Current Research (2009) Newfoundland and Labrador Department of Natural Resources
Geological Survey, Report 09-1, pages 305-314

GEOPHYSICAL DATA FROM RECENT AIRBORNE SURVEYS, NEWFOUNDLAND AND LABRADOR

G. Kilfoil
Geochemistry, Geophysics and Terrain Sciences Section

ABSTRACT

Modern, specialized, and often multi-parameter airborne surveys are designed using a range of aircraft, geophysical instrumentation and survey specifications, targeted at the detectable physical characteristics of specific mineral deposit models, or styles of mineralization. Airborne surveys have gained prominence as a commonly applied exploration method during the early stages of exploration on a property. The province has experienced a significant expansion in modern airborne-survey coverage over the last few years, largely as a result of heightened mineral exploration activity during the recent cycle of increased commodity prices.

The results from several airborne surveys have recently been released. The surveys were flown over various parts of the province in exploration for a wide variety of mineral deposit types. The data generated by these surveys have been added to a continually expanding geoscience resource-knowledge base being archived and maintained by the Geological Survey. As a result of a 3-year confidentiality period on mineral assessment reports and data, updates to the geophysical database are made as the data become publicly available.

The locations and logistical information about airborne surveys, as well as the geophysical data acquired, have been made accessible through an online digital index within the Geoscience Resource Atlas *of the department. Improved methods of delivering online geophysical data are continually being developed. In particular, a means to display the results of selected survey blocks needs to be incorporated directly into the Resource Atlas.*

WHY FLY AIRBORNE SURVEYS?

The rate at which airborne surveys are completed and the type of geophysical instrumentation deployed in each survey strongly reflects current trends in exploration and commodity prices. In times of heightened exploration levels, such as during the staking 'rush' following the Voisey's Bay nickel discovery or the recent 'boom' in uranium exploration, reconnaissance-airborne surveys are commonly flown as the first stage of exploration. Airborne geophysical surveys can generate multi-parameter, uniform data over large areas, from which field activities in future years are planned. Surveys can be flown and results obtained within a short time period and at a relatively low cost per unit area. Airborne surveys are often the only means to spend sufficient funds to hold the large properties acquired during a staking rush, particularly in more remote areas of Labrador, where the field season is short and surface access to the properties is limited.

A major advancement in airborne-survey accuracy has been the use of differential GPS for aircraft positioning. Control or 'tie' lines are incorporated at regular intervals into the airborne-survey grid. The GPS enables aircraft pilots to navigate the entire survey grid to a specified tolerance, in real time, and this has a profound influence on the accuracy of post-survey corrections, such as instrument drift or heading errors. Fixed-wing aircraft are routinely fitted with several non-co-linear GPS sensors to accurately and continually record the pitch, yaw and roll of the aircraft during flight. These GPS sensors are commonly secured directly onto 'birds' that are towed behind, and below, the aircraft to record magnetic or electromagnetic data. This configuration reduces aircraft noise, places instruments as close to the ground as possible and increases transmitter-receiver separation.

Many advances in geophysical instrumentation and recording have led to new techniques being available from the airborne platform. A good example is recording gravity data onboard an aircraft, not possible only a few years ago due to the accelerations of this 'unstable' platform.

Advancements in desktop-mapping packages have provided the power to efficiently and accurately image even subtle features from airborne geophysical data. The results can be readily combined with all other types of digital geoscience information. Digital airborne-survey images or maps are routinely interpreted to refine geological interpretations and deposit models, or to focus advanced exploration activities, such as ground geophysical surveys, detailed sampling or drilling.

DATA ACCESSIBILITY

Since the early 1990s, a digital index of airborne surveys flown within the province has been maintained. During this period, the index was used primarily for internal planning purposes, and to establish priorities for ongoing efforts to digitally capture and georegister the results of airborne surveys from paper maps in assessment files.

Legislation was changed in 1995, requiring data to be submitted digitally as part of mineral assessment reporting. Digital data became subject to the same confidentiality period as the remainder of the assessment report – a maximum of 3 years from the date of submission. At this point, a separate metadata index was initiated for these digitally held surveys as additional fields were required to describe the formats and archival descriptors of the data.

Large volumes of airborne survey data became digitally available in the late 1990s, primarily those data collected in Labrador following the Voisey's Bay nickel discovery. The index became a valuable means of identifying where detailed surveys had been flown, the geophysical instrumentation deployed, and the logistical details of those surveys. At this time, the index was made publicly available to download GIS-ready layers, in MapInfo and ArcView formats. Those interested in obtaining a copy of the data for a particular survey could e-mail their requests, and the data were provided for download on one of Newfoundland and Labrador Geological Survey's ftp sites.

In late 2006, the non-digital and digital airborne-geophysical data indexes from surveys flown in the province were merged and the result was migrated to the online *Geoscience Resource Atlas*. The *Resource Atlas* is a well-utilized tool for delivering airborne-survey information, as it has been assembled from many other geoscience and georeferencing layers, and it does not require specialized software on the client's end.

DATA ON THE RESOURCE ATLAS

The online *Geoscience Resource Atlas* is currently available at the GeoScience OnLine link: *http://gis.geosurv.gov.nl.ca/*

To access the index of airborne surveys from within the *Geoscience Resource Atlas* click on the *Interactive Maps* link, then follow these steps (as numbered in Figure 1):

1) Click on the '+' beside 'Indexes' to expand, and check the box beside 'Airborne Surveys'
2) Click on the 'Refresh' button
3) Set the Active Layer in the drop-down box to 'Airborne Survey Index'
4) Now, when you query any location on the map (-on left hand menu), summary information about all airborne surveys covering that location will be displayed in the lower panel. Use the scroll bar (right hand side) to access others, if more than one exists.
5) To access a more extensive description of a particular survey in a new browser window, click on the 'Survey Info' link provided beneath each unique survey block identifier, Survey_ID. Choosing the link shown in Figure 1 will generate a listing of the metadata, for survey DN08786 flown in 1996 by Celtic Minerals Ltd (Figure 2) over the former Rambler mines area on the Baie Verte Peninsula. This information may be accessed directly by using the appropriate URL: *http://www.geosurv.gov.nl.ca/airborne/disp_airborne.asp?survey_id=DN08786*. To access the listing for a different airborne-survey block, simply replace the 'DN08786' in this URL with its Survey ID number.

