MINERAL RESOURCES BRANCH

Report on potential field modelling project, Targeted Geoscience Initiative, Antigonish, Guysborough, Cape Breton, Inverness, Richmond and Victoria Counties (NTS 11F/10, 11, 14, 15 and 11K/02), South-central Cape Breton Island, Nova Scotia[1]

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[1]Contribution to the Natural Resources Canada (Geological Survey of Canada) and Nova Scotia Department of Natural Resources joint project 'Geological Mapping for Mineral Development, South-central Cape Breton Island', a Natural Resources Canada **Targeted Geoscience Initiative 2000-2003.**

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Introduction

R. C. Boehner

The Potential Field Modeling Project, South-central Cape Breton Island, was undertaken in 2001-2002 as part of the Targeted Geoscience Initiative (TGI) project 2000-2003: Geological Mapping for Mineral Development in South-central Cape Breton Island. The Targeted Geoscience Initiative was funded by Natural Resources Canada (Geological Survey of Canada) and the Nova Scotia Department of Natural Resources. Geophysical investigations, modelling, mapping activities and products were identified in the TGI project area in parts of Antigonish, Guysborough, Cape Breton, Richmond and Inverness Counties. The products of this work are included in the attached report and maps by M. S. (Steve) King.

The geophysical investigations were undertaken by M. S. King as a complement to a more geologically extensive M.Sc. thesis project supervised by Dr. S. Barr, Acadia University. *The Mira - Bras d'Or terrane boundary in Cape Breton Island, Nova Scotia: potential field and petrophysical investigations applied to tectonic analysis in the northern Appalachian orogen* (thesis defended 18/7/2002). The thesis project was supported by an NSERC Grant to Dr. S. Barr and included virtually all of the TGI map area, as well as other contiguous areas of eastern and southern Cape Breton Island. It included, for example, interpretations of how the "basement" map units of the Mira and Bras d'Or terranes extend through the TGI area, their correlations among exposed basement blocks at Sporting Mountain, North Mountain, and the Creignish Hills, and depth to basement and basin configuration under Carboniferous rocks.

Requirements for the modelling and mapping project that was supported in part by TGI included: (1) necessary geophysical data and base maps; (2) some field support for ground-truthing; (3) support for the acquisition of a physical properties database (e.g. measure the magnetic susceptibility and specific gravity of representative samples from the area).

The project included gravity and magnetic data compilation and processing, multiple map product preparation, and selected section modelling to establish basin and basement geological constraints and relationships. Associated work included the development of necessary physical properties data for representative rock units in the area. This work was undertaken as support to the broader thesis work by M. S. King.

Potential Field Maps

The TGI modelling and map project coverage included: NTS 11F/10W, 11F/11, 11F/14, 11F/15W, and 11K/02W. The products were to be produced by NTS sheet, with map coverage (gravity and magnetic) and the level of "enhanced products" to vary according to original data coverage and survey quality. The map products planned were as follows. (1) Levelled, colour/shaded relief total field images with the cell size, hence image resolution, to vary within an NTS sheet (based on survey spacing). (2) Colour/shaded relief regional-residual separation maps. This enhanced map product would highlight moderate to shallow features (e.g. 1 to 2 km) at the expense of deeper features. It would correspond with the geological mapping at the surface. In many cases, this product may be the only enhancement procedure that the data could tolerate. Derivative maps and or other enhancement procedures would be undertaken depending on data quality and coverage (e.g. vertical 1st and 2nd derivatives calculated and presented where reasonable).

Gravity and Aeromagnetic Model Line Sections

The project included preparation of a series of geophysical model line sections (gravity and aeromagnetic) that represent the geology and relationship of the late Paleozoic and younger Mesozoic-Cenozoic basin fill in the lowlands, and the early Paleozoic and older rocks in the basement highland blocks. Representative regional cross-section lines were selected on 10-15 km spacing as NW-SE or NNW-SSE orientation across regional structure (lines 1 to 9). Internal basin cross-sections were selected to investigate buried basement features with magnetic and gravity highs (lines 10-13). Isolated or point gravity lows (3-5 mGal) were selected for short lines to transect isolated local high-amplitude gravity lows near basin/basement contacts (lines 14-17). Note that lines 4, 6, 8, 10 and 16 (included in line 5) were not undertaken due the excessive work required to complete the model lines initially planned. The location references, estimated length, and identified ***geological features of interest (FOI)*** to be investigated are summarized as follows.

- **(1) Troy-Port Richmond (20 km)**: (FOI) line nearly parallel to the Strait of Canso, (a) crosses over the southern extension of the Creignish Hills beneath Horton Group - Fisset Brook Formation cover? (b) crosses Horton-Windsor group contact at Port Hastings - nature of faulted contact? (c) transects thick upper Carboniferous strata in the Port Hawkesbury area - basin depth? (d) extends over the Port Richmond salt structure, depth to Horton? and/or pre-Carboniferous basement?

- **(2) Kingsville-West Bay Road-Inhabitants Harbour (28 km)**: (FOI) line transects basin fill from Creignish Hills to Port Richmond salt structure, including inferred Mira-Bras d'Or terrane boundary, (a) starts at the major fault contact east of the Creignish Hills to investigate its character and relation to thick Windsor Group at Kingsville, depth to Horton? and/or pre-Carboniferous basement?, steep/low angle, normal, reverse?, (b) crosses near the Sugar Camp granite basement/Horton Group contact and buried extension of North Mountain to the south? nature of basement extension, depth, structural controls?, faulted contacts? (c) extends over the Port Richmond salt structure, nature of contacts?, depth to Horton Group? and/or pre-Carboniferous basement?

- **(3) West Bay Road-Dundee-Arichat (35 km)**: (FOI) regional line transects basin fill from North Mountain extension to Arichat, including inferred Mira-Bras d'Or terrane boundary, (a) starts above southern extension of North Mountain to investigate the nature of boundaries, faults on south and southeast borders with Windsor Group/upper Carboniferous strata, depth to Horton Group? and/or pre-Carboniferous basement? steep/low angle, normal, reverse?, (b) crosses near Dundee/Black River pre-Carboniferous basement, Windsor/Horton group contact and buried extension of Sporting Mountain to the south? nature of basement extension, depth, structural controls?, faulted contacts? (c) transects major northeast-trending faults (e.g. Grand Anse gravity low - possible Windsor Group evaporite structure, Lennox Passage and Grand River) bounding the allochthonous L'Ardoise block and the Fourchu block in southeastern Cape Breton, nature of contacts, basement depth?

- **(4)** DELETED **Melford-Cummings (12 km)**: (FOI) line transects basin fill from Creignish Hills to North Mountain, (a) starts and ends in high-amplitude gravity lows near basement contacts (see 14 and 15) to investigate the nature of boundaries, faults on northwest and southeast borders of basement with Windsor Group/upper Carboniferous strata, depth to Horton Group? and/or pre-Carboniferous basement? steep/low angle, normal, reverse?, (b) crosses near center of River Denys Basin ? nature of basin, basement depth, structural controls?, faulted contacts?

- **(5) Wilburn-Orangedale-Marble Mountain-includes Line 16 (18 km)**: (FOI) similar to (4) this line transects basin fill from Creignish Hills to North Mountain, (a) starts and ends in basement blocks of Creignish Hills and North Mountain to investigate the nature of boundaries, faults on northwest and southeast borders of basement with Windsor Group/upper Carboniferous strata, depth to Horton? and/or pre-Carboniferous basement? steep/low angle, normal, reverse?, (b) crosses near center of River Denys Basin adjacent to Noranda deep potash drilling? nature of basin, basement depth, structural controls? internal faulted contacts? (see also Line 16) below a high-amplitude gravity low.

- **(6)** DELETED **West Bay-Sporting Mountain-St. Peters (36 km)**: (FOI) extension of line (5), this line transects basin fill extending from the West Bay of the Bras d'Or Lakes through Sporting Mountain to St. Peters, (a) transects the submerged Carboniferous basin between North Mountain and South Mountain and ends the major faults bounding the L'Ardoise block, to investigate the nature of boundaries, faults on northwest and southeast borders of basement with Windsor Group/upper Carboniferous strata, depth to Horton? and/or pre-Carboniferous basement? steep/low angle, normal, reverse?, (b) transects the inferred Mira-Bras d'Or terrane boundary.

- **(7) Malagawatch (8 km)**: (FOI) east-west transect of the northeast extension of North Mountain and the adjacent Windsor Group onlap geology with major saline evaporites defined by deep drilling at Malagawatch, (a) section aided by deep drilling extends into the Bras d'Or Lakes, with a major gravity low adjacent to Chevron deep potash drilling?, nature of basin, basement depth, structural controls?, internal faulted contacts, possible cross regional strike (northwest-oriented) faults?

- **(8)** DELETED **Little Narrows-Estmere-Bras d'Or Lake (20 km)**: (FOI) transect of the northeast extension of the River Denys Basin between Little Narrows and Malagawatch, (a) to define major basin structure, depths ? nature of faults extending from Washabuck block and Orangedale areas? structural controls?, internal faulted contacts? possible cross regional strike (northwest-oriented) faults? (b) investigate nature of internal basin coincident magnetic and gravity highs potentially indicating intrabasinal basement highs?

- **(9) St. Patricks Channel-McIvor Point-Gillis Point (18 km)**: (FOI) transect of the northwest extension of the River Denys Basin, Washabuck block and overlying Windsor Group defined in drilling and quarries in the Little Narrows/Jubilee area with the major saline evaporites defined by deep drilling at McIvor Point, (a) section aided by deep drilling with a major gravity low tested by Chevron deep potash drilling? nature of basin, basement depth, structural controls? internal faulted contacts? nature of major fault continuation from the River Denys basin area? high/low angle, normal or reverse/thrust? (b) nature of faults associated with the Washabuck block, high/low angle, normal or reverse/thrust?

Internal Basin Sections

A series of shorter cross-section lines were selected to investigate features within basins, including buried basement features indicated by magnetic and gravity anomalies.

- **(10)** DELETED **Byers Brook-Port Richmond (13 km)**: (FOI) transect of the Strait of Canso, (a) section limited by good coverage of magnetic or gravity data as well as deep drilling?, nature of the contact between Horton and Macumber strata on the mainland? and thick upper Carboniferous strata and saline Windsor Group between Port Hastings and Port Richmond? basin, basement depth, structural controls?, internal faulted contacts? nature of major fault continuation from the Judique and Troy areas of southwestern Cape Breton? high/low angle, normal or reverse/thrust? (b) section through the Port Richmond structure, nature of contacts?, depth to Horton? and/or pre-Carboniferous basement?

- **(11) Mulgrave-Cleveland (15 km)**: (FOI) line transects basin fill from the Strait of Canso (see line 10 above) to southwestern extension of Sporting Mountain, (a) to investigate the nature of Strait of Canso structure, depth to Horton Group? and/or pre-Carboniferous basement? steep/low angle, normal, reverse? (b) crosses the major late Carboniferous synclinal basin fill near Port Hawkesbury through to the buried extension of Sporting Mountain? nature of basement extension, depth, structural controls? faulted contacts? (c) transects contact between Windsor Group and upper Carboniferous strata in the Cleveland deposit/nature of contacts, basin depth? (d) extends over the McIntyre Lake salt structure, nature of contacts? depth to Horton? and/or pre-Carboniferous basement?

- **(12) Alba-Big Harbour (7 km)**: (FOI) north-south transect of the Alba area northeast of the deep saline basin section at Malagawatch, (a) to define internal basin structure, depths? nature of faults extending from Washabuck block and Orangedale areas? structural controls?, internal faulted contacts? possible cross regional strike (northwest-oriented) faults? (b) investigate nature of internal basin magnetic and gravity highs, potentially indicating intrabasinal basement highs?

- **(13) Wilburn-Alba (11 km)**: (FOI) similar to 12 (above), an east-west transect of the Alba area northeast of the deep saline basin section at Orangedale, (a) to define internal basin structure, depths? nature of faults extending from Washabuck block and Orangedale areas? structural controls? internal faulted contacts? possible cross regional strike (northwest-oriented) faults? (b) investigate nature of internal basin magnetic and gravity highs, potentially indicating intrabasinal basement highs?

Isolated-point Gravity Lows (3-5 mGal)

A series of isolated-point gravity lows were selected (FOI 14 to 17) for short model section lines. These transects isolated local high-amplitude gravity lows near basin/basement contacts (see 4 and 5) and the objective was to investigate the nature and influence of thick unconsolidated deposits on magnetic and gravity data, and genetic relations to basin boundary faults or solution-trench landscape features on the northwest and southeast basin borders.

- **(14) Melford (2 km)**
- **(15) Cummings (1 km)**
- **(16) Munroe Bridge-Valley Mills (1 km) Note: included in section line 5**
- **(17) Big Brook (1 km)**

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M. S. (Steve) King[2]

Introduction

The Potential Field Modelling Project was designed to enhance the level of geological knowledge in the Targeted Geoscience Initiative (TGI) project area. In particular, this project supported geological mapping for mineral development in south-central Cape Breton Island by providing insight into the three-dimensional geometry of Carboniferous basins in the study area. Many of these basins host salt and industrial mineral deposits, and more recently they are being investigated for natural gas deposits and potential natural gas storage. Exploration related to these targets relies on knowledge of the three-dimensional character of each Carboniferous basin and quantitative estimates are presently lacking in the geoscience database.

The TGI Potential Field Modelling Project is part of a recently completed M.Sc. thesis at Acadia University in Wolfville, Nova Scotia, by the author (King, 2002). The thesis project deals with the location and three-dimensional orientation of the Mira - Bras d'Or terrane boundary through Cape Breton Island. The TGI project and M.Sc. thesis make extensive use of existing geophysical data and new petrophysical data to generate 2.5-dimensional models over select target areas.

In order to develop the TGI potential field models, gravity and aeromagnetic data were processed to make enhanced map images of the project area at 1:50 000 scale. Profile data were extracted from these images and used in the modelling procedure. The potential field maps and enhanced map products are also included as deliverables in this project (contact the DNR Library in Halifax for information on obtaining these maps, or visit the web site: http://www.gov.ns.ca/natr/meb/pubs/pubs3.htm).

[1]Contribution to the Natural Resources Canada (Geological Survey of Canada) and Nova Scotia Department of Natural Resources joint project 'Geological Mapping for Mineral Development, South-central Cape Breton Island', a Natural Resources Canada **Targeted Geoscience Initiative 2000-2003.**
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2.0 Purpose and Scope

The purpose of this project was to utilize existing gravity and magnetic data, provided by government agencies and supported by new petrophysical measurements, to create a series of 2- and 2.5-dimensional potential field models that investigated:

1. How "basement" map units (i.e. pre-Carboniferous) of the Mira and Bras d'Or terranes extend through the TGI area.
2. Relationships between "basement" belts (e.g. Sporting Mountain, North Mountain, and the Creignish Hills) and sub-surface units modelled beneath Carboniferous basins.
3. Depth to "basement" under Carboniferous rocks and internal Carboniferous basin geometry.

The project area encompassed all or parts of NTS map sheets 11F/10, 11F/11, 11F/14, 11F/15, and 11K/02 (Fig. 1). Map products (Section 3.0 and Appendix I) vary by NTS sheet; however, coverage and image quality is variable even within each sheet as data quality (e.g. sample spacing) is highly variable.

Potential field models were selected in consultation with staff at the Nova Scotia Department of Natural Resources, Mineral Resources Branch (see Introduction by R. C. Boehner). Model locations were chosen on the basis of, (1) gravity data coverage, (2) geological criteria, and (3) geophysical response. Thirteen models were selected to investigate a series of geological targets and/or geophysical (i.e. gravity) anomalies (Section 5.0 and Appendix IV).

3.0 Geophysical Data

Geophysical data utilized in this study consisted of: (1) ground gravity data provided by the Nova Scotia Department of Natural Resources, and (2) aeromagnetic survey data supplied by the Geological Survey of Canada (Geophysical Data Centre and Radiation Geophysics Division). All data were provided in digital format and archived in UTM NAD27 projection (see Figs. 2 and 3, Appendix I and Table 1).

The gravity data (Fig. 2) were extracted from the Nova Scotia Department of Natural Resources Open File 95-005 (Howells and Clark, 1995). These data consisted of station Bouguer gravity with elevation information in a Lat/Long format. The data were edited and re-projected to UTM NAD27 (Fig. 2). Approximately 5000 stations were extracted and processed to generate the map images and data for the potential field models.

The aeromagnetic data used in this study (maps and models) were compiled from several airborne surveys flown by the Geological Survey of Canada (GSC) from 1950s to the 1990s (Fig. 3). The aeromagnetic data are as follows:

(1) The Bras d'Or survey data were digitally acquired in 1990 by the Geological Survey of Canada (GSC), Radiation Geophysics Section. These data were acquired along flight lines spaced 1000 m apart oriented in an east-west direction, at a nominal altitude of 150 m.

