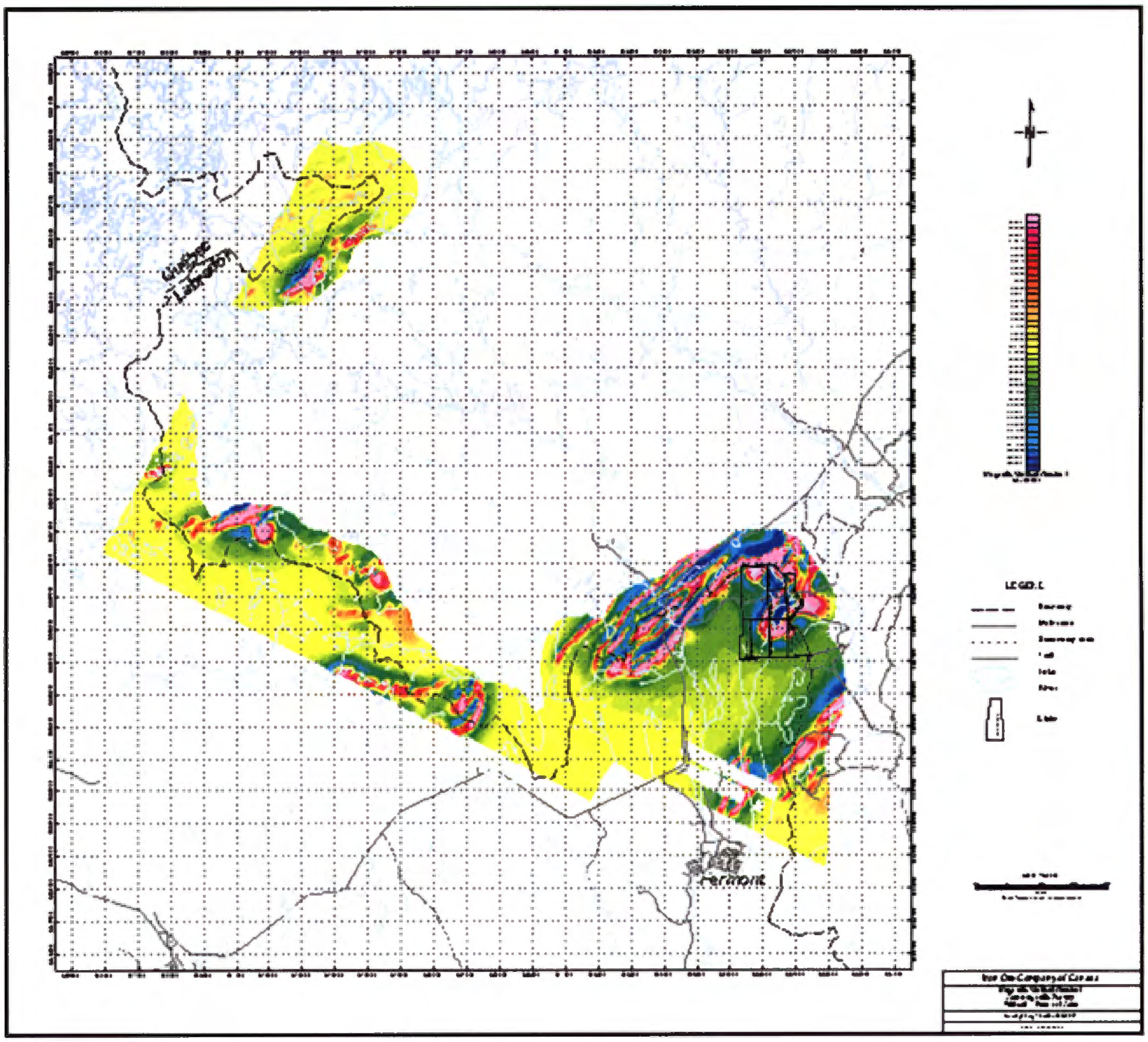

Figure 6.4h. Airborne magnetic survey – First vertical derivative of the total magnetic field.

6.5 Field Mapping and Prospect Evaluation.

Following a review of R. Hulstein's sub-licenced property evaluation report (Hulstein, R., 2000), historical data, and the 2001 aeromagnetic results, the Duley No.1 – Polly Lake area was selected for field evaluation. Proximity to Labrador City, accessibility, and tonnage potential were also determining factors in target prioritisation.

Field assessment of the Duley No.1- Polly Lake Prospect and surrounding areas was carried out between the end of May 2001 and the beginning of October 2001. Geological compilation, mapping and surface sampling was done by consultant senior geologists Alain Cotnoir and Marcel Durocher, and by IOCC's short term staff junior geologist Christine Molloy. One geological student (Carol Seymour) from IOCC's student employment program was also involved in various field duties.

Outcrop, sample and structural measurement locations were determined by using a Garmin's GPS 12CX hand held unit. Due to magnetic deviation caused by magnetite-bearing iron formations, structural measurements were established by using a sun chart. All results from the geological mapping and surface sampling have been compiled and integrated with IOCC's GIS /resource database.

A total of thirty-one surface rock samples were collected during the May – October 2001 period, on both Duley No.1 and Polly lake prospects. All samples were submitted to IOCC's Laboratory of Labrador City, Newfoundland-Labrador. Assay results can be found in appendix E, and details of the analytical procedures can be found in section 7.0 of this report.

6.5.1 Results

Geology

The Duley No.1 (Province of Newfoundland-Labrador) - Polly Lake (Province of Quebec) prospect area is predominantly underlain by the Sokoman Iron Formation which consists of the full sequence which can be differentiated down stratigraphic section into the UIF, MIF and LIF members based on the recent and ongoing structural synthesis (figure 6.5a). Subordinate quartzite of the underlying Wishart Formation is exposed to the immediate south on the Quebec side of the boarder. Overlying graphitic schists of the Menihek Formation have been intersected in drilling to the NW but are not exposed in outcrop. Large bodies of gabbro interpreted to represent sills occur regularly both immediately above and below the ore forming middle iron formation (MIF) member of the Sokoman Formation.

The magnetite rich MIF horizon is typically characterised by a very high magnetic signature, which can be traced through areas of till cover and limited outcrop exposure. Outcrop exposure is generally very limited particularly over the northern claim area. The geological (figure 6.5a) and structural interpretations are being revised using the formational aeromagnetic anomaly trends (figure 6.5b) and gravity modelling techniques (see section 6.4).

The structural interpretation is an ongoing process. In general the structure is fairly complex consisting of an early generation of NW-SE oriented isoclinal (synclinally dominated) folds (F1) which have been refolded by the later broader more open NE-SW structural event (F2) with a large antiform being the dominant structure. This results in typical dome and basin interference structures, which have been difficult to define due to limited, sporadic outcrop exposure. Structural thickening is the principal element responsible for producing the large tonnage required to develop economically viable deposits.

This property hosts two related prospect areas (Duley No.1, Newfoundland-Labrador and Polly Lake, Quebec) which are separated only by geographic location and localized structural setting.

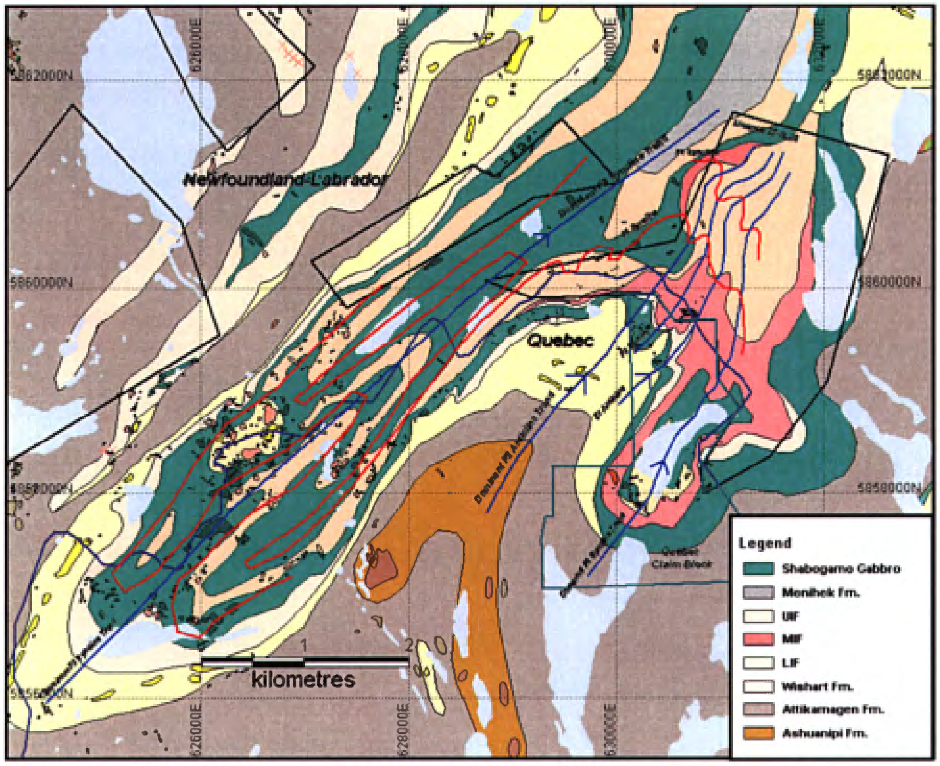

Figure 6.5a – Duley No.1-Polly Lake Prospect area. Surface Geology with F1 (red) – F2 (blue) fold relationship. Blue arrows indicate plunge direction and solid navy blue line indicate the Quebec-Newfoundland-Labrador Provincial Boundary.

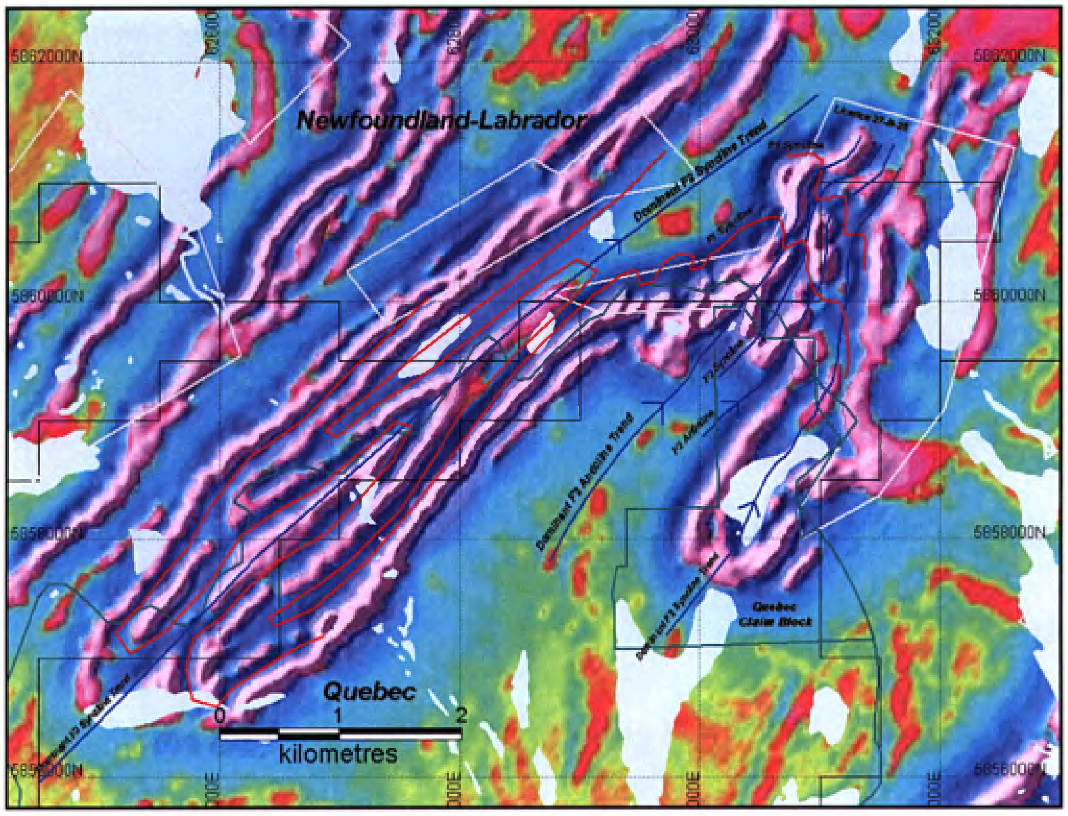

Figure 6.5b – Duley No.1-Polly Lake Prospect area, showing F1 (red) – F2 (blue) fold pattern interference, interpreted from 2001 aeromagnetic 2nd vertical derivative data and surface geology.Blue arrows indicate plunge direction.

Duley No.1 (Newfoundland-Labrador) Prospect

The Duley No.1 iron occurrence was first reported in 1949. Between 1949 and 1979 reconnaissance mapping, surface sampling, drilling, gravity, and airborne and ground magnetometer surveys were conducted on this prospect, but no detailed work to investigate its potential (Hulstein, 2000) has been done.

It is hosted in the MIF, and consists of hard to friable quartz-magnetite-specularite and quartz-magnetite-specularite-grunerite gneiss and schist. Minor limonite and pyrolusite are reported from surface mapping and drill logs data. Previous surface sampling returned an averaged grade of 37.36% Fe and 0.13 to 2.48% Mn (0.35%Mn Av. Two IOCC holes intercepted possible MIF mineralisation, returning 8.54m @ 32.12% Fe and 0.52% Mn in hole Y220c; and 16.75m @ 35.73% and 0.35% Mn in hole Y374c. Both holes terminated in mineralisation. Recoveries varied from 40% to 95%.

The Duley No.1 prospect area is characterised by tight secondary folding associated with and along the limbs of the larger NE-SW trending F2 anticline. The structure is further complicated by interpreted NW-SE trending isoclinal F1 folds which have been refolded by the F2 event resulting in numerous apparent repetitions of the of the mineralised MIF horizon. This is especially evident in the filtered aeromagnetic survey data (2nd vertical derivative) which emphasizes the surficial expression of the magnetic anomaly trend (figure 6.5b) and accounts for the large, high intensity gravity anomaly (see section 6.4.2) associated with the most intensely deformed or structurally complex area near the main fold axis.

(*The northwest-verging F2 folds which are northeast trending (N10°-N55°) and shallowly plunging (18°to35°, are superimposed on F1 isoclinal folds. F1 folds are generally parallel to F2, but the trend direction, which can be at an angle with F2, varies from south to southwest with plunges ranging from 20° to 50°. S1 foliation's vary from east-northeast trending and appear to be steeply dipping (70°) to the south-southeast.*)

During the 2001 geological mapping program a number of new outcrop exposures of middle iron formation were discovered along the aeromagneticaly-defined trend. These outcrops helped confirm the structural complexity of the general showing area. Unfortunately the overall exposure is limited and the higher grade more massive specularite / magnetite zones are typically very friable and even less well exposed. The mapping has helped define drill target areas where full stratigraphic sections of the MIF can be intersected and the potential thickness of the zone can be defined. Sampling confirmed the previously estimated average grade of 37.36% Fe, 0.35% Mn.

The MIF horizon is partly concealed under 0 to 35 metres of overburden and straddles the Newfoundland-Labrador and Quebec provincial boundary. Sparse outcrops of MIF occur at the nose and on both flanks of an F2 anticline, and along the periphery of an F2 syncline. Thickness and depth extent of the MIF horizon remains undefined.

The 2001 aeromagnetic survey suggest that the most prospective area lies within a 2,200m x 900 m area, especially at the nose closure of the F2 anticline where structural thickening appears to be the most intense.

During the month of November 2001 a gravity survey (see section 6.4.2) was carried out over the Duley No.1-Polly Lake prospect. This survey resulted in the definition of a 1,500m x 700m 15 mgals anomaly that is coincidental with the nose closure of the F2 anticline. This gravity anomaly appears to be centred over a basin structure limited on both sides by two F2 anticlines.

Polly Lake (Quebec) Prospect

This portion of the aeromagnetic anomaly is situated predominantly in Quebec and was acquired in 2001 as map staked claims. The Polly Lake prospect area is the southern extension of the distinct oval shaped aeromagnetic anomaly trending over the provincial boarder into the Duley #1 prospect and is a continuation of the mineralized MIF described above. This anomaly is interpreted as a syncline that either represents a broad F1 syncline superimposed on the eastern limb of the large F2 anticline or is the result of an F2 syncline. There is a slightly more subtle gravity response (5 to 8 mgals) over this area however the data confirms the structural interpretation which is favorable for producing large tonnage potential.

Three surface samples (12026,12036-037) have been collected from specularite and/or magnetite bearing MIF units, and returned a grade varying from 16.65 to 50.97 % Fe, and 0.13% to 0.24% Mn. Assay results reflect the compositional variability within the MIF sequence and not the average composition of the sequence. Twelve diamond drill holes (HH30 to HH41) totaling 287 metres (24 m av.) were drilled in 1958 by Holannah Mines at Polly Lake but drilling assay results are not documented.

(Results obtained during the 2001 field evaluation RAP program are encouraging and suggest that tonnage potential would occur through structural thickening of the horizon around the nose closure of the F2 anticline and possibly within a F2 synclinal structure centred over Polly Lake. Based on the gravity data and assay results, the potential for a geological resource greater than 300Mt of iron ore with grade ranging from 35% to 45% Fe, within the Duley No.1 –Polly Lake prospect is not unreasonable.)

7. Analytical Procedures

All surface rock and drill core samples collected during the 2001 field mapping season were assayed in-house at IOCC's Chem Lab facilities located in Labrador City. The analytical procedure used for both surface rock and drill core samples is describe below.

Surface rock samples.

All grab samples were delivered to IOCC's laboratory tagged and labeled. IOCC's RAP department entered sample numbers into the LIMS (library information management system) system.

- Each sample was put into an oven for drying, then stage crushed through jaw crushers, and split using a ¾ inch splitter.
- After drying, each sample was put through a roll crusher twice then screened through a -14 mesh screen. The +14 mesh material was passed through the roll crusher again, and re-screened through the -14mesh screen until all materials was -14mesh.
- Each sample was then further split down to one portion, which was pulverised and sent for analysis. Another portion of each sample was used for screen analysis. The meshes required for the screen analysis were 35, 65, 100, 200 and -200mesh. A percentage weight was required for each fraction and a portion saved and pulverised for the magnetite content determination.
- Each sample was analysed for magnetite content, Fe, SiO_2, CaO, MgO, Mn, Al_2O_3, TiO_2, CO_2 and combined water (H_2O^+). Screen analysis for each 35, 65, 100, 200, and -200mesh fraction was done for Fe and magnetite content in weight percent.
- Each analysis for Fe, SiO_2, CaO, MgO, Mn, Al_2O_3, and TiO_2 was performed by the XRF (X-Ray-fluorescence) single glass discs method. Single XRF glass discs were retained at the IOCC laboratory for future work.

(n.b. Al_2O_3 determination was not done for all grab samples)

- H_2O^+ determination was done to calculate the limonite/goethite by heating (1000°C) a one gram rock sample in a current of dried nitrogen and liberated water is absorbed by magnesium perchlorate which is weighed and the combined water determined from the increase in weight. The limonite/goethite content of a rock sample can than be calculated by using the following formula: (H_2O^+ x 8.6) - 0.235.
- CO_2 determination was done to calculate the amount of carbonate in a rock sample. It is done by heating (1000°C) a one-gram sample in a current of dried nitrogen. Carbon dioxide gas is then absorbed by ascarite in an absorption bulb. The bulb is weighed before and after. The difference in weight multiplied by 100 equals the percentage of CO_2.

- The magnetite content was established with the satmagan (saturation magnetisation) analyser. The satmagan is a balance in which the sample is weighed in gravitational and magnetic fields. The ratio of the two weighings indicates the amount of magnetite present in the sample.

- Quality control was achieved using duplicates and standards.

- All assay results were reported to IOCC's RAP department through the LIMS system.

8. Conclusions and Recommendations

Based on IOCC's 2001 Resource Assessment Program and the evaluation of its results, it can be concluded that:

- F1/ F2 interference folds played an important role in terms of the distribution of existing iron ore bodies. The dominant structural trends between Polly Lake and Julienne Lake are controlled by northeast trending F2 folds and thrust faults, which cut, overturn, and repeat the MIF ore-bearing horizon. These structures are superimposed on earlier F1 structures, causing structural thickening of iron ore beds.

- Gravity surveys are useful to investigate iron ore prospects. Magnetic surveys indicate only the presence of magnetite but gravity surveys reveal the presence of both magnetite and hematite. Gravity provides a quantitative evaluation of a prospect and allows a better selection of drill hole targets for a formal prospect evaluation.

- Areas with positive magnetic and gravity signature, F1/F2 fold interference patterns, favourable geology, with potential to host a sizeable (>100Mt) should be considered as prime exploration targets.

- The Duley No.1-Polly Lake area has the potential to host a sizeable iron ore deposit.

- The Duley No.1 – Polly Lake prospect covers a 1,500m x 700m 15 mgals gravity and coincident aeromagnetic anomalies associated with isoclinal F1 folds refolded about a dominantly northeast trending and plunging, northwest verging anticlinal F2 fold trend. Possible structural thickening and grade enhancement may have occurred. Surface sampling averaged 32.58% Fe, 0.48% Mn, 3.66% limonite-goethite, and 43.78% weight recovery. A smaller 5-8 mgals anomaly surrounding Polly Lake has been delineated and remains untested. Geophysical modeling suggest that of the Duley No.1 – Polly Lake prospect could host a geological resource of 1000Mt of iron ore.

The results from the 2001 IOCC RAP program are very encouraging and more work is recommended to fully evaluate the iron resources potential of the Duley No.1 – Polly Lake prospect area. This includes:

1) Re-assessment and integration of all the geological, structural, aeromagnetic, gravity, field mapping data; in order to generate a new geological map of the Wabush-Shabogamo Lake area. An attempt to differentiating the Sokoman Fm. into UIF, MIF and LIF should be made.

2) Follow-up drilling on Polly Lake to delineate the extent and geometry of the iron ore mineralisation. Ore characterization should be initiated during this phase of drilling.

3) Detailed structural mapping over the Duley#1-Polly Lake prospect area is recommended.

9. References

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10. Statement of Qualifications

I, Alain Cotnoir, of the City of Quebec, Province of Quebec do hereby certify that:

1. I am a professional geologist residing at 4605 Boulevard Des Cimes, Quebec, QC, G2A 3X9

2. I am a graduate of L'Université Laval, Sainte-Foy, Quebec with a degree in geological engineering (1985) and a member of the Quebec Order of Engineer (Member # 107245) and of the Quebec Order of Geologist (Member # 275).

3. I am a graduate of Melbourne University, Melbourne, Australia with a Master of Science in Geology (1990).

4. I have been practicing as a geologist for over 13 years

5. I have been working with IOCC as a consultant geologist since February 2001.

6. I am familiar with the material covered by this report and, I do not have any direct or indirect interest in any of IOCC properties nor do I expect to receive any direct or indirect interest in return for preparing this report.

DATED at Labrador City,

Newfoundland-Labrador

this 31st day of May,2002.

Alain Cotnoir, P. Geo.