The numeric part of a survey identifier is unique to each survey block, and is usually based on one of the underlying mineral licences or the number assigned to the assessment file in which it is reported. Survey identifiers that begin with 'D' denote that the airborne survey data were submitted digitally. The letters 'L' and 'N' at the beginning of the survey identifier indicate the locations in Labrador and Newfoundland parts of the province, respectively. For instance, the Survey ID for the Monster Copper airborne-gravity and magnetic survey in central Labrador, 'DL09387', indicates this is survey polygon 9387 of the index of digitally held airborne surveys flown in Labrador.

Most of the information listed on these summary pages (Figure 2) is self-explanatory. A few items are noteworthy on these listings. Primarily, not all of the descriptors will be present for all surveys. For surveys where the database field is blank or unknown, the descriptor may not be displayed on these listings.

Under the 'General' category, the Geofile number refers to the Geological Survey's library designation assigned to the report and data associated with the survey block after it has been submitted for mineral assessment requirements. Currently, assessment reports in the Survey's library are being scanned in efforts to increase accessibility to these

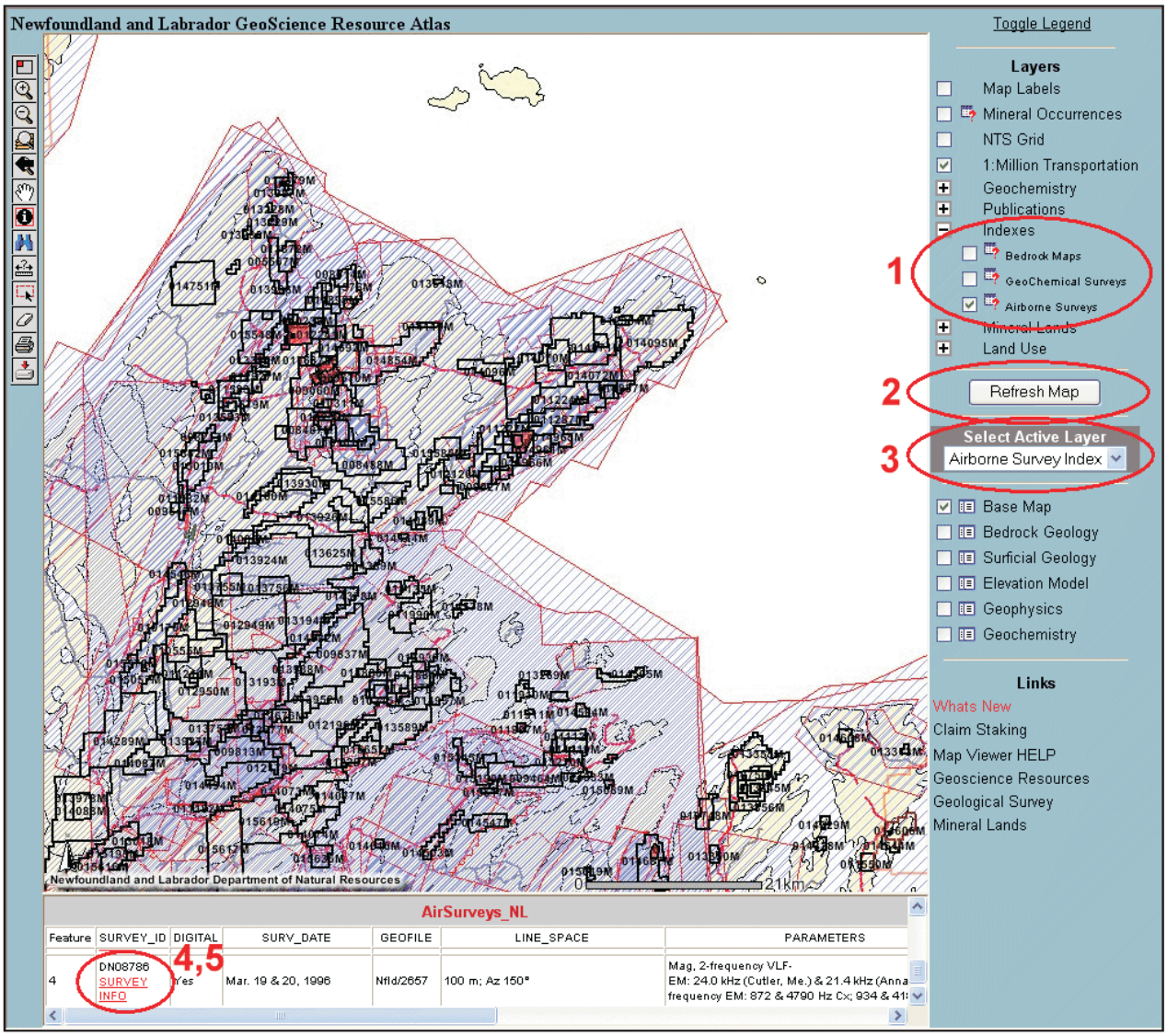
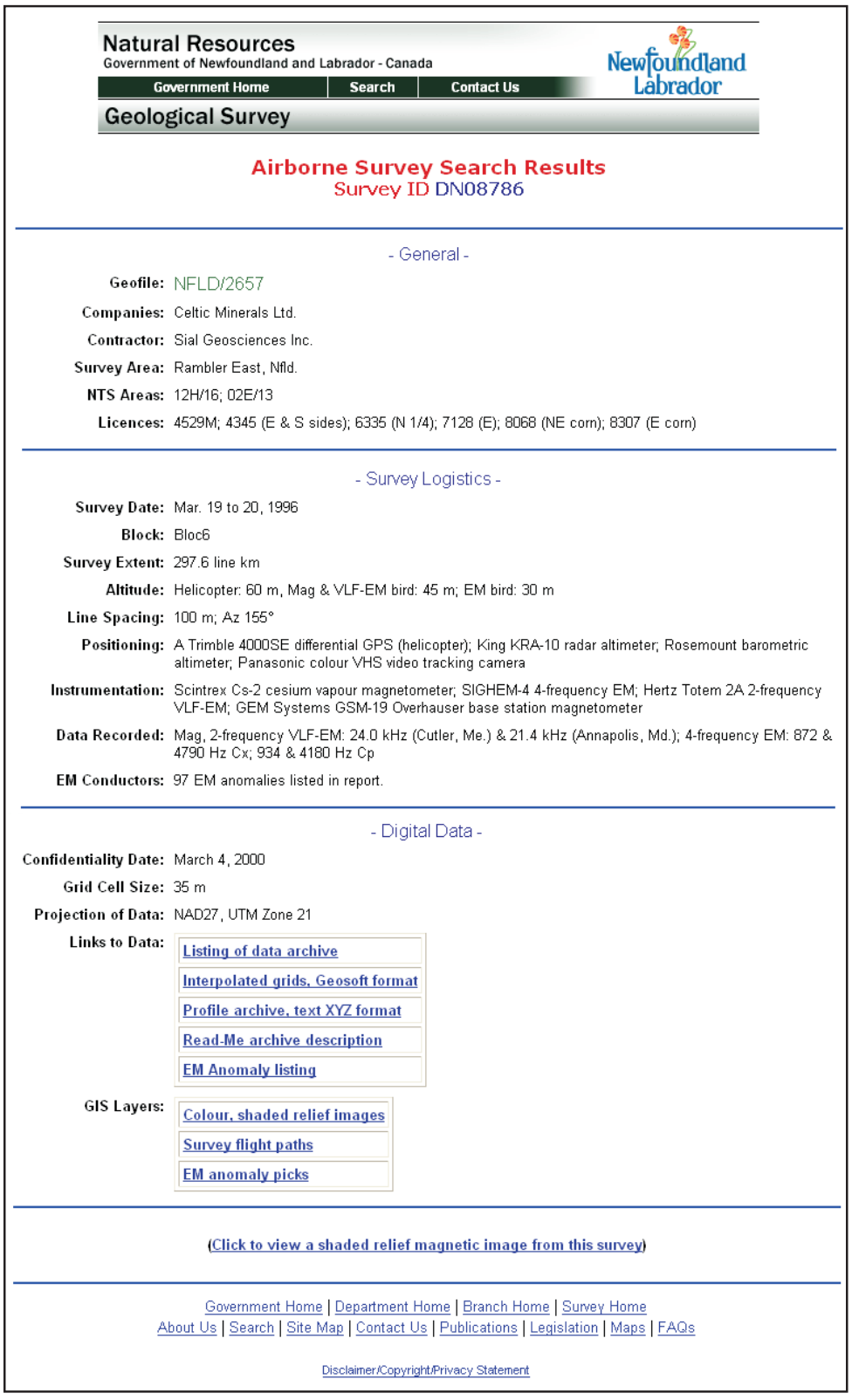