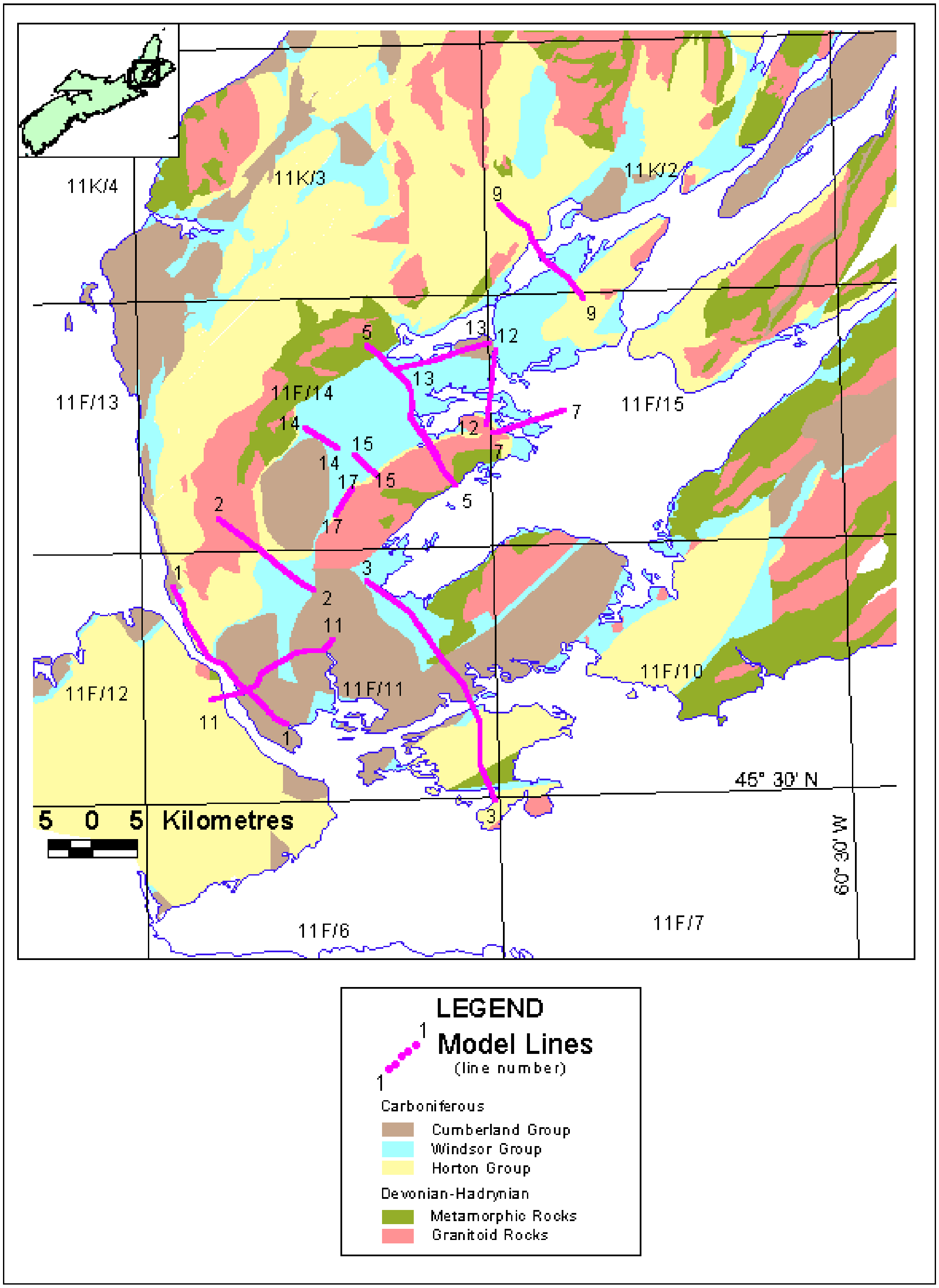

Figure 1. General location map for study area (red).

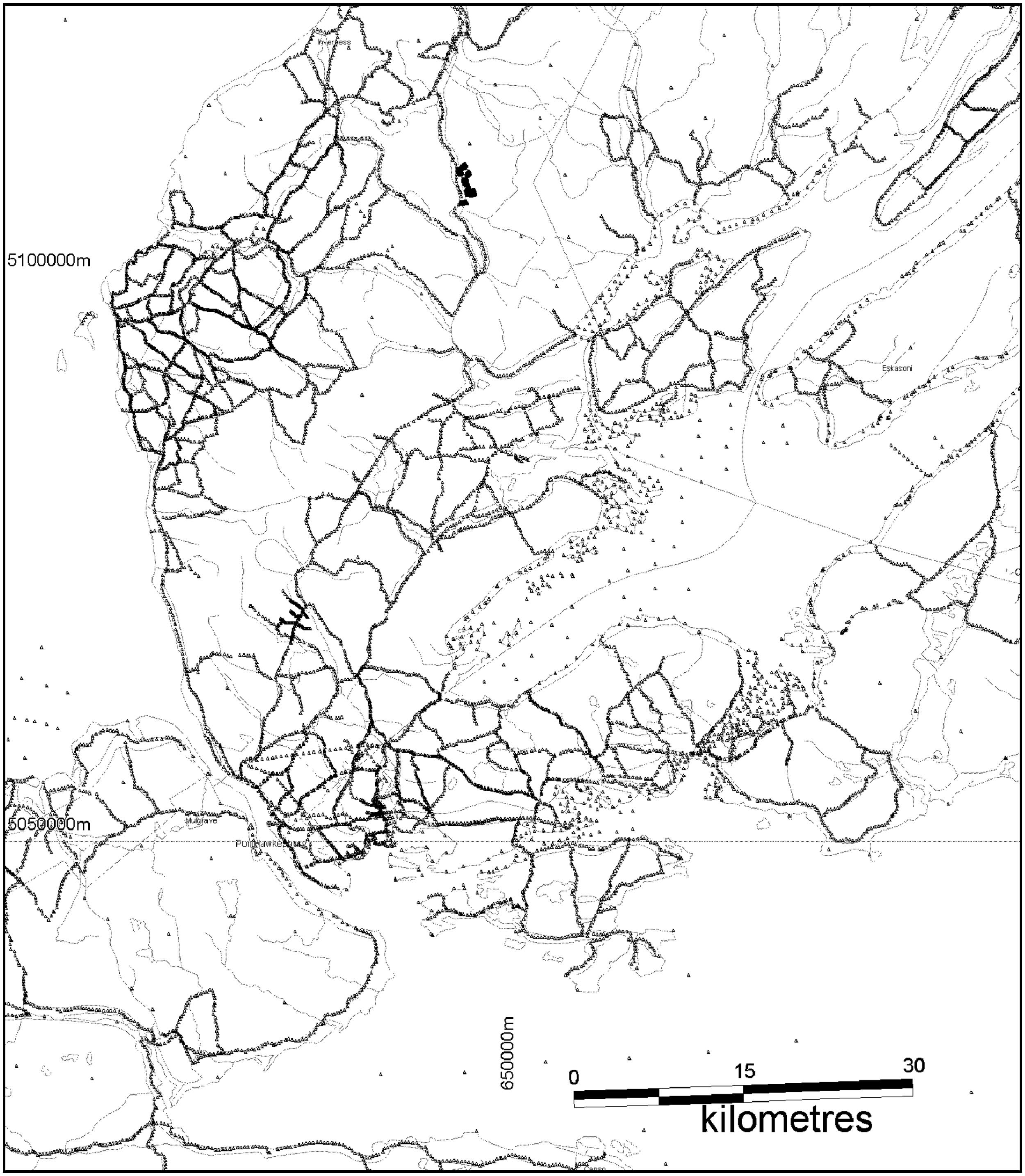

Figure 2. Gravity station (black triangles) coverage for southern Cape Breton Island.

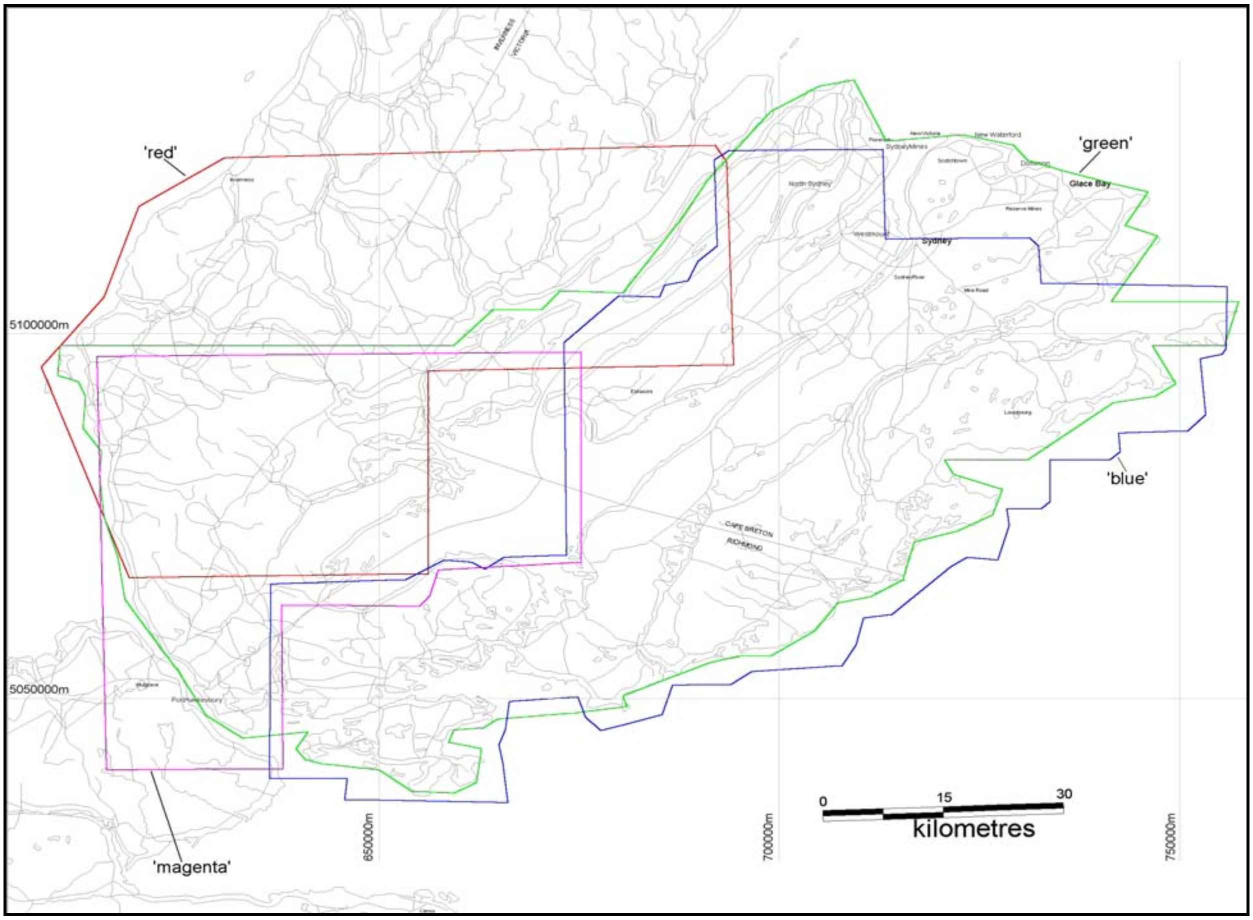

Figure 3. Aeromagnetic survey coverage for southern Cape Breton Island (see Table 1 for legend).

Table 1. Legend for aeromagnetic and gravity survey coverage in the project area.

Government Agency	Survey Reference	Survey Data Format	Fig. 3 Legend
GSC Radiation Geophysics Section (High-resolution Surveys)	**Bras d'Or**	**Digital**	**Green Polygon**
GSC Geophysical Data Centre (Regional Surveys)	**# 260**	**Digital**	**Red Polygon**
	NS_07	**Analogue**	**Magenta Polygon**
	NS_11	**Analogue**	**Blue Polygon**
Nova Scotia Department of Natural Resources	**Howells and Clarke (1995)**	**Analogue**	**See Fig. 2 for gravity station locations**

(2) Survey #260 contains digitally acquired "high-resolution" data. These data were collected along lines spaced 300 m apart at a mean terrain clearance of 150 m. The lines were oriented in a northwest-southeast direction.

(3) Surveys NS_07 and NS_11 contain data digitized from older regional surveys. Surveys date from the 1950s and 1960s and data were compiled in analogue format. To create digital files, pseudo-flight lines were constructed over contoured magnetic data at a spacing of one or two miles. The intercepts of the pseudo-flight lines and contour intervals were used as digital data points. The data set provides broad regional coverage but is superceded by the datasets described in (1) and (2) over more than 90% of the project area.

3.1 Geophysical Data Processing

The enhanced map products derived from the aeromagnetic data are dependant on the original survey specifications and vary from area to area (e.g. Tables 1 and 2). Although it is possible to generate highly detailed second derivative images from high-resolution survey data, more regional surveys are not amenable to such advanced processing and the first vertical derivative calculation represents the highest level of detail achieved using these aeromagnetic data. Note that due to the large difference in quality, there were artifacts in the merged first vertical derivative data. These areas were extracted from the final product to reduce the probability of misinterpretation, and appear as white or blank data regions. Other linear (e.g. E-W and/or N-S) features may also be related to flight lines and/or analogue processing. The processing and enhancement of the aeromagnetic data were divided into two streams depending on the original survey specifications and data format (Tables 2 and 3). The potential field models make use of residual aeromagnetic data. These data were generated by subtracting a low-order polynomial surface from the gridded total field data. This procedure is used to remove regional variations in the geomagnetic field.

The original gravity data used in this project (Howells and Clarke, 1995) contained numerous syntax and format errors that were corrected prior to processing data for this study. The sub-set for this study consisted of total field point information that was gridded to create map images. The gridding procedure for a data set of this nature is somewhat problematic due to the highly variable sample density. Relatively detailed data collected at approximately 235 m intervals along roads are superimposed over the national gravity net (5 km stations). To overcome the problem in choosing an appropriate gridding algorithm and final grid cell size, the gridding process was completed using two methods.

1. A high-resolution but non-continuous grid using a 100 m cell size and maximum tension. This procedure generates a grid image that most closely approximates the actual measured data but extends a limited distance from the data points. The resulting image has a "spotty" appearance around data points where neighboring data were more than 1000 m apart. This procedure is designed to make a semi-continuous image from which profile data can be extracted for use in the potential field models. Note that profiles were selected along transects of semi-continuous gravity data, therefore this gridding method would produce a continuous image in these areas.

2. A lower resolution but spatially continuous grid using a 500 m cell size and minimum tension. This procedure generates a grid image that varies smoothly from point to point and extends a

Table 2. Processing template for analogue and regional aeromagnetic surveys.

Survey ASCII Format	NS_11	NS_07	Bras d'Or
Data Source	Geophysical Data Centre		Radiation Geophysics Section
Gridded Format	Residual Total Field (250 m cell size)		Total Field (250 m cell size)
Levelling Step 1			Static Correction (remove 54,000 nT) Compare overlapping data
Levelling Step 2			Residual calculation Remove 1st order surface Upward Continue
Merge Surveys	Combine gridded data Bras d'Or survey given 100% weighting in areas of overlap Analogue data comprise ~5% final grid		
Working Map Products (equal area colour images)	Total magnetic field Residual magnetic field First vertical derivative(e.g. 11F/11) Regional (low-pass) magnetic field		

Table 3. Aeromagnetic processing template for high-resolution survey (#260).

Survey ASCII Format	Project # 260
Data Source	Geophysical Data Centre
Gridded Format	Total Field (75 m cell size)
Processing - 1	Calculate second vertical derivative Assess noise source and amplitude
Processing - 2	De-corrugate data Calculate directional hi-pass noise Subtract from total field
Processing - 3	Calculate second vertical derivative Assess noise and amplitude
Processing - 4	Upward continue data (~1 cell size)
Gridded Format	Total Magnetic Field Levelled, de-corrugated, smoothed
Working Map Products (equal area colour images)	Total magnetic field Calculated first vertical derivative* Calculated second vertical derivative Low-pass magnetic filter
* Due the large difference in quality, there were artifacts in the merged first vertical derivative data. These areas were extracted from the final product to reduce the probability of misinterpretation and appear as white or blank data regions. Other linear (e.g. E-W and/or N-S) features may also be related to flight lines and/or analogue processing.	

maximum distance from measured points. The resulting image is a relatively smooth continuous grid image for the entire survey area. This procedure is designed to make a complete map image for map pattern interpretations. The actual station locations were noted when interpreting these images to avoid misidentifying features and/or making detailed spatial interpretations beyond the limit of the original data. This latter point is particularly relevant if one attempts to adjust geological map boundaries based on gravity map patterns.

The total field gravity data are not amenable to a high degree of enhancement because of the original survey parameters. However, some simple enhancement procedures such as regional-residual separation are useful. These regional-residual data are suited to isolating deeper sources (i.e. regional signals) from more shallow sources (i.e. residual signal). Ideally, residual gravity map patterns relate more directly to geological mapping, whereas regional gravity map patterns reflect sub-surface structure and stratigraphy.

4.0 Petrophysical Data and Analysis

To calculate the specific gravity an apparatus was constructed to measure samples in air and water. The apparatus consisted of a suspended mechanical scale and a plastic mesh bag with negligible mass wet or dry. The scale was zeroed with the bag attached, a sample was placed in the bag and suspended in air and the weight recorded (i.e. weight in air; W_{air}). Then the bag containing the sample was lowered into a container of water until the sample was completely submerged and this weight recorded (i.e. weight in water; W_{water}). The sample was raised clear of the water and a third weight measurement recorded (i.e. weight wet; W_{wet}). This third measurement checked sample porosity and virtually all data indicated a mass difference (i.e. $(W_{air}-W_{wet})/W_{air}$) of less than 1%, thereby indicating that porosity was not a significant factor in calculating the specific gravity by this method. The measured data were compiled and the specific gravity calculated using the following formula:

(Eq. 1) $\text{Specific Gravity} = W_{air} / (W_{air} - W_{water})$

Specific gravity is a ratio of the density of a material to the density of water. Therefore, SG is unitless. However, at standard temperature and pressure, specific gravity is equal to density, and these conditions are assumed here. As such, all data are presented as Density with units of g/cm^3.

The resulting measurements and calculations are presented along with sample descriptions in Table 4 and Appendix II.

Susceptibility measurements were carried out using a handheld magnetic susceptibility meter. The Exploranium KT-9 Kappameter records up to 10 readings in memory to an accuracy of two decimal places and data are displayed in SI units x 10^{-3}. The electronic operating principal of the KT-9 can be described as follows:

1. The electromagnetic frequency is determined in free space (zeroing).
2. The electromagnetic frequency is then measured next to the material for which the susceptibility is to be determined.
3. The electromagnetic frequency is determined in free space.
4. The difference in the measured electromagnetic frequencies is directly proportional to the magnetic susceptibility.

Four measurements were made on each sample at various orientations and care was taken to ensure the best contact between the sensor and sample. The arithmetic mean of the four measurements is used as the magnetic susceptibility value for that particular sample. The magnetic susceptibility data are presented in Appendix II, along with specific gravity data and sample descriptions.

A comparison of petrophysical data generated from this study to data published in various reports is presented in Table 4. These data cover a representative suite of rock types from Carboniferous units in the study area and, in general, there is consistency between all sources. A more detailed breakout of salt samples with varying percentages of clastic material or anhydrite can be found in Appendix II.

5.0 Potential Field Models

The 2- and 2.5-dimensional potential field models typically require the magnetic and gravity data to be in a coincident profile format. Where these data are collected together, appropriate station data can be used directly in the modelling process. However, in the present study and most regional cases combining airborne and ground data, the gravity and magnetic data are not directly coincident and may not be spatially continuous along a particular transect. This situation is remedied by generating gridded data sets for the measured aeromagnetic and gravity total fields (this procedure was described in Section 3.1). The gridded data provide a continuous measured potential field response (i.e. magnetic and gravity) along the model transect.