10. Statement of Qualifications (continued)

I, Jean Hubert, of the City of Quebec, Province of Quebec do hereby certify that:

1. I am a professional geophysicist residing at 1912 Boulevard Laurier, Sillery, Quebec, G1S 1M8.
2. I am a graduate of L'École Polytechnique, Montreal, Quebec with a degree in geological engineering (1972) and a member of Quebec Order of Engineer (Member # 22848).
3. I have been practising as geophysicist for over 30 years.
4. I have been working with IOCC as a consultant geophysicist since August 2001.
5. I am familiar with the geophysical surveys covered by this report. I do not have any direct or indirect interest in any of IOCC properties nor do I expect to receive any direct or indirect interest in return for preparing this report.

DATED at Labrador City,
Newfoundland-Labrador this 31th day of May, 2002.

Jean Hubert ing. f.

Jean Hubert, P.Eng.

2001 SURFACE SAMPLING ASSAY RESULTS

SampleID	Prospect	Licence	Easting	Northing	Fe%	Mag%	CaO%	MgO%	Mn%	Al2O3%	SiO2%	CO2%	H2O%	TiO2%	Lim/Goeth%	-200mesh	-200mesh Fe	Wht Rec.
12002	Duley No.1	Newfoundland	630772	5858755	29.39	0.10	0.41	1.60	0.765	n/a	49.92	0.19	0.40	0.01	3.19	4.87	26.03	41.00
12003	Duley No.1	Newfoundland	630772	5859742	38.71	0.20	0.16	0.83	1.154	n/a	37.46	0.11	0.45	0.01	3.62	5.63	26.79	52.80
12004	Duley No.1	Newfoundland	630780	5859740	33.05	29.40	0.09	0.18	0.661	n/a	47.60	0.10	0.20	0.01	1.48	13.79	45.18	43.20
12005	Duley No.1	Newfoundland	630780	5859710	16.62	0.40	1.94	2.44	9.999	n/a	55.33	0.54	0.65	0.02	5.33	8.87	14.44	21.80
12006	Duley No.1	Newfoundland	630425	5859918	36.16	6.80	1.62	1.28	0.155	n/a	40.59	0.20	0.25	0.01	1.91	11.14	37.46	46.80
12007	Duley No.1	Newfoundland	630741	5859927	30.98	0.20	0.14	0.23	0.103	n/a	49.93	0.20	0.21	0.01	1.56	3.71	29.98	44.40
12008	Duley No.1	Newfoundland	630659	5860997	21.88	3.70	0.25	1.33	0.838	n/a	61.28	0.11	0.38	0.04	3.02	10.05	21.67	29.10
12009	Duley No.1	Newfoundland	630638	5859709	41.74	6.90	1.84	3.08	0.202	n/a	29.08	0.14	0.54	0.29	4.39	7.60	34.52	55.00
12010	Duley No.1	Newfoundland	630630	5859682	41.91	1.60	0.06	0.11	0.066	n/a	35.63	0.11	0.15	0.01	1.05	3.38	42.75	59.70
12011	Duley No.1	Newfoundland	630624	5859697	30.21	0.90	0.85	0.64	0.500	n/a	49.35	0.81	0.30	0.01	2.33	7.46	25.45	41.10
12012	Duley No.1	Newfoundland	630622	5859682	31.78	0.70	0.16	0.32	0.168	n/a	49.63	0.64	0.54	0.01	4.39	2.56	33.05	44.90
12013	Duley No.1	Newfoundland	630588	5859675	41.17	2.70	0.07	0.17	0.146	n/a	38.46	0.12	0.34	0.01	2.68	5.18	33.38	56.70
12014	Duley No.1	Newfoundland	630667	5859774	44.11	55.00	0.11	0.28	1.079	n/a	33.14	0.29	0.35	0.01	2.76	8.11	44.18	57.70
12015	Duley No.1	Newfoundland	630654	5859768	34.84	1.40	0.08	0.20	0.182	n/a	48.58	0.15	0.31	0.01	2.42	4.07	30.84	49.00
12016	Duley No.1	Newfoundland	630734	5859786	36.90	50.40	0.53	1.37	0.491	n/a	42.52	0.27	0.58	0.04	4.73	10.85	32.93	47.71
12017	Duley No.1	Newfoundland	630759	5859736	26.11	35.20	0.28	0.40	0.221	n/a	58.97	0.40	0.49	0.02	3.96	11.58	40.01	34.35
12018	Duley No.1	Newfoundland	630687	5859730	35.07	49.00	0.64	1.15	0.503	n/a	44.38	0.30	0.47	0.01	3.79	8.77	50.18	45.72
12019	Duley No.1	Newfoundland	630724	5859819	20.09	1.50	1.01	4.08	1.386	n/a	61.68	0.27	0.75	0.02	6.19	6.66	15.67	26.58
12020	Duley No.1	Newfoundland	630797	5859796	27.21	37.00	0.38	0.42	0.261	n/a	57.41	0.48	0.46	0.02	3.70	7.50	40.34	35.79
12021	Duley No.1	Newfoundland	630762	5859838	46.55	0.90	0.08	0.42	0.210	n/a	30.85	0.20	0.38	0.01	3.02	3.93	53.68	64.80
12022	Duley No.1	Newfoundland	630761	5859851	23.25	1.30	0.38	2.12	2.669	n/a	57.89	0.29	0.55	0.02	4.47	7.66	27.26	31.07
12023	Duley No.1	Newfoundland	630695	5859998	27.81	38.00	0.18	0.31	0.165	n/a	56.95	0.31	0.43	0.02	3.45	10.34	61.85	36.70
12024	Duley No.1	Newfoundland	630431	5859922	50.65	0.00	1.90	0.38	0.430	n/a	0.01	0.07	0.27	0.40	3.19	8.07	41.84	67.17
12025	Duley No.1	Newfoundland	629723	5859916	24.40	7.80	1.09	0.39	0.360	0.06	58.10	1.48	0.46	0.01	3.72	6.42	30.60	34.73
12026	**Polly Lake**	**CDC1020717**	**630,817**	**5858531**	**50.97**	**57.80**	**0.67**	**4.09**	**0.260**	**0.07**	**20.30**	**0.24**	**1.16**	**0.01**	**9.74**	**18.45**	**57.56**	**65.95**
12027	Duley No.1	Newfoundland	631047	5858583	29.43	18.40	0.21	0.19	0.280	0.09	53.12	0.32	0.40	0.01	3.21	17.03	52.50	37.93
12028	Duley No.1	Newfoundland	631047	5858583	30.14	14.80	0.08	0.05	0.370	0.09	52.02	0.16	0.46	0.01	3.72	11.34	41.59	40.33
12029	Duley No.1	Newfoundland	629655	5860011	27.38	32.00	0.84	1.25	0.540	0.09	53.70	2.22	0.54	0.01	4.41	14.32	29.87	37.19
12030	Duley No.1	Newfoundland	630819	5860240	35.31	43.00	2.46	1.64	0.450	0.17	41.05	0.28	0.62	0.09	5.10	15.42	42.13	46.90
12036	**Polly Lake**	**CDC1020713**	**629966**	**5858090**	**16.65**	**12.00**	**0.10**	**0.19**	**0.130**	**0.08**	**72.79**	**0.28**	**0.40**	**0.01**	**3.21**	**8.52**	**18.49**	**22.73**
12037	**Polly Lake**	**CDC1020714**	**630575**	**5857920**	**29.47**	**37.00**	**1.30**	**1.16**	**0.240**	**0.19**	**55.41**	**0.07**	**0.45**	**0.02**	**3.64**	**21.33**	**30.60**	**38.39**

B-043

OPERATIONS REPORT

HIGH SENSIVITY MAGNETIC AIRBORNE SURVEY

LABRADOR CITY, LABRADOR

NEWFOUNDLAND

for

IRON ORE COMPANY OF CANADA

by

TERRAQUEST LTD.

May 15, 2001

TABLE OF CONTENTS

1.0 INTRODUCTION

This report describes the specification and results of an airborne geophysical survey carried out for IRON ORE COMPANY OF CANADA, address Central Warehouse, P.O. Box 1000, Labrador city, Labrador, Newfoundland, A3V 2L8, attention Mr. Marcus Flis, telephone 709-944-8819. The survey was performed by Terraquest Ltd., 1373 Queen Victoria Avenue, Mississauga, Ontario, Canada L5H 3H2, telephone 905-274-1795 and fax 905-274-3936. The project was managed by Paterson, Grant & Watson, attention Mr. Karl Kwan, telephone 416-368-2888.

The purpose of the survey of this type is to collect geophysical data that can be used to prospect directly for anomalous magnetic areas in the earth's crust which may be caused by or related to economic minerals. Secondly, the geophysical patterns may be used indirectly for exploration by mapping the geology in detail, including the faults, shear zones, folding, alteration zones and other structures.

To obtain this data, the area was systematically traversed by an aircraft carrying geophysical equipment along parallel flight lines spaced at even intervals and oriented so as to intersect the geology and structure in a way as to provide optimum contour patterns of the geophysical data.

2.0 SURVEY AREA

The survey area lies to the south and north of Labrador City, Labrador. The survey coordinates in the NAD27 datum Zone 19 as supplied by the client are as follows

658370	5938290
678350	5927800
668440	5909360
672400	5907270
659450	5882870
652260	5886660
642340	5867910
639470	5869420
635890	5862670
642380	5859200
636610	5848080
625350	5853980
624560	5852580
610040	5860210
618210	5875660
623770	5872700
658370	5938290

3.0 EQUIPMENT SPECIFICATIONS

3.1 AIRCRAFT

The survey was carried using a single engine Cessna 206U aircraft registration C-GGLS, which carries three high sensitivity magnetometers. It is equipped with long range tanks, outboard tanks (total 9 hours range), tundra tires, cargo door and full avionics.

The aircraft has been extensively modified to support a tail stinger and two wing tip extensions. The transverse separation between the wing tip sensors is 13.5 metres and the longitudinal separation to the tail sensor is 7.2 metres. Considerable effort has been made to remove all ferruginous materials near the sensors and to ensure that the aircraft electrical system does not create any interference or noise. The figure of merit using Geological Survey of Canada standards is approximately 9 nT uncompensated and approximately 0.8 to 1.2 nT compensated depending on the latitude and geological environment..

The aircraft is owned and operated by Terraquest Ltd. under full Canadian Ministry of Transport approval and certification for specialty flying including airborne geophysical surveys. The aircraft is maintained at base operations by a regulatory AMO facility, Leggat Aviation Inc. and when in the field, by a Terraquest Ltd. AME who is also in association with Leggat Aviation Inc.

3.2 AIRBORNE GEOPHYSICAL EQUIPMENT

The primary airborne geophysical equipment includes three high sensitivity cesium vapour magnetometers. Ancillary support equipment includes a tri-axial fluxgate magnetometer, video camera, video recorder, radar altimeter, barometric altimeter, laser altimeter, GPS receiver, GPS receiver with a real-time correction service, and a navigation system. The navigation system comprises a left/right-up/down indicator for the pilot and a screen showing the survey area, planned flight lines, and the real time flight path. All data were collected and stored by the data acquisition system. The following provides detailed equipment specifications:

Cesium Vapour Magnetometer Sensor (mounted in tail stinger and wing tip extensions)

Model	CS-2
Manufacturer	Scintrex
Resolution	0.001 nT counting at 0.1 per second
Sensitivity	+/- 0.005 nT
Dynamic Range	15,000 to 100,000 nT
Fourth Difference	0.02 nT

Tri-Axial Fluxgate Magnetic Sensor (for compensation, mounted in midpart of tail stinger)

Model	MAG-03MC
Manufacturer	Bartington Instruments Ltd.
Input	24-34 VDC, >30 milliamps
Field Range	+/- 100,000 nanotesla
Internal noise	at 1Hz to 1 kHz: 0.6 nT rms.
Bandwidth	0 to 1 kHz maximally flat, -12 dB/octave roll off beyond 1 kHz
Freq. Response	1 to 100 Hz:+/-0.5%; 100 to 500 Hz:+/-1.5%; 0.5 to 1 kHz:+/-5.0%
Calibration. Accuracy	+/-0.5%
Orthogonality	+/-0.5% worst case
Package alignment	+/-0.5% over full temperature range
Scaling Error	absolute:+/-0.5%; between axes: +/-0.5%

Video Camera (mounted in belly of aircraft)

Model	VDC-2982 (colour)
Manufacturer	Sanyo
Serial Number	698000-30
Specifications	½", 470hr, 1.3LX, 12 VDC, C/CS, EI/ES, backlite compensation
Lens	Rainbow 2/3", 4.7 mm, F1.8-360, auto iris

Video Recorder (mounted in rack)

Model	AG 2400 (commercial grade) 12 VDC
Manufacturer	Panasonic
Media	VHS cassette
Serial Number	C8TA00281

Radar Altimeter

Model	KRA-10A
Manufacturer	King
Serial Number	071-1114-00
Accuracy	5% up to 2,500 feet
Calibrate accuracy	1%
Output	~~Analog for pilot~~, converted to digital for data acquisition

Barometric Altimeter

Model	LX18001AN
Manufacturer	Sensym
Source	coupled to aircraft barometric system

Navigation Interface ~~(console mounted in rack with remote displays for pilot~~)

Model	PNAV 2001
Manufacturer	Picodas Group Inc.
Data input	real time processing of GPS output data
Pilot readout	left/right and up/down pilot indicator
Operator readout	screen modes: map, survey and line
Data recording	~~all data recorded in real time by PDAS 1000~~

Real-Time GPS Correction (connects to Novatel GPS receiver see below)

Model	Landstar Mark III
Manufacturer	Racal
Antenna	post type
Operating temperature	~~0-50~~ °C
Broadcast Services	Service Satellite Link: American Satellite Corp. (AMSC) L band broadcast (1525 to 1559 MHz satellite band Data update 2 seconds, Data latency 5-6 seconds Cold acquisition 12 seconds Reacquisition 7 seconds

Power supplies:

1) PC6B converter to convert 13.75 volt aircraft power to 27.5 volts DC.
2) Power distribution unit located in the instrument rack, manufactured by Picodas Group Inc., interfaces with the aircraft power and provides filtered and continuous power at 13.75 and 27.5 VDC to components.
3) The 1000A ~~console manufactured by Picodas Group Inc. contains three~~ 32 ~~VDC~~ switching power supply for the cesium vapour magnetometer sensors; console also provides switching power for fluxgate magnetometer (real time magnetic compensation), radar altimeter, barometric altimeter, and ancillary equipment.

Data Acquisition System (mounted in rack)

Model	~~PDAS 1000~~
Manufacturer	Picodas Group Inc.
Operating System	MSDOS
Microprocessor	80486dx-66 CPU
Coprocessor	Intel 80486dx
Memory	on board 8 MB, page interleaving, shadow RAM for BIOS, EMS 4.0
Clock	~~real time, hardware implementation of MC14618 in the integrated~~ peripheral controller
I/O slots	5 AT and 3 PC compatible slots
Display	electroluminescent 640 x 400 pixels
Graphic display	scrolling analog chart with 5 windows operator selectable, freeze display capability to hold image for inspection

Recording media	standard hard drive with extra shock mounts, standard floppy drive and quarter inch tape backup (QIC format)
Sampling	selectable sampling for each input type: 1.0, 0.5, 0.25, 0.2, 0.1 seconds
Inputs	12 differential analog input with16 bit resolution
Serial ports	2 RS-232C (expandable)
Parallel ports	10 definable 8 bit I/O; 2 definable 8 bit outputs

The PDAS 1000 contains several boards as described below:

Magnetometer Board (three boards, one for each magnetometer sensor)

Model	PCB
Manufacturer	Picodas Group Inc.
Input range	20,000 – 100,000 nT
Sampling	1,000 per second
Bandwidth	selectable 0.7, 1.0 or 2.0 Hz
Resolution	0.0001 nT
Microprocessor	TMS 9995
Firmware	8 Kbit EPROM board resident
Internal crystal	18,432 kHz
Crystal accuracy	absolute <0.01%
Host interfacing	8 kByte dual port memory
Address selection	within 20 bit addressing in 8 kByte software selectable steps
Input signal	TTL, CMOS, open collectible compatible or sine wave with decoupler
Input impedance	TTL>1 kOhm

Magnetic compensation for aircraft and heading effects is done in real time. Raw magnetic values are also stored and thus if desired, compensation with different variable can be performed at a later date.

GPS Differential Receiver Board

Model	GPS card 3951 R
Manufacturer	Novatel
Antenna	Model 511, low profile
Channels	12
Position update	0.2 second for navigation
Accuracy	position with SA implement 100 metres, with no SA 10 metres, velocity 0.1 knot time recovery 1pps, 100 nsec pulse width
Data recording	all raw GPS and positional data logged by PDAS1000

Analog Processor Board

Model	PCB
Manufacturer	Picodas Group Inc.
	Provides separate A/D converter for each analog input with no multiplexing; each channel is sampled at a rate of 1,000 samples per second with digital processing applied

3.3 STANDARD BASE STATION EQUIPMENT

High sensitivity magnetic base station data was provided by a cesium vapour magnetometer logging onto a notebook and with time synchronization from the GPS base station receiver.

The magnetometer is the same as used in the aircraft, a CS-2 magnetometer manufactured by Scintrex. The processor is also the same as used in the aircraft but is housed in a portable box model MEP-710, manufactured by Picodas Group Inc. The logging software is written by Picodas Group Inc., BASEMAG version 5.02 for an IBM compatible PC (notebook) with RS232 input. It supports real time graphics, automatic startup, compressed data storage, selectable start/stop times, plotting of data to screen or printer at user-selected scales, and fourth-digital difference and diurnal quality flags which are set by user in BASEPLOT. Time recorded is taken from the base GPS receiver.

The GPS base station data are provided by a GPS receiver, with logging onto a notebook. These data were used to perform post flight differential corrections using C3NAVs software to the flight path data.

Model	MX 4200D
Manufacturer	Magnavox
Serial number	5057
Type	continuous tracking, L1 frequency, C/A ode (SPS), 6-channel independent
Receiver sensitivity	-143 dBm Costas threshold
Logging rate	1 per second

3.4 OPTIONAL REMOTE BASE STATION EQUIPMENT

Apart from the standard base station equipment normally provided on high sensitivity airborne magnetic surveys, two optional remote magnetometers with recorders were deployed, one located north of the airport and one south of the airport near the south end of the survey area.

Model	GSM-19
Manufacturer	GEM Systems Inc.
Type	Overhauser
Resolution	0.01 nT
Relative Sensitivity	0.02 nT
Absolute Accuracy	0.2 nT
Range	20,000 to 120,000 nT
Storage Capacity	170,000 to 700,000 readings
Power	12 VDC

4.0 SURVEY SPECIFICATIONS

4.1 LINES AND DATA

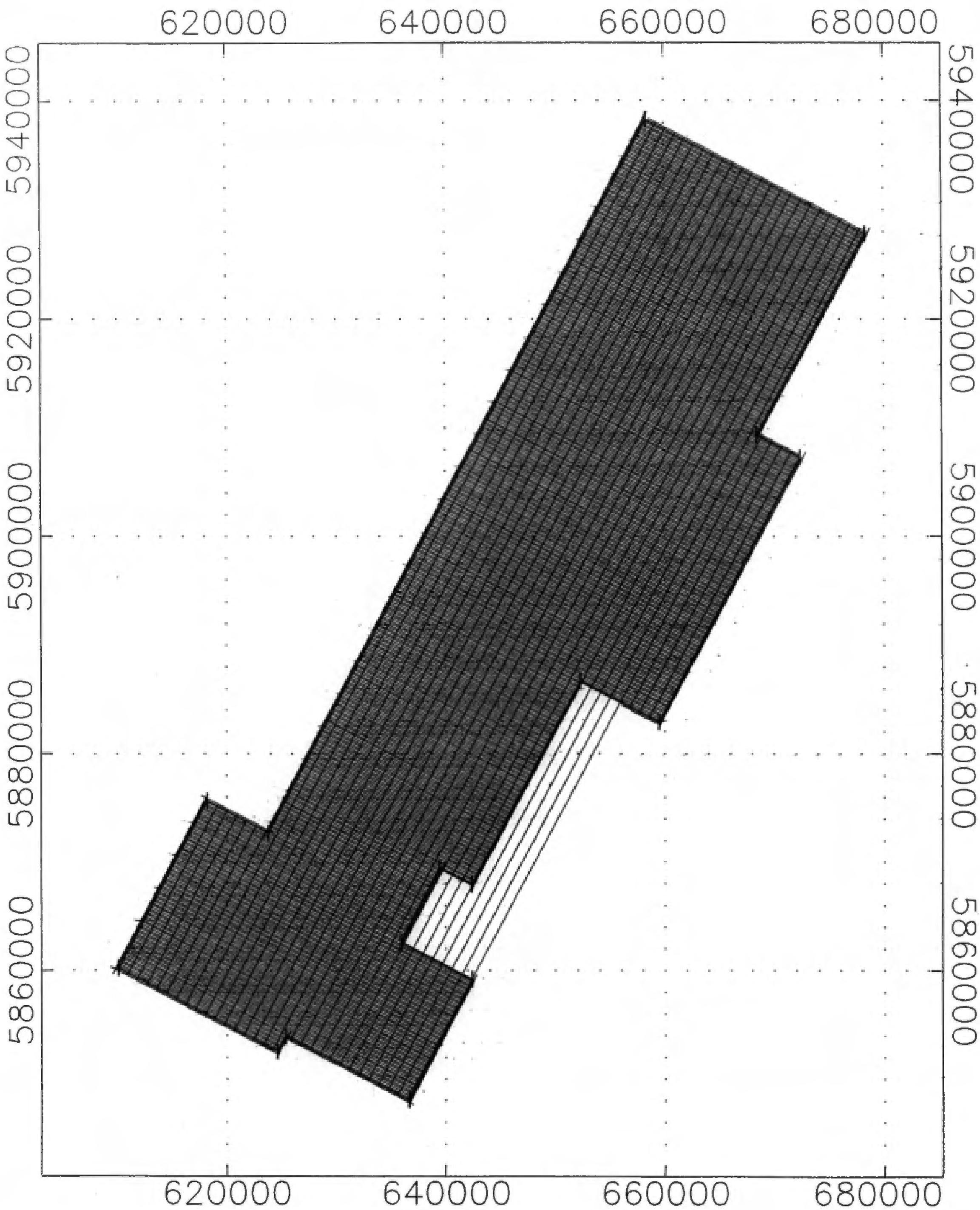
Survey lines	21,782 km
Tie lines	2,283 km
Total Survey	24,065 km
Survey Line Interval	100 metres
Tie Line Interval	1 km
Survey Line Direction	120 degrees
Tie Line Direction	030 degrees
Terrain Clearance	60 metres (mean terrain clearance)
Average Ground Speed	60 metres/second
Data Point Interval	6 metres

4.2 TOLERANCES

Line Spacing: Reflights will take place if the final differentially corrected flight path deviates from the intended flight path by +/-25% of the line spacing over a distance greater than 1 kilometre.

Terrain Clearance: The aircraft terrain clearance will be smoothly maintained at 60 metres MTC in a drape mode. Reflights will take place if the final differentially corrected altitude deviates from the flight altitude by +/-25% over a distance of one kilometre or more.

Aircraft Speed: Aircraft speed should not exceed 220 km/hr.



IOC AIRBORNE SURVEY

Lines+Tie=21,782+2283=24,065 km

Nov 7/00 TERRAQUEST LTD.

Diurnal Magnetic Variation: The airborne survey will be confined to periods in which the diurnal activity is 2 nT or less over a chord of 30 seconds in length.

GPS Data: GPS data shall include at least four satellites for accurate navigation and flight path recovery. There shall be no significant gaps in any of the digital data including GPS and magnetic data.