Figure 1. *Screen capture taken from the online* Geoscience Resource Atlas*, showing the airborne-survey coverage (hatched areas) over the northeastern parts of the Baie Verte Peninsula and Notre Dame Bay areas of Newfoundland. Numbers refer to steps described in the text.*

documents. For surveys where the scanning has been completed, the Geofile number provides a link on this listing to its pdf document(s).

Under the 'Digital Data' section of this listing, links may exist to download the original data, as well as any digital maps, interpolated images, reports and descriptive information submitted for digitally acquired surveys (Figure 2). In addition, there may be links available to various GIS layers created from the data (MapInfo and Arc Shapefile formats). Where available, links are provided to any merged magnetic data images or other geophysical compilations related to the area covered by the survey (*e.g.*, Kilfoil, 2002; Oneschuk *et al.*, 2002). In a few cases, as shown near the bottom of Figure 2, a link is provided to a preview image created from the magnetic results of the airborne survey. This preview is not necessary for many of the recent airborne-survey blocks, as these commonly include various maps of the results in pdf format.

Efforts are being made to improve the online delivery of airborne-survey data that have been released. Currently, there is no means to display images of the results within the *Resource Atlas* once a client identifies a survey of interest. This functionality would be a great improvement, as it would enable the combination of geophysical images and layers from individual surveys with the other geoscience layers available through the Atlas.



Natural Resources
Government of Newfoundland and Labrador - Canada

Government Home | Search | Contact Us

Newfoundland Labrador

Geological Survey

Airborne Survey Search Results
Survey ID DN08786

- General -

Geofile: NFLD/2657
Companies: Celtic Minerals Ltd.
Contractor: Sial Geosciences Inc.
Survey Area: Rambler East, Nfld.
NTS Areas: 12H/16; 02E/13
Licences: 4529M; 4345 (E & S sides); 6335 (N 1/4); 7128 (E); 8068 (NE corn); 8307 (E corn)

- Survey Logistics -

Survey Date: Mar. 19 to 20, 1996
Block: Bloc6
Survey Extent: 297.6 line km
Altitude: Helicopter: 60 m, Mag & VLF-EM bird: 45 m; EM bird: 30 m
Line Spacing: 100 m; Az 155°
Positioning: A Trimble 4000SE differential GPS (helicopter); King KRA-10 radar altimeter; Rosemount barometric altimeter; Panasonic colour VHS video tracking camera
Instrumentation: Scintrex Cs-2 cesium vapour magnetometer; SIGHEM-4 4-frequency EM; Hertz Totem 2A 2-frequency VLF-EM; GEM Systems GSM-19 Overhauser base station magnetometer
Data Recorded: Mag, 2-frequency VLF-EM: 24.0 kHz (Cutler, Me.) & 21.4 kHz (Annapolis, Md.); 4-frequency EM: 872 & 4790 Hz Cx; 934 & 4180 Hz Cp
EM Conductors: 97 EM anomalies listed in report.