Typically, profiles are extracted from residual grids that have had long wavelength (>5 km), regional variations removed. In this case, model data were extracted from the gridded residual data by defining a poly-line or vector corresponding to the desired model location. This line was selected and the underlying grid values (magnetic, gravity, and digital elevation) were automatically exported into an ASCII data file. The extraction and modelling software have a station limit of 500 points. Therefore, the sample interval for any particular model is a function of the length of the section (e.g. station interval (m) = profile length (m) / 500) and is on the order of 30 to 70 m. The profile data were input into the modelling software as the measured components and used to generate a potential field model of the subsurface structure and stratigraphy.

Thirteen models were completed throughout the project area and detailed location maps are presented in Appendix III. Models were initially divided into three groups based on the target scale and features of interest:

1. Regional Sections (Line numbers 1, 2, 3, 5, 7, 9):
   These sections were long sections covering diverse geological settings designed to investigate basement / basin geometry and potential regional structural controls.
2. Internal Basin Sections (Line numbers 11, 12, 13):
   These sections were designed to investigate internal structure and stratigraphy, basin boundaries and possible salt distribution and tectonism.
3. Isolated Gravity Lows (Line numbers 14, 15, 16- included in Line 5, 17):
   These models were designed to investigate the source for a series of localized gravity anomalies present on some published assessment report maps.

5.1. Summary of Modelling Results

The results of the potential field models are summarized below. Locations of the models are presented in Appendix III and the models themselves are presented in Appendix IV. Geological unit names referred to are based upon Keppie (2000).

- **Line # 1:** The potential field model for Line #1 is complicated by the fact that it is near and parallel to the Strait of Canso. However, several significant features can be identified from this model including the position of the Mira - Bras d'Or terrane boundary. The terrane boundary is marked by a significant (~0.1 g/cm^3) and systematic increase in the density of the pre-Carboniferous basement units and contrast in the magnetic susceptibility values (Mira - Bras d'Or). The boundary is projected to surface as a fault (re-activated) near station 9000 m. The lower density (2.71 g/cm^3) Bras d'Or units north of the terrane boundary are unlikely to be Fisset Brook Formation units, based on the density measurements. Therefore, it is more likely that the pre-Carboniferous basement north of the terrane boundary is Blues Brook Formation or equivalent units. Pringle Mountain Group units may comprise the pre-Carboniferous basement south of the terrane boundary. The juxtaposition of the Bras d'Or terrane south of the interpreted terrane boundary (7 500-13 000 m) is an effect of a sinistral regional fault parallel to the model line (e.g. Canso Fault). It is unlikely that this block is directly beneath the line, but most probably it occurs just west of the line. Carboniferous units in the north appear to have a maximum thickness of 1000-1300 m and thicken in the south to approximately 3600 m.
- **Line # 2:** The contact between units in the Creignish Hills Pluton and the Carboniferous basin is modelled as a series of normal, sub-vertical faults with more than 1000 m of cumulative displacement. Thin but uniform Horton Group rock underlies a thick Windsor section. The Kingsville Deposit is modelled as a discrete fault-bounded salt body (~50-70% salt). The basin shallows dramatically to the south (<1000 m) and pre-Carboniferous basement units appear to comprise the Blues Brook or the Malagawatch formations. There are discrete, spatially limited (yellow = 2.5-dimension) magnetic bodies that represent mafic units. These are similar to dykes mapped in the North Mountain area by Justino and Barr (1994). The geometry of these magnetic anomalies provides some additional depth control, albeit slightly dependent on the survey elevation (i.e. flight altitude).
- **Line #3:** This model provides insight into the Mira and Bras d'Or terranes, as well as potentially discriminating between the character of the terranes at surface versus at depth. The Mira - Bras d'Or terrane boundary is located at the northern end of the measured data profile and occurs as a dipping and re-activated fault contact, similar to that modelled on Line #1. Numerous structures affect both the Carboniferous and pre-Carboniferous units, the most dramatic of which is located at station 11 000 m. North of this regional fault the Carboniferous cover is very thin, whereas south of this structure the basin thickness ranges from 2300 m to 400 m. A discrete 2.5-dimensional mafic intrusive unit occurs beneath the southern end of the model and this is presumably related to gabbroic units mapped at St. Peters (Keppie, 2000).
- **Lines # 5 and #16:** There are short wavelength features in the measured gravity profile that appear to be related to topography and overburden (up to 50 m). This section shows the contact with the Marble Mountain Pluton as a steep north-dipping fault. The Marble Mountain Pluton also contains several discrete bodies with physical properties (e.g. susceptibility) similar to units in the Big Brook Pluton. Therefore, two 2.5-dimensional bodies are modelled to reflect a potential co-magmatic relationship. Maximum basin depths approach 2200 m and the

Table 4. A comparison of petrophysical data collected from Carboniferous drill core samples and measurements made in this study. Density units are g/cm^3 and magnetic susceptibility (k) units are x10^{-3} SI.

Lithology	Boehner (1986)	Howells (1986)	Spector (1981)	Telford et al. (1988)	This Study (Appendix II)				
					N	SG_{ave}	SD	k_{ave}	SD
"Anhydritic" Mudstone	2.5 -2.57								
Anhydrite	2.9 -2.93	2.82	2.95	2.93	10	2.92	0.10	0.01	0.02
"Dark" Salt	2.16					~2.20			
"Light" Salt	2.12-2.13					~2.15			
Salt		2.27	2.15		11	2.25	0.09	0.02	0.03
Mudstone	2.4-2.42	2.50	2.45	2.22	6	2.36	0.13	0.07	0.05
Limestone		2.65-2.72	2.65	2.55	7	2.74	0.15	0.02	0.03
Sandstone / shale		2.50 – 2.71		2.24 - 2.79					
Gypsum				2.35	2	2.34		0.01	
Sandstone / conglomerate		2.60	2.55						
				TOTAL	36				

Orangedale salt deposit is modelled as a "salt-rich" (i.e. ~ 50% salt) stratigraphic section within the lower Windsor Group. Several significant faults mark the boundary between the Carboniferous basin and the pre-Carboniferous Bras d'Or units. The pre-Carboniferous units south of the Marble Mountain Pluton contain variable lithologies that generate discrete magnetic anomalies.

The potential field model for the area corresponding with Line # 16 shows little variation except in the location of the contact between the Marble Mountain Pluton and the Windsor Group. There is nearly 200 m of vertical relief in this area, therefore the short wavelength, low amplitude measured gravity variations are presumably related to topography.

- **Line # 7:** Detailed modelling of this section was restricted somewhat by lack of gravity data, particularly over the eastern third of the line. The internal character of the Carboniferous basin appears to consist of layered, geophysically isotropic stratigraphy. There are two faults modelled on this section; however, they have very little displacement and may be related to lithological contacts in the pre-Carboniferous units. Division of the Windsor Group into upper, middle and lower units is based on an average of the representative lithologies (e.g. major cycles 1, 2, and 3; Boehner, 1992). In other models, these divisions have been averaged for the sake of simplicity. Divisions in the pre-Carboniferous Bras d'Or terrane units reflect magnetic variations related to lithologies (e.g. marble) found in these units (e.g. Malagawatch).

- **Line # 9:** The elevated gravity and magnetic response at the northern end of this line appears to be caused by a buried granodiorite body similar to one mapped just south of the profile (e.g. Keppie, 2000). Three major faults affect both Carboniferous and unexposed pre-Carboniferous units, and these structures have been recognized in regional mapping (e.g. Keppie, 2000). A discrete low-density body (<50% salt) is modelled in the central part of the section (7800 m) where the basin reached a maximum thickness of 1800-2000 m.
- **Line #11:** This section represents a complicated geophysical and geological situation where there is poor data quality (e.g. 1950s magnetic) and coverage (magnetic and gravity) on the mainland side of the Canso Strait (0-1500 m). However, there is good agreement between Line #1 and Line #11 where they intersect (4200 m). Carboniferous stratigraphy thickens dramatically north of the Cape Breton Island side of the Canso Strait to a thickness in excess of 3000 m. Carboniferous units are relatively flat lying, with the exception of a large scale salt-cored anticline over minor basement relief (faulted?) around station 10 000 m. The poor data quality and coverage south of the Strait prevents a highly detailed model from being developed; however, it is very likely that one or two regional faults correspond to the dramatic uplift in the pre-Carboniferous basement units. Based on interpretation of other lines (e.g. Line #1) these structures are probably re-activated sinistral fault (s) with moderate components of vertical movement.
- **Line #12:** This model defines simple basin geometry with a uniform Horton section. Maximum basin thickness is nearly 2000 m around station 5500 m. The Marble Mountain Pluton sub-crops at the southern end of the section. The section is underlain by units with variable magnetic responses; however, the physical properties are consistent with units in the Bras d'Or metamorphic suite (e.g. Blues Brook and Malagawatch formations). The basement unit associated with the magnetic high around station 3700 m probably represents a mafic unit (basalt?).
- **Line #13:** This section originates (0 m) approximately 330 m west of station 15 200 m on Line #5. There is excellent agreement between the two model sections in this area. The Orangedale salt deposit appears to continue along a northern trend from Line #5 to this section where it is also modelled as a "stratiform" salt-rich horizon containing approximately 50% salt. The basin geometry appears to have been largely unaffected by some minor interpreted faults, although there is a potential fault near station 6000 m. The basin shallows from 2000 m in the southwest to approximately 1000 m in the northeast. The pre-Carboniferous basement units show a marked contrast in magnetic response, and may indicate an intrusive relationship between the northern unit and the southern unit that may be marble-rich Malagawatch Formation.
- **Line #14:** The potential field model for this section defines a relatively isotropic geological within-basin setting with the exception of a minor, discrete salt section. A discrete body containing less than 50% salt is modelled; however, it is most likely that this body represents a salt-rich horizon with local halokinetic activity. This would be similar to the Orangedale Deposit where complexly folded salt sections make up the deposit. The basin reached a maximum depth of approximately 2000 m and appears to be relatively unaffected by any large-scale regional structures. The pre-Carboniferous units in the model may consist of the Blue Brook Formation with more mafic units being located north of station 15 000 m.
- **Line #15:** The discrete gravity low, cited as a rationale for this particular model, is interpreted to be an overburden phenomenon. A drillhole in the area indicated overburden thickness on the order of 70 m. A thickness of 40-70 m was used to match the measured gravity response between stations 2600 and 3300 m. South of this topographic effects dominate the measured

gravity response as the profile traverses part of the North Mountain. Maximum basin thickness reached 2000 m, similar to other values derived from models, and stratigraphic thickness remains fairly constant for the Horton Group. The pre-Carboniferous units include the Marble Mountain Pluton to the south and undivided Bras d'Or terrane units to the north. These units probably include the Malagawatch Formation; however, a discrete magnetic body north of 800 m could correspond to mafic dominated stratigraphic package or intrusion.

- **Line #16:** This discrete gravity low was included in the model for Line #5 and it appears to be closely related to topography. The anomaly is located adjacent to North Mountain, which has nearly 200 m of relief over approximately 1000 m. A fault contact has also been interpreted for this area and under these conditions, a significant and localized increase in overburden thickness is likely.
- **Line #17:** This was a complex section to model due to the orientation of the line with respect to the West Brook Pluton. In this situation a 2.5 dimensional body (i.e. limited strike length; yellow lines) was used since the Big Brook Pluton occurs to one side of the profile line. The basement units in the area consist of the Big Brook Pluton in the north and a diorite unit in the south. The basin itself appears to be very shallow (<300 m) along the contact with the pluton.

6.0. Conclusions and Recommendations

The potential field models completed over southern Cape Breton Island present a semi-quantitative description of the distribution of pre-Carboniferous units with respect to exposed belts of the same units and these models detailed the internal structure and stratigraphy of the Carboniferous basins in the area. Estimates on the thickness of units (e.g. Horton and Windsor groups) have been quantified as well as the distribution of salt-rich and salt-dominated areas within each basin. Further-more, the detailed analysis of gravity data through potential filed modelling has resolved some potential artifacts in the measured data that may be related to topography and/or overburden.

A significant amount of information was gleaned for the nature and location of the Mira - Bras d'Or terrane boundary. Potential field models show a consistent physical property contrast for the average density (~2.72 g/cm^3) of pre-Carboniferous units in the Bras d'Or terrane versus those in the Mira terrane (~2.80 g/cm^3). A similar contrast in magnetic susceptibility estimates also exists (Bras d'Or - Mira).

The complex geology and structure near the Canso Strait was also addressed with Lines # 1 and 11. These models showed evidence of the location of the terrane boundary and sinistral offset by a major fault(s) coincident with the Strait.

The resolution and detail of the potential field models is dependant on the sample spacing of the magnetic and gravity data. It is evident from this study that more measured data would greatly enhance the detail in the potential field models, and this in turn would impact the benefit to industry. It is recommended that where areas are identified for investigation, more gravity data be collected to supplement and or replace NSDNR data and ground magnetic surveys should also be completed.

7.0 References

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8.0 Statement of Qualifications

I, Mark Stephen King, residing at 48 Crown Drive, Halifax, Nova Scotia, do hereby certify that:

1. I am a Professional Geophysicist, licensed to practice by the Association of Professional Engineers and Geoscientists of Newfoundland, Member # 3047.

2. I received a B.Sc. Degree (Geophysics) from Memorial University of Newfoundland in 1991. I am presently completing an M.Sc. from Acadia University in Wolfville, Nova Scotia.

3. I am an independent Geophysical Consultant and I have actively consulted on geophysical projects for government and industry clients continuously since 1992.

4. The conclusions drawn in this report are based on data collected from various sources. These sources are presumed to be accurate and correct.

5. I am actively consulting on other projects with similar scope and purposes.

6. I have no interest, in matter or promise, in the foregoing projects because of the conclusions or recommendations contained herein.

August 14, 2002

Mark S. King, P. Geo.
Geophysicist

9.0 Appendix 1: Potential Field Map Products

POTENTIAL FIELD MAPS (plot scale 1:50 000)				**POTENTIAL FIELD MODELS**		
MAGNETIC DATA				***REGIONAL SECTIONS***		
NTS	**Data**	**TF[3]**	**Enhanced[3]**	**Line[4]**	**MAG**	**GRAV**
11F/10	1 km RGS[1]	TF C/SR	1D C/SR	1	RGS[1]	OFR 95-005
11F/11	1 km RGS[1]	TF C/SR	1D C/SR	2 3	RGS[1]	OFR 95-005
11F/14	300 m GDC[2]	TF C/SR	2D C/SR	5	#260[2]	OFR 95-005
11F/15	1 km RGS[1]	TF C/SR	1D C/SR	7	RGS[1]	OFR 95-005
11K/02	300 m GDC[2]	TF C/SR	2D C/SR	9	#260[2]	OFR 95-005
GRAVITY DATA				***INTERNAL SECTIONS***		
11F/10	OFR 95-005	TF C/SR	Trn/Res C/SR	11	RGS[1]	OFR 95-005
11F/11	OFR 95-005	TF C/SR	Trn/Res C/SR	12	#260[2]	OFR 95-005
11F/14	OFR 95-005	TF C/SR	Trn/Res C/SR	13	#260[2]	OFR 95-005
11F/15	OFR 95-005	TF C/SR	Trn/Res C/SR	***ISOLATED FEATURES***		
11K/02	OFR 95-005	TF C/SR	Trn/Res C/SR	14	#260[2]	OFR 95-005
TOTAL = 20 Maps TOTAL = 13 Models				15	#260[2]	OFR 95-005
				16	#260[2]	OFR 95-005
				17	#260[2]	OFR 95-005

[1]Digital data delivered on Aug 17th, 2001. Digital data supplied by the Radiation Geophysics Section. Data merged with small amount of "digitized" analogue data from the Geophysical data Centre.
[2]Data delivered on June 10th, 2001. Digital data supplied by the Geophysical Data Centre. High resolution GSC Survey # 260.
[3]TF=Total Field; C/SR= colour/shaded relief; 1D=calculated first vertical derivative; 2D=calculated second vertical derivative; DEM=digital elevation model derived from 1:10000 scale ASCII point data; Trn/Res=residual data generated by subtracting a polynomial surface from the total field data.
[4]Ref. E-mail from R. C. Boehner (28/6/2001) and (7/6/2001).
[5]Digital data edited and re-compiled to correct syntax and other errors.