4.3 NAVIGATION AND RECOVERY

The satellite navigation system was used to ferry to the survey sites and to survey along each line. The survey coordinates of each area outline was supplied by the client and was used to establish the survey boundaries and the flight lines. The Clark 1866 ellipsoid for Canada East was used with x-y-z delta shifts of 22, -160 and -190 respectively. The UTM zone is 19.

The flight path guidance accuracy is variable depending upon the number and condition (health) of the satellites employed. The selective availability normally imposed by the military was at a minimum during this period and consequently the accuracy was for the most part better than 10 metres. Real-time correction using the Racal (receiver and broadcast services) improves the accuracy to about 5 metres or less. Post flight differential correction, which corrects for satellite range errors, using the base station data improves the accuracy of the recovered flight to less than 2-3 metres.

A digital terrain model was supplied by PGW with data points at one-kilometre intervals. This was used in a computer-assisted drape control program to guide the terrain clearance using real time corrected GPS data. In some cases this was helpful to the pilot, but in many places there were significant deviations both above and below the desired altitude. It is assumed that the resolution of the digital terrain model was not sufficient for the level of detail of this survey.

A video camera recorded the ground image along the flight path. A video display screen in the cockpit enabled the operator to monitor the flight path during the survey.

4.4 OPERATIONAL LOGISTICS

Standard Base Station

The base of operations was at the airport, Labrador City. The standard base station (combined high sensitivity magnetic and GPS) was set up at a seldom-used hanger with heat limited to a small workshop. The exact base station coordinates were 52 degrees 55 minutes 31.16 seconds north and 66 degrees 52 minutes 20.02 seconds west at an elevation of 536 metres above the geoid.

Data from this location is referred to in the database as BASE 3.

Optional Remote Base Stations

A provision was made in the contract as an option to supply extra base station magnetometers at remote locations. The selection and initial deployment of these magnetometers were done in conjunction with the client. The equipment consisted of GSM-19 Overhauser type magnetometers running off car batteries. They were leased from Terraplus Inc. in Richmond Hill, ON. This type was selected due to low power consumption requirement and ability to record the data without resorting to notebook loggers which were not suitable to the cold or power available.

Base 1 was set up north of the airport at the edge of Javelin road and was referred to as Javelin. Base 2 was set up near the southern edge of the survey near Fermont just off the main highway and was referred to as Fermont. These base stations would hold up to three days of data at which point the data would have to be recovered. This required 1-2 hours each for recovery and redeployment the following day after data recovery and the batteries were recharged.

Data were logged successfully from all base stations from initial setup through to mid December. This allowed the client to make judgements regarding the usefulness of multiple base stations. At that point Base 1 on Javelin Road was not recording the data correctly and was sent back to Terraplus in late December for servicing. A guarantee could not be obtained from Terraplus that it would not recur, and the client decided to cancel that station. Terraplus did not charge any lease for Base #1.

Base 2 (Fermont) continued successfully to March 13, 2001 at which point it too was cancelled on the recommendation of PGW in light of the fact that the survey portion south of the airport had been completed.

Mobilization and Survey Production

In late November 2000, the client provided a verbal commitment to proceed with the survey and requested that the aircraft mobilize as soon as possible. The ground support vehicle arrived on site Dec 10th and the aircraft on Dec 16th, being delayed by unscheduled aircraft maintenance and weather. In the interim, arrangements were made with local suppliers, the main base station was set up at the airport, and the two remote base stations were set up with the advice of the client. The following six days were primarily weather days, alternating between snow and rain, however two short data flights were made for purposes of laser altimeter testing over the runway plus a compensation box, a figure of merit box and four survey lines. The crew left for Christmas break on December 23rd.

The crew returned to the site on January 2nd. Also, PGW requested that the contract be revised to address primarily tolerance issues; this was accepted on January 3rd and the contract start date was reset to January 2nd. This meant that the weather days experienced during December would not contribute to total elapsed days or Standby Days as set out in the contract.

The last survey flight was completed on May 1st and a fax of authorization to demob was received from PGW on May 2nd. The following summarizes the utilization of days throughout the survey starting on January 3rd.

	Survey	Weather /Diurnal	Maintenance Aircraft
January	10	9	9
February	13	8	7
March	10	7	11
April	12	8	10
May	1		
Total	46	32	37

If weather and maintenance occurred on same day, that day is flagged as maintenance. Any flight that was curtailed by weather but had production, no matter how little, was not flagged as weather but rather as production. The high number of maintenance days was caused in part to the cold weather and the lack of suitable facilities at the airport to perform maintenance; all maintenance had to be done in Sept Isle.

The survey required 46 survey days and 32 weather/diurnal days for a total of 78 days not including maintenance. The contract defined standby charges if the survey extends past 65 elapsed days, hence there are 13 standby days.

Reporting

Three types of reports were generated throughout the survey period. Each survey flight has a digital log referred to as a "text file" that is created automatically by the data acquisition system. It contains flight specifications including aircraft, crew, name and location of files, name of magnetic compensation file (coefficient) utilized, and name, direction, time, GPS time and fiducial of each line flown. The operator generates a flight report that includes the line/time list plus up/down time, weather, any diurnal plus maintenance and logistic information on all days including non-flight days. All reports were placed on the FTP site for access by head office, processing office, PGW and the client throughout the survey.

Calibration

During both mobilization and demobilization, the aircraft proceeded to the Bourget test calibration site near Ottawa and flew 2 passes in all four cardinal headings. These data were compared with the Ottawa Geomagnetic Reference data, and supplied to PGW on the standard GSC format chart.

Before and after the survey, suitable compensation flights and Figure of Merit (as defined by GSC) calculations were performed. Considerable difficulty was encountered attempting to obtain a gradient of less than 30 nT over the calibration flights due to the high concentration of iron that is pervasive throughout the region.

At the beginning and after maintenance on the radar altimeter, altitude tests were flown over the runway at 100-foot intervals to a maximum of 800 feet to compare and calibrate the radar altimeter, barometric altimeter, laser altimeter and GPSz and the data and results were forwarded to PGW. The results of these two calibrations were very close to each other.

Lag tests were flown in all directions over a visual source within the survey area.

5.0 DATA PROCESSING

After every flight the data were transmitted via an FTP site to the Terraquest Ltd. processing laboratory in Calgary, Alberta, Canada where it was reviewed thoroughly for quality control and tolerances on all channels. This included post flight differential GPS corrections to the flight path, making flight path plots, importing the base station data, creating a database on a flight by flight basis, and posting the data. All data were checked for continuity and integrity every night. Any errors or omission or data beyond tolerances were flagged for reflight and the crew was notified by return FTP transmission, ready for their flight in the morning.

The remote base station data were collected every two to three days. After collection, it was transmitted to the processing laboratory where it was imported into the relevant flight database. At this point these completed data bases were transmitted by FTP site to PGW for inspection and processing. Terraquest did not process any of the data; the contractual obligation was solely to provide high quality data acquisition and field ready databases in Geosoft format throughout the survey on an ongoing basis. The data were archived on CD-ROM in Geosoft format.

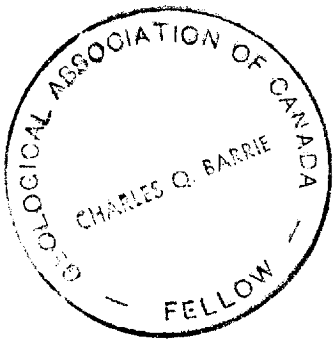
6.0 SUMMARY

An airborne high sensitivity magnetic survey with three magnetometers was performed at 60 metre mean terrain clearance, 100 metre line interval, 1 kilometre tie line interval, and data sample points at 6 metres along the flight lines. A high sensitivity magnetic and a GPS base station located in the airport of Labrador City recorded the ~~diurnal magnetic activity and reference GPS data during the survey for adherence~~ to survey tolerances and post flight corrections in the flight path. A remote base magnetic station was set up near the southern edge of the survey area and operated while the survey was being performed in that area. All data have been archived on a CD-ROM.

Respectfully Submitted,

TERRAQUEST LTD.

Charles Q. Barrie, M.Sc.



APPENDIX I

PERSONNEL

Field:	Pilots	Tony DeAngelis Dave Shaver Brian Harvey
	Operators	Paul Beaubien Frank Glass Kevin Jackman
	Maintenance	SA7i, Sept Isle, Quebec
Office:	Chief Geophysicist Manager	Dr. Shuchun (Harry) Du Charles Barrie

APPENDIX II

CERTIFICATE OF QUALIFICATION

I, Charles Barrie, ~~certify that~~ I:

1) am registered as a Fellow with the Geological Association of Canada and work professionally as a geologist,
2) hold an Honours degree in Geology from McMaster University, Canada, obtained in 1977,
3) hold an M.Sc. ~~in Geology from Dalhousie University, Canada, obtained in 1980~~,
4) am a member of the Prospectors and Developers Association of Canada,
5) am a member of the Canadian Institute of Mining , Metallurgy and Petroleum,
6) have worked as a geologist for over twenty five years,
7) am employed by and am an owner of Terraquest Ltd., specializing in high sensitivity airborne ~~geophysical surveys~~, and
8) have prepared this operations and specifications report pertaining to airborne data collected by Terraquest Ltd..

Mississauga, Ontario, Canada
May 15, 2001

Signed

Charles Q. Barrie, M.Sc.
Vice President, Terraquest Ltd.

APPENDIX III

FLIGHT LOG

Project: B-043	**Grid: Labrador City**
Flown: Jan. - May, 2001	**Aircraft: Cessna C-GGLS**

Date	Flight	Line	Comments	
Jan. 05	G072	None	COMP + FOM	
Jan. 05	G073	L9120-9170	processing done	
Jan. 07	G074	L8940-9110	processing done	
Jan. 08	G075	L3540-3550	processing done	
Jan. 10	G076	None	COMP	
Jan. 10	G077	L8840-8930	processing done	
		T290-340		
Jan. 10	G077a	L8850	processing done	recovered
Jan. 12	G078	L8780-8830	processing done	reprocessed
		T230-290, T241, 251, 301		
Jan. 12	G079	L8680-8770	processing done	reprocessed
		T261		
Jan. 14	G080	None	Radar Test	
Jan. 17	G081	None	Radar Test	
Jan. 17	G082	L8620-8670	processing done	8650-8670: no bmag2
		T271, 281, 291		reprocessed
Jan. 18	G083	L2050	processing done	
		T10-90		
Jan. 18	G083b	L2040	processing done	
		T100-110		
Jan. 20	G084	L2060	processing done	
		T120-160		
Jan. 20	G085	T170-180	processing done	
Jan. 07	G086	None	GPS Test	
Jan. 25	G087	L30-160	processing done	
Jan. 27	G088	L170-280	processing done	
Jan. 27	G088a	T190-220	processing done	
Jan. 27	G089	L290-340	processing done	
Feb. 03	G090	L8320-8610	processing done	L8410, 8560 not recorded
Feb. 03	G090a	L8410, 8560	processing done	recovered
Feb. 04	G091	L4190-4310,8140-8310	processing done	
Feb. 04	G091a	L8260	processing done	recovered
Feb. 05	G092	L350-500	processing done	470-500: no bmag2
Feb. 05	G093	L7980-8130	processing done	

Feb. 07 G094	L510-540	processing done	
Feb. 14 G095	L7780-7970	processing done	
Feb. 15 G096	L7580-7770	processing done	
Feb. 15 G097	L7410-7570	processing done	
Feb. 16 G098	L7260-7400	processing done	
Feb. 16 G098a	L4320	processing done	recovered
Feb. 16 G099	L550-620	processing done	
Feb. 17 G100	L7060-7250	processing done	
		failed due to ground reflection, use remote GPS	
Feb. 17 G101	L6920-7650	processing done	
Feb. 18 G102	L6830-6910	processing done	
Feb. 21 G103	L640-760	processed done	
Feb. 23 G104	L770-780	processed done	
Feb. 23 G105	none		
Feb. 24 G106	L6590-6800	processed done	
Feb. 24 G107	L6450-6580	processed done	
		failed due to ground reflection, use remote GPS	
Feb. 25 G108	L6260-6440	processing done	
Feb. 25 G109	L790-940	processing done	
Feb. 28 G110	L940-1120	processing done	
Mar. 03 G111	L1130-1300	processing done	
Mar. 03 G112	L1310-1420	processing done	
Mar. 04 G113	L1430-1660	processing done	
Mar. 19 G114	L1670-1760	processing done	
Mar. 20 G115	L1770-2040	processing done	
Mar. 20 G116	L2050-2200	processing done	
Mar. 21 G117	L6040-6250	processing done	
Mar. 21 G118	L5890-6030	processing done	
Mar. 22 G119	L5690-5880	processing done	
Mar. 23 G120	L5550-5680	processing done	
Mar. 23 G121	L5480-5540	processing done	
Mar. 29 G122	L5500-5540	processing done	
	L10-20, 630, 5710	processing done	
	L1 – 12	Lag shift test line	
Mar. 30 G123	L5330-5490	processing done	
Mar. 30 G124	L5170-5320	processing done	
Mar. 31 G125	L5010-5160	processing done	
Mar. 31 G126	L4830-5000	processing done	
Apr. 01 G127	L4660-4820	processing done	
Apr. 02 G128	L4460-4650	processing done	
Apr. 02 G129	L4330-4450	processing done	
Apr. 06 G130	L4180,4490,330	processing done	
Apr. 07 G131	L2210-2490	processing done	
Apr. 07 G132	L2500-2610	processing done	
Apr. 11 G133	L3920-4170	processing done	

Apr. 18 G134	L3630-3910	processing done
Apr. 18 G135	L3420-3620	processing done
Apr. 19 G136	L3160-3410	processing done
Apr. 19 G136	L3160-3410	processing done
Apr. 21 G137	L2840-3150	processing done
Apr. 21 G138	L2620-2830	processing done
Apr. 23 G139	L640,8840-9030,	processing done
	L9110-9120, 5820	processing done
Apr. 23 G140	L790,1970,2210-2220,2650	processing done
	2660,2800,3140-3170, 4430	processing done
	4450,5170-5180,5500-5510	processing done
	6100,7880,8320	processing done
Apr. 25 G141	L1 – 4	COMP flight
	L9050-9060, 8950, 7300	processing done
Apr. 26 G142	L6200-6330,7100-7240	processing done
Apr. 29 G143	L1070-1200,1670-1720	processing done
Apr. 29 G144	L910-1060,480-540	processing done
May 01 G145	L2230-2260	processing done
	L4590-4660	processing done
	L7250-7290	processing done
May 01 G146	L670	processing done

Cowan Geodata Services

12 Edna Road – Dalkeith WA 6009. Australia
Tel +61 (08) 9389-6959, Fax (08) 9386-1603
e-mail: cowangeo@compuserve.com

Memo

To: Marcus Flis, Hamersley Iron Pty Ltd

From: Duncan R. Cowan, Consultant Geophysicist

CC:

Date: 26 October, 2001

Re: IOC Magnetic Survey, Wabush Area, Labrador

Summary

Quality control and data re-processing has been carried out for the Wabush survey, Labrador flown by Terraquest for IOC/Hamersley Iron. The survey consisted of 973 lines, 932 traverses flown 120° with 100 m spacing and 41 tie lines flown 30° with 1 km spacing. Total line km was 23,942. Nominal terrain clearance was 60 m.

In early June, preliminary QC on the original data delivered by PGW revealed two very serious problems and a number of less serious defects in the data. The serious problems found were:

1. Numerous GPS dropouts where blocks of ten scans had identical coordinates that were repeats of the last reading in the previous block. Some lines had more than 1000 of these repeat readings.

2. Numerous periodic spikes in steep gradients affecting a high proportion of flight lines.

Less serious problems included tares in the GPS height and virtually useless laser altimeter data. In addition significant differences in flight height between lines in opposite directions has affected the high frequency content of the data. The levelling of the dataset provided by PGW was poor making it difficult to see more subtle problems in the data

These problems were reported to Terraquest as unacceptable and Terraquest commissioned CGI in Toronto to attempt the repair the data. CGI worked on the GPS problem and were able to improve the GPS data although the work took 14 weeks and appears to have been only partially successful. Flight lines with only a few bad blocks of data have been repaired successfully but lines with numerous bad blocks, especially where these were contiguous, show significant pulls or herringboning as the interpolation errors become high. The final data from CGI was just as badly levelled as that from PGW making it difficult to see position related errors. Picodas have accepted

that there are two serious hardware problems in the Terraquest system. First of all a timing problem in the acquisition system which resulted in the bad blocks and the inability of the magnetometer boards to track rapidly changing gradients producing the periodic spikes (see appendix)

The final database from CGI was received on September 11th. After careful QC on the final database and attempts to clean up and relevel the CGI levelled data channel we decided it was preferable to re-process the data from scratch using the raw data for the three magnetometer sensors. Even after profile drape corrections to the CGI levelled channel and excluding traverse/tie intersections in steep gradients, intersection errors were large and not systematic. The data were completely re-processed starting with improved parallax corrections, manual levelling instead of tie-line levelling, profile drape correction, removal of spikes in steep gradients and microlevelling. The final total magnetic intensity grid was produced using pseudo-line transverse gradient enhancement and both 20-m and 10-m mesh grids were produced. Re-processing has resulted in a significant improvement over the original data but positional problems remain in the data and the combination of spike removal and microlevelling has resulted in the loss of significant high frequency information especially close to the flight line direction. The GTIME fixes have removed the major glitches in the data but left uncertainty in interpolated coordinates. The very poor levelling of the final database masks these problems as it is difficult to separate levelling errors from minor pulls. However, the automated parallax correction statistics confirm the presence of problems in line to line correlation. In fact these interpolation problems may be the cause of some of the levelling errors as 10 of the 42 tie-lines are affected. Even in moderate gradients X,Y positional problems of the order of a few tens of metres indicated by the parallax tests produce large intersection errors. This is supported by the relatively large intersection errors after draping of the profile data. i.e problems may be in X,Y rather than Z. I have done my best to work around these problems and produce a final levelled dataset but the effects of two hardware problems in the data acquisition persist and there is no doubt that the quality of the survey has been degraded. The problem of positional uncertainty is clear in high frequency filters such as 2nd vertical derivatives and high gain AGC filters. Many of the residual problems are subtle pulls or kinks, others such as the problems associated with lines 5630,5660 and 5820 are larger. Despite the best efforts of CGI and us the magnetic data have been significantly degraded by the problems in acquisition. Similarly the combination of problems in the GPS height channel and noisy radar altimeter data has resulted in a degraded altimetric dtm.

It is difficult to quantify the degree to which the final data have been degraded by the problems encountered as both positional errors and loss of high frequency affect different lines to different extents. However if you take the GPS fix problems on their own there are 132 lines out of a total of 973 lines with interpolation problems. These lines cannot be fixed to the positional accuracy needed for a high-resolution aeromagnetic survey where expensive drilling decisions will be made based on the results. About 70% of lines have periodic spikes in steep gradients resulting in loss of high frequency information caused by recursion filtering. Microlevelling to remove DC shifts in the data affects all lines and is highly directional with significant reduction in amplitude for trends subparallel to the flight line direction. Great care will be needed to allow for these problems in the interpretation.

This short report documents the diary of QC and re-processing steps and statistics on bad lines are included in the appendix.

Processing Diary

Hamersley Iron requested QC and reprocessing of the data from Terraquest. The following products were required:

1. Magnetic grids at 20m or smaller mesh using gradient enhancement and derived products
2. Analytic signal
3. Texture image
4. Derivatives
5. Magnetic susceptibility
6. Separation filter

We examined the first data set presented on CD dated 15th May 2001. The CD contained zipped ASCII data of flight lines in 5 files. The following problems were noted at the time and reported:

1. Series of repeated x,y readings – occurring in groups of 10 fids. Some lines had more than 1000 repeat readings. The concern is raised as to whether the gps-derived coordinate results are then out for the rest of the line. These problems are seen as steps in the data that produces artifacts in grids and profiles. High pass stacked profiles show how widespread these problems are

2. Format errors were found in line 620 – '**' in GPS Alt field

3. Missing data. There are ~3km gaps in the flight path in the south of the area. There are also at least two gaps in the flight path where line spacing exceeds the specification.

4. Spikes in the data over the steep gradients. This appears to be an error in the data acquisition system. See figures 1 and 2 for an example. The same problem is seen in many lines. The Excel file NOISRPT.XLS is a report of rms error for the tail mag for all traverses.

5. Variable parallax problems may be seen in parts of the data but these effects are minor compared with the steps and spike problems noted above.

6. The GPS height channel has dropped out completely on several lines and there are odd tares in GPS height which correspond to irregularities in x,y coordinates throughout the survey. Figures 3 and 4 show an example of the problem. The laser altimeter channel had numerous spikes and 77 lines had no data. Altimetric dtm grids were produced from GPS height/radar altimeter and barometric/radar altimeter data and both were relatively poor.

We considered this survey to show serious inadequacies. The data reports were returned to Terraquest for explanation and fixes. They contracted Controlled Geophysics Inc to produce corrected data. CGI produced a new CD dated August 10 2001. This CD contained a Geosoft GDB file and descriptions of the processing applied. Many of the gps related problems were fixed, but not all. Figure 5 shows the gaps in the data where there were major GPS stoppages. Figure 6 shows the data before GPS correction with numerous small glitches. The problem of spikes in the magnetic data was not corrected. We queried this directly with Terraquest/CGI and Picodas admitted that the problem was due to their acquisition system. The GPS height channel problems were still present. These problems were returned to CGI for further repairs.

A third CD was produced dated Sept 7th 2001 and this data was used for our processing and final results. This CD contained a Geosoft GDB and processing notes. Further gps location problems had been fixed but magnetometer and altimeter problems remain and have made it impossible to achieve what we would consider a quality product. There are still lines with obvious positional/parallax problems that degrade final images. Note that final processing utilised the raw tail stinger and wingtip data, re-processed from scratch. There were too many PGW/CGI introduced levelling problems to be able to use the levelled magnetics channel in the database. Even after profile drape corrections and excluding traverse/tie intersections in steep gradients, intersection errors were large and not systematic. The data were completely re-processed starting with improved parallax corrections, manual levelling instead of tie-line levelling, profile drape correction, removal of spikes in steep gradients and microlevelling. The final total magnetic intensity grid was produced using pseudo-line transverse gradient enhancement and both 20 m and 10 m mesh grids were produced. Re-processing has resulted in a significant improvement over the original data but positional problems remain in the data and the combination of spike removal and microlevelling has resulted in the loss of significant high frequency information especially close to the flight line direction. Figures 6, 7,8 and 9 show the various processing stages. Despite the best efforts of CGI and us the final results are disappointing. Further improvement would involve considerable manual editing to remove artifacts which affect segments of lines etc and may not be cost effective. In the final analysis lines which had a large number of bad GPS blocks of 10 repeat scans (especially where these are contiguous) can not be restored satisfactorily and should have been re-flown based on field QC.

Quality Control and Levelling Processing Notes:
We imported the final data into our binary format and produced quality control reports and test plots. We undertook an extensive series of attempts to level the magnetic data. The magnetic data provided by the contractor show severe striping along flight lines ranging from huge level busts to micro-corrugations. The following problems were encountered:

1. Magnetic readings were at different levels for lines flown in one direction to the other. This resulted in severe striping – micro-corrugations. Many of these level shifts are due to different terrain clearance for lines flown in opposite directions, sometimes with differences of plus 20 m

2. Certain lines were at extremely different levels to adjacent lines and had to be adjusted individually

3. Ultra high frequency filters show dramatic differences in signal levels between flights. There are some anomalously high signal levels in the northern part of the survey. Figure 11 shows lines with low signal as well as general striping.