- Digital Data -

Confidentiality Date: March 4, 2000
Grid Cell Size: 35 m
Projection of Data: NAD27, UTM Zone 21
Links to Data:
Listing of data archive
Interpolated grids, Geosoft format
Profile archive, text XYZ format
Read-Me archive description
EM Anomaly listing

GIS Layers:
Colour, shaded relief images
Survey flight paths
EM anomaly picks

(Click to view a shaded relief magnetic image from this survey)

Government Home | Department Home | Branch Home | Survey Home
About Us | Search | Site Map | Contact Us | Publications | Legislation | Maps | FAQs

Disclaimer/Copyright/Privacy Statement

Figure 2. *Screen capture showing the descriptive metadata results from querying airborne survey polygon DN08786.*

TYPES OF AIRBORNE SURVEYS FLOWN WITHIN THE PROVINCE

The design of airborne surveys and the instrumentation employed are often tailored to the physical characteristics of the style of mineralization for the mineral commodity under exploration.

For magmatic nickel sulphide or volcanogenic massive sulphide (VMS) exploration, the airborne survey may be designed for, and the survey results interpreted in relation to the response of, a particular expected deposit model. For example, VMS deposits commonly occur as a series of discontinuous lens-type bodies, whereas magmatic sulphide deposits may be more continuous, sheet-like bodies.

Generally, these sulphide-rich deposit types respond to electromagnetic (EM) excitation. There are a wide range of airborne-EM-survey systems currently available to choose from. However, these can be classified into two broad types: 1) frequency-domain surveys that measure and compare the response of the Earth to smoothly varying input signals generated at a range of frequencies, and 2) time-domain surveys that rely on the response of the Earth to abrupt changes in the EM-input signal at a single frequency, measured in a series of responses at a series of times after the change occurs.

In recent years, airborne surveys for sulphide deposits have trended toward large dipole moment, time-domain systems, such as MEGATEM, in attempts to detect conductive orebodies to greater depths. The effectiveness of employing EM systems in exploration can be hampered by the presence of near-surface conductive materials, such as overburden, graphitic horizons in bedrock, or proximity to salt water. Due to survey design considerations, such as a heavy payload of geophysical gear, airborne time-domain EM surveys are comparatively expensive on a per kilometre basis. As well, since time-domain EM systems are capable of detecting conductive zones to a greater depth and lateral extent than frequency-domain EM surveys, time-domain surveys are usually flown at coarser flight spacing and higher altitudes than frequency-domain airborne surveys.

Magmatic sulphide and VMS deposits commonly have a large contrast in specific gravity with their host rocks. Thus, airborne-gravity surveying can be an effective exploration method for these deposits, particularly so in the case of zinc-rich Buchans-style VMS deposits, which show little response to EM surveys due to the predominance of sphalerite mineralization. Airborne-gravity surveys can be used to delineate any deposit that has a significant density contrast with the surrounding host rock. The density contrast of a deposit can be positive, as is the case for many sulphide deposits, or negative, as is the typical character of salt domes or anticlines.

Radiometric surveying is the primary technique used for uranium exploration in which data are recorded with a gamma-ray spectrometer. In almost all examples, the total magnetic field output from a magnetometer, and in several instances, frequency-domain EM data, are recorded during the survey. The effectiveness of radiometric surveys is hampered by soil and vegetation moisture, as gamma-rays are strongly attenuated by even a few millimetres of water. This can severely limit the weather window for airborne gamma-ray surveying, as it may be necessary to wait a day after a major rainfall, and limit flying to periods when the ground is snow-free, thus considerably limiting the available survey season for parts of Labrador. Magnetic data are nearly always recorded with radiometric surveys, as an aid to interpreting the radiometric responses of the underlying geology.

Aeromagnetic surveys can be used for the direct detection of iron-ore deposits, as the ores are often enriched in magnetite. However, it may be difficult to estimate the size of a deposit from an aeromagnetic survey due to the potentially large remnant magnetization effects, extreme magnetic gradients, and variable magnetite contents of the iron-ore bodies. Because iron ores also have a high density, an airborne-gravity survey may be used to estimate tonnages once a deposit has been identified.

Airborne geophysical surveys are often flown during the early stages of exploration for gold and other precious metals, even though these mineral commodities do not naturally occur in sufficient quantities to be detected directly by current geophysical technology. The main exploration tool for these minerals is high-resolution aeromagnetic surveys. Aeromagnetic surveys deployed in the search for precious metals are usually flown at a relatively small flight spacing (100 m or less) and commonly include gradient measurements. The surveys are designed to delineate even subtle magnetic features associated with bedrock structure, such as folds, faults, and intrusive bodies, which may have played a key role in focusing mineralization.