Appendix I: Potential Field Map Products (Continued)

Description	File Name	NTS Coverage	Grid Cell (m)	Image Cell (m)	Illumination	
					Az.	Inc.
MAGNETIC DATA						
Total Field Mag	TGI-TFM.tif	all	250	25	300	35
Registration File	TGI-TFM.reg	all	250	25	300	35
TFM Colour Bar	TFM-BAR.tif	all	250	25	300	35
First Vertical Derivative Mag	TGI-1DM.tif	all	250	25	300	35
Registration File	TGI-1DM.reg	all	250	25	300	35
1DM Colour Bar	1DM-BAR.reg	all	250	25	300	35
Second Vertical Derivative Mag	TGI-2DM.tig	11F/14 1K/02	75	25	300	35
Registration File	TGI.2DM.reg	11F/14 1K/02	75	25	300	35
2DM Colour Bar	2DM-BAR.tif	11F/14 1K/02	75	25	300	35
GRAVITY DATA						
Total Field gravity	TGI-TFG.tig	all	500	25	300	45
Registration File	TGI-TFG.reg	all	500	25	300	45
TFG Colour Bar	TFG-BAR.tif	all	500	25	300	45
Residual Gravity	TGI-RES.tif	all	500	25	300	45
Registration File	TGI-RES.reg	all	500	25	300	45
TFG Colour Bar	RES-BAR.tif	all	500	25	300	45

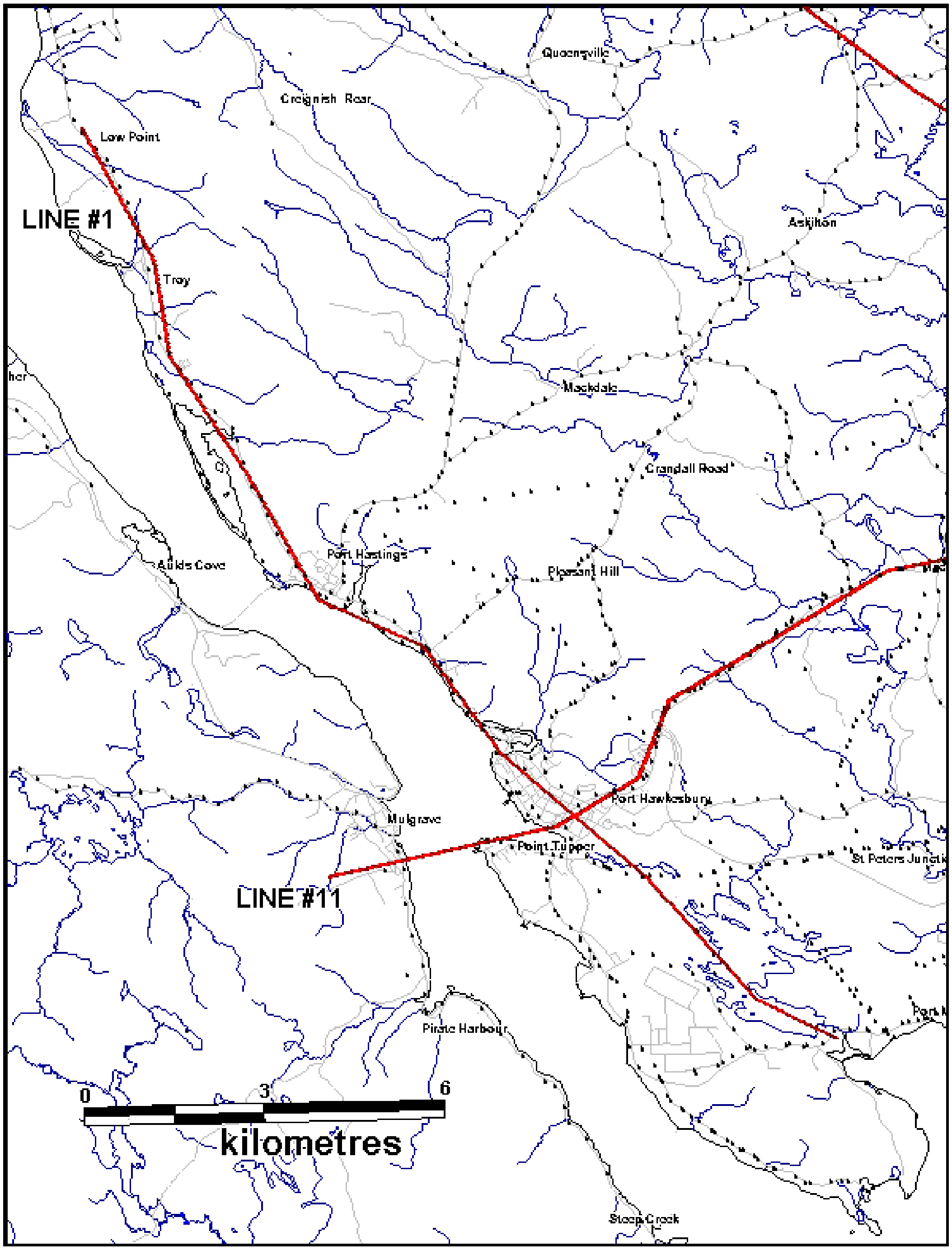
9.1. Appendix II. Petrophysical Data and Sample Descriptions

Sample Number	Depth (ft)	DDH #	Core Size	Mag k 1	Mag k 2	Mag k 3	Mag k4	Ave. k	Weight air	Weight water	Weight wet	SG	Lithology Rock Type
K-001	568	Chev 9-78	B	0.00	0.00	0.01	0.00	0.00	195	112	197	2.35	Gypsum
K-002	526	Chev 9-78	B	0.01	0.00	0.00	0.00	0.00	327	218	330	3.00	Anhydrite
K-003	446	Chev 9-78	B	0.00	0.00	0.00	0.00	0.00	275	184	275	3.02	Anhydrite
K-004	343	Chev 9-78	B	0.00	0.00	0.00	0.00	0.00	224	142	227	2.73	Limestone (petroliferous)
K-005	307	Chev 9-78	B	0.00	0.00	0.00	0.00	0.00	270	179	272	2.97	Anhydrite
K-006	290	Chev 9-78	B	0.01	0.00	0.00	0.00	0.00	292	192	296	2.92	Limestone (petroliferous)
K-007	197	Chev 9-78	B	0.00	0.00	0.01	0.00	0.00	313	209	313	3.01	Anhydrite
K-008	150	Chev 9-78	B	0.00	0.00	0.00	0.00	0.00	281	187	282	2.99	Anhydrite
K-009	65	Chev 9-78	B	0.03	0.02	0.02	0.00	0.02	154	88	155	2.33	Sandstone / Siltstone
K-010	902	Mala M-8	N	0.00	0.00	0.00	0.00	0.00	382	220	382	2.36	Salt / Anhydrite (50/50)
K-011	873	Mala M-8	N	0.00	0.00	0.01	0.00	0.00	307	163	309	2.13	Salt
K-012	728	Mala M-8	H	0.00	0.00	0.00	0.00	0.00	511	275	510	2.17	Salt
K-013	705	Mala M-8	H	0.02	0.01	0.01	0.01	0.01	309	168	310	2.19	Salt (Main Salt-red)
K-014	657	Mala M-8	H	0.03	0.03	0.02	0.01	0.02	949	606	949	2.77	Anhydrite
K-015	620	Mala M-8	N	0.11	0.08	0.07	0.04	0.08	529	294	529	2.25	Salt with Silt
K-016	363	Mala M-5b	H	0.09	0.08	0.07	0.07	0.08	439	248	444	2.30	Mudstone / Siltstone (Red)
K-017	298	Mala M-5b	H	0.06	0.03	0.05	0.06	0.05	779	438	780	2.28	Siltstone
K-018	203	Mala M-5	H	0.02	0.02	0.02	0.02	0.02	377	221	378	2.42	Siltstone (Limey)
K-019	78	Mala M-5	H	0.06	0.09	0.05	0.08	0.07	597	330	608	2.24	Siltstone (Red)
K-020	409	Mala M-5a	H	0.01	0.02	0.01	0.02	0.02	724	481	731	2.98	Anhydrite
K-021	452	Mala M-5a	H	0.10	0.11	0.08	0.11	0.10	446	272	450	2.56	Limestone (Herbert River)
K-022	494	Mala M-5a	H	0.01	0.00	0.02	0.01	0.01	754	496	755	2.92	Limestone (B sub-zone)

9.1. Appendix II. Petrophysical Data and Sample Descriptions (Continued)

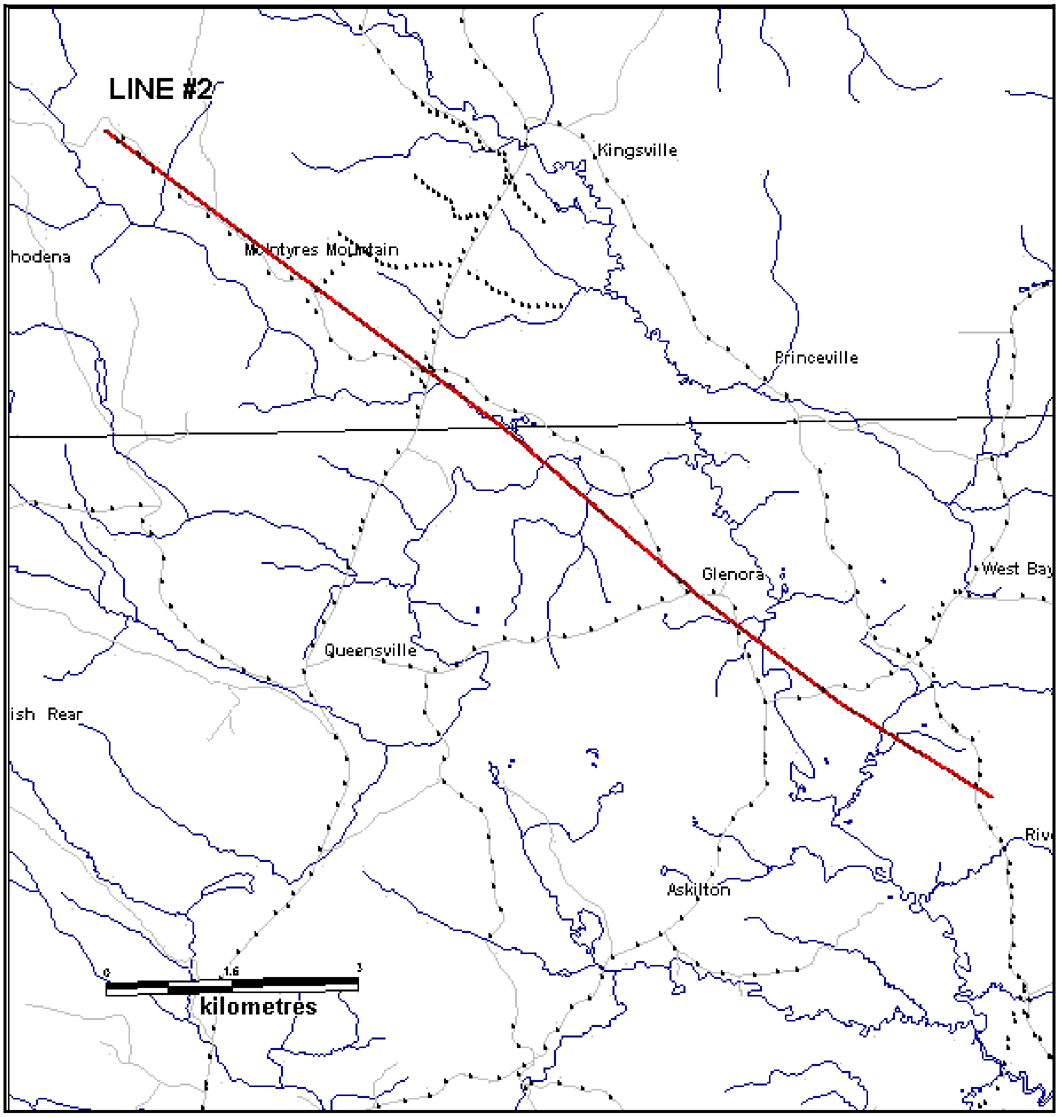
Sample Number	Depth (ft)	DDH #	Core Size	Mag k 1	Mag k 2	Mag k 3	Mag k4	Ave. k	Weight air	Weight water	Weight wet	SG	Lithology Rock Type
K-023	576	Mala M-5a	H	0.01	0.02	0.03	0.00	0.02	796	505	796	2.74	Limestone (Anhydrite clasts)
K-024	606	Mala M-5a	H	0.06	0.03	0.03	0.06	0.05	511	291	510	2.32	Salt (dirty red)
K-025	823	Mala M-5a	N	0.04	0.04	0.05	0.03	0.04	197	113	197	2.35	Salt (dirty)
K-027	1008	Mala M-5a	N	0.01	0.02	0.02	0.02	0.02	357	224	359	2.68	Limestone
K-028	431	Mala M-4	H	0.03	0.00	0.04	0.03	0.03	738	406	745	2.22	Salt and Mudstone (red)
K-029	477	Mala M-4	H	0.03	0.07	0.03	0.05	0.05	794	509	797	2.79	Anhydrite (Dolomite)
K-030	487	Mala M-4	H	0.00	0.00	0.00	0.02	0.01	461	251	461	2.20	Salt (crystalline)
K-031	554	Mala M-4	H	0.02	0.01	0.02	0.03	0.02	812	532	812	2.90	Anhydrite (dolomitized)
K-032	639	Mala M-4	H	0.00	0.00	0.01	0.02	0.01	603	350	606	2.38	Salt / Anhydrite (80/20)
K-033	660	Mala M-4	H	0.03	0.04	0.02	0.02	0.03	461	297	462	2.81	Anhydrite / Limestone / Dolomite
K-034	700	Mala M-4	H	0.01	0.01	0.03	0.00	0.01	837	513	837	2.58	Limestone
K-035	711	Mala M-4	H	0.14	0.16	0.18	0.15	0.16	729	447	729	2.59	Sandstone
K-036	754	Mala M-4	N	0.00	0.01	0.02	0.00	0.01	705	379	705	2.16	Salt / Anhydrite (92/8)
K-037	1010	LL-1-91	H	0.00	0.00	0.01	0.01	0.01	354	202	354	2.33	Gypsum

9.2. Appendix III. Potential Field Model Locations



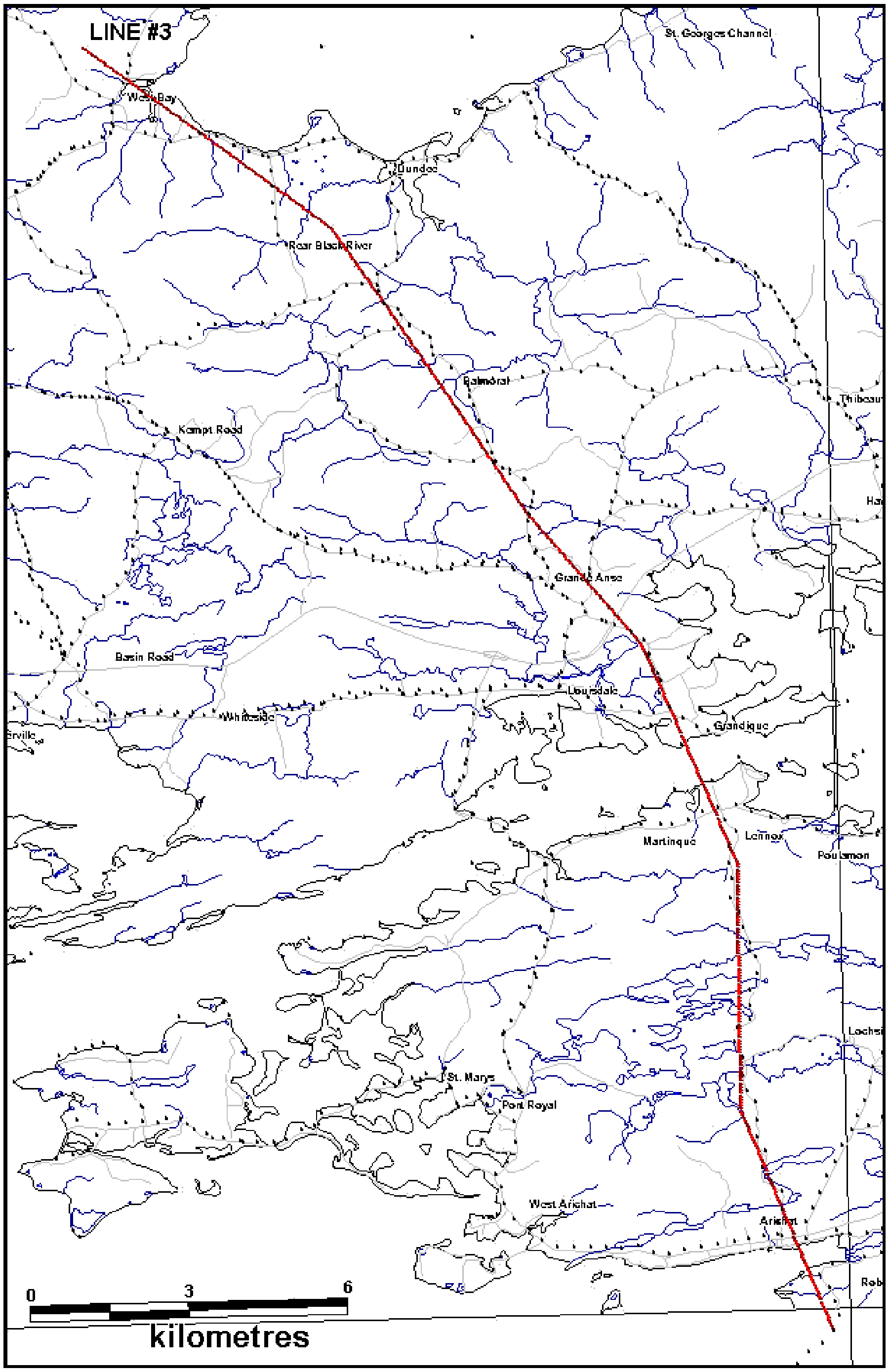
Location map for line #1 (red). Planimetric base including roads (grey), lakes and streams (blue) and coastline (black) are from 1:50 000 NTS bases. Gravity stations (black triangles) plotted after Howells and Clarke, 1995.

9.2. Appendix III. Potential Field Model Locations (Continued)



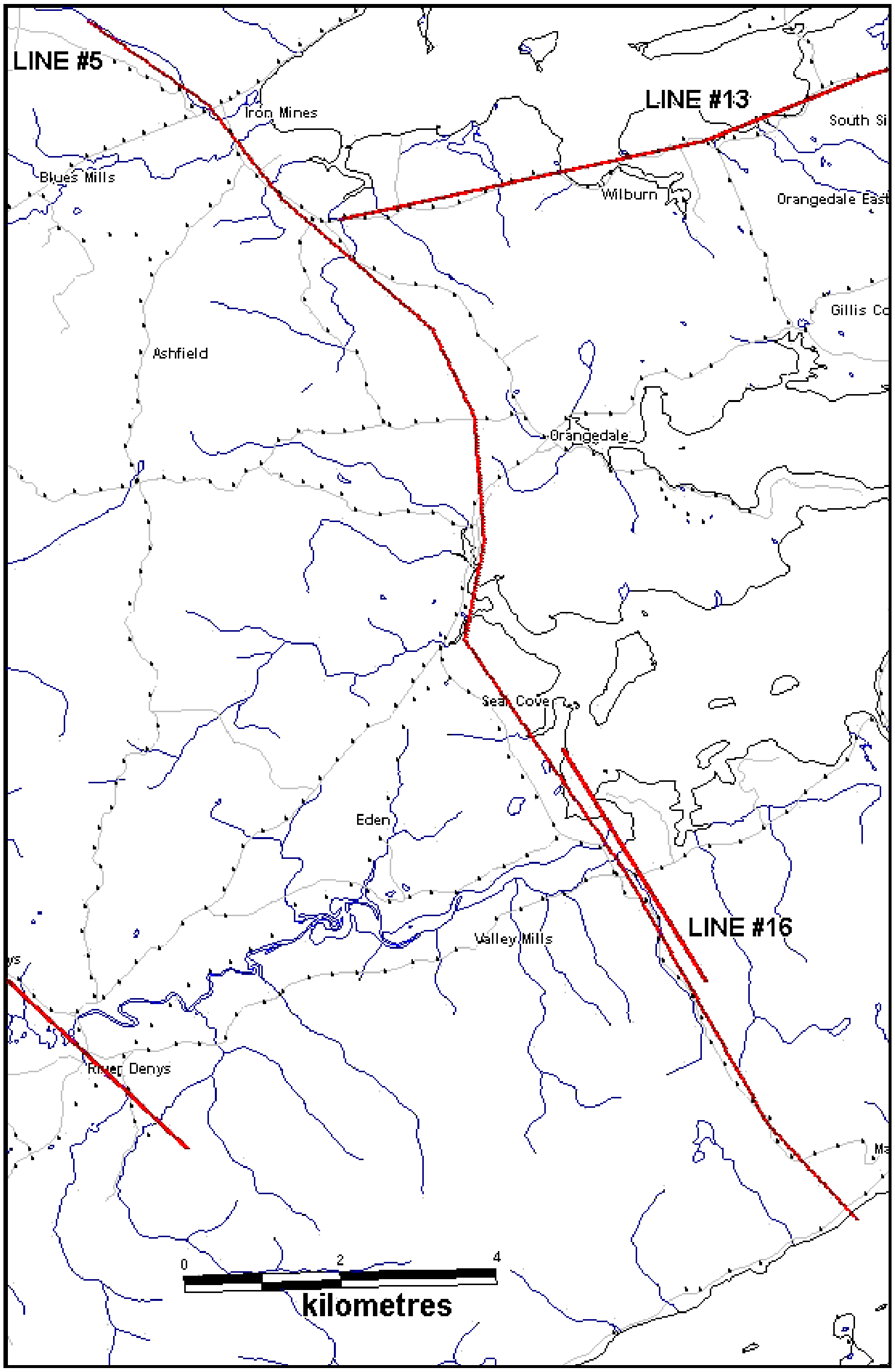
Location map for line #2 (red). Planimetric base including roads (gray), lakes and streams (blue) and coastline (black) are from 1:50 000 NTS bases. Gravity stations (black triangles) plotted after Howells and Clarke, 1995.