4. In some cases where numerous gaps in GPS readings have been interpolated, serious pulls and herringboning effects are observed.

5. Spikes in the magnetometer data were present on the flanks of the steep gradients. Figure 10 shows the recursion filter used to remove the spikes.

6. Some lines had anomalously high values in one or other wingtip magnetometer readings resulting in stripes in the transverse gradient data.

7. Altimeter data were poor. The laser altimeter channel was unusable. 77 lines had no laser altimeter data, 9 lines were just random spikes and about half the lines had significant numbers of spikes which did not correlate from line to line. The GPS height has a number of tares and considerable variation in DC level. Radar altimeter data were noisy but generally useable after non-linear and recursion filtering. An altimetric dtm was produced from the GPS height and filtered radar altimeter data. This was better than the original version from PGW but still sub-standard. A list of bad laser altimeter data is included in the appendix.

8. Raw base station data were not available in the GDB but inspection of the filtered data suggests problems including the base station magnetometer stopping and repeating readings. A total of 17 lines are suspect and line numbers and fiducials listed in the appendix.

Enhancement and Derived Products

After cleaning up the wingtip data we calculated the longitudinal and transverse gradients

The Geosoft method of calculating pseudo-lines using the transverse gradient was used to produce a 20-m mesh gradient-enhanced TMI grid. Gradient enhancement improved line to line correlation with fewer 'stepladder' and 'string of beads effects'.

A 20-m gradient enhanced TMI grid and a 25-m dtm grid were used for all subsequent processing. A 10-m gradient enhanced TMI grid was also produced for image display purposes.

1. 1st and 2nd derivative and 3D analytic signal grids, layer filtered grids and tilt angle grids were produced using wavenumber filtering.

2. An apparent susceptibility grid was produced using the USGS terracing operator.

3. High gain AGC filtered grids were produced for both the 20 m gradient enhanced TMI and the 10-m data.

4. Gradient maxima/strike plots of the separation filter were produced.

5. A combination of the terraced apparent susceptibility in colour with separation and tilt angle greyscale seems to provide the best resolution of local anomalies.

6. A series of A3 plots of the various filters etc has been produced at 1:250,000 scale as a further check on data integrity. The second vertical derivative image is the least satisfactory of these as it clearly amplifies minor herringboning and other parallax relate artifacts.

Plates A3 – 1:250,000 Scale

QC

Plate 1 Flight path plot

Plate 2 High gain AGC filter of original TMI data from PGW showing numerous small glitches due to GPS problem and levelling busts and micro-corrugations.

Plate 3 Separation filter image produced by filtering the line data then gridding. The image shows gaps in the data due to contiguous bad blocks with GPS coordinate problems.

Enhanced Products

Plate 4. Gradient enhanced TMI colour shade image, shaded from the NW

Plate 5. High gain AGC filter of gradient enhanced TMI data

Plate 6. 1st vertical derivative colour shade image, shaded from NW

Plate 7. 2nd vertical derivative colour shade image, shaded from the NW. The 2nd vertical derivative has amplified pulls and other parallax/positional interpolation errors in the data.

Plate 8. 3D analytic signal amplitude colour shade image, shaded from NW

Plate 9. Separation filter colour shade image, shaded from NW

Plate 10. Terraced separation filter in colour with gradient tilt angle greyscale.

Plate 11. Transverse gradient colour shade image, shaded from NW. The stripes in the data are due to bad values in one wingtip sensor.

Plate 12. GLCM texture filter greyscale image, difference variance parameter F10, 7x7 window.

Plate 13. Altimetric dtm colour shade image, shaded from NW. This version was produced from the GPS height and radar altimeter data.

Plate 14. Altimetric dtm colour shade image, shaded from NW. This version was produced from the barometric altimeter and radar altimeter data with smoothing applied.

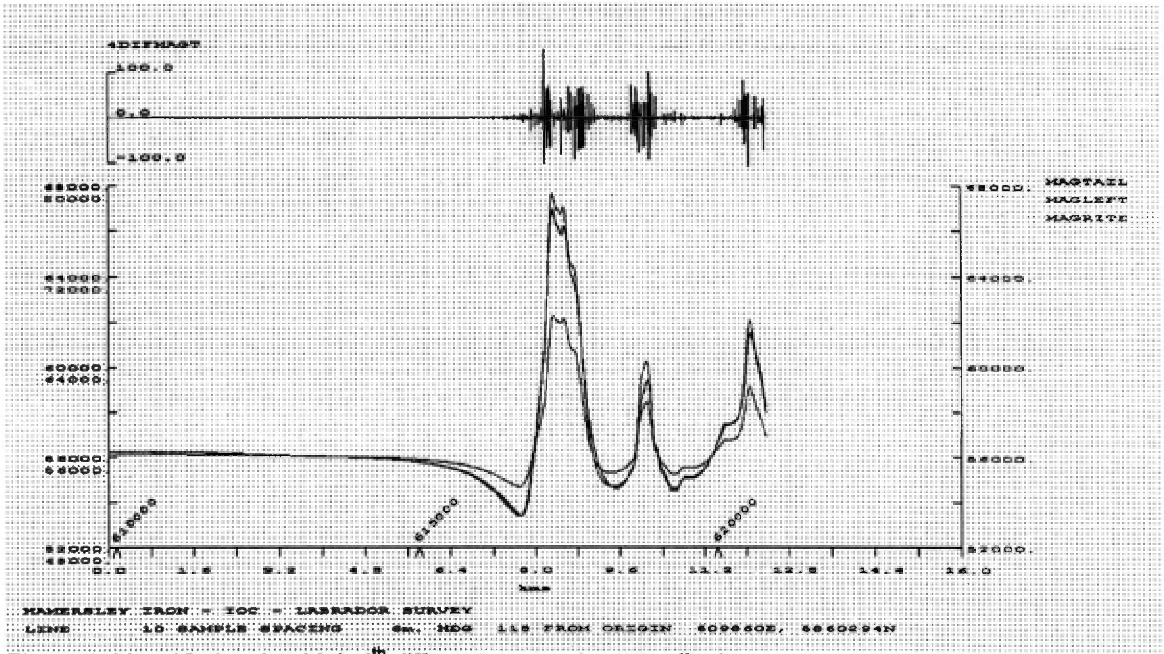


Figure 1. Line 10 showing high 4th difference over steep gradients

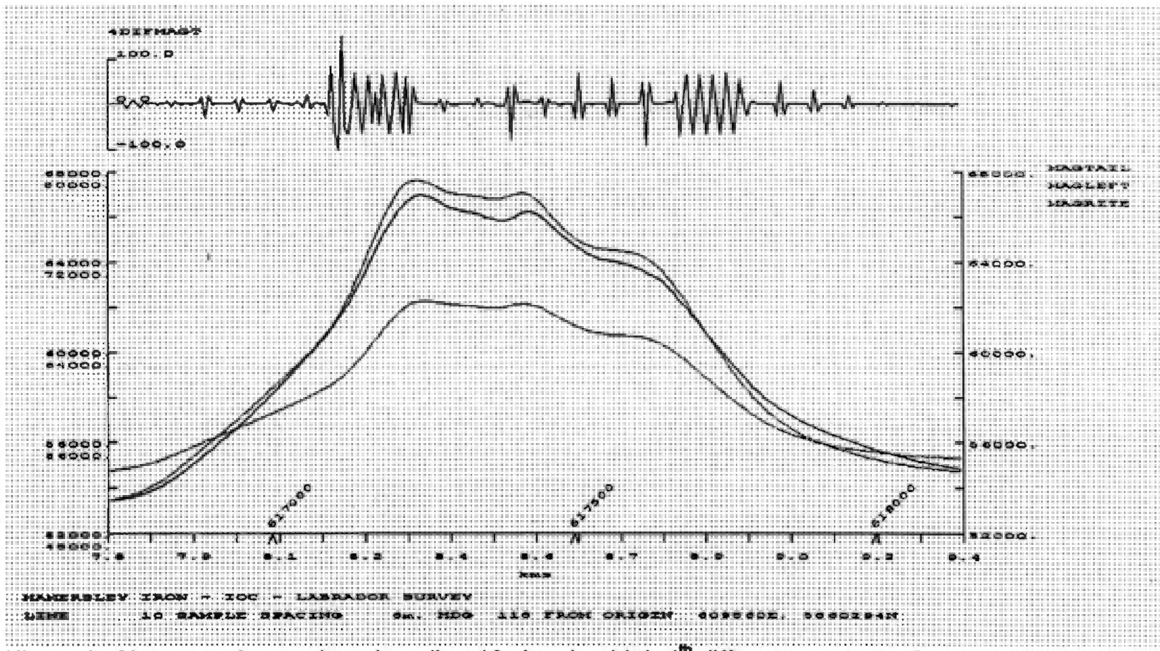


Figure 2. Close-up of central peak on line 10 showing high 4th difference over flanks

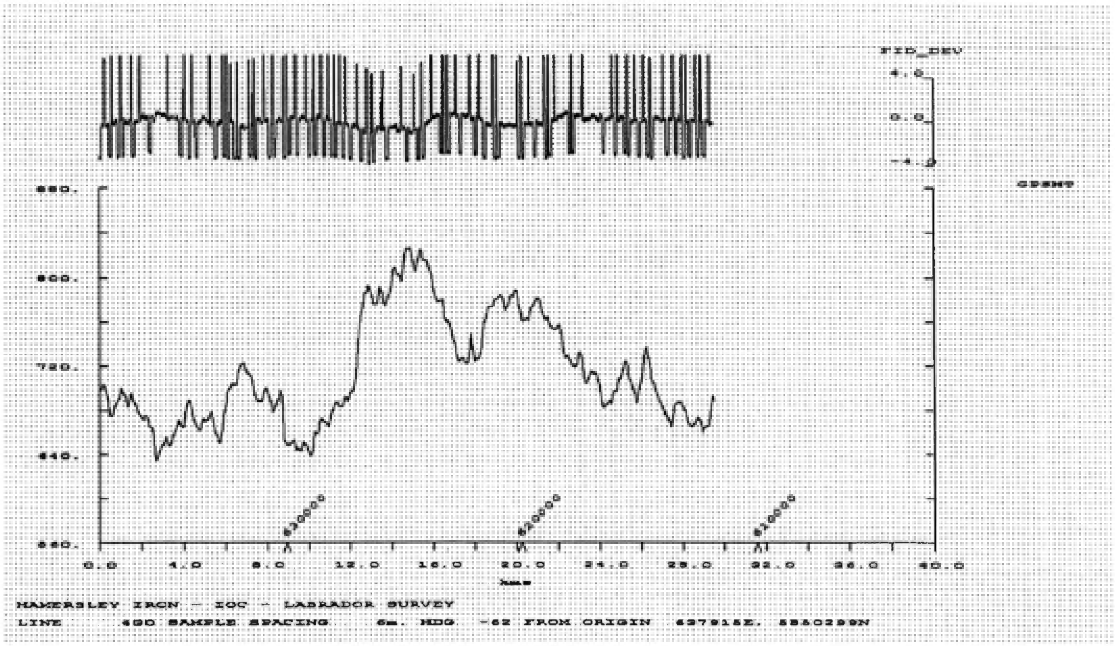


Figure 3. GPS Altimeter stepping problem. Example from line 430

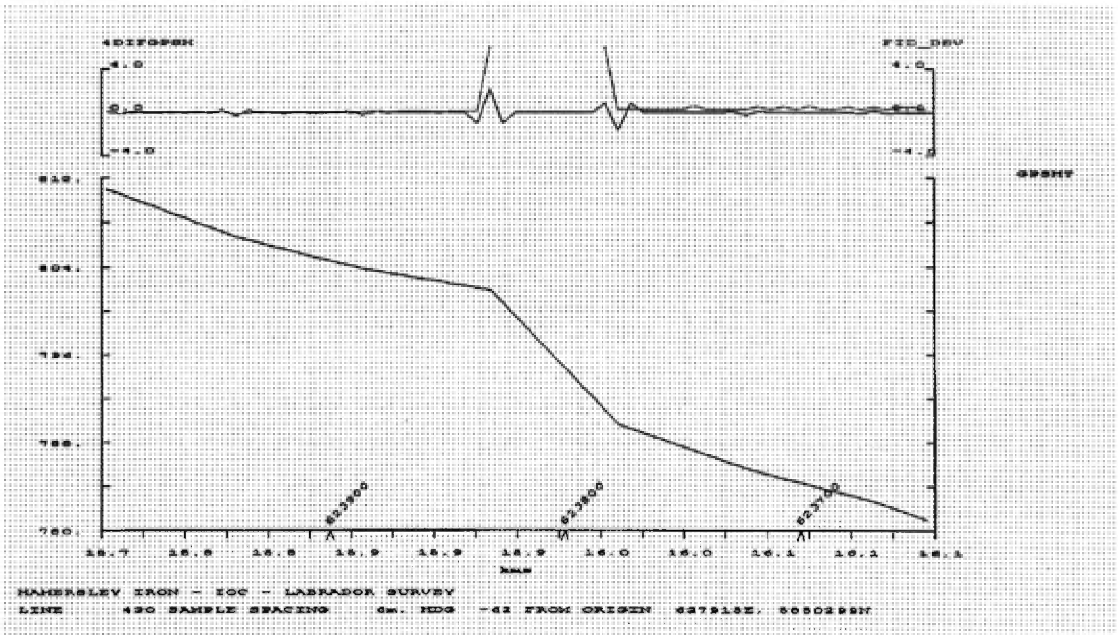


Figure 4. Detail of GPS Altimeter stepping problem. Example from line 430

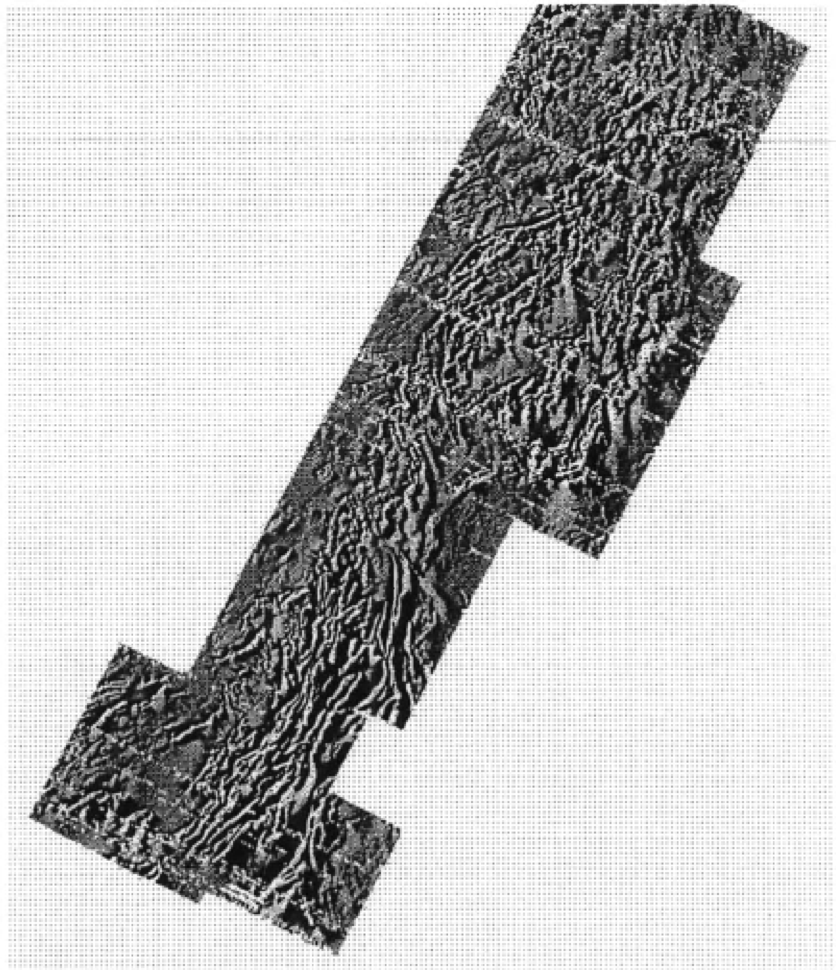


Figure 5. Hanning residual filter showing the gaps in data due to large numbers of GPS stoppages. As see above there are some lines in the database with a large number of these undefined points. Note also that many tie-lines have large numbers of undefined values which must have a serious effect on tie-line levelling. These lines with large numbers of undefined coordinates can not be restored accurately.

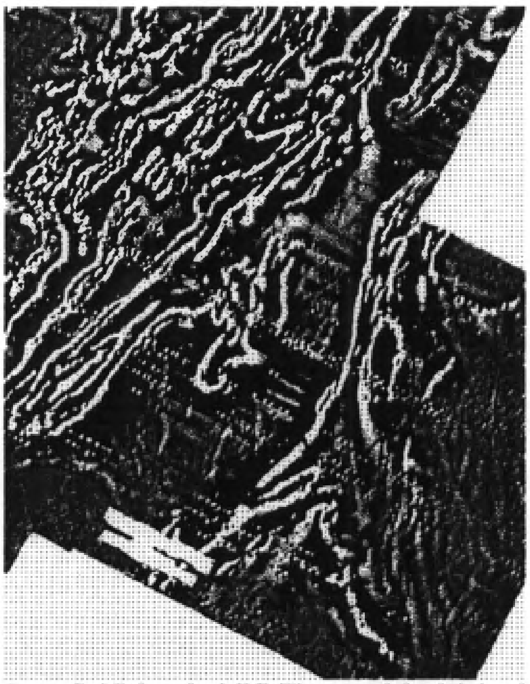
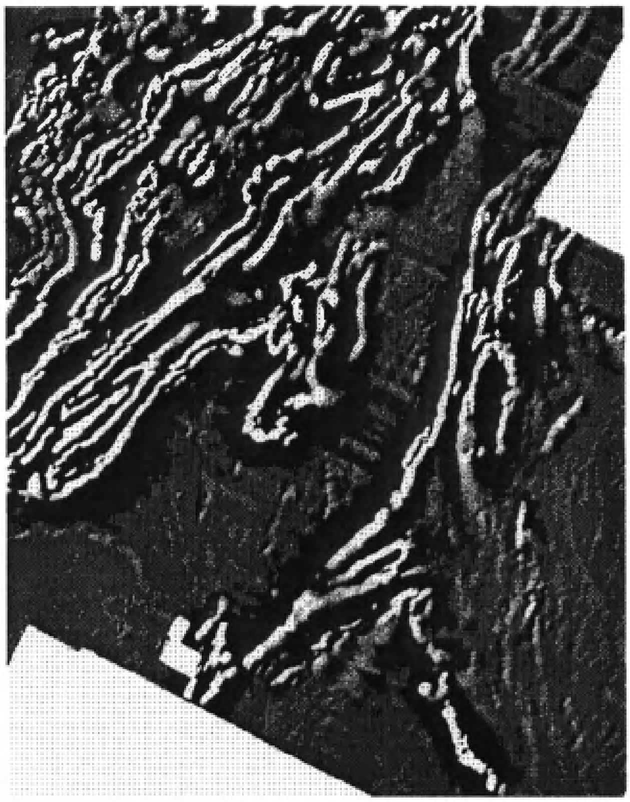
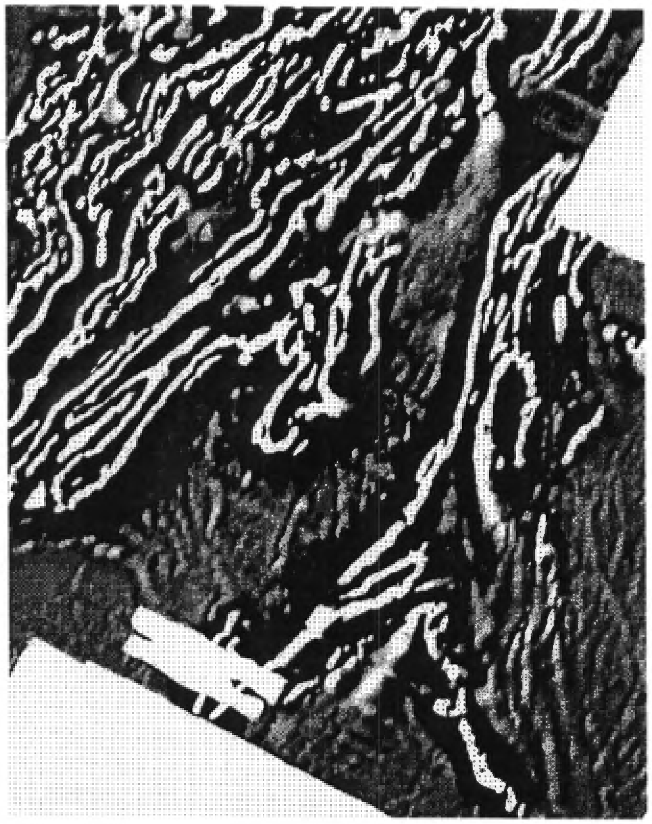


Figure 6. High gain AGC filter or original data showing numerous glitches due to GPS stoppage problems as well as levelling errors.





Figures 7 and 8. High gain AGC filter after CGI fix of GPS GTIME problem (Figure 7 -left image) and after reprocessing from scratch (Figure 8 -right image). In Figure 7, the numerous glitches seen in Figure 6 have been removed but there are still clear parallax problems seen as pulls and kinks. In Figure 8 the parallax problems have been reduced and line to line correlation is improved.