SUMMARY OF RECENT AIRBORNE-SURVEY DATA RELEASES

The following section describes recently released airborne-survey data collected within the province. Maps highlighting the locations of these new surveys in Labrador and Newfoundland are shown as red outlines in Figures 3 and 4, respectively. Blue polygons on these figures outline the locations of older airborne-surveys, for which digital data are available. The solid green outlines on Figure 4 highlight government-sponsored airborne-geophysical surveys flown

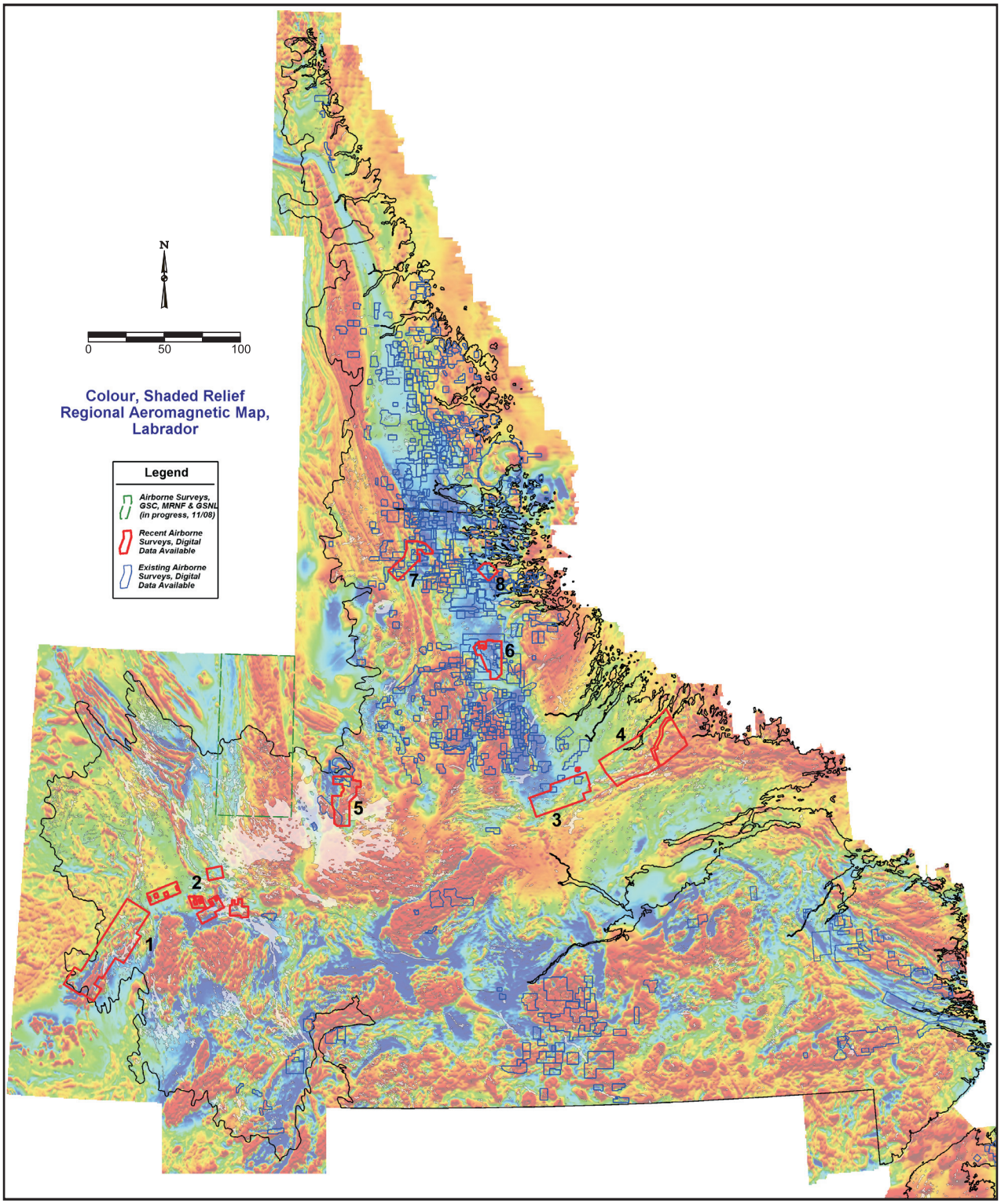


Figure 3. *Colour, shaded-relief map of the regional aeromagnetic data for Labrador region, showing the locations of airborne surveys where digital data have been archived. The blue polygons outline surveys older than 5 years, most of which were flown after the discovery of the Voisey's Bay deposit. The red polygons outline surveys for which the digital data have recently become publicly available; numbers used for reference in the text. The green outline identifies an area where a detailed aeromagnetic survey is currently being flown as part of a cooperative project between the provincial geological surveys of Québec, and Newfoundland and Labrador, and the Geological Survey of Canada.*