9.2. Appendix III. Potential Field Model Locations (Continued)



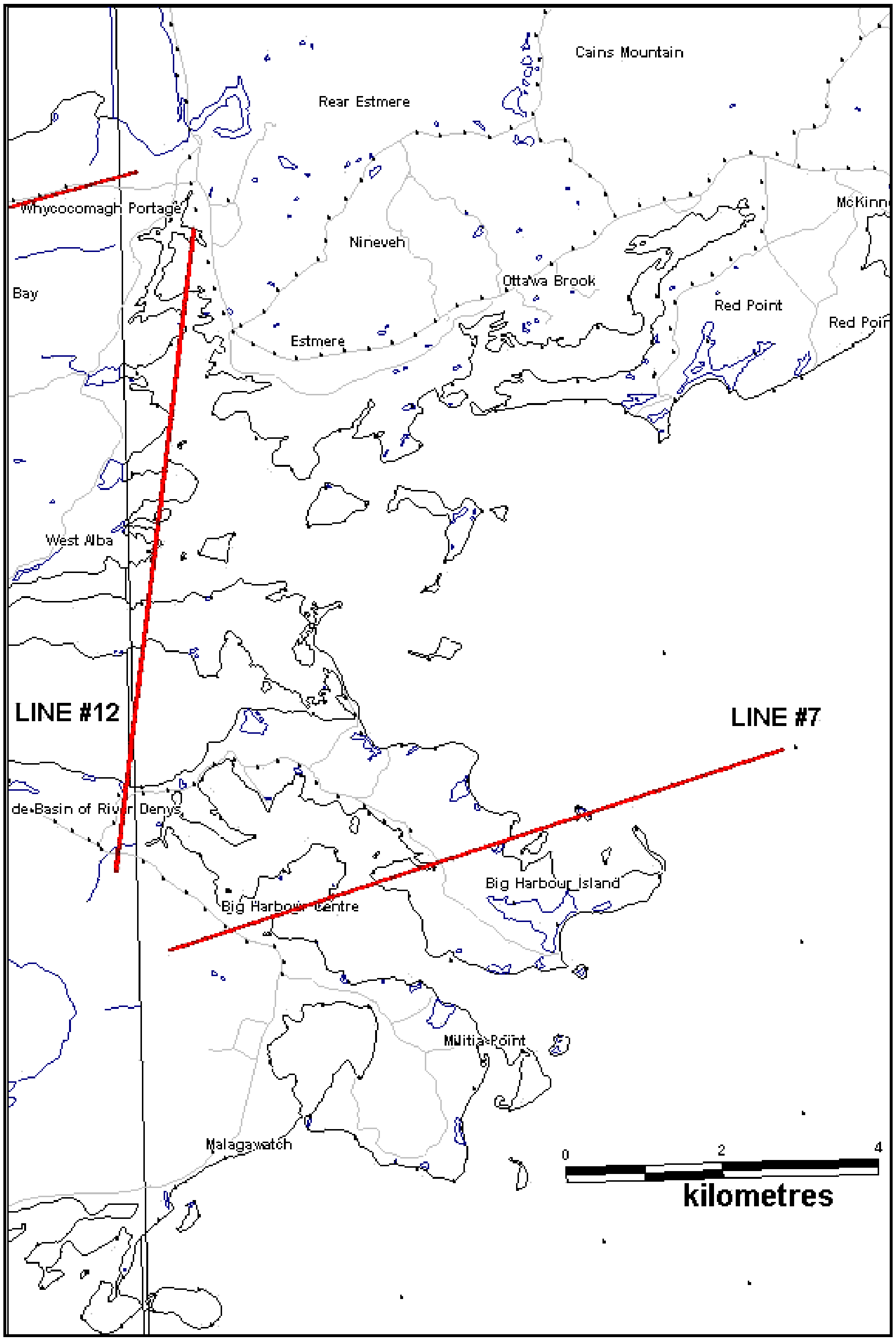
Location map for line #3 (red). Planimetric base including roads (grey), lakes and streams (blue) and coastline (black) are from 1:50 000 NTS bases. Gravity stations (black triangles) plotted after Howells and Clarke, 1995.

9.2. Appendix III. Potential Field Model Locations (Continued)



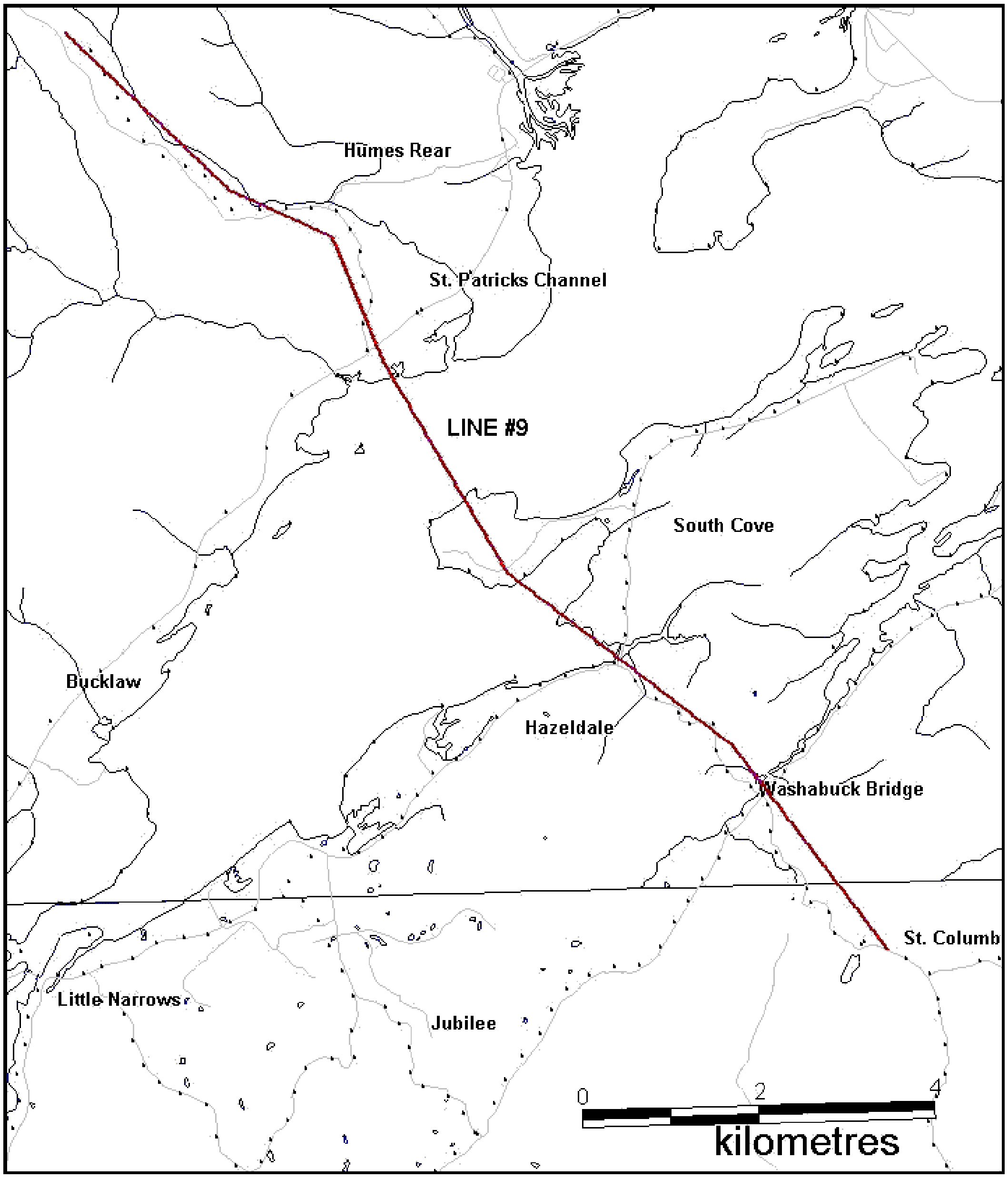
Location map for lines #5 and #16 (red). Planimetric base including roads (grey), lakes and streams (blue) and coastline (black) are from 1:50 000 NTS bases. Gravity stations (black triangles) plotted after Howells and Clarke, 1995.

9.2. Appendix III. Potential Field Model Locations (Continued)



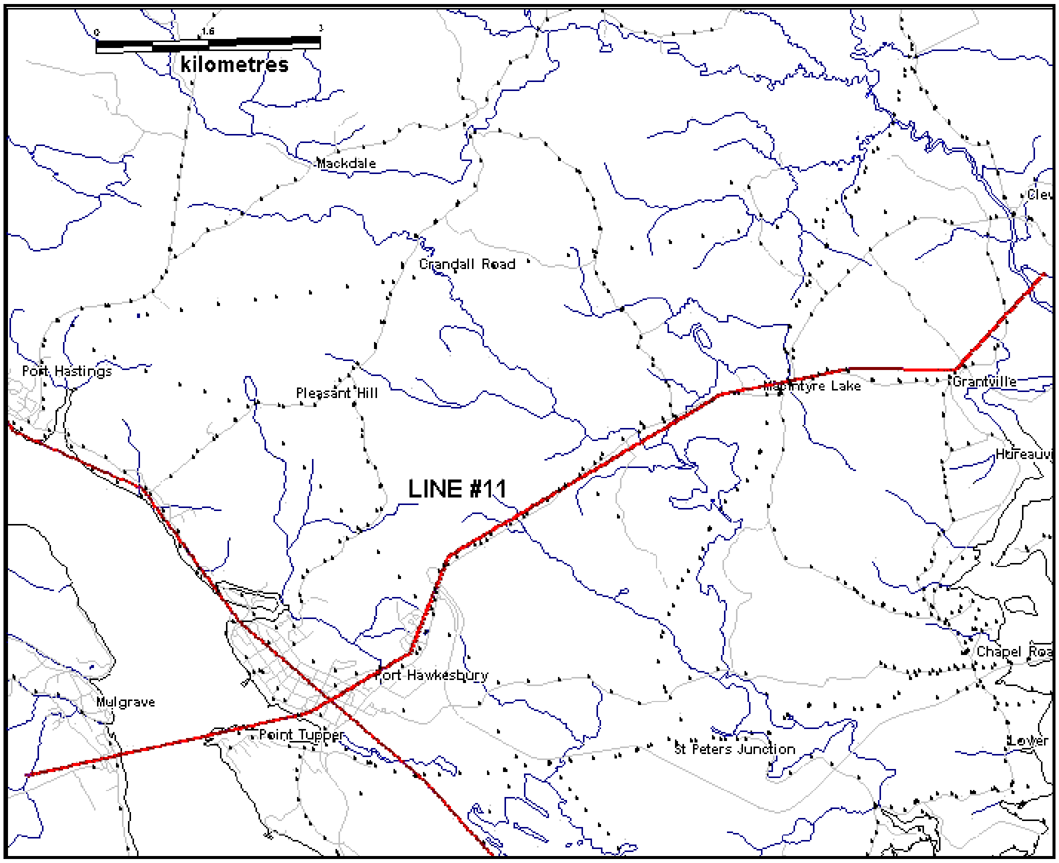
Location map for lines #7 and #12 (red). Planimetric base including roads (grey), lakes and streams (blue) and coastline (black) are from 1:50 000 NTS bases. Gravity stations (black triangles) plotted after Howells and Clarke, 1995.

9.2. Appendix III. Potential Field Model Locations (Continued)



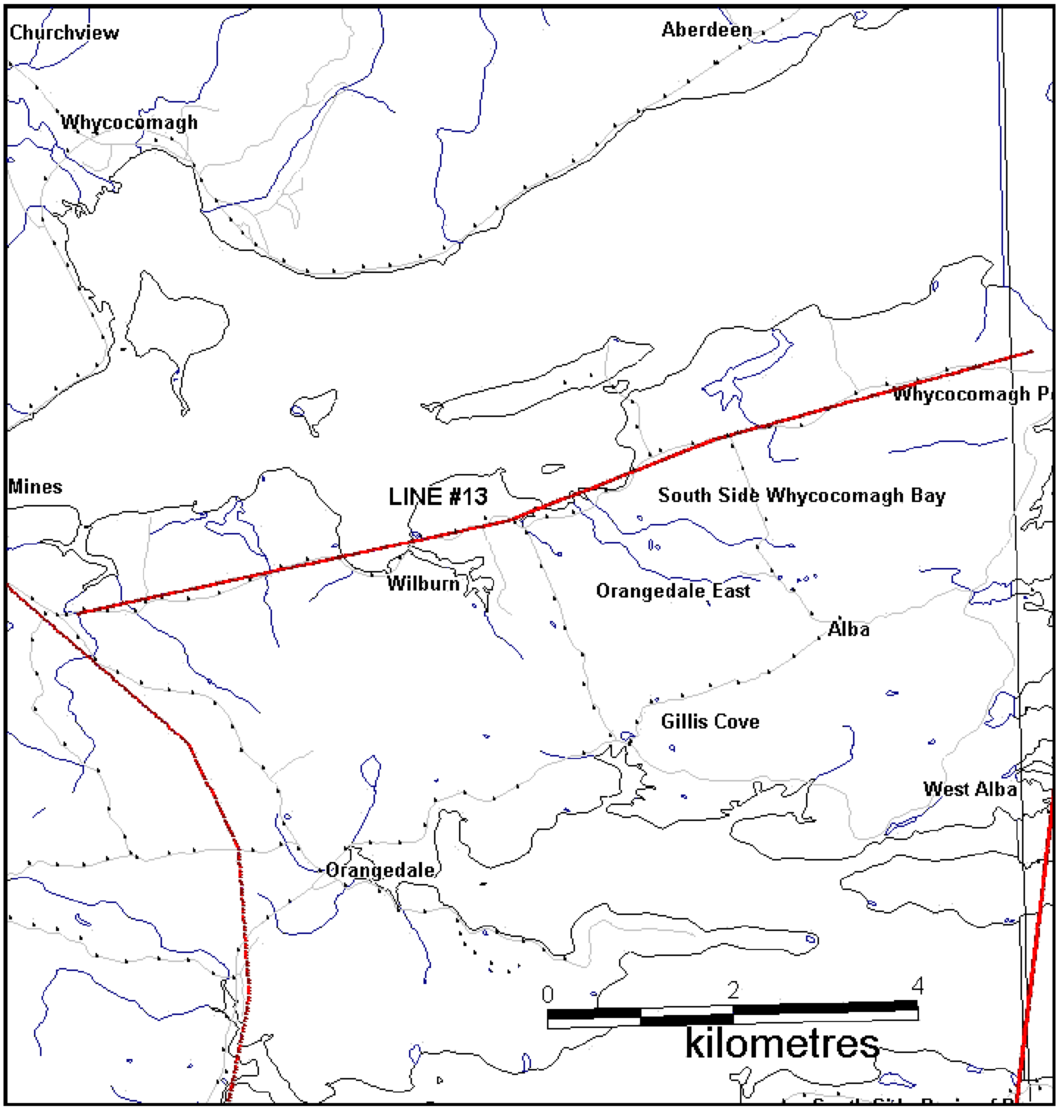
Location map for line #9 (red). Planimetric base including roads (grey), lakes and streams (blue) and coastline (black) are from 1:50 000 NTS bases. Gravity stations (black triangles) plotted after Howells and Clarke, 1995.