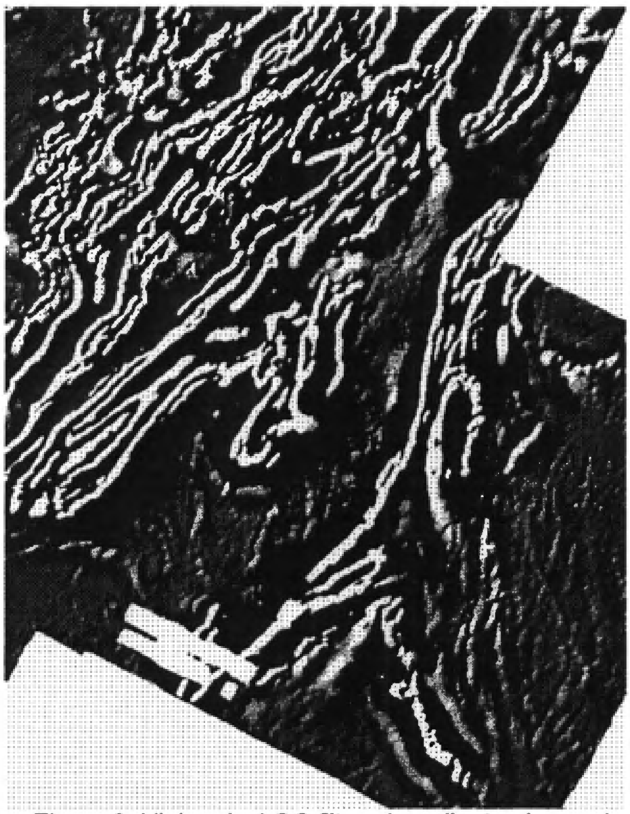


Figure 9. High gain AGC filtered gradient enhanced grid

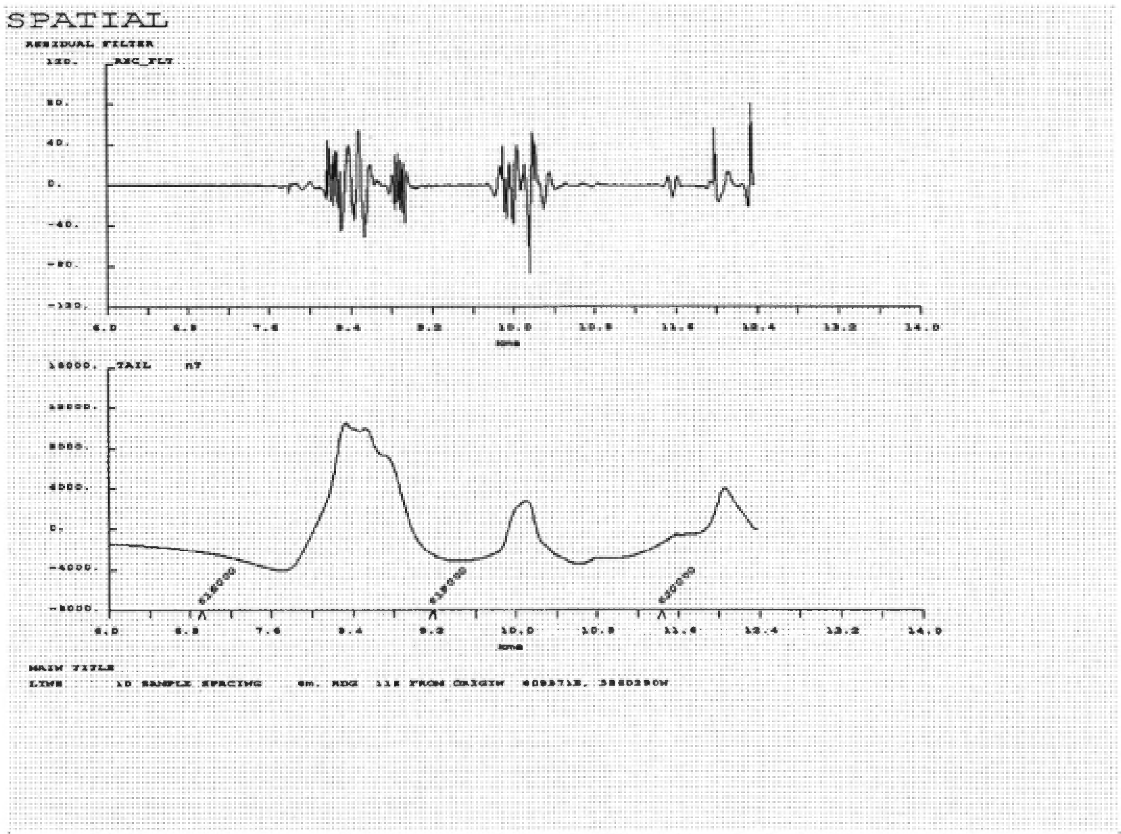


Figure 10. Spike removal using a recursion filter. The filtered image is the recursion filter residual showing what has been removed. The periodic spikes over the steep gradients have been removed cleanly but some high frequency signal has been removed from the major anomaly peaks. However the signal removed is only a few percent of the anomaly amplitude.

Figure 11 Ultra high frequency filter showing bad lines with low signal levels and as general striping.

NOTES ON DATA ENHANCEMENT

Enhancement and Analysis of Gridded Data

A range of different spatial and wavenumber filters are applied to the data. It is concluded that wavenumber separation or layer filters give the best separation of shallow anomalies. The spatial and wavenumber filtering is supported by gradient maxima/strike plotting.

Filtering operations on the gridded data included:

- ⇒ Scalar horizontal gradient of total magnetic intensity.
- ⇒ Separation filters to enhance shallow sources,
- ⇒ AGC filter of total magnetic intensity to enhance shallow sources. This is a spatial filter so it does not suffer from the edge effects seen in the FFT methods.
- ⇒ Gradient tilt angle to enhance low amplitude signals. The separation filter and tilt angle can be combined to produce a wavenumber 'texture' filter,
- ⇒ A grey level co-occurrence texture filter to enhance the textural content of the data.

Scalar Gradient Maxima/Strike Plots

The gradient maxima/strike plot is usually superimposed on a separation filter greyscale image or terraced TMI/texture filter. The scalar horizontal gradient maxima of the TMI data have been plotted as magnetic strike symbols, coded to reflect relative amplitudes. The plots are an effective way of mapping contacts, faults etc. from aeromagnetic data and also map circular or elliptical anomalies as closed clusters of strike symbols. The plot highlights the main linear and curvilinear anomalies.

Separation Filtering

Separation or layer filtering of magnetic data allows deconvolution of the effects of causative sources occurring around a particular level. In theory it is impossible to achieve a complete separation since the problem is non-linear and the assumptions made are quite restrictive, however, in practice, results are very useful. The double separation filter is an alternative to a vertical derivative and is more stable.

AGC filter

The Automatic Gain Control filter (AGC) is a spatial filter designed to enhance shallow sources. The filter operates on a moving window of data and normalises amplitudes to enhance small amplitude anomalies while attenuating large amplitude anomalies. The AGC enhancement has no directional bias. The AGC filter had less tonal information content than the separation filter greyscale images so was only used as worksheet to highlight local detail.

Texture Filtering

Texture is an innate property of any image. In the literature describing image processing and analysis it is common to find an image described in terms of its **tone** and **texture**. Tone is basically equivalent to amplitude in geophysical terms and corresponds to the varying shades of colour assigned to individual pixels. In contrast texture refers to the spatial/statistical distribution of the tones. Thus it is fundamentally different from tone, which is defined at one location (pixel) since texture occurs over some finite area and hence requires some finite number of pixels to represent it.

'Texture filters' analyse the textural characteristics of a window which is progressively moved over the dataset to be filtered. At each location the data within the window are analysed and a parameter calculated which represents the amount that a particular textural characteristic presents. The spatial variation in this parameter is used to generate a new image. Thus, the resulting 'texturally filtered' image is a map of the variation in texture within the data. This project has used grey-level co-occurrence (GLCM) filters.

Gradient Tilt Angle

The gradient tilt angle is defined as the ratio of the vertical gradient of the potential field to the total horizontal gradient of the field. The gradient tilt angle has some interesting properties. As a dimensionless ratio it responds equally well to shallow and deep sources and to a large dynamic range of amplitudes for sources at the same level. The tilt angle is positive over a source and negative elsewhere and has a range of –90° to +90°, so it is much simpler than the analytic signal phase angle.

Gradient tilt = $\tan^{-1}$ (vertical gradient / absolute total horizontal gradient)

The gradient tilt angle is stable provided the input vertical and horizontal gradients are stable. The use of wavelets or orthogonal polynomials to calculate the derivatives overcomes most problems.

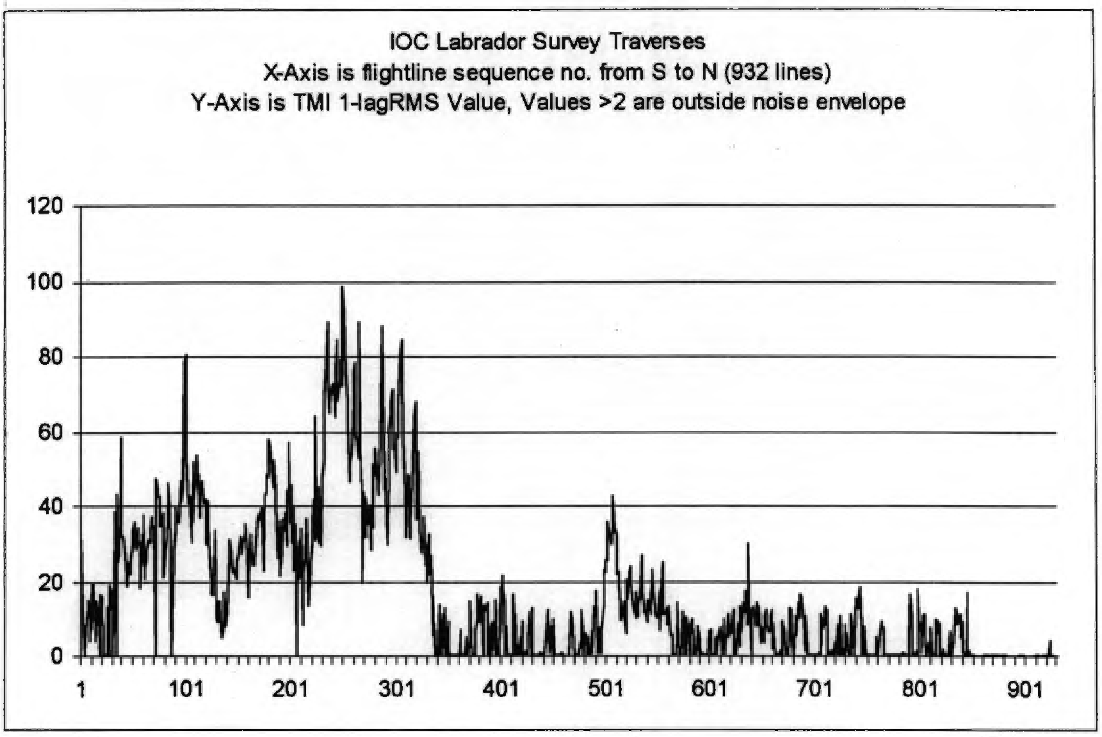
Appendix Listing of Data problems

GPS BAD LINES

```
OPENED FILE "C:\HAMERSLY\LABRADOR\INPUT.XYZ" TO READ

FILETYPE= 1, Geosoft file, Line header record with XYZ data following
OPENED FILE "C:\HAMERSLY\Labrador\import.trk" TO WRITE

List of REALLY BAD LINES - repeat x,y points & '*' in x,y fields >500
pts
Ln:     180,      0 Data Errors,  1074 Repeat Points
Ln:     190,      0 Data Errors,   684 Repeat Points
Ln:     200,      0 Data Errors,   817 Repeat Points
Ln:     220,      0 Data Errors,   798 Repeat Points
Ln:     251,      0 Data Errors,   950 Repeat Points
Ln:     370,      0 Data Errors,   618 Repeat Points
Ln:     380,      0 Data Errors,   893 Repeat Points
Ln:     420,      0 Data Errors,   760 Repeat Points
Ln:     430,      0 Data Errors,  1197 Repeat Points
Ln:     460,      0 Data Errors,   713 Repeat Points
Ln:     690,      0 Data Errors,  1578 Repeat Points
Ln:     750,      0 Data Errors,   941 Repeat Points
Ln:     770,      0 Data Errors,   608 Repeat Points
Ln:     780,      0 Data Errors,   789 Repeat Points
Ln:     950,      0 Data Errors,  1007 Repeat Points
Ln:     960,      0 Data Errors,   817 Repeat Points
Ln:     970,      0 Data Errors,  1159 Repeat Points
Ln:     980,      0 Data Errors,   684 Repeat Points
Ln:    1210,      0 Data Errors,   722 Repeat Points
Ln:    1721,      0 Data Errors,   532 Repeat Points
Ln:    4300,      0 Data Errors,   941 Repeat Points
Ln:    4490,      0 Data Errors,  1245 Repeat Points
Ln:    4580,      0 Data Errors,   988 Repeat Points
Ln:    4920,      0 Data Errors,  1235 Repeat Points
Ln:    4950,      0 Data Errors,   779 Repeat Points
Ln:    4990,      0 Data Errors,   808 Repeat Points
Ln:    5630,      0 Data Errors,  1419 Repeat Points
Ln:    5660,      0 Data Errors,   922 Repeat Points
Ln:    5670,      0 Data Errors,  1064 Repeat Points
Ln:    5820,      0 Data Errors,   912 Repeat Points
Ln:    6170,      0 Data Errors,   663 Repeat Points
Ln:    6241,      0 Data Errors,   703 Repeat Points
Ln:    6350,      0 Data Errors,   988 Repeat Points
Ln:    6420,      0 Data Errors,   608 Repeat Points
Ln:    6430,      0 Data Errors,   855 Repeat Points
Ln:    6600,      0 Data Errors,   694 Repeat Points
Ln:    6710,      0 Data Errors,   656 Repeat Points
Ln:    6780,      0 Data Errors,  1178 Repeat Points
Ln:    6910,      0 Data Errors,   931 Repeat Points
Ln:    7330,      0 Data Errors,   504 Repeat Points
Ln:    7360,      0 Data Errors,   627 Repeat Points
Ln:    7380,      0 Data Errors,   608 Repeat Points
Ln:    7400,      0 Data Errors,   846 Repeat Points
Ln:    7690,      0 Data Errors,   542 Repeat Points
Ln:    7830,      0 Data Errors,   874 Repeat Points
Ln:    7970,      0 Data Errors,   931 Repeat Points
Ln:    8120,      0 Data Errors,  1270 Repeat Points
Ln:    8130,      0 Data Errors,   803 Repeat Points
```

```
Ln:    8160,     0 Data Errors,    713 Repeat Points
Ln:    8200,     0 Data Errors,    618 Repeat Points
Ln:    8210,     0 Data Errors,    608 Repeat Points
Ln:    8290,     0 Data Errors,   1178 Repeat Points
Ln:    8300,     0 Data Errors,    532 Repeat Points
Ln:    8440,     0 Data Errors,    979 Repeat Points
Ln:    8550,     0 Data Errors,    580 Repeat Points
Ln:    8580,     0 Data Errors,    865 Repeat Points
Ln:    8600,     0 Data Errors,    646 Repeat Points
Ln:    8610,     0 Data Errors,    589 Repeat Points
Ln:    8690,     0 Data Errors,   1112 Repeat Points
Ln:    8810,     0 Data Errors,    808 Repeat Points
Ln:    9150,     0 Data Errors,   1131 Repeat Points
Ln:   50020,     0 Data Errors,    551 Repeat Points
Ln:   50030,     0 Data Errors,    627 Repeat Points
Ln:   50070,     0 Data Errors,    893 Repeat Points
Ln:   50080,     0 Data Errors,    941 Repeat Points
Ln:   50090,     0 Data Errors,    618 Repeat Points
Ln:   50120,     0 Data Errors,   1188 Repeat Points
Ln:   50160,     0 Data Errors,    646 Repeat Points
Ln:   50200,     0 Data Errors,    665 Repeat Points
Ln:   50251,     0 Data Errors,   1150 Repeat Points
Ln:   50300,     0 Data Errors,   1919 Repeat Points
Ln:   50330,     0 Data Errors,    599 Repeat Points

FINAL SUMMARY:
READ 3880196 records. Found : 88878 Repeat Points
READ    973 TRKs of 3877953 records. Tot Dist 23945.1kms @ av.spacing
6M
```

RMS NOISE PLOT SHOWING GROUPS OF LINES WITH SPIKES



The plot shows rms noise reports for lag 1 from Noiserpt.xls. All values greater than 2 are outside the noise envelope. Nearly all high rms values are due to the periodic spikes in steep gradients.

DIURNAL BAD LINES

1280, fid252/302 1650, fid206/345 1860 fid29/85 1930 fid216/267 2221 fid60/77

2620 fid56/116 2790 fid189/216 3420 fid15/62 4160 fid14/123 5430 fid351/396

5460 fid24/153 6390 fid37/189 6810 fid297/378 7780 fid267/399 8390 fid 163/225

50110 fid1033/1361

LASER ALTIMETER BAD LINES

Spurious data

170,180,190,200,210,220,230,791,50080

No data

290,291,300,481,491,501,511,521,531,541,651,661,671,682,991,1001,1011,1021,1031,1041,1051,1061,2211,2231,2241,2251,2261,2270,2280,2290,2300,2310,2320,2330,2340,2350,2360,2370,2380,2390,2400,2410,2420,2430,2440,2450,2460,2470,2480,2490,2800,3141,3151,3161,3171,4431,4441,4591,4601,4611,4621,4631,4641,4651,4661,8231,9051,50100,50110,50120,50130,50140,50150,10160,50170,10180,50220

PICODAS NOTES

GPS GTIME PROBLEM

TERRAQUEST PDAS REPAIR – AUG11, 2001

PDAS configuration:
- 486/66MHz CPU, classic motherboard
- 3x Picodas magnetometer board, AB0029
- Picodas 12 ch. Analog board, AB0011
- Video overlay & PPS board, AB0043
- Novatel GPS card, model 3951R
- Yamaha SVGA LCD interface board
- Mono LCD display
- Survey configuration CL75

The main problem reported – big GPS gaps, data inconsistency. Problems started after the Laser altimeter was added and the Survey code changed from V5.40 to V6.30, dated to the end of year 2000.

Following steps had been done:
1. PDAS HDD checked for a computer virus, none found.
2. Broken GPS antenna connector replaced on the GPS card, possible source of problems under vibrations.
3. Laser altimeter removed from compilation, Survey version dropped to 6.12. Gaps less frequent but still coming. Three CS-2 simulators connected.
4. PPS synchronization pulse from GPS card was connected to an external device and stretched from 100 microseconds to 200 milliseconds. Output pulse was connected to the last analog channel to verify PPS synchronization functionality. PPS drift shown on the

PDAS screen was in the range –30 to + 30 microseconds during 2 hours test. The analog input showed the PPS pulse long 200 milliseconds in the same position. The PDAS was turned OFF and ON a few times but PPS always worked the same way. GPS gaps seemed to be a result of Survey program decoding. The GPS raw data showed no problems at all.

5. Survey code V6.XX series was introduced in 1997. PDAS1000 was using Teknor Viper807, 486/100MHz CPU since 1996. A new Teknor CPU compatible with Viper807 was not available so SW solution had to be done. A speed problem was suspected because the decoding part of code was much bigger in 6.XX series. Therefore the older version 5.40 has got a few new lines from 6.12 to support the hardware configuration but leaving GPS decoding intact. The modified V5.40 worked with no gaps so PDAS was ready to do a test flight.

Conclusion:
PDAS system has to be tested in full configuration before a job is started. Recorded data have to be closely watched for irregularities. Any HW or SW changes must be properly tested and verified. Version 6.XX of Survey program requires 100MHz CPU at least.

Best Regards
Ivo Mejzr
Aug 23, 2001

PERIODIC SPIKE PROBLEM

1. My email to Picodas

Dear Ivo,

Thanks for the information on the Picodas magnetometer processing.

I understand the limitations of the post processing GPS accuracy and its effect in high gradient areas.

However, my query concerned the shape and periodic nature of the spikes we see in gradient greater than 30nT/m.

I did some quick calculations using the GPS error and a fractal noise model and find:

1. The synthetic spikes are not periodic but are random.

2. The synthetic spikes do not suddenly appear at a 30 nT/m threshold but are progressive.

As you can see on the attached .bmp profile plot of high pass filtered residual data, the spikes have a characteristic shape and are periodic.

This looks like a problem in tracking a rapidly changing signal with overshoot and undershoot?

I wondered if Bob Pavlik had any ideas based on the shape and periodicity of the spikes.

The critical decision I need to make as the person interpreting the IOC data is how to remove the spikes cleanly so we can get maximum information from the high frequency content of the data.

Simple non-linear and low-pass filters don't remove the spikes cleanly. A Morlet wavelet does a good job but would involve running all 23,000 line km through the Matlab software which would be very slow. Any thoughts you have on removing the spikes would be appreciated.

I will try to track down the Kevron Geophysics engineer at the time of the survey and get details of the RMS filter. My recollection is that the RMS AADC does more filtering than Picodas. Certainly we don't see these spikes in Kevron data but so far I have only been able to find data up to 50 nT/m.

Best regards,

Duncan Cowan

2. Reply from Picodas

Hello Duncan,

Problems on the the high gradient as shown are based on the counting technique which is quite old. This particular HW design is about 5 to 6 years older than RMS AADC. The basic problem is a pre-scaler which is dynamically changed and on the higher gradient the tracking algorithm is not having enough resolution, one sample is longer, the other is longer. The internal sampling is about 200Hz on 50nT field and this value goes from 100 to 400 Hz approx. depending on the field value. This will genarate a spectrum frequencies. The timebase oscillator is 9MHz. As you wrote, simple non-linear and low-pass filters don't remove the spikes cleanly. Bob suggests to try some averaging before a low pass filter is used.

CGI CHRIS VAUGHAN

August 10, 2001

Terraquest Aeromagnetic Survey for IOC
CGI Preliminary Database following GPS Synchrnization Fix

The database CGI_FIXED.GDB contains the results of CGI's repair of the GPS slipping problem. The LAT/LON/X/Y positions are all DGPS locations re-loaded following fixing of the GTIME parameter.

All CMA3 (stinger mag) data have been lagged uniformly by 0.4 seconds, then Tie line levelled (first statistical adjustment of the tie lines followed by line by line levelling of each survey line using the intersection with the adjusted tie lines.

Owing to the high magnetic gradient in the survey, a number of intersections were omitted. The included Geosoft map includes a layer of colour coded symbols showing the location and magnitude of the levelling adjustment (CSYM_CROSS_DIFF_WIND).

In order to acheive a final magnetic grid, Some time must now be spent on refining the levelling adjustments especially in areas of severe topographic relief. We also have to adjust places along the survey boundary where some lines in PGW's supplied database failed to reach the edge tie line.

Other than that incorporated in minimum curvature gridding, no filtering has been applied to the magnetic data nor the GPS positions.

Presumably, both the aeromagnetic data and the digital elevation model will have benefited from the GPS repairs. There should no longer be discontinuities within survey lines.

Best Regards,

Chris Vaughan, President and Chief Geophysicist

September 7, 2001

Terraquest Aeromagnetic Survey for IOC
CGI Final Database following GPS Synchronization Fix

The database CGI_FIXED.GDB contains the results of CGI's repair of the GPS slipping problem. The LAT/LON/X/Y positions are all DGPS locations re-loaded following fixing of the GTIME parameter.

Approximately 50 lines from the previous edition of the database (August, 2001) have now been repaired.

All CMA3 (stinger mag) data have been lagged uniformly by 0.4 seconds, then Tie line levelled (first statistical adjustment of the tie lines followed by line by line levelling of each survey line using the intersection with the adjusted tie lines.

In order to acheive a final magnetic grid, time has been spent on refining the levelling adjustments especially in areas of severe topographic relief and severe magnetic gradient. We also have adjusted places along the survey boundary where some lines in PGW's supplied database failed to reach the edge tie line.

We believe that the levelling will be more effective using the drape algorithm proposed by Duncan Cowan.

Other than that incorporated in minimum curvature gridding, no filtering has been applied to the magnetic data nor the GPS positions. The short duration gaps in the GPS fixes have been linearly interpolated.

Presumably, both the aeromagnetic data and the digital elevation model will have benefited from the GPS repairs. There should no longer be discontinuities within survey lines.