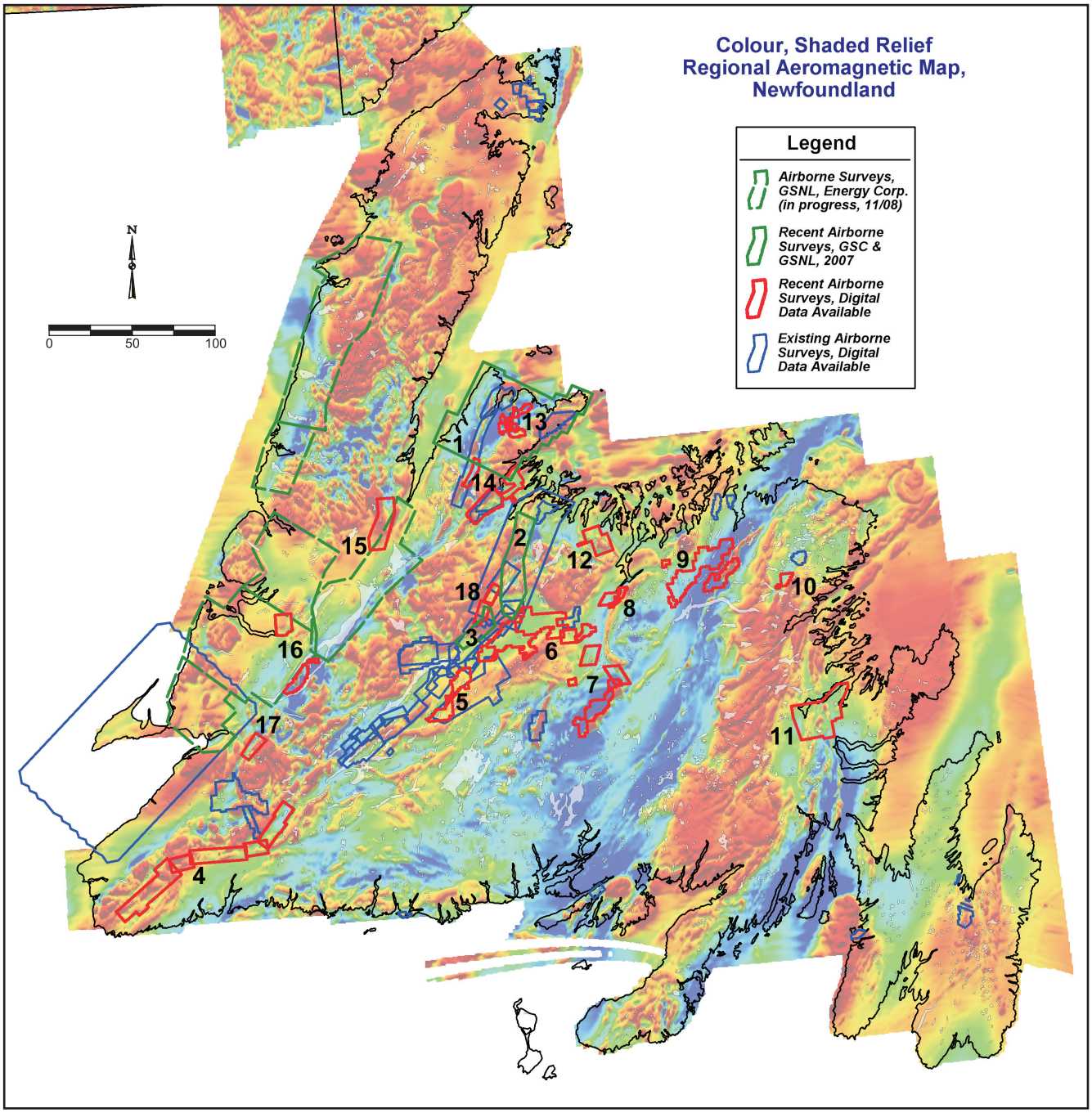


Figure 4. *Colour, shaded-relief map of the regional aeromagnetic data available for the Island of Newfoundland, showing the locations of airborne surveys where digital data have been archived. The blue polygons outline surveys older than 5 years; red polygons outline surveys for which the digital data have recently become publicly available and are numbered for reference in the text. The green outlines areas where government-sponsored detailed aeromagnetic surveys were flown in 2007 (solid) or are currently in progress (dashed).*

in early 2007 as part of the Targeted Geoscience Initiative (TGI 3). The dashed green outlines on both figures highlight government-sponsored airborne geophysical surveys that are in progress at the time of writing. For a more detailed location and description of all surveys, the reader should access the Airborne Index within the *Geoscience Resource Atlas*.

In the following section, the recent surveys are classified into broad groupings based upon similar survey type

and/or commodity under exploration. Number references in the text describing each survey refer to survey blocks identified on Figures 3 and 4. In addition, survey identifications (beginning with 'DL' for Labrador and 'DN' for Newfoundland) are provided for each survey block. These numbers can be used to directly access a much more detailed descriptive listing for a particular survey block, as described above.

LABRADOR (FIGURE 3)

1) High-resolution magnetic and magnetic gradient surveys targeted at iron-ore deposits. In 2001, the Iron Ore Company of Canada flew a multi-component magnetic survey (DL08793) at 100-m line spacing over a large area underlain by very magnetic iron-oxide deposits. The survey block is located near Wabush, western Labrador (1).

2) Time-domain EM and magnetic surveys, in the search for magmatic nickel-sulphide mineralization. Examples of this type of survey for which data have been released are: (2) several survey blocks flown in the Evening Lake area of western Labrador by Gallery Resources and BHP Billiton World Exploration (DL08995 to DL09007); (5) a MEGATEM survey flown over the Michkamau intrusion, central Labrador by Altius and Teck Cominco (DL10076); (6) a MEGATEM survey flown by Falconbridge (DL08795) and Commander Resources (DL07634, DL08189) in the South Voisey's Bay project area of central Labrador; (7) a MEGATEM survey flown over Cornerstone's Konrad property, located west of Voisey's Bay in northern Labrador (DL09070); and (8) a MEGATEM survey flown by Falconbridge (DL08796) in the Kogaluk River area, located 20 km south of Voisey's Bay in northern Labrador. The surveys indicated here were flown at 250 to 400-m line spacing.

3) Airborne-gravity and magnetic survey over a potential iron-oxide–copper–gold (IOCG) mineral deposit. Survey block (3) covers a large part of the western Central Mineral Belt of Labrador. The data from this survey, collected by Monster Copper Resources (DL09387) at 100-m line spacing, represent the first airborne-gravity data to be released within the province.

4) Radiometric and magnetic surveys in the search for uranium mineralization. Since the start of the current boom in uranium exploration, there have been many of these surveys flown in the Central Mineral Belt of central Labrador. This type of survey has also been flown in other areas of Labrador where existing geoscientific data, such as lake-sediment analyses, have indicated a potential for uranium mineralization. Currently, the confidentiality period of only one of these surveys has expired – a large survey block, flown at 200-m line spacing using both fixed wing (DL10049) and helicopter (DL10052) by Altius Resources and Fronteer Development Group (4) over the Michelin Deposit and adjacent areas. The data from several other radiometric surveys flown in various parts of Labrador are scheduled for release within the next year.