9.2. Appendix III. Potential Field Model Locations (Continued)



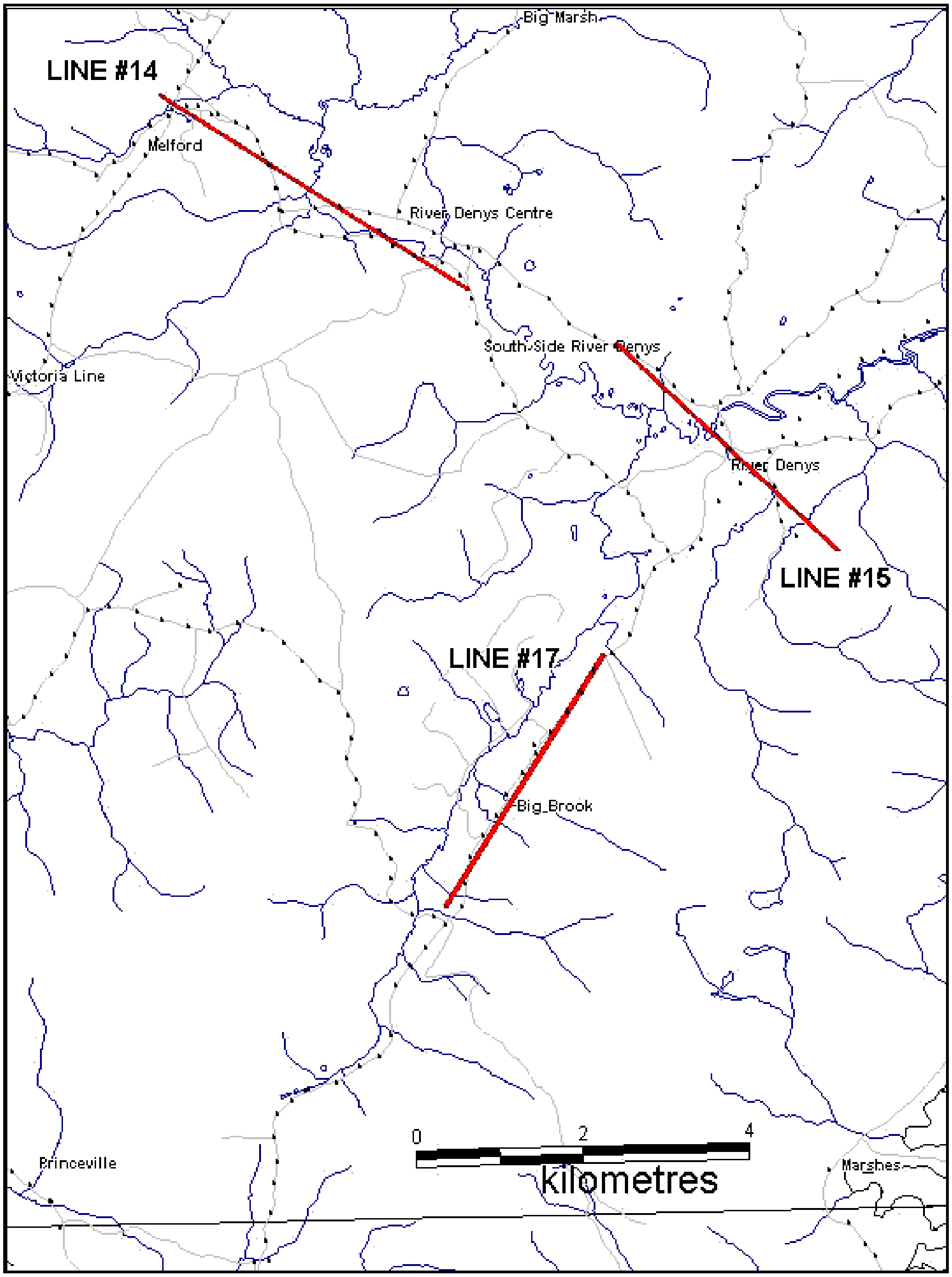
Location map for line #11 (red). Planimetric base including roads (grey), lakes and streams (blue) and coastline (black) are from 1:50 000 NTS bases. Gravity stations (black triangles) plotted after Howells and Clarke, 1995.

9.2. Appendix III. Potential Field Model Locations (Continued)



Location map for line #13 (red). Planimetric base including roads (grey), lakes and streams (blue) and coastline (black) are from 1:50 000 NTS bases. Gravity stations (black triangles) plotted after Howells and Clarke, 1995.

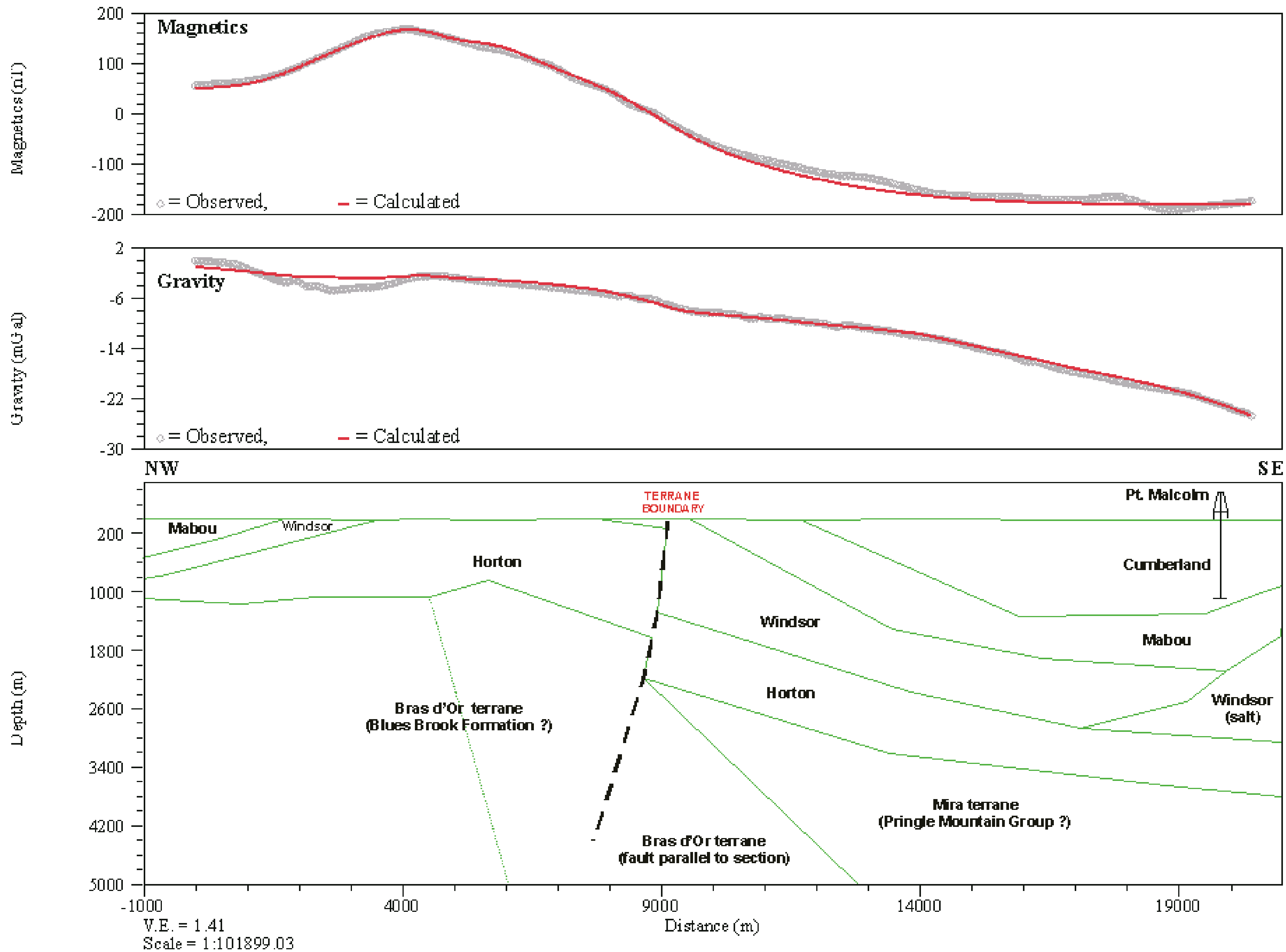
9.2. Appendix III. Potential Field Model Locations (Continued)



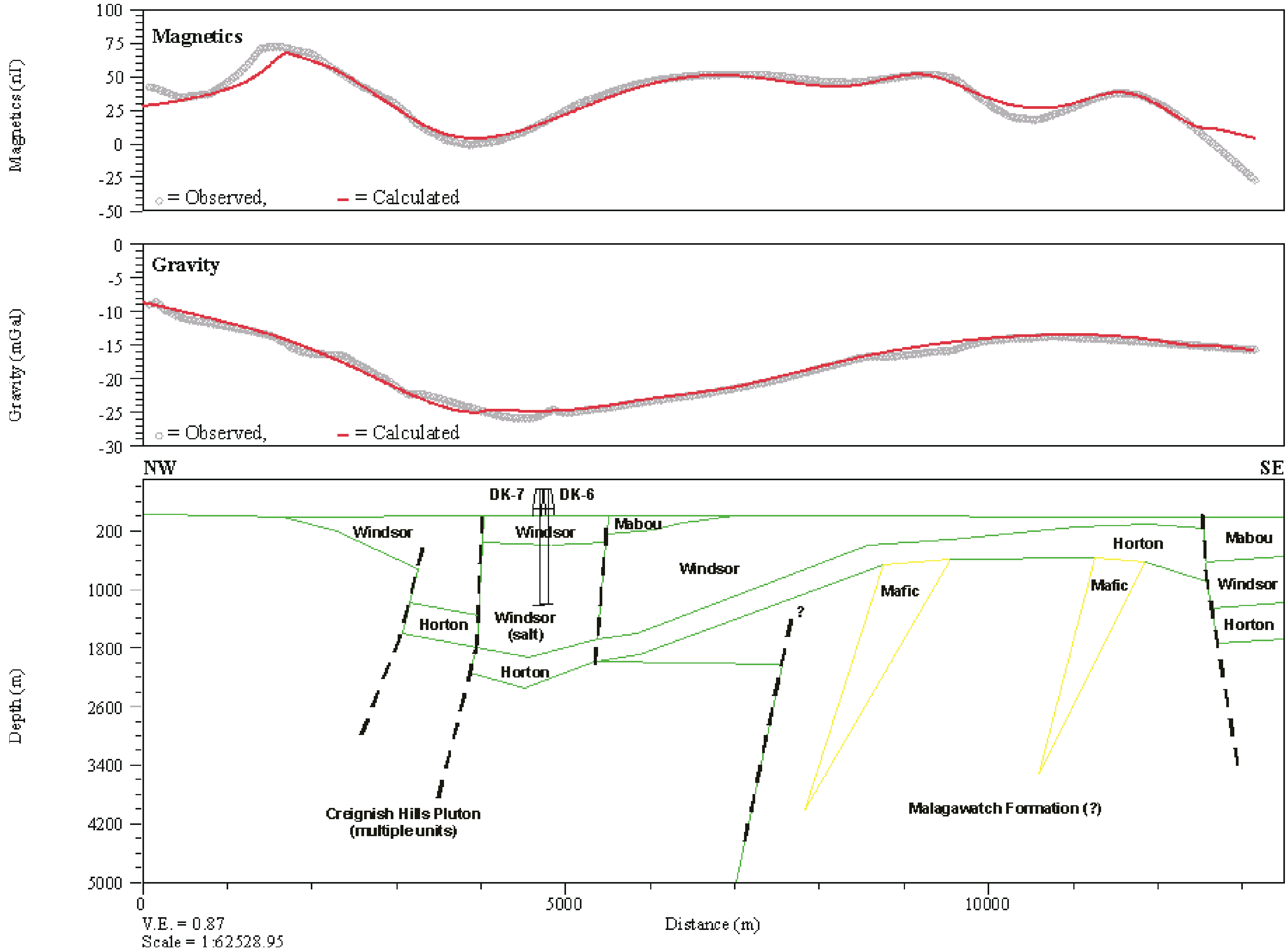
Location map for lines #14, #15, and #17 (red). Planimetric base including roads (grey), lakes and streams (blue) and coastline (black) are from 1:50 000 NTS bases. Gravity stations (black triangles) plotted after Howells and Clarke, 1995.

9.3 Appendix IV. Potential Field Models

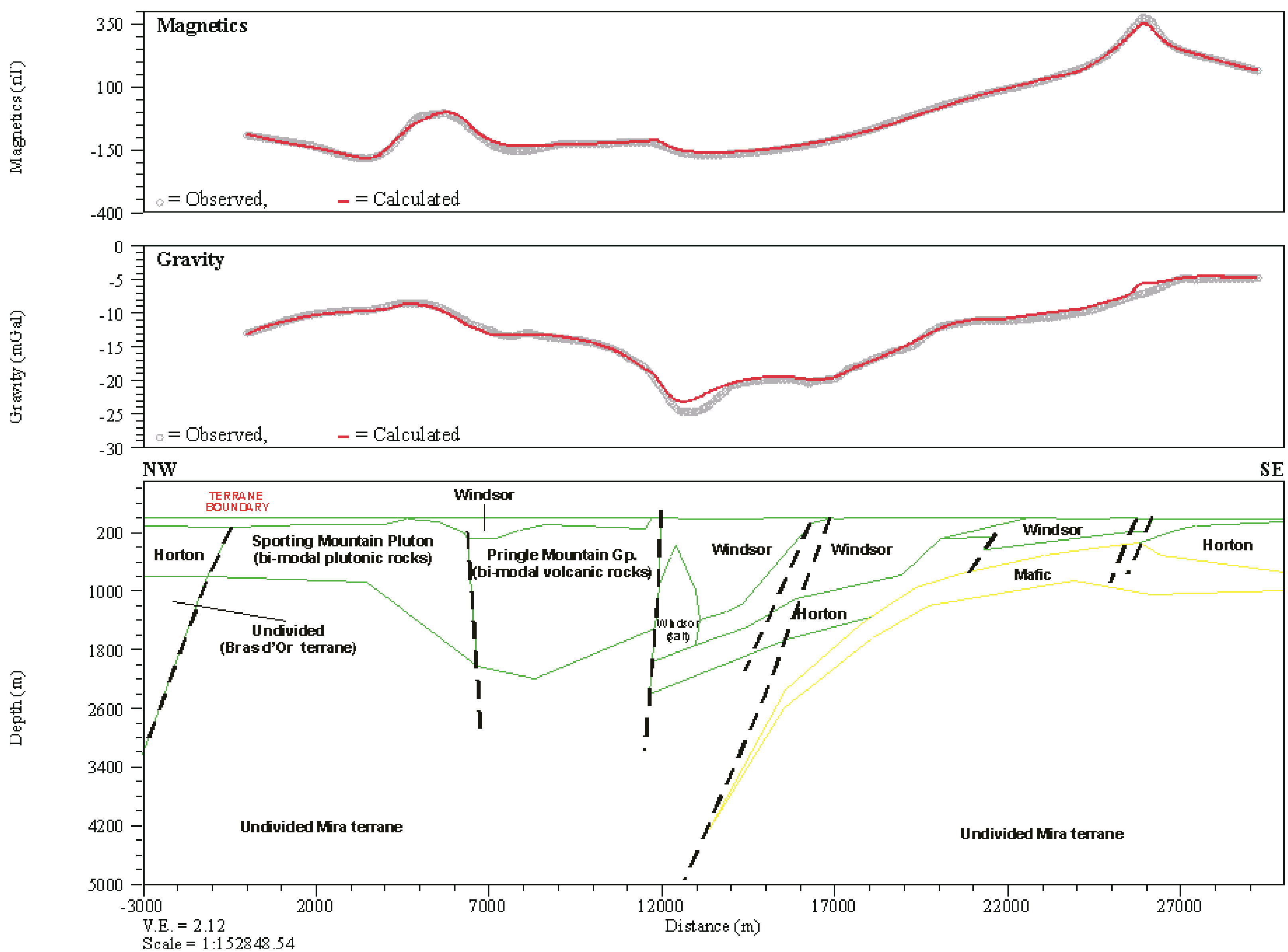
Line #1

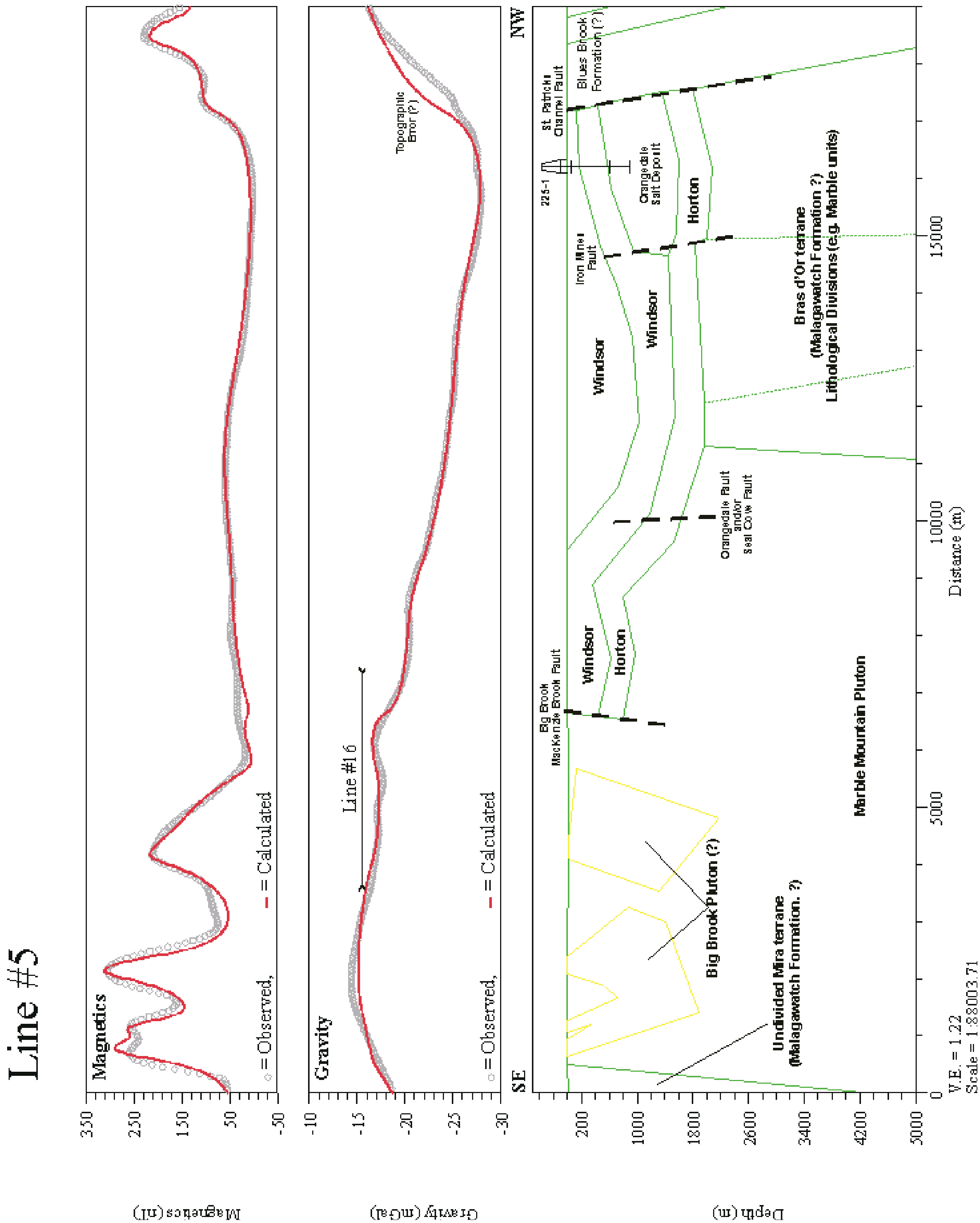


Line #2


Magnetics (nT)
Magnetics
○ = Observed,
= Calculated
Gravity (mGal)
Gravity
○ = Observed,
= Calculated
NW
SE
Depth (m)
DK-7
DK-6
Windsor
Windsor
Mabou
Windsor
Horton
Windsor (salt)
Horton
Horton
Mabou
Windsor
Horton
Mafic
Mafic
?
Creignish Hills Pluton (multiple units)
Malagawatch Formation (?)
Distance (m)
V.E. = 0.87
Scale = 1:62528.95