Best Regards,

Chris Vaughan, President and Chief Geophysicist
CGI Controlled Geophysics Inc.
189 Clark Avenue East,
Thornhill, Ontario, CANADA
L3T 1T3

Tel. 905 881-2059   Fax. 905 881-9517   e-mail. cgigeo@home.com

If required…

Airborne magnetic survey

Terraquest's Personnel

Field:	Pilots	Tony DeAngelis Dave Shaver Brian Harvey
	Operators	Paul Beaubien Frank Glass Kevin Jackman
Office:	Geophysicist	Dr. Shuchun (Harry) Du
	Manager	Charles Barrie

Mobilisation 2nd January 2001
Demobilisation 2nd May 2001

Survey 46 days
Weather/Diurnal 32 days
Maintenance 37 days

Survey supervision

PGW Personnel

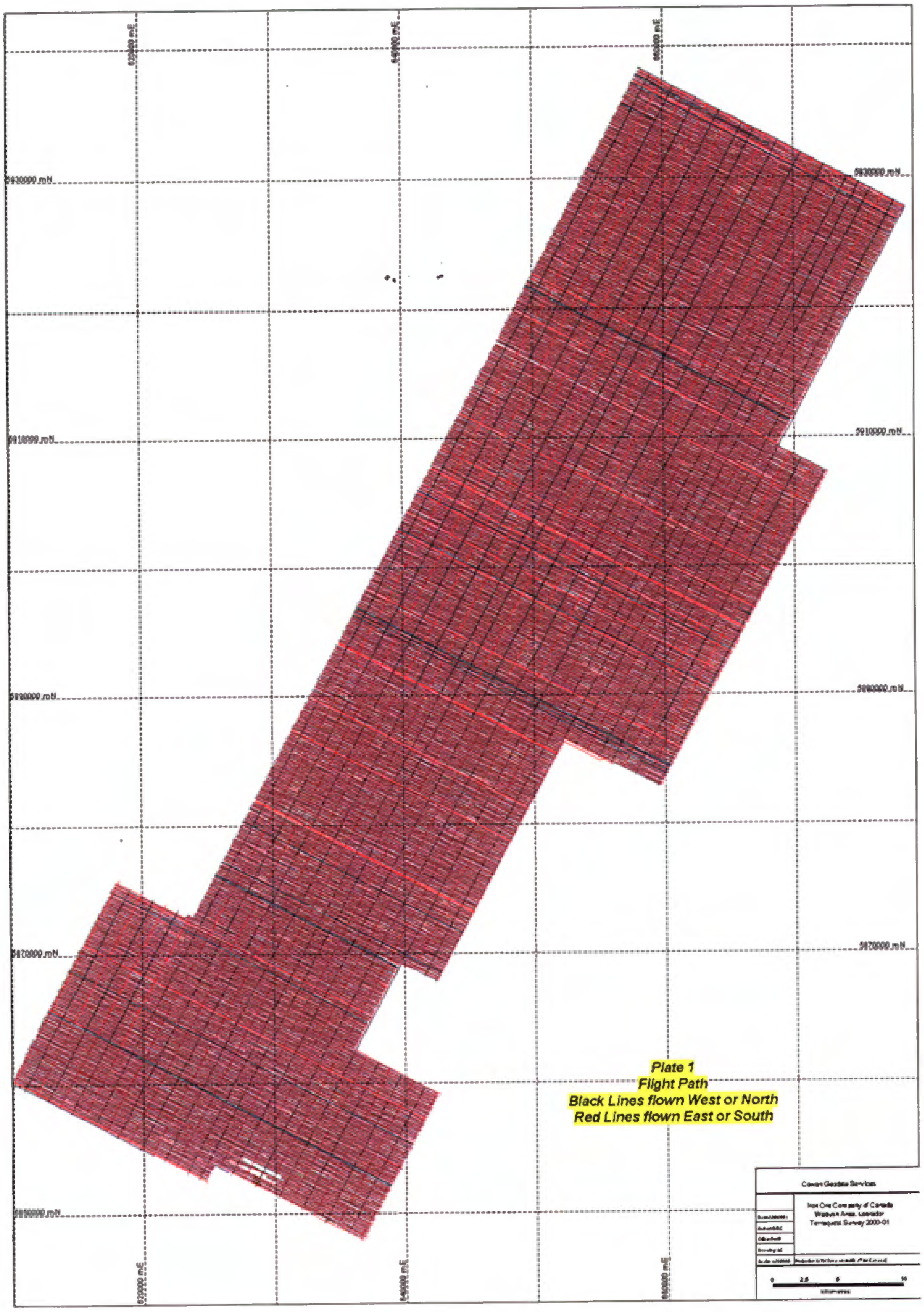
Geophysicist : Karl Kwan
? 115 days

IOC
Geophysicist : Marcus Flis
?

Magnetic data processing

Cowan Geodata Services

QC : 6 – 8 June 2001 + 23rd August + ?
Reception of data : 11th September 2001
Final report : 26th September 2001


5930000 mN
5910000 mN
5890000 mN
5870000 mN
Plate 1
Flight Path
Black Lines flown West or North
Red Lines flown East or South
Terraquest Survey 2000-01

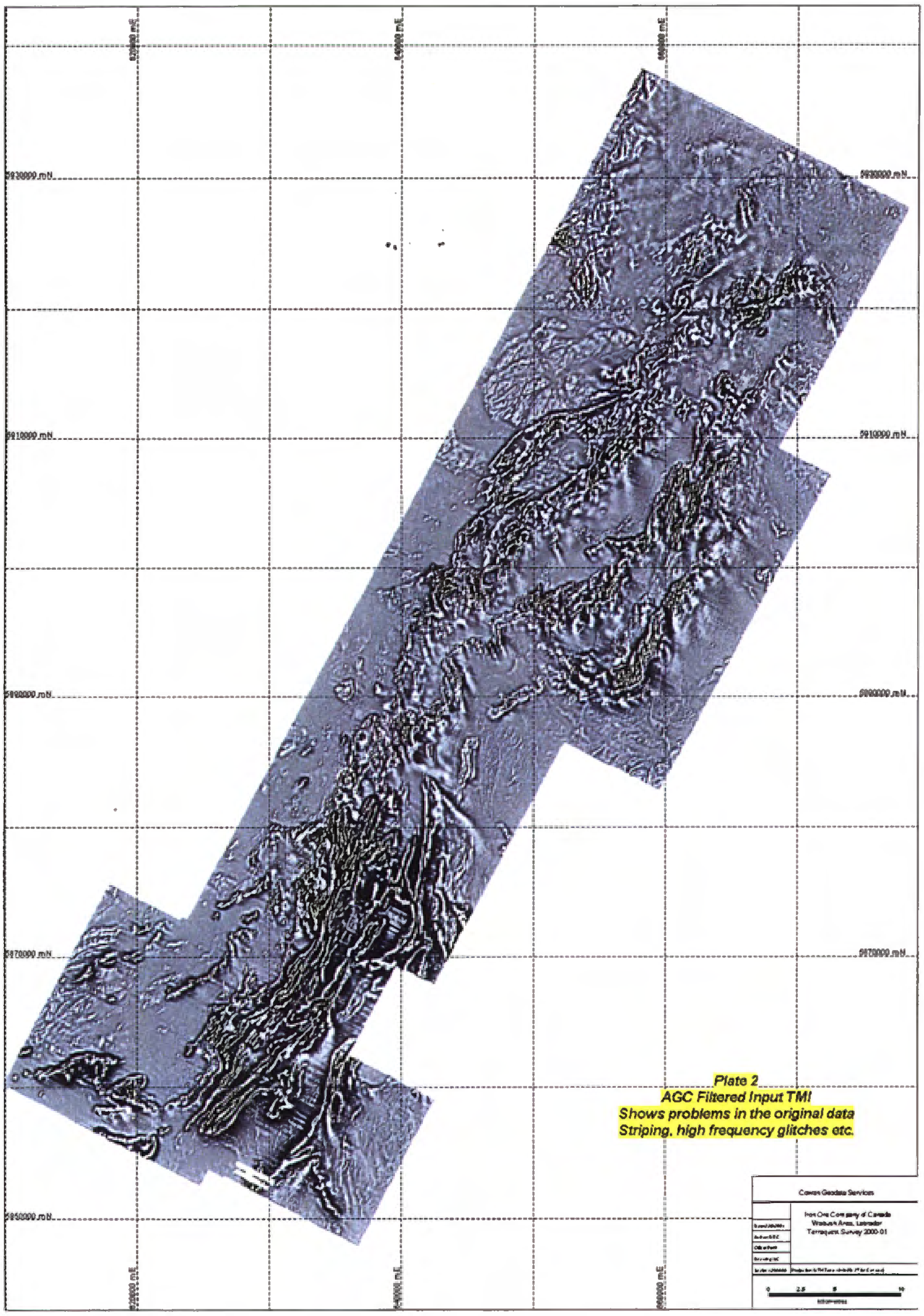


Plate 2
AGC Filtered Input TMI
Shows problems in the original data
Striping, high frequency glitches etc.

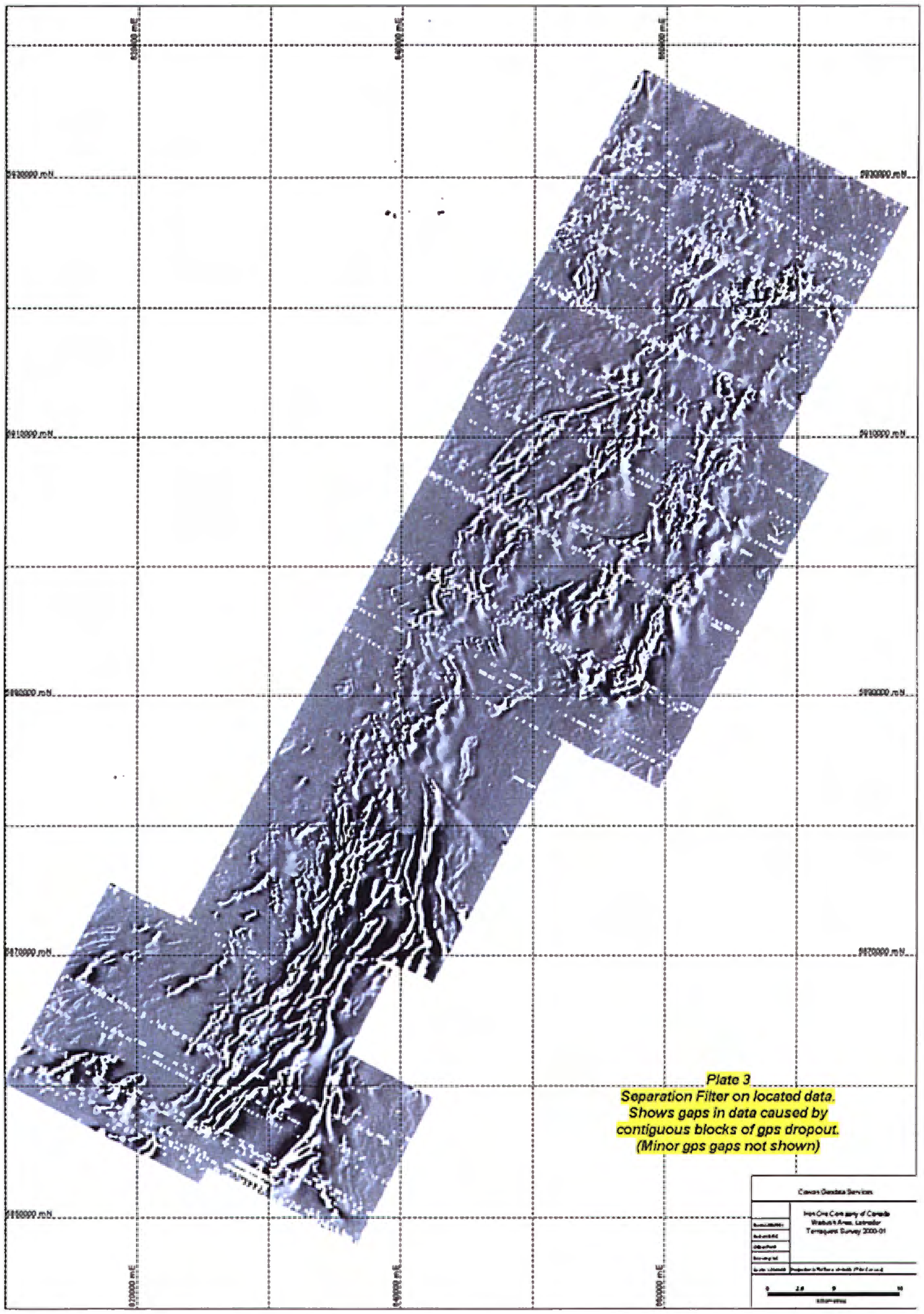


Plate 3
Separation Filter on located data.
Shows gaps in data caused by contiguous blocks of gps dropout.
(Minor gps gaps not shown)

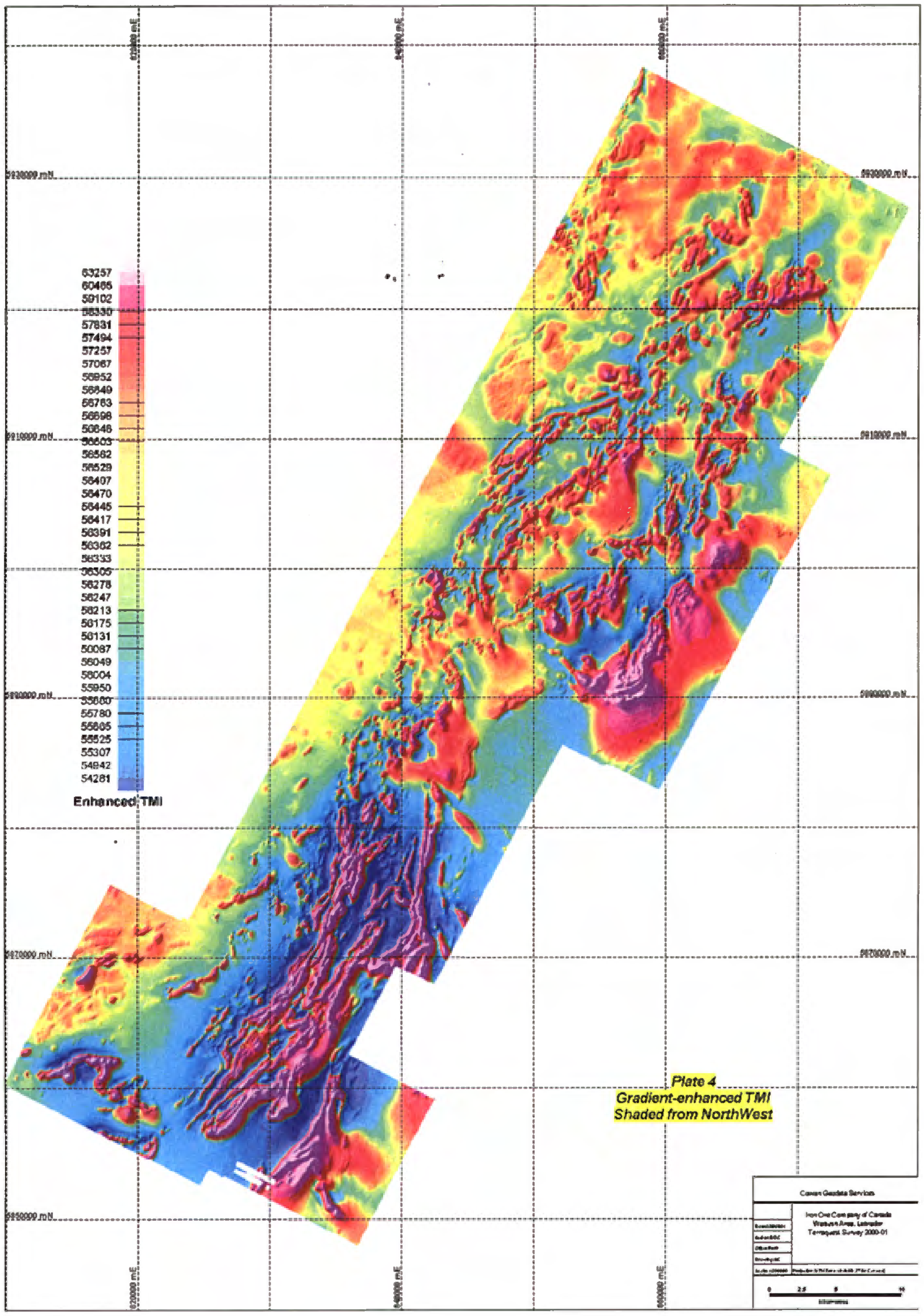
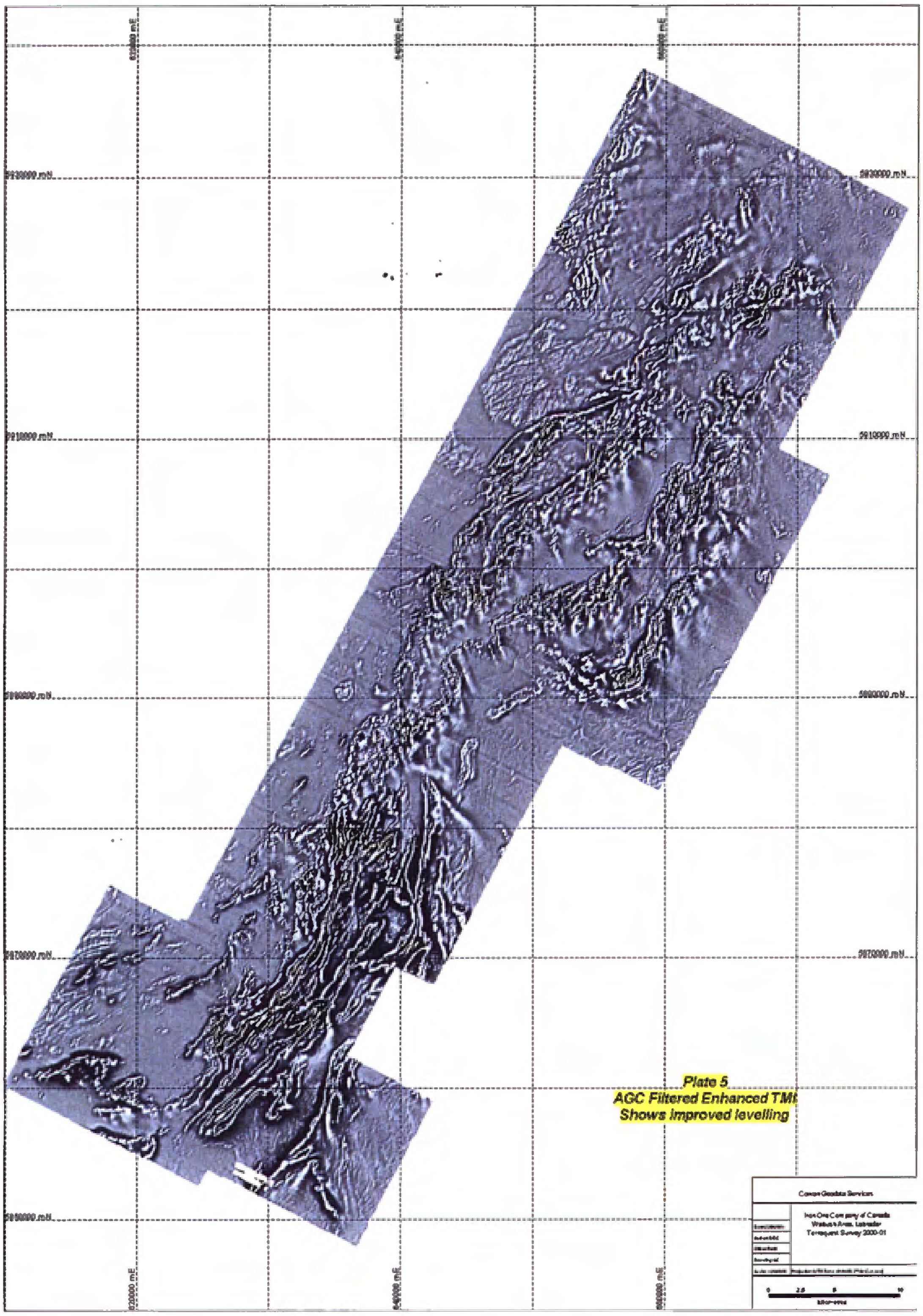
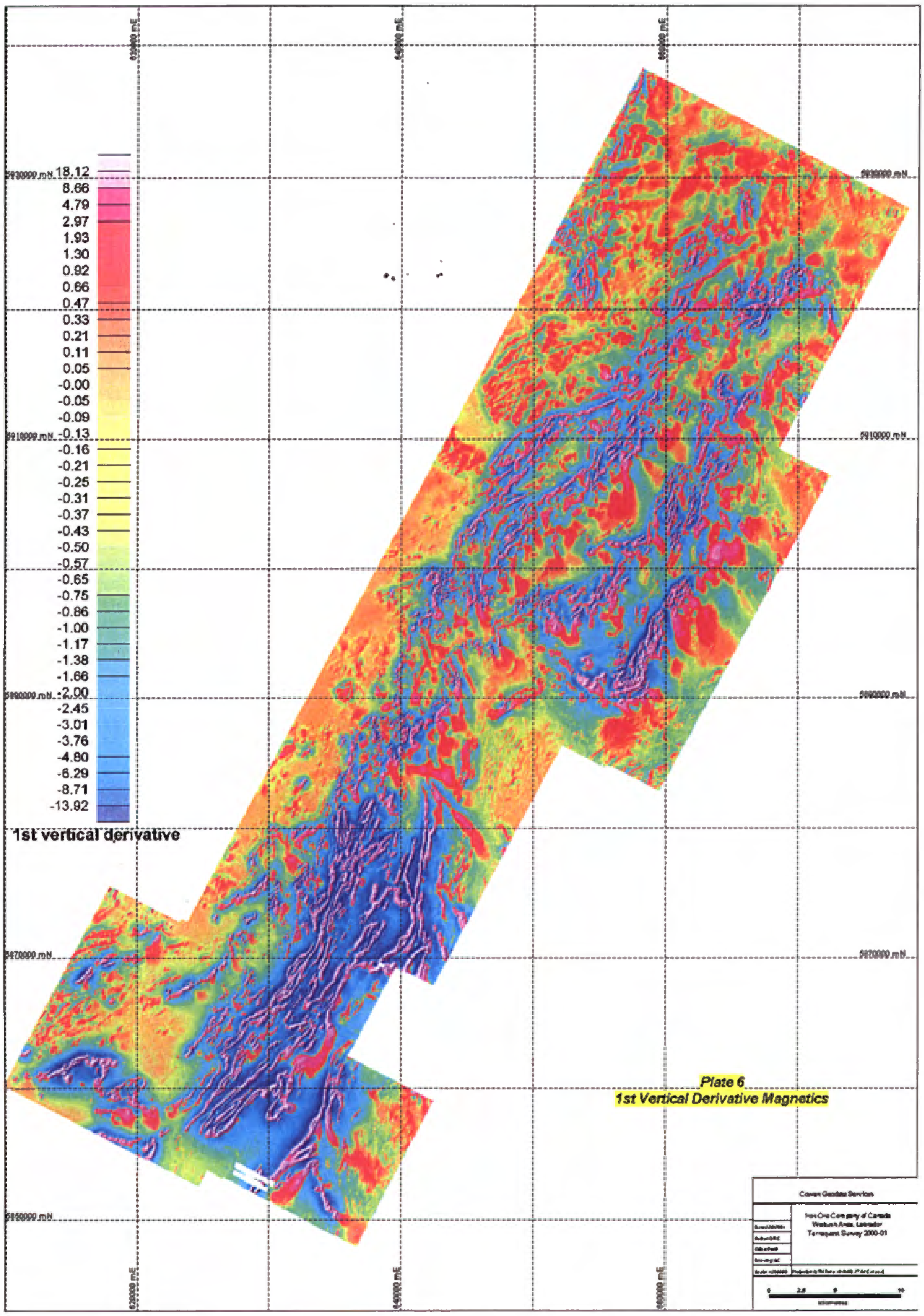
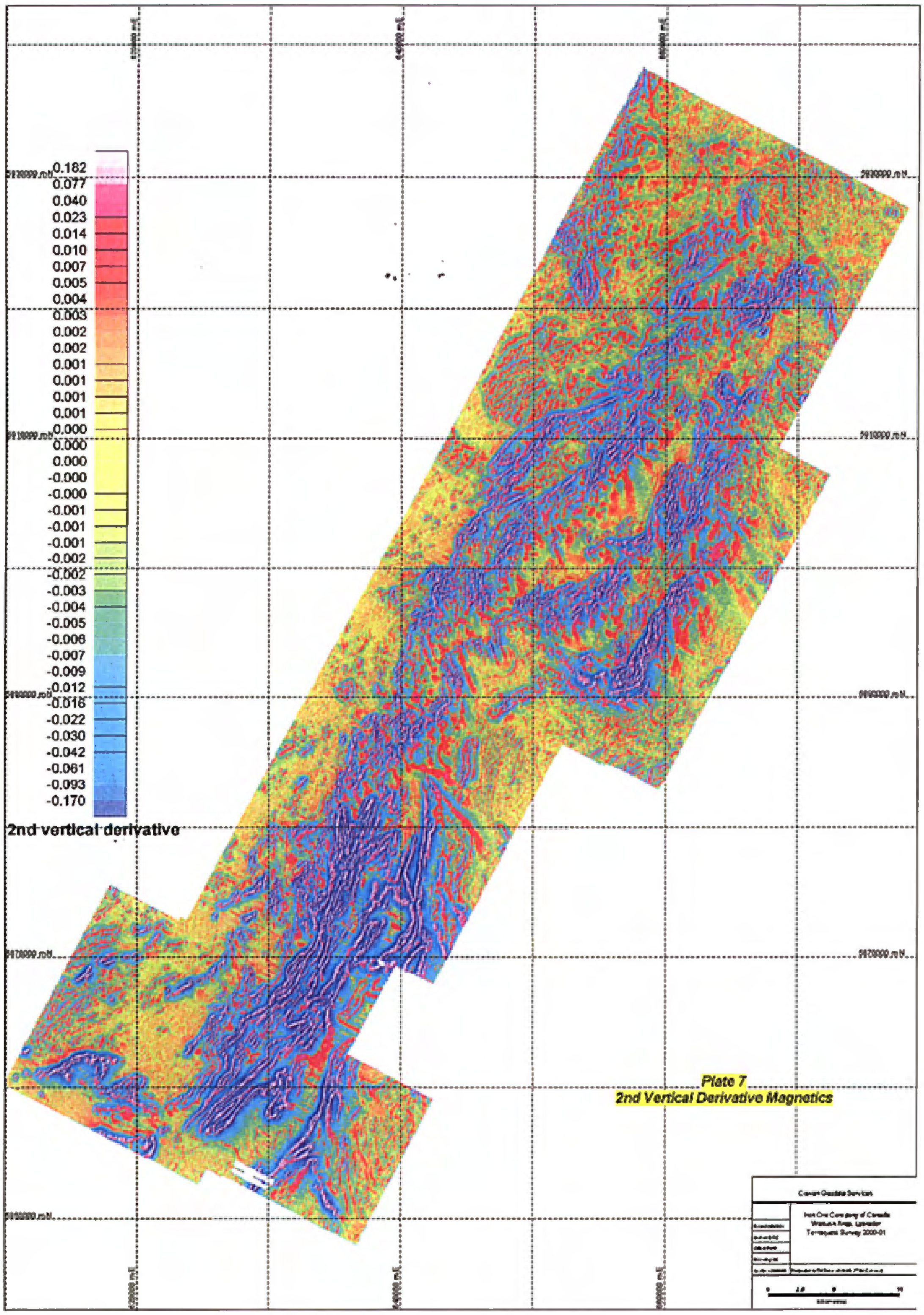