NEWFOUNDLAND (FIGURE 4)

1) Magnetic and magnetic gradient surveys flown by the Geological Survey of Canada in March, 2007, as an early phase of TGI 3 (solid green outlines on Figure 4). The northern portion of the Baie Verte Peninsula (1) was flown by fixed-wing aircraft at 250-m line spacing (DN09902). The results of this survey significantly improve the magnetic resolution as compared to existing data for this region. Maps generated from the survey were used extensively to refine TGI 3 geological mapping on the peninsula during the 2007 field season. The remaining two TGI 3-funded survey blocks (2 and 3) were flown by helicopter at 100-m line spacing in the Gullbridge area, located northeast of Buchans (DN09903, DN09904). Of particular note in the gradient-enhanced total magnetic field results, are the clear definition of a series of magnetic features (Figure 5), interpreted to be late-stage dykes and faults that cut across the north to northeast geological strike. Many other faults having east to northeast orientation can be delineated from the displacements of magnetic features evident in the data. The data were released as preliminary maps in June, 2007. The final fully processed data and maps were released in November, 2007, and January, 2008 (Gullbridge areas - Dumont and Potvin, 2007a, b; Baie Verte - Coyle and Oneschuk, 2008a, b). Both preliminary and final copies of the data are available for download *via* the online *Geoscience Resource Atlas*.

2) Surveys flown to better define geological structure in the exploration for gold. These are predominantly high-resolution magnetic and magnetic gradient surveys, and in several cases, frequency domain EM data. Examples shown in Figure 4 are: (4) a fixed-wing magnetic gradient survey flown at 100-m and 200-m line spacing by Cornerstone

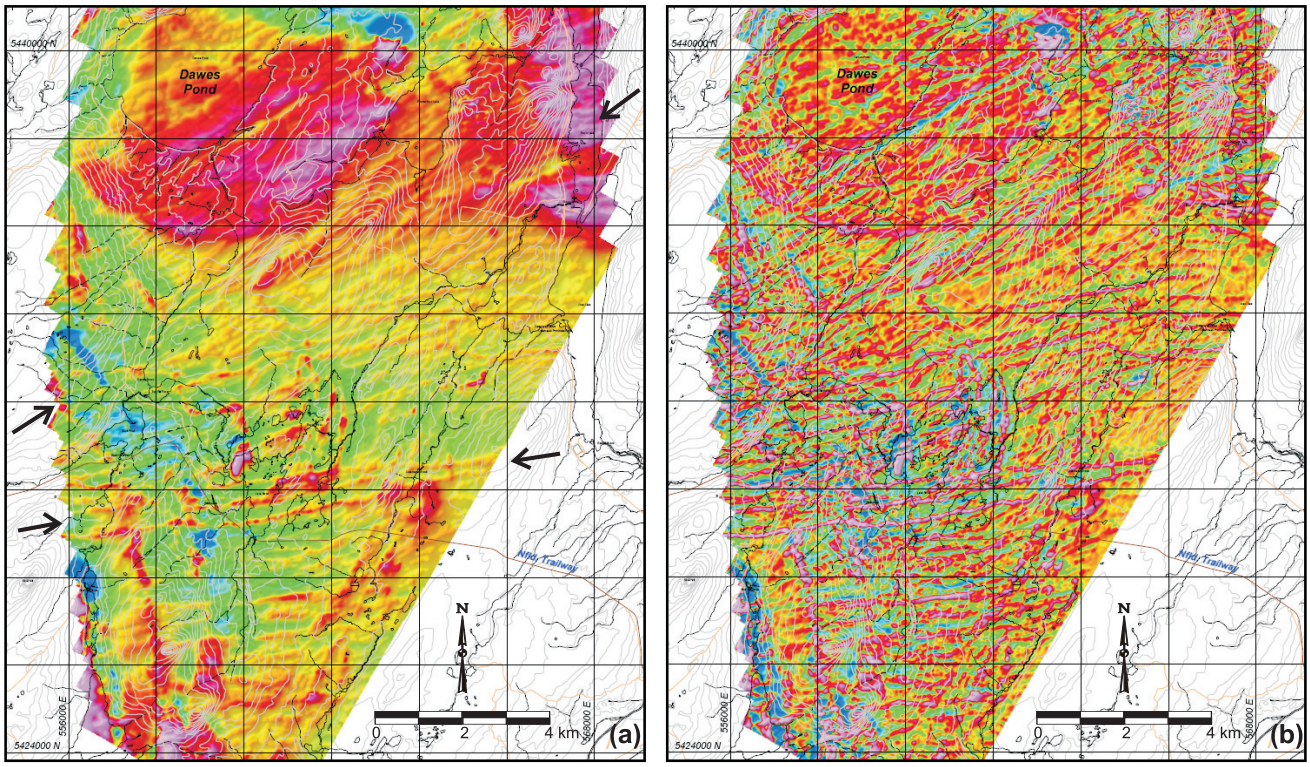


Figure 5. *Shaded-relief images for a portion of the 2007 airborne survey of the Gullbridge area, flown by the Geological Survey of Canada and the Geological Survey of Newfoundland and Labrador. The two images show results for the same area: a) residual magnetic field, and b) calculated vertical magnetic gradient. Note the predominance of linear magnetic features, identified by arrows, trending from approximately 080° in the south to 060° in the northern part of these images. These linear features are interpreted as dykes that obliquely transect sedimentary and volcanic rocks of the area with a strike ranging from 030° to 330°. The Dawes Pond granodioritic intrusion, located beneath Dawes Pond near the top of this image, has a nearly circular magnetic expression and shows concentric rings of interpreted magnetite layering. An UTM grid spaced at 2 km provides a scale for these images.*