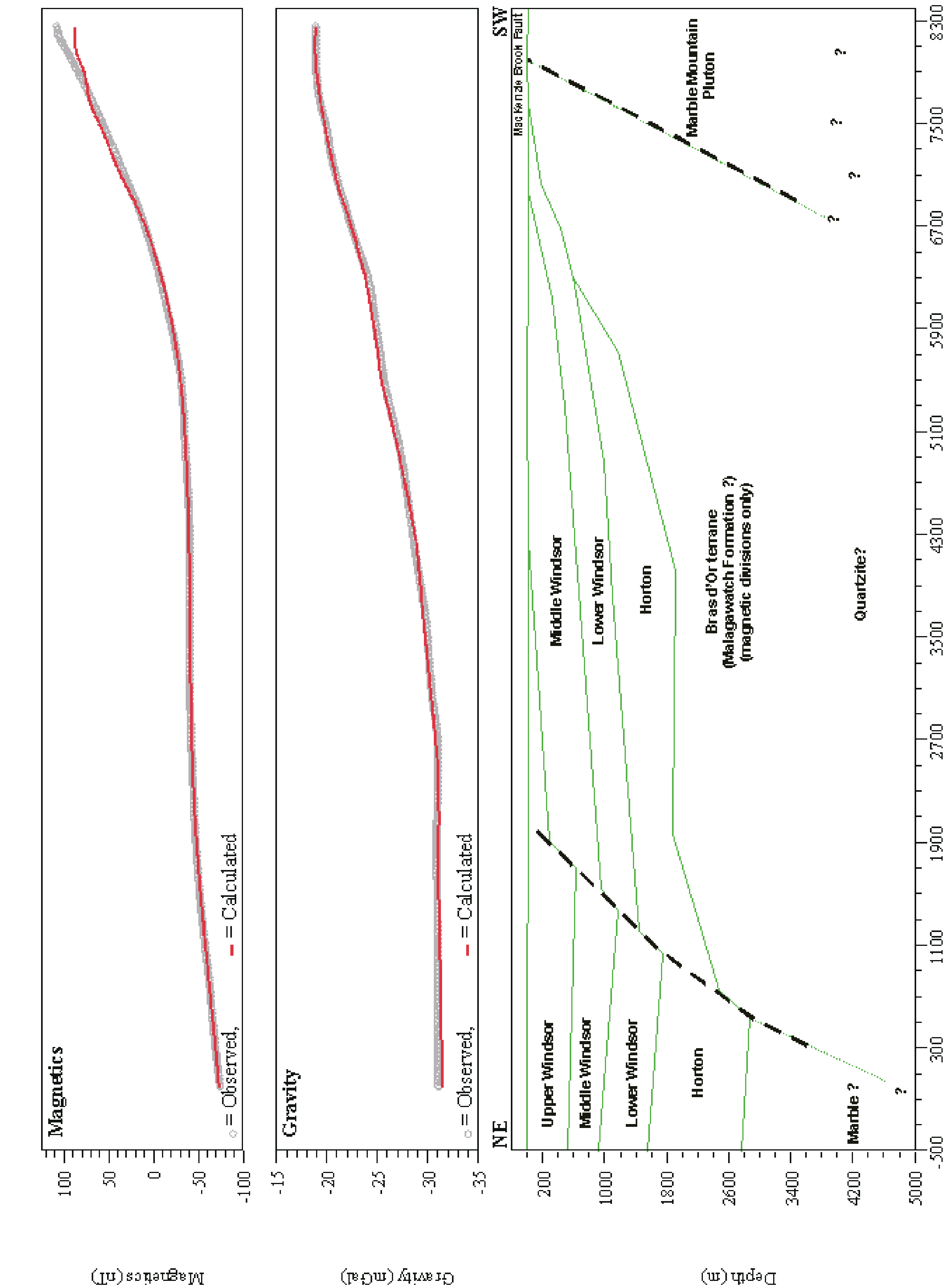
Line #3

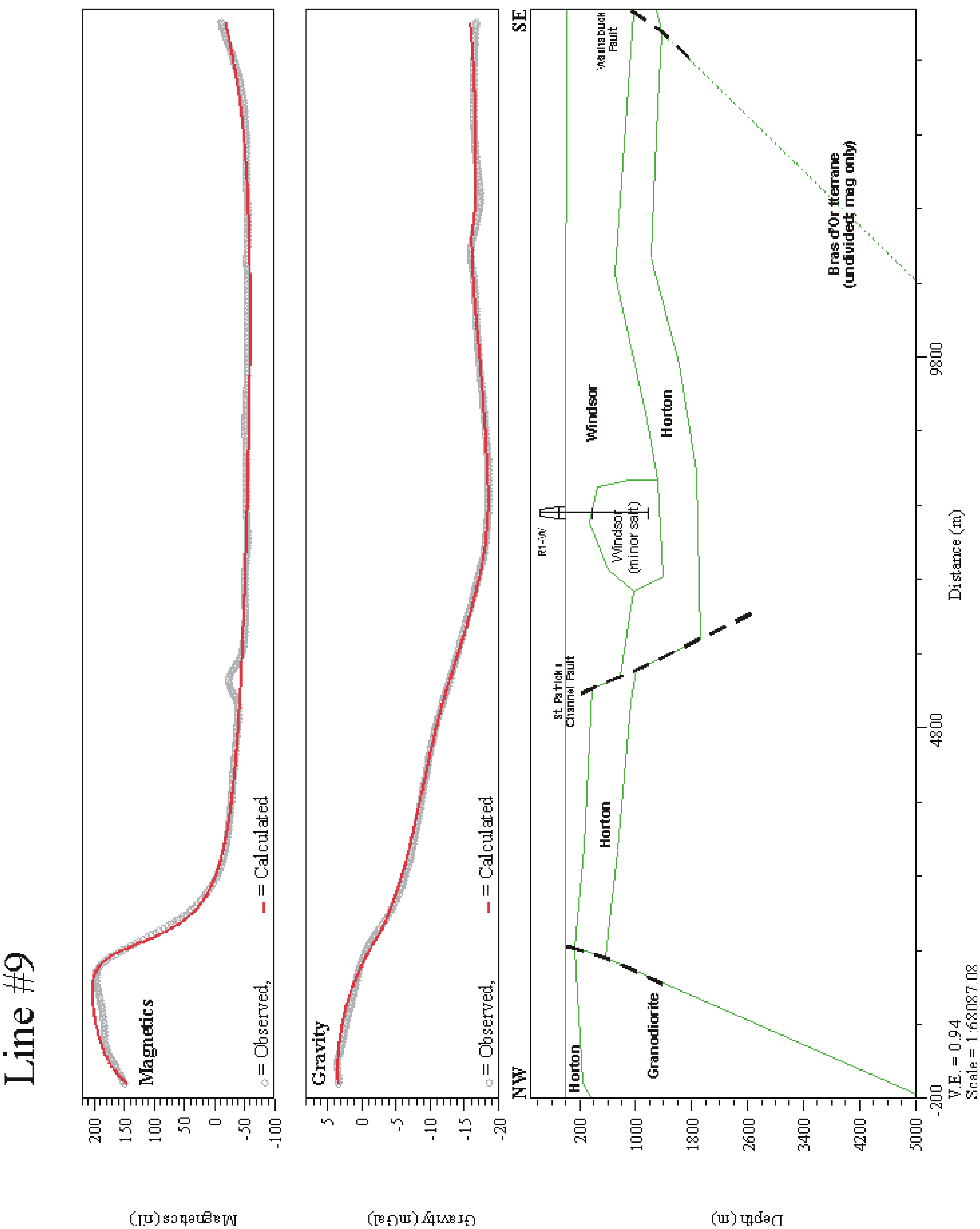

Magnetics
Magnetics (nT)
350
100
-150
-400
= Observed,
= Calculated
Gravity
Gravity (mGal)
0
-5
-10
-15
-20
-25
-30
= Observed,
= Calculated
NW
SE
TERRANE BOUNDARY
Windsor
Horton
Sporting Mountain Pluton
(bi-modal plutonic rocks)
Pringle Mountain Gp.
(bi-modal volcanic rocks)
Windsor
Windsor
Windsor
Horton
Mafic
Horton
Undivided
(Bras d'Or terrane)
Undivided Mira terrane
Undivided Mira terrane
Depth (m)
200
1000
1800
2600
3400
4200
5000
-3000
2000
7000
12000
17000
22000
27000
Distance (m)
V.E. = 2.12
Scale = 1:152848.54



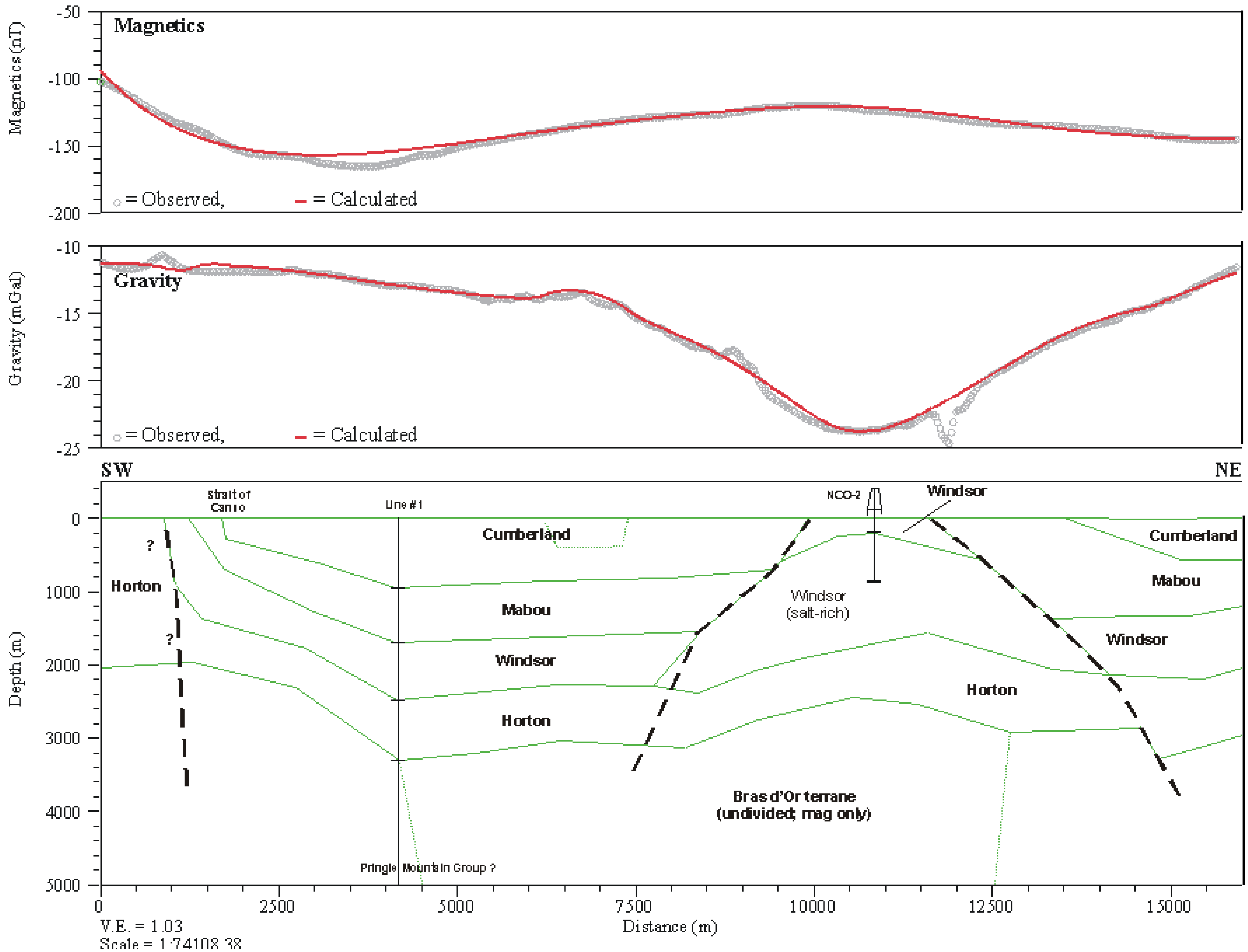
Line #5
Magnetics
Magnetics (nT)
350
250
150
50
-50
○ = Observed, — = Calculated
Gravity
Gravity (mGal)
-10
-15
-20
-25
-30
Line #16
Topographic Error (?)
SE
NW
Depth (m)
200
1000
1800
2600
3400
4200
5000
0
5000
10000
15000
Distance (m)
V.E. = 1.22
Scale = 1:88003.71
Undivided Mira terrane
(Malagawatch Formation ?)
Big Brook Pluton (?)
Marble Mountain Pluton
Big Brook
MacKenzie Brook Fault
Windsor
Horton
Orangedale Fault
and/or
Seal Cove Fault
Iron Mines Fault
225-1
Orangedale Salt Deposit
St. Patricks Channel Fault
Blues Brook Formation (?)
Bras d'Or terrane
(Malagawatch Formation ?)
Lithological Divisions (e.g. Marble units)

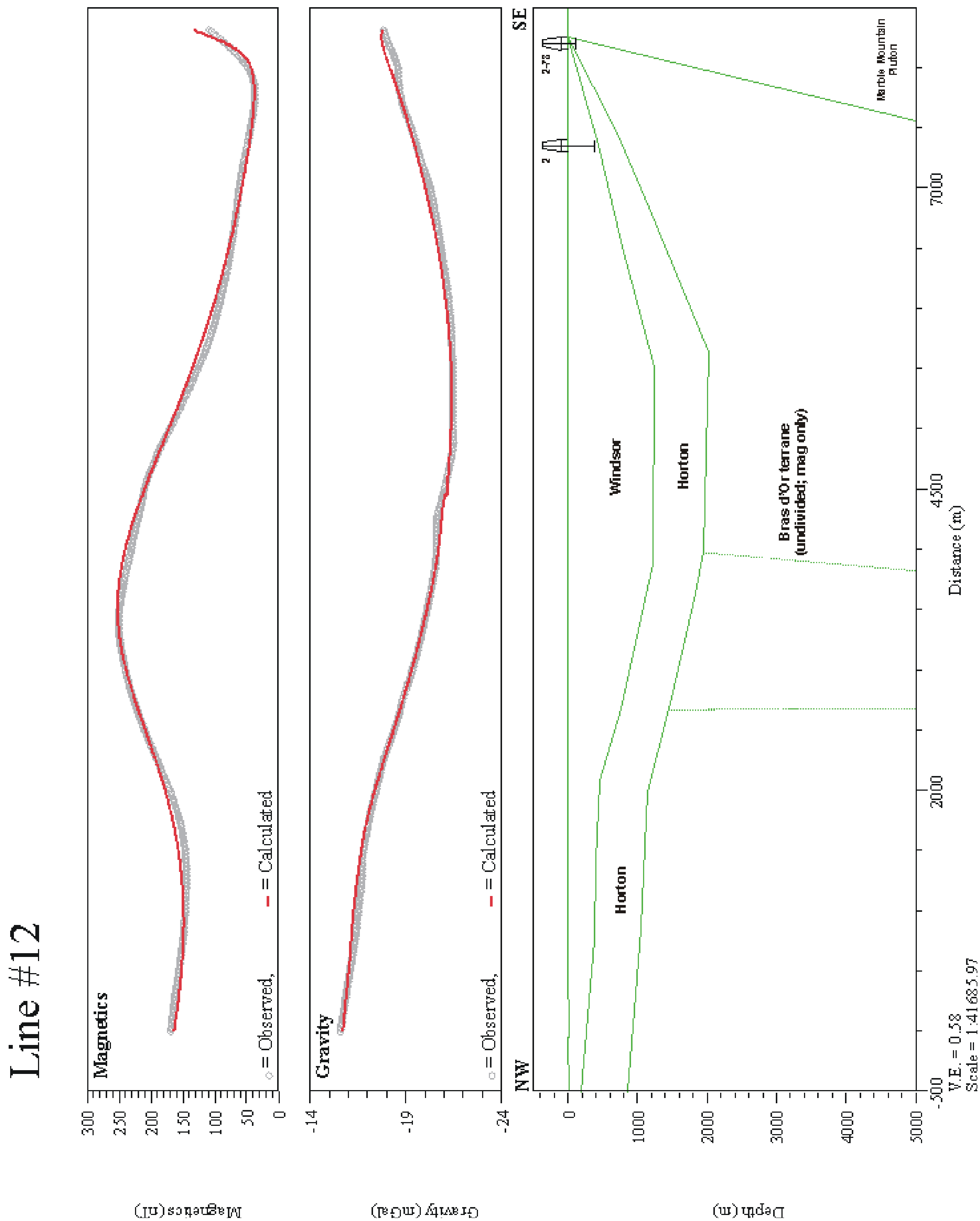
Line #7


Magnetics
Magnetics (nT)
100
50
0
-50
-100
○ = Observed, ▬ = Calculated
Gravity
Gravity (mGal)
-15
-20
-25
-30
-35
○ = Observed, ▬ = Calculated
NE
SW
Depth (m)
200
1000
1800
2600
3400
4200
5000
Upper Windsor
Middle Windsor
Lower Windsor
Horton
Marble ?
Middle Windsor
Lower Windsor
Horton
Bras d'Or terrane
(Malagawatch Formation ?)
(magnetic divisions only)
Quartzite?
MacKenzie Brook Fault
Marble Mountain
Pluton
?
-500
300
1100
1900
2700
3500
4300
5100
5900
6700
7500
8300
Distance (m)
V.E. = 0.6
Scale = 1:41222.79