Plate 4
Gradient-enhanced TMI
Shaded from NorthWest


620000 mE
5930000 mN
5910000 mN
5890000 mN
5870000 mN
Plate 5
AGC Filtered Enhanced TMI
Shows improved levelling
Iron Ore Company of Canada


18.12
8.66
4.79
2.97
1.93
1.30
0.92
0.66
0.47
0.33
0.21
0.11
0.05
-0.00
-0.05
-0.09
-0.13
-0.16
-0.21
-0.25
-0.31
-0.37
-0.43
-0.50
-0.57
-0.65
-0.75
-0.86
-1.00
-1.17
-1.38
-1.66
-2.00
-2.45
-3.01
-3.76
-4.80
-6.29
-8.71
-13.92
1st vertical derivative
Plate 6
1st Vertical Derivative Magnetics
Cowan Geodata Services


0.182
0.077
0.040
0.023
0.014
0.010
0.007
0.005
0.004
0.003
0.002
0.002
0.001
0.001
0.001
0.001
0.000
0.000
0.000
-0.000
-0.000
-0.001
-0.001
-0.001
-0.002
-0.002
-0.003
-0.004
-0.005
-0.006
-0.007
-0.009
-0.012
-0.016
-0.022
-0.030
-0.042
-0.061
-0.093
-0.170
2nd vertical derivative
Plate 7
2nd Vertical Derivative Magnetics
Iron Ore Company of Canada
Survey 2000-01

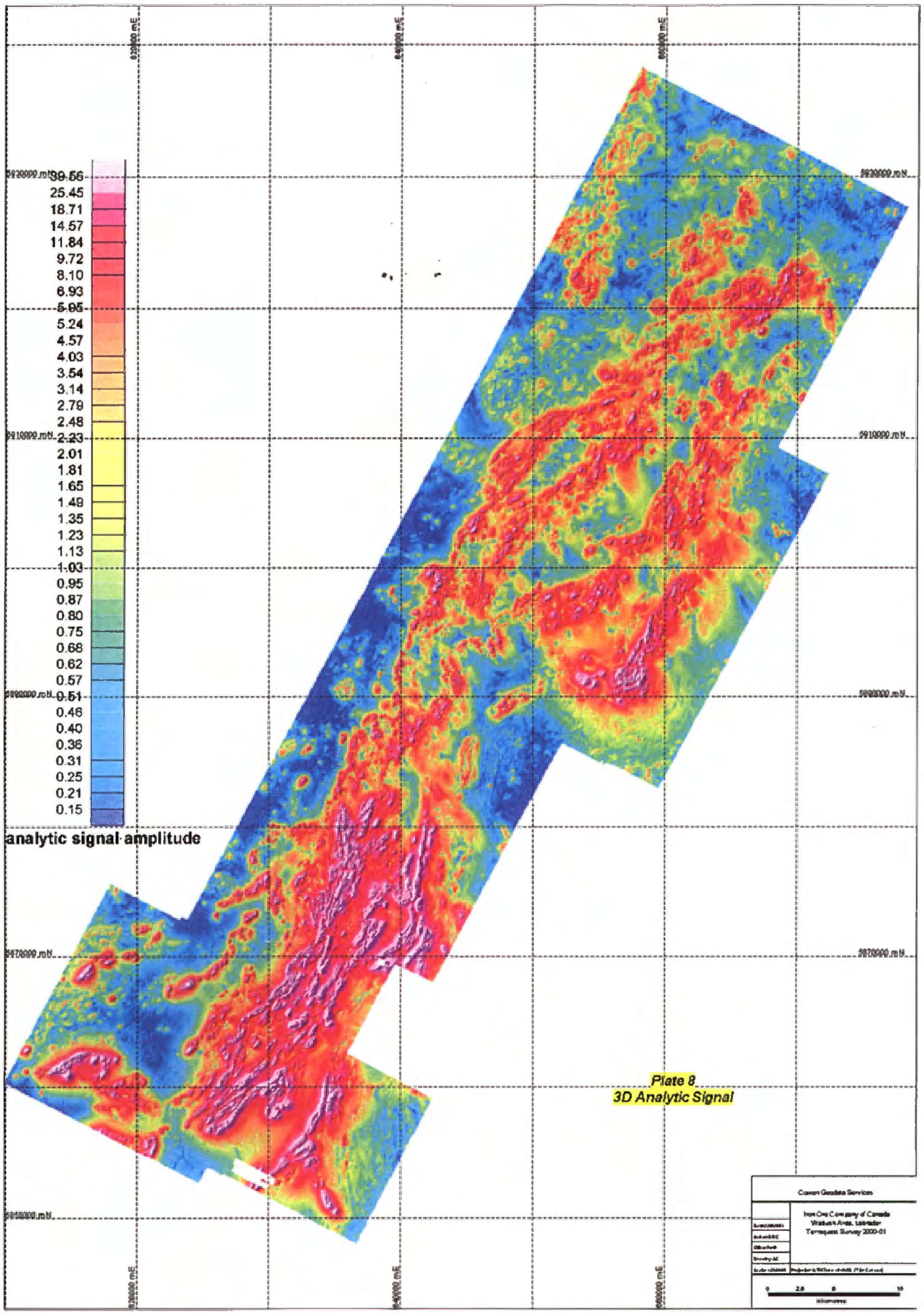
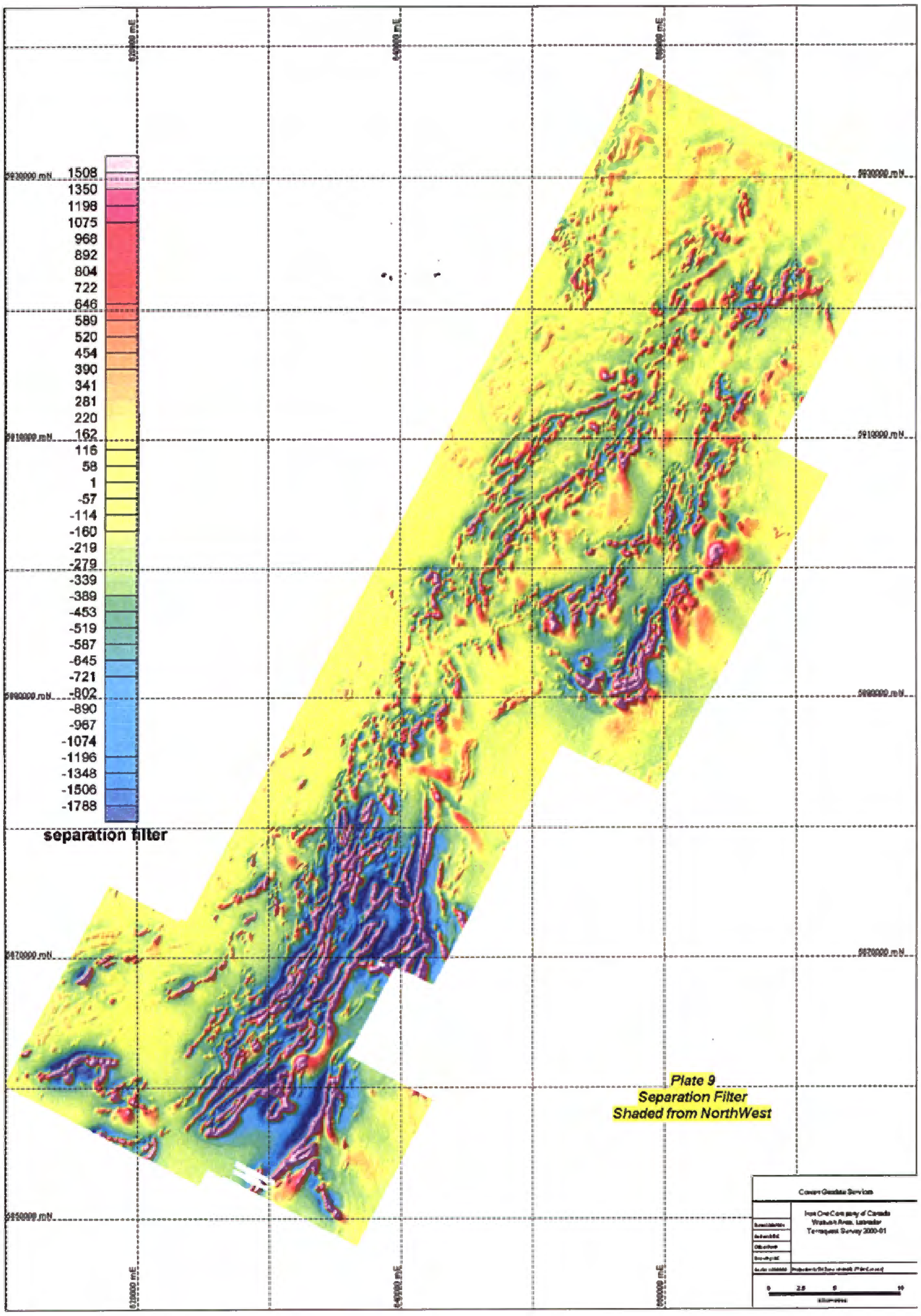
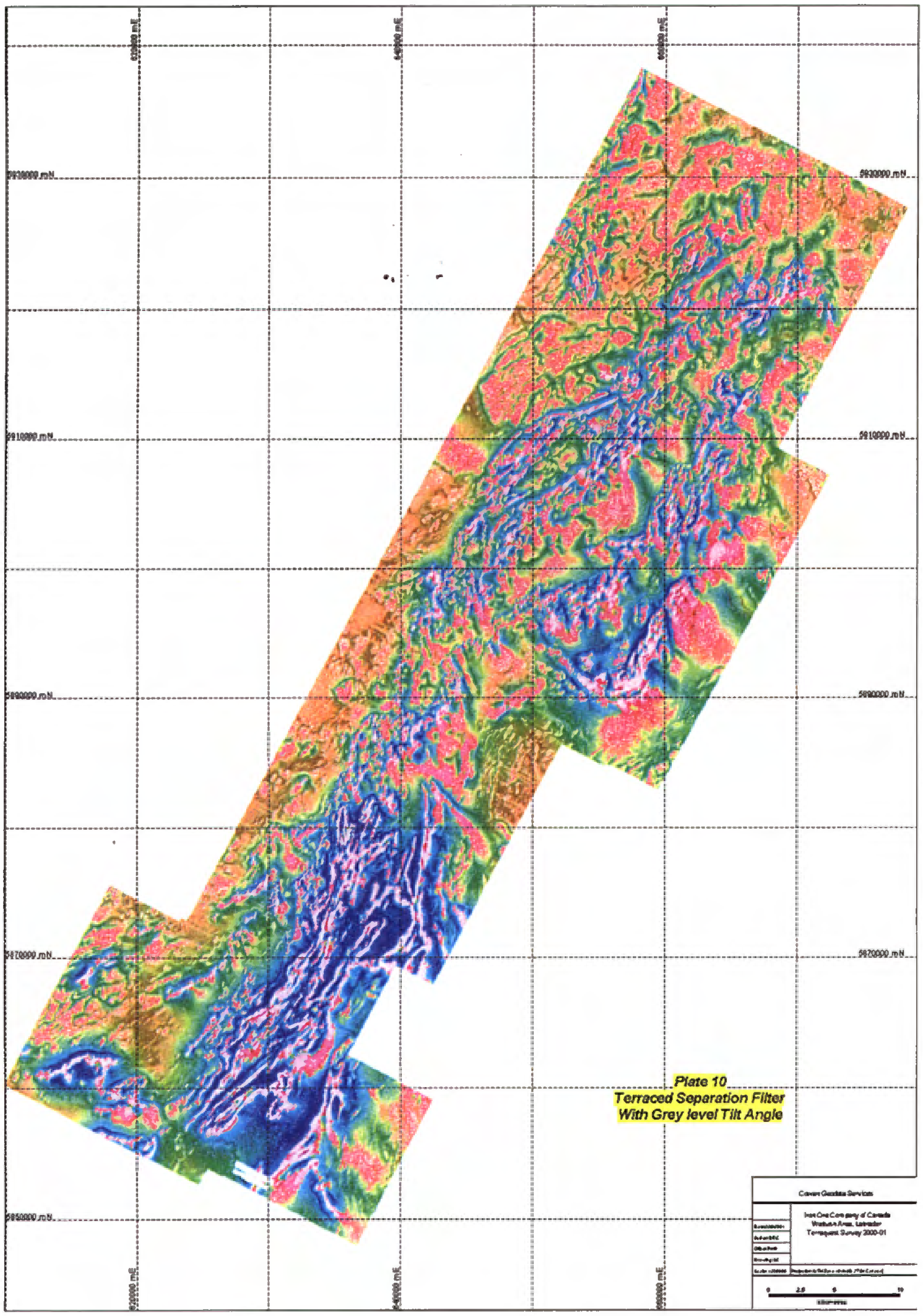
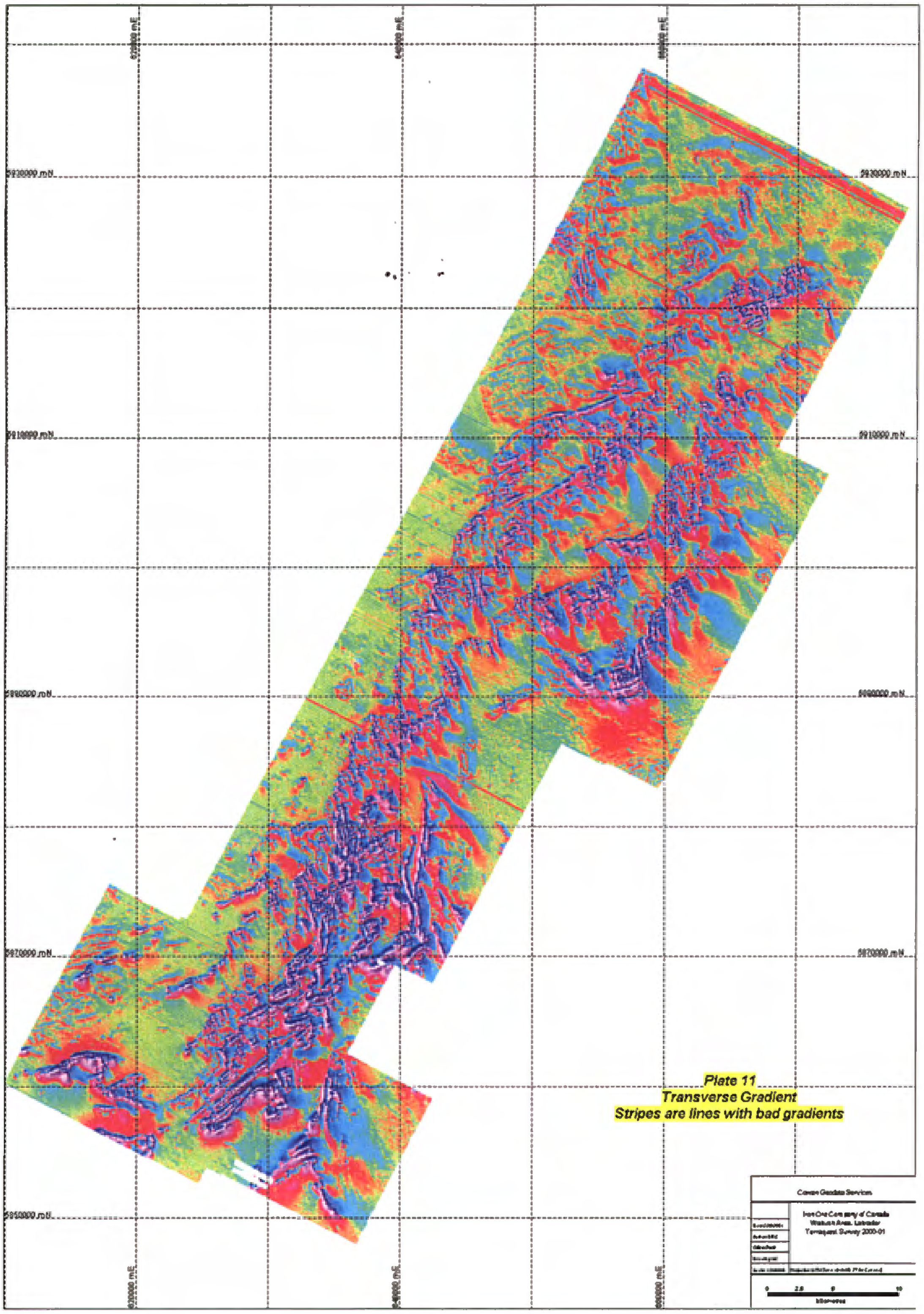


Plate 8
3D Analytic Signal


1508
1350
1198
1075
968
892
804
722
646
589
520
454
390
341
281
220
162
116
58
1
-57
-114
-160
-219
-279
-339
-389
-453
-519
-587
-645
-721
-802
-890
-967
-1074
-1196
-1348
-1506
-1788
separation filter
Plate 9
Separation Filter
Shaded from NorthWest


5930000 mN
5910000 mN
5890000 mN
5870000 mN
Plate 10
Terraced Separation Filter
With Grey level Tilt Angle
0
2.5
5
10


5930000 mN
5910000 mN
5890000 mN
5870000 mN
Plate 11
Transverse Gradient
Stripes are lines with bad gradients
Terraquest Survey 2000-01