Resources of the Cape Ray Project (DN09268, DN09269, DN09270, DN09272, DN07273); (5, 6, 7 and 9) helicopter-borne transverse magnetic gradient and frequency-domain EM survey, flown at 75 m line spacing over several blocks by Rubicon Minerals and Linear Gold (DN03079, DN03080, DN03087, DN03088, DN08606, DN08607; DN09215; DN09216); (6, 7, 8, 9 and 10) helicopter-borne 3-axis magnetic gradient survey, flown at 50 m line spacing over several blocks by Rubicon Minerals and their partners (DN08259, DN08261, DN08262, DN08291, DN08292, DN08350). These surveys yield very detailed results, defining many subtle magnetic features not previously recognized in the existing low-resolution, regional magnetic data.

3) Aeromagnetic and frequency-domain EM surveys (± VLF-EM) flown to define volcanogenic- to sediment-hosted massive-sulphide mineralization. Examples are survey blocks flown at 200-m and 100-m line spacing, respectively, by Corner Brook Pulp and Paper in the Corner Brook area (DN02693) and New Island Minerals Ltd. (DN07584, DB07590) on Glover Island.

4) Aeromagnetic and time-domain EM surveys flown in the exploration of volcanogenic massive sulphide orebodies. Examples are: (5) a 100-m spaced survey by Altius Resources and Thundermin on their South Tally Pond project (DN08183); (12) a GeoTEM survey flown at 150 m spacing by Rubicon Minerals in the Lewis Lake area (DN5435); (13) several AeroTEM survey blocks flown at 100 m by John Carroll and associates in the Rambler mines area (DN07001 to DN07005); (14) a 200-m line spaced GeoTEM survey flown by Hudson's Bay Exploration and Development in the Green Bay area (DN08746);); (17 and 18) two AeroTEM II survey blocks flown at 200 m by Benton Resources on the Nita's Brook (DN11185) and Little Joe Glodes (DN11109) properties; and (18) an

AeroTEM II survey flown at 150 m by Vinland Resources on their Little Joe Glodes Pond property (DN07754).

5) Aeromagnetic, gamma-ray spectrometric and VLF-EM surveys flown in exploration for redbed copper (also gold and silver) mineralization. A single survey of this type (11) was carried out at 200 m by Cornerstone Resources on their Princess property (DN02777) located north of Clarenville, Newfoundland. In this case, a radiometric survey was conducted based upon an IOCG deposit model.

6) Aeromagnetic and magnetic gradient surveys executed to define geological structures related to roll-front style uranium mineralization within sedimentary basins. A fixed-wing 3-axis magnetic gradient survey (15) was flown by Altius Resources over their Rocky Brook property (DN08647), in exploration for uranium in the northern part of the Carboniferous Deer Lake sedimentary basin.

Please note that the digital-airborne data coverage shown on Figures 3 and 4 depicts the status at the time of writing. The results from several additional airborne surveys have been submitted and are scheduled for release in the upcoming months. References will be added to the Airborne Index of the online *Geoscience Resource Atlas* as this information becomes available.

The geophysical method common to all of these surveys is the accurate measurement of the Earth's naturally occurring total magnetic field. The magnetic field, recorded at a variety of resolutions and widely varying survey configurations, can be merged to yield maps and images of the most detailed residual magnetic field available, as previously shown (Kilfoil, 2002). Eventually, the results from these surveys may be incorporated into similar compilations.

REFERENCES

Coyle, M. and Oneschuk, D.

2008a: Residual total magnetic field, Baie Verte Aeromagnetic Survey, (various map areas), Newfoundland and Labrador, Geological Survey of Canada Open Files 5631 to 5636, Newfoundland and Labrador Open Files 002E/1490, 002L/04/0013, 012H/16/1811, 012H/15/1812, 012I/01/0273, NFLD/2950, scale 1:50 000.

2008b: First vertical derivative of the magnetic field, Baie Verte Aeromagnetic Survey, (various map areas), Newfoundland and Labrador, Geological Survey of Canada Open Files 5625 to 5630, Newfoundland and Labrador Open Files 002E/1489, 002L/04/0012, 012H/16/1809, 012H/15/1810, 012I/01/0272, NFLD/2949, scale 1:50 000.

Dumont, R. and Potvin, J.

2007a: Residual total magnetic field, Gullbridge Aeromagnetic Survey, (various map areas), Newfoundland and Labrador, Geological Survey of Canada Open Files 5647 to 5651, Newfoundland and Labrador Open Files 012A/1239, 012H/1813, NFLD/1251, NFLD/1252, NFLD/2953, scale 1:25 000.

2007b: First vertical derivative of the magnetic field, Gullbridge Aeromagnetic Survey, (various map areas), Newfoundland and Labrador, Geological Survey of Canada Open Files 5652 to 5656, Newfoundland and Labrador Open Files 012A/1240, 012H/1814, NFLD/1254, NFLD/1255, NFLD/2956, scale 1:25 000.

Kilfoil, G.J.

2002: A digital Atlas of merged magnetic data from existing airborne surveys, Labrador (NTS 14C, 14D, 14E, 14F, and 24A), Newfoundland and Labrador Geological Survey, Open File LAB/1370 Version 1.0 (on CD-ROM).

Oneschuk, D., Tod, J. and Kilfoil, G.

2002: Airborne geophysics compilation (part II, Vol. 1-3), Red Indian Line, central Newfoundland, Geological Survey of Canada Open File 4254, Newfoundland and Labrador Geological Survey, Open File NFLD/2773 (on 3 CD-ROM volumes).