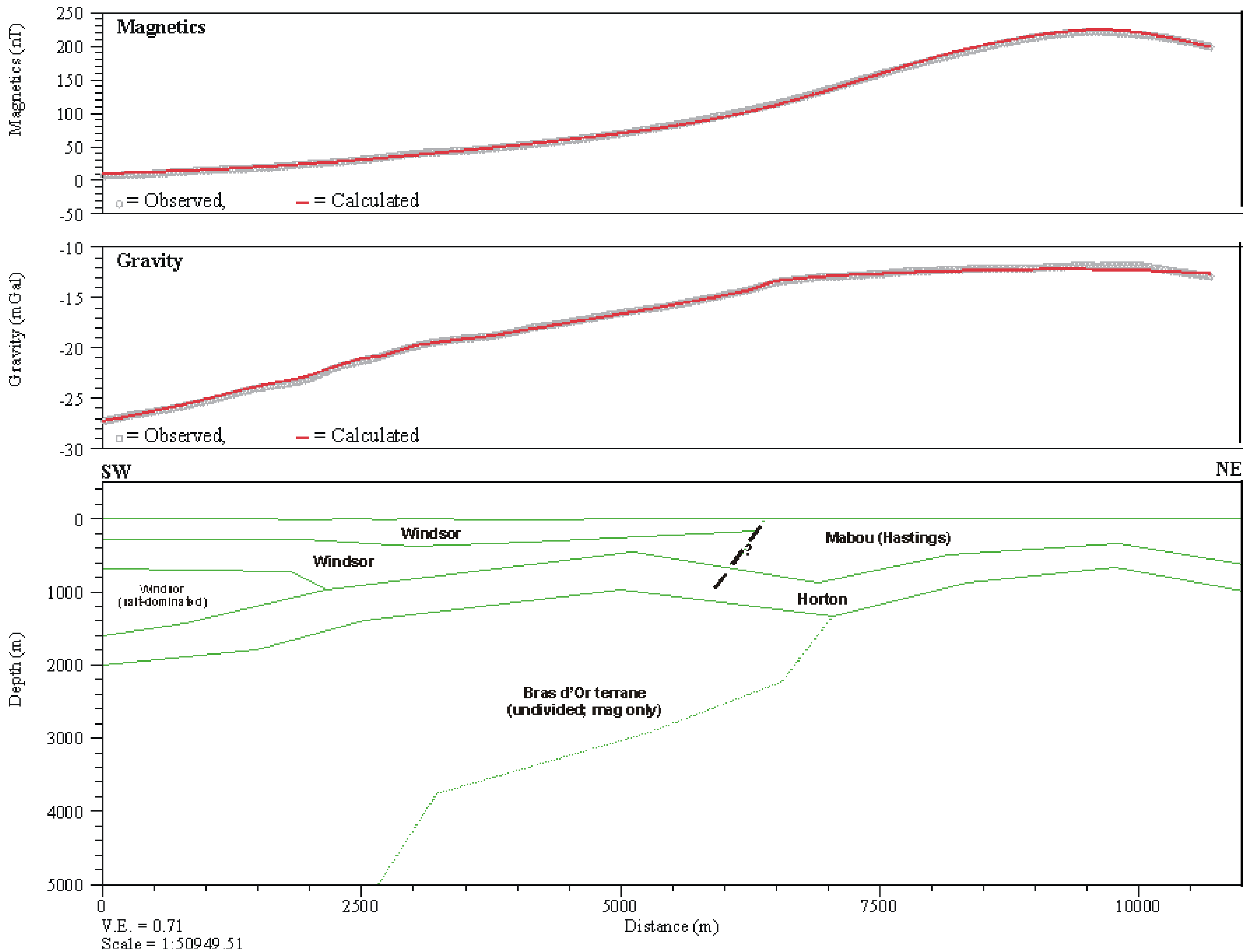

Line #9
Magnetics
○ = Observed, – = Calculated
Magnetics (nT)
Gravity
○ = Observed, – = Calculated
Gravity (mGal)
NW
SE
Horton
Granodiorite
Horton
St Patricks Channel Fault
Windsor (minor salt)
Windsor
Horton
Bras d'Or terrane (undivided; mag only)
Depth (m)
Distance (m)
V.E. = 0.94
Scale = 1:68087.08

Line #11


Magnetics
Magnetics (nT)
-50
-100
-150
-200
○ = Observed,
= Calculated
Gravity
Gravity (mGal)
-10
-15
-20
-25
○ = Observed,
= Calculated
SW
NE
Strait of Canso
Line #1
NCO-2
Windsor
Cumberland
Mabou
Windsor
Horton
Horton
?
?
Windsor (salt-rich)
Cumberland
Mabou
Windsor
Horton
Bras d'Or terrane (undivided; mag only)
Pringle Mountain Group ?
Depth (m)
0
1000
2000
3000
4000
5000
0
2500
5000
7500
10000
12500
15000
Distance (m)
V.E. = 1.03
Scale = 1:74108.38

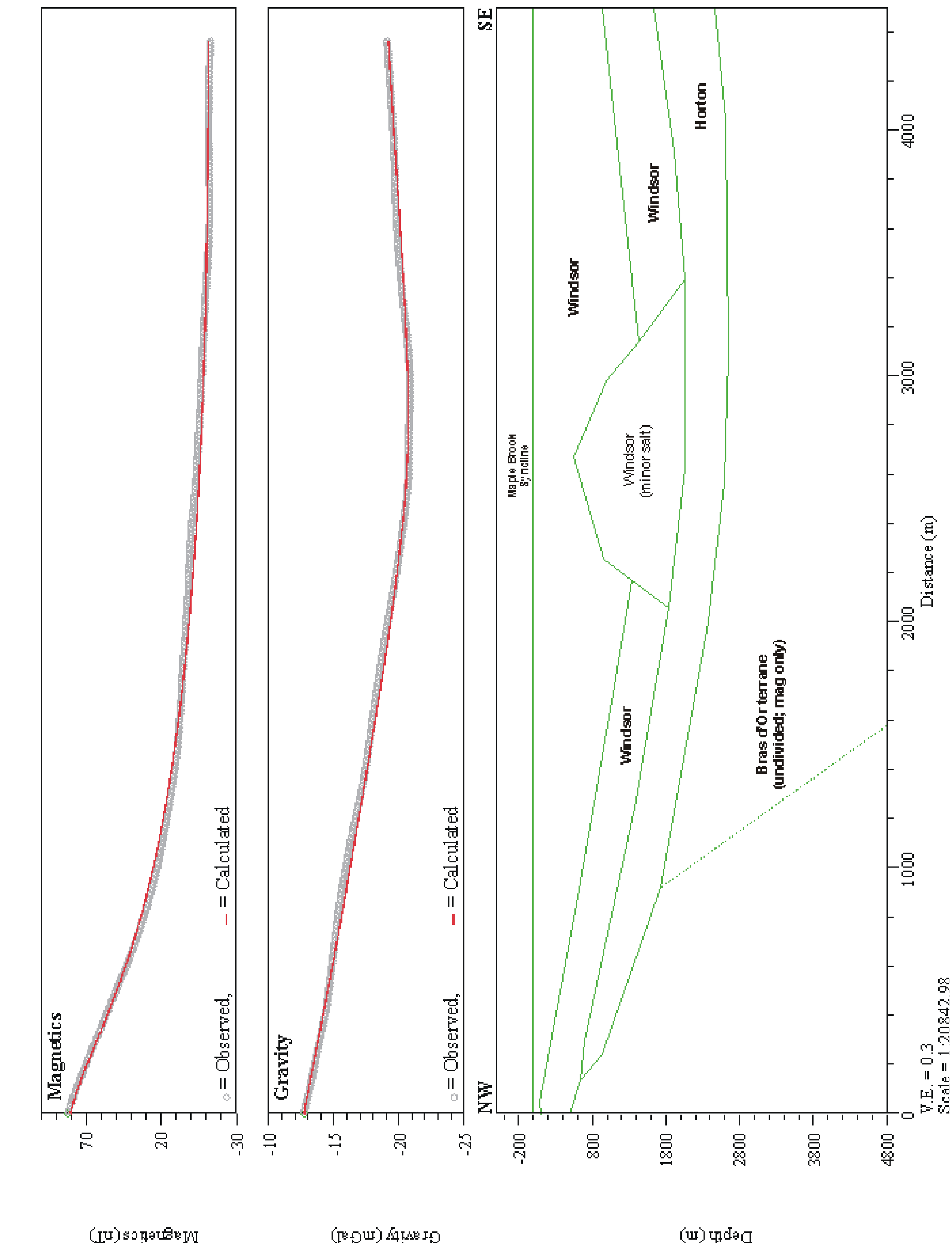

Line #12
Magnetics
Magnetics (nT)
300
250
200
150
100
50
0
○ = Observed,
— = Calculated
Gravity
Gravity (mGal)
-14
-19
-24
○ = Observed,
— = Calculated
NW
SE
Depth (m)
0
1000
2000
3000
4000
5000
Horton
Windsor
Horton
Bras d'Or terrane
(undivided; mag only)
Marble Mountain
Pluton
2
2-78
-500
2000
4500
7000
Distance (m)
V.E. = 0.58
Scale = 1:41685.97

Line #13



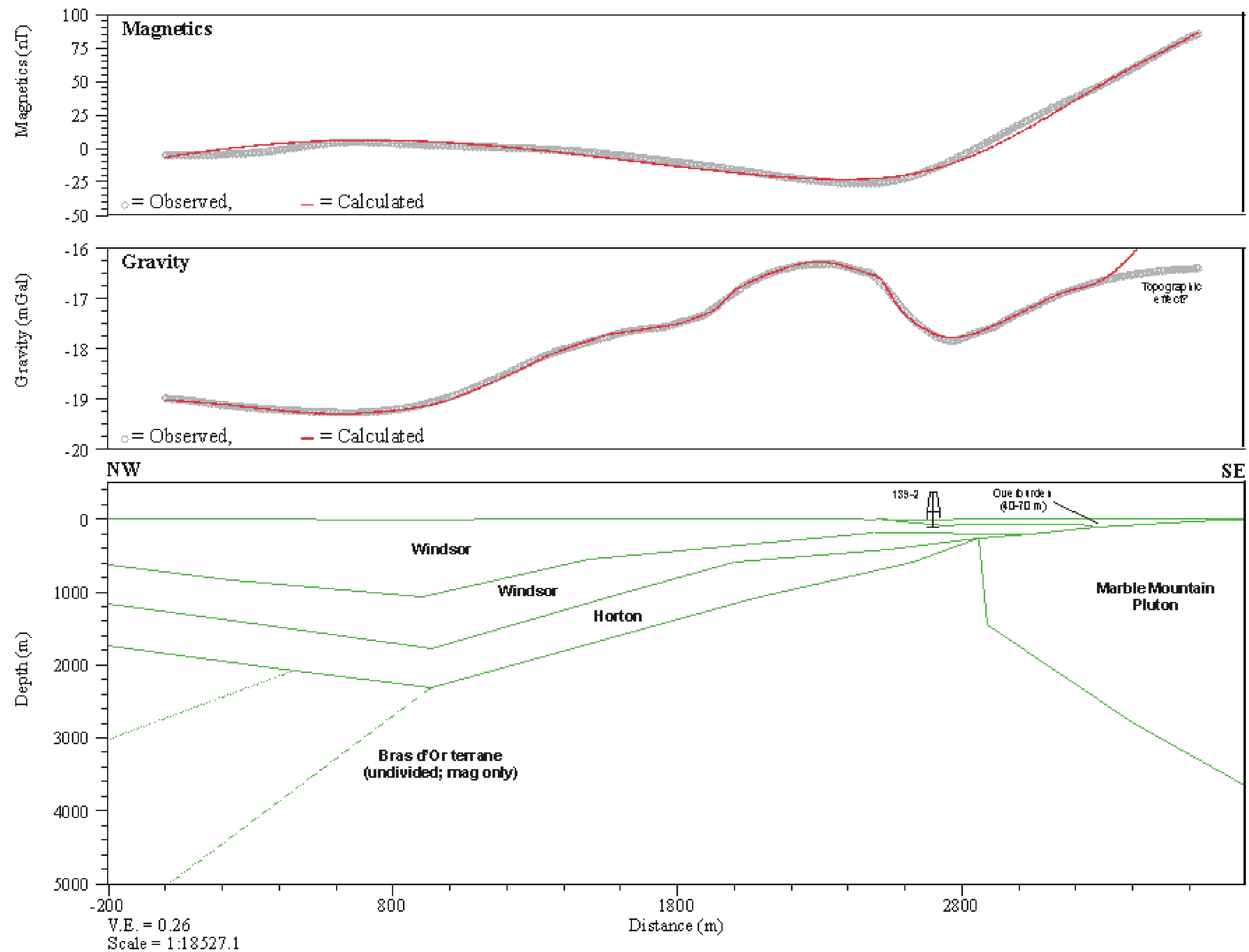
Magnetics
Magnetics (nT)
250
200
150
100
50
0
-50
○ = Observed,
= Calculated
Gravity
Gravity (mGal)
-10
-15
-20
-25
-30
□ = Observed,
= Calculated
SW
NE
Depth (m)
0
1000
2000
3000
4000
5000
Windsor
Windsor
Windsor (salt-dominated)
Mabou (Hastings)
Horton
?
Bras d'Or terrane (undivided; mag only)
0
2500
5000
7500
10000
Distance (m)
V.E. = 0.71
Scale = 1:50949.51

Line #14

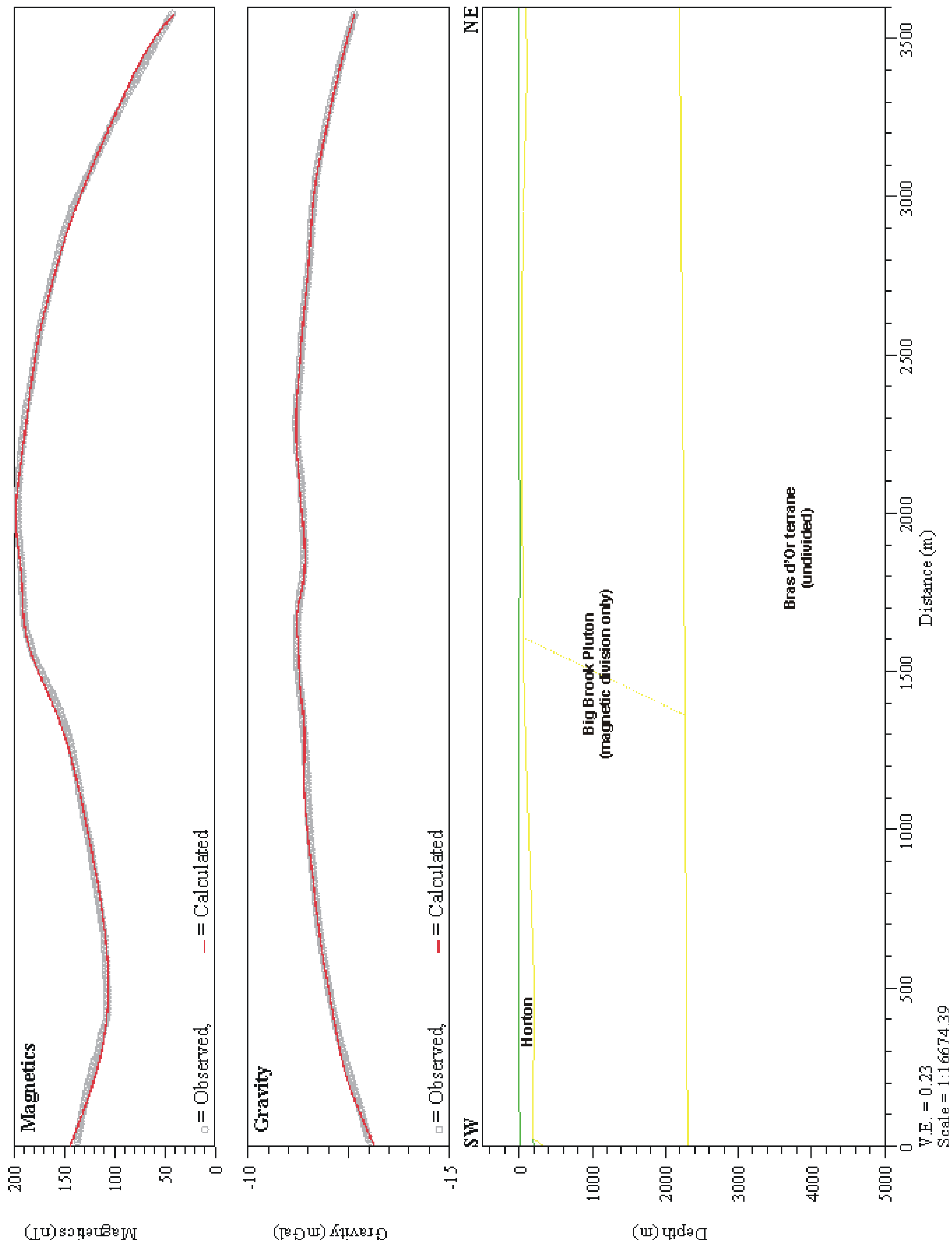


Magnetics
◇ = Observed, — = Calculated
Magnetics (nT)
70
20
-30
Gravity
◇ = Observed, — = Calculated
Gravity (mGal)
-10
-15
-20
-25
NW
SE
Maple Brook Syncline
Windsor
Windsor (minor salt)
Windsor
Windsor
Horton
Bras d'Or terrane (undivided; mag only)
Depth (m)
-200
800
1800
2800
3800
4800
0
1000
2000
3000
4000
Distance (m)
V.E. = 0.3
Scale = 1:20842.98

Line #15


Magnetics
Magnetics (nT)
100
75
50
25
0
-25
-50
= Observed,
= Calculated
Gravity
Gravity (mGal)
-16
-17
-18
-19
-20
= Observed,
= Calculated
NW
SE
139-2
Windsor
Windsor
Horton
Marble Mountain Pluton
Bras d'Or terrane
(undivided; mag only)
Depth (m)
0
1000
2000
3000
4000
5000
-200
800
1800
2800
Distance (m)
V.E. = 0.26
Scale = 1:18527.1

Line #17


Magnetics
○ = Observed,
— = Calculated
Magnetics (nT)
200
150
100
50
0
Gravity
○ = Observed,
— = Calculated
Gravity (mGal)
-10
-15
SW
NE
Horton
Big Brook Pluton
(magnetic division only)
Bras d'Or terrane
(undivided)
Depth (m)
0
1000
2000
3000
4000
5000
Distance (m)
0
500
1000
1500
2000
2500
3000
3500
V.E. = 0.23
Scale = 1:16674.39