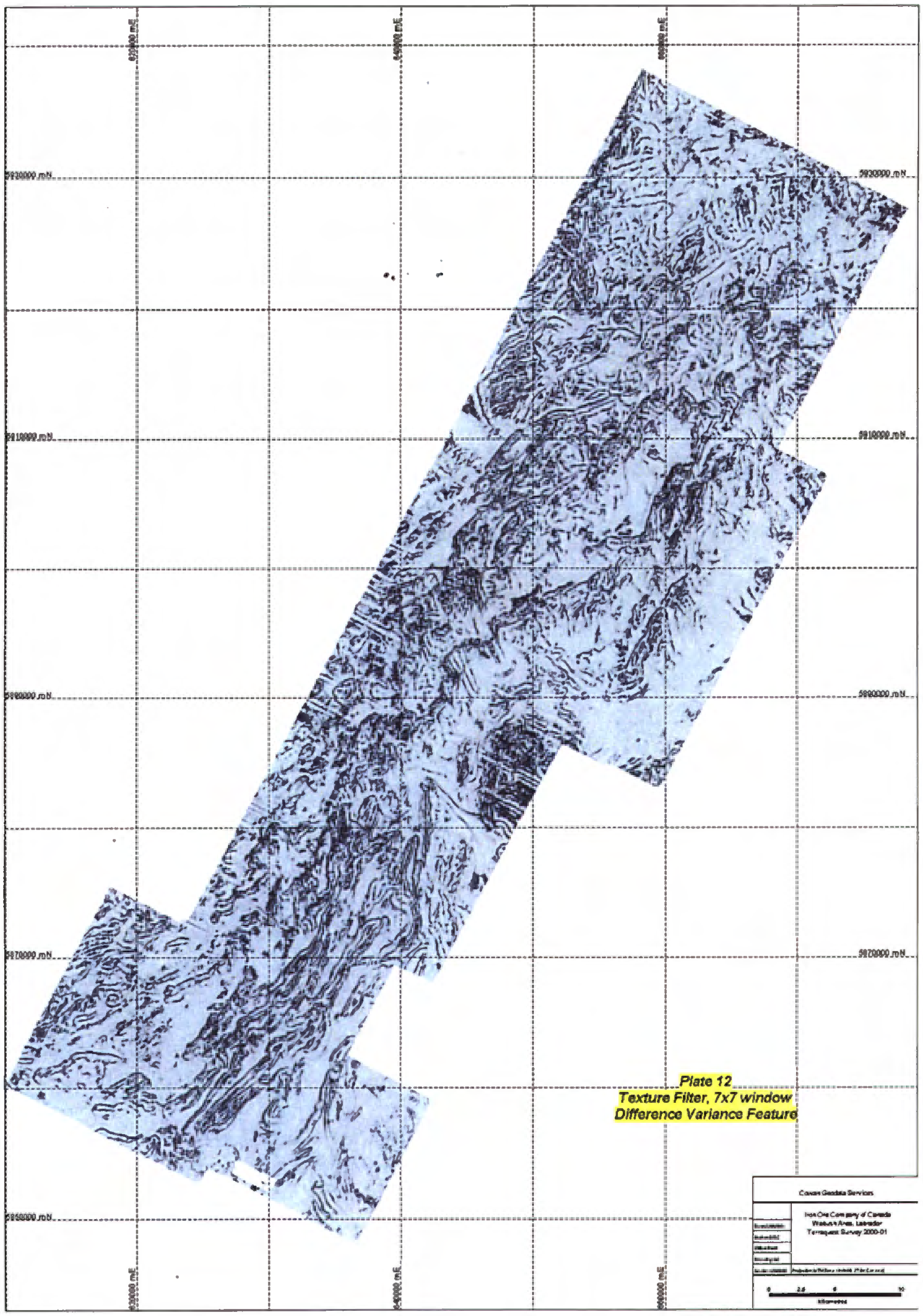


Plate 12
Texture Filter, 7x7 window
Difference Variance Feature

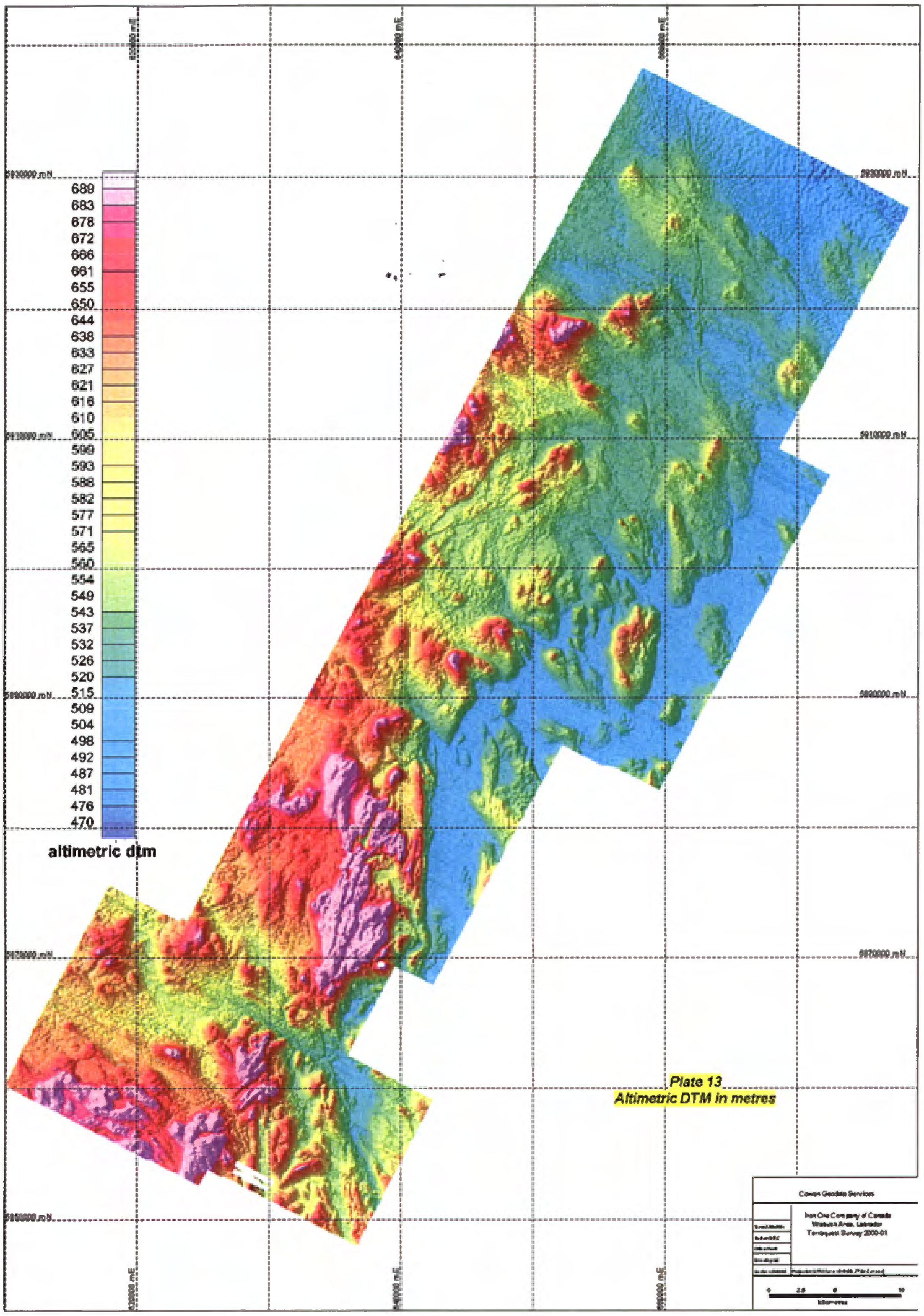
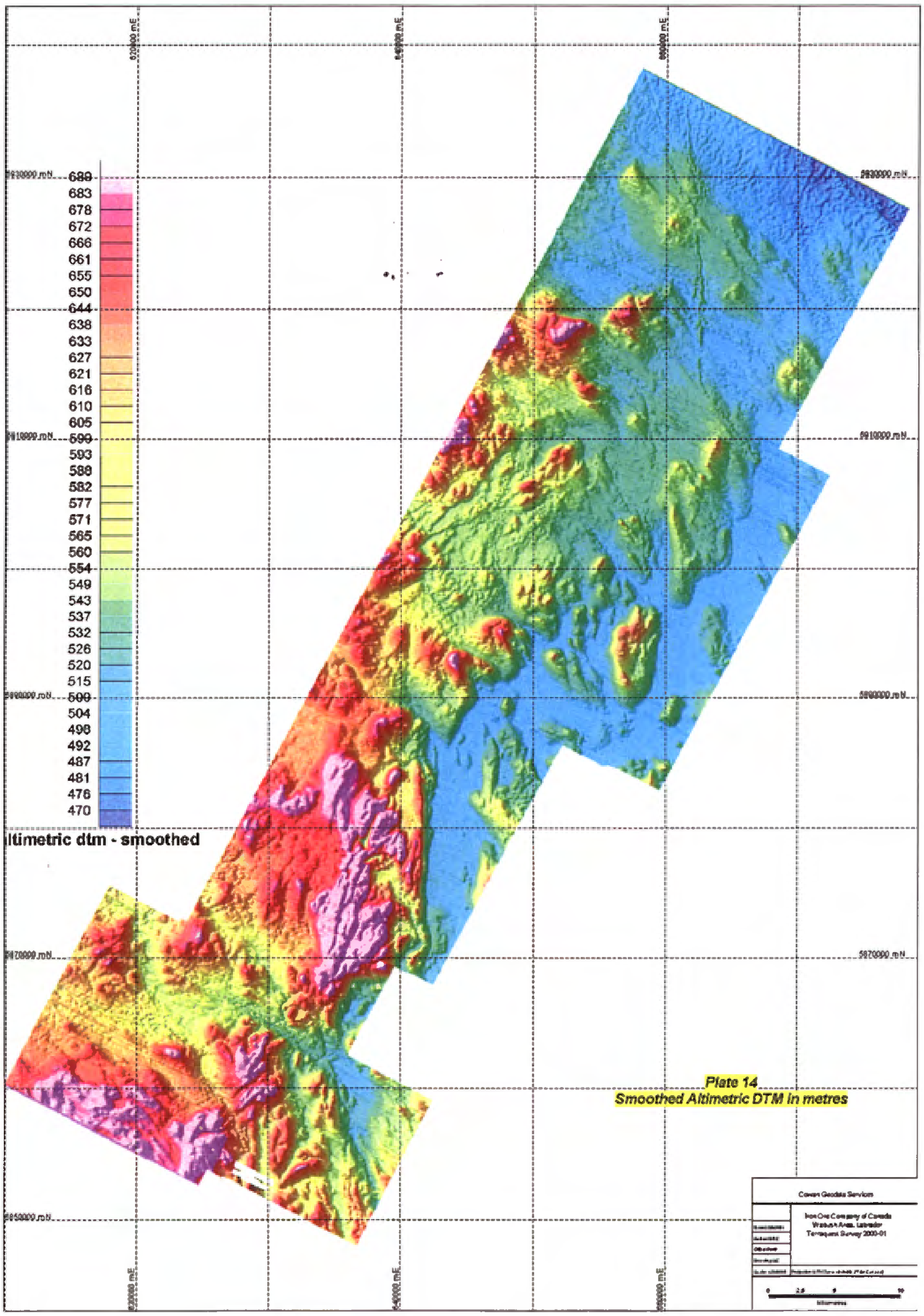


Plate 13
Altimetric DTM in metres


689
683
678
672
666
661
655
650
644
638
633
627
621
616
610
605
599
593
588
582
577
571
565
560
554
549
543
537
532
526
520
515
509
504
498
492
487
481
476
470
ltimetric dtm - smoothed
Plate 14
Smoothed Altimetric DTM in metres

List of Personnel and Contractors for 2001

Name	Fonction	Days
Marcel Durocher 3905 De La Misaine, Ville Ste Marie, (Quebec) J0L 1E0	Consultant Geologist Field Mapping	6
Alain Cotnoir 4605 Boul. Des Cimes Quebec,QC G2A 3X9	Consultant Geologist Field Mapping, Data Compilation Property Evaluation, Assessment Report	7
Jean Hubert 1912 boul. Laurier, Sillery, (Quebec) G1S 1M8	Consulting Geophysicist Data Compilation, Quality Control of Gravity Surveys	17
GEOSIG Inc. 3700,boul. De la Chaudiere, Ste-Foy (Quebec), G1X 4B7	Geophysical Contractor Gravity Surveys	
TerraQuest Ltd, Airborne Geophysics 1373 Queen Victoria Avenue, Mississauga,ON L5H 3H2	Airborne Geophysical Survey	
Paterson, Grant & Watson LTD (PGW) 8th Floor, 85 Richmond Street West, Toronto Canada M5H 2C9	Consulting Geophysicists (Quality Control, Supervision & Data Processing)	
Cowan Geodata Services 12 Edna Road-Dalkeith WA 6009 Australia	Geophysical Contractor Quality control and data re-processing of 2001 Aeromagnetic Survey.	
ChemLab	Rock Sample Analysis, IOCC	
Marcus Flis	Project Managing Supervisor-Geologist/Geophysicist IOCC-Rio Tinto	97
Christine Molloy	Junior Geologist, IOCC Short Term Staff	6
Carol Seymour	Staff Suport Student Geologist, IOCC	6

2001 Expenditures for Quebec - Polly Lake Prospect Map Designated Claims.

Licence #	Licence Name	Licence Type	Location	Township	NTS	Area (Hectares)	Expiry Date	Airborne survey	Gravity survey	Surface Rock Samp	C.Molloy Geol.	M. Dorocher Senior Geol.	A. Cotnoir Senior Geol.	Staff Suport (C. Seymour)	Total
CDC 1020712	Polly Lake	Exploration	Quebec	Lislois	23B-14	25.50	6/11/2003	1935.14	948.00		120.00	304.29	300.00	85.71	3693.14
CDC 1020713	Polly Lake	Exploration	Quebec	Lislois	23B-14	52.04	6/11/2003	1935.14	948.00	100.00	120.00	304.29	300.00	85.71	3793.14
CDC 1020714	Polly Lake	Exploration	Quebec	Lislois	23B-14	52.04	6/11/2003	1935.14	948.00	100.00	120.00	304.29	300.00	85.71	3793.14
CDC 1020715	Polly Lake	Exploration	Quebec	Lislois	23B-14	36.27	6/11/2003	1935.14	948.00		120.00	304.29	300.00	85.71	3693.14
CDC 1020716	Polly Lake	Exploration	Quebec	Lislois	23B-14	52.03	6/11/2003	1935.14	948.00		120.00	304.29	300.00	85.71	3693.14
CDC 1020717	Polly Lake	Exploration	Quebec	Lislois	23B-14	39.88	6/11/2003	1935.14	948.00	100.00	120.00	304.29	300.00	85.71	3793.14
CDC 1020718	Polly Lake	Exploration	Quebec	Lislois	23B-14	49.08	6/11/2003	1935.14	948.00		120.00	304.29	300.00	85.71	3693.14
							Total:	13546.00	6636.00	300.00	840.00	2130.00	2100.00	600.00	26152.00

FACSIMILE TRANSMITTAL SHEET

TO: M. MARC FULLUM	FROM: JEAN HUBERT
FAX NUMBER: 9 1 418 643 4264	DATE: FEBRUARY 12, 2002
COMPANY: MINISTÈRE DES RESSOURCES NATURELLES	TOTAL NO. OF PAGES INCLUDING COVER: 3
PHONE NUMBER: 91 418 944 643 4264	SENDER'S REFERENCE NUMBER:
RE: DÉCLARATION D'UN LEVÉ AÉRIEN	YOUR REFERENCE NUMBER:

☐ URGENT ☐ FOR REVIEW ☐ PLEASE COMMENT ☐ PLEASE REPLY ☐ PLEASE RECYCLE

NOTES/COMMENTS:

Suite a notre conversation telephonique du 11 fevrier, je vous envoie les renseignements concernant le leve aerien que je veux declarer comme travail statutaire. Il s'agit d'un leve magnetique de haute resolution effectue par Terraquest. Les mesures ont ete prises a l'aide de trois magnetometres haute sensibilite a vapeur de cesium situes a l'extremite des ailes et a la queue d'un Cessna 206U et d'un magnetometre fluxgate triaxial. Le systeme permet la mesure des composantes XYZ du champ magnetique ainsi que les gradients longitudinal et transversal.

Le leve possede les caracteristiques suivantes :

Longueur totale:	24065 km
Intervalle des lignes de leve :	100 m
Intervalle des lignes de rattache :	1 km
Altitude moyenne	60 metres
Intervalle de lectures	6 m.
Surface du leve :	2148,18 km^2
Surface au Quebec :	73,2 km^2
Region au nord de Fermont	43,5 km^2
Surface des claims au Quebec	3,44 km^2
Valeur totale	environ 400 000$

Questions : Quelle portion du levé peut être declarée aux travaux statutaires?

Jean Hubert

IOCC• RESOURCE ASSESSMENT PROGRAM • P.O. BOX 1000 • LABRADOR CITY (NFLD) A2V 2L8
PHONE: (709) 944-7009 • FAX: (709) 944-8779

Confirmation Report – Memory Send

Time : Feb-12-02 09:58am
Tel line : 7099448779
Name : MINE OFFICE

Job number	:	896
Date	:	Feb-12 09:56am
To	:	914186434264
Document pages	:	03
Start time	:	Feb-12 09:56am
End time	:	Feb-12 09:58am
Pages sent	:	03
Status	:	OK

Job number : 896 *** SEND SUCCESSFUL ***

FACSIMILE TRANSMITTAL SHEET

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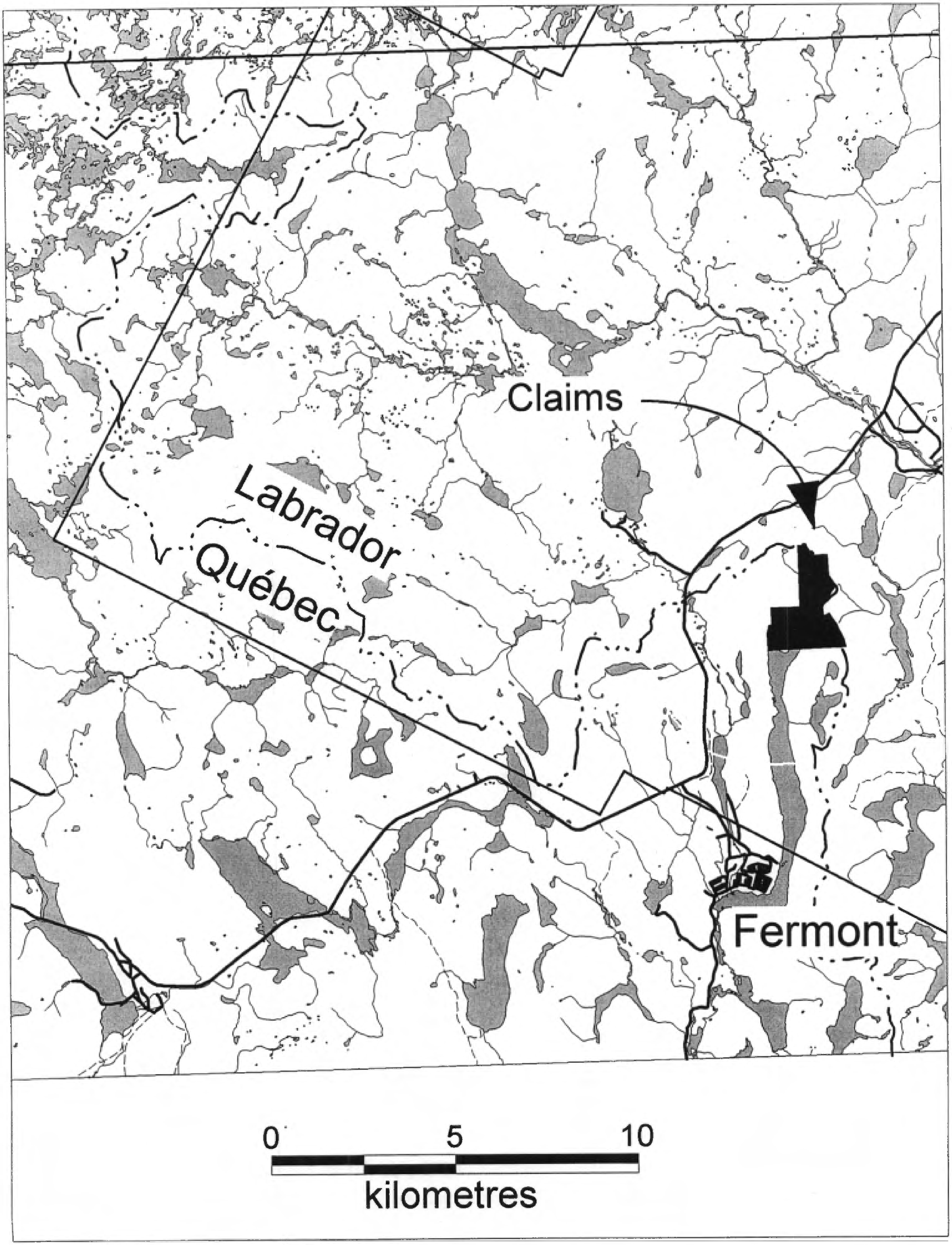
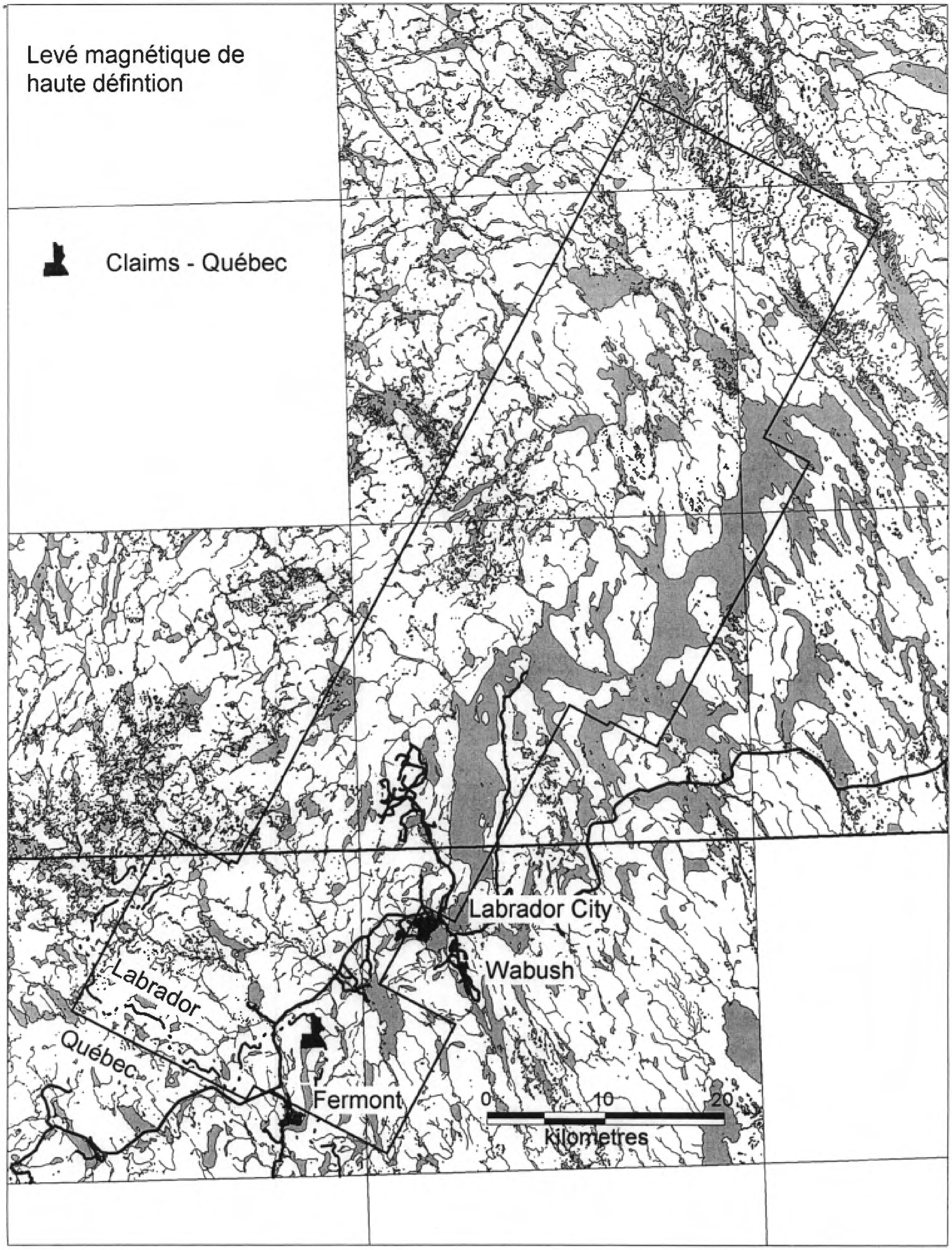


Claims
Labrador
Québec
Fermont
0
5
10
kilometres



Levé magnétique de haute défintion
Claims - Québec
Labrador City
Wabush
Labrador
Québec
Fermont
0
10
20
Kilometres

M. Marc Fullum 1-418-687-6787
1-800-387-7233 poste 5334

Fax 643-4246

Téléphone du 13 février 2002

Après consultation avec M. Marcel Tremblay,
M. Marc Fullum me confirme que le levé magnétique aéroporté sera accepté pour 73.2/2148.2 = 3,40%
de la somme total ($ 400,000) soit $13 630.