



AIRBORNE GEOPHYSICAL SURVEY OF THE  
BURIN PENINSULA REGION, NEWFOUNDLAND

NTS MAP AREAS  
1L13, 1L14, 1M03 AND 1M04

RATIO OF EQUIVALENT URANIUM TO PERCENT POTASSIUM

MAP 2022-13  
OPEN FILE NFLD/3402  
Map 13 of 26

G.J. Kilfoil

ABOUT THE SURVEY

**Introduction**  
This qualitative gamma-ray spectrometric, aeromagnetic and VLF-Electromagnetic airborne geophysical survey of Burin Peninsula region, Newfoundland, was completed by Sander Geophysics Limited. The survey was flown from November 12th 2021 to March 29th, 2022 using a single Cessna 208 Caravan (C-GSGW). The nominal traverse and control line spacings were, respectively, 150 m and 1000 m. The survey area was 1300 km<sup>2</sup> and the survey was conducted in 13 flights. The traverse lines were oriented 135° with orthogonal control lines. The flight path was recovered following post-flight differential GPS surveys using raw data recorded by Global Positioning Systems in the survey aircraft and at a static reference station.

**Gamma-ray Spectrometric Data**  
The gamma-ray spectrometric measurements were made with a Sander Geophysics SGL Spec gamma-ray spectrometer using fifteen 1024x1024x6 mm NaI (Tl) crystals. The main detector array consisted of twelve crystals (total volume 50.4 liters). Three crystals (total volume 10.8 liters) were used as passive monitors to record the natural gamma-ray background. The system continuously adjusted the gain of each crystal by monitoring the natural potassium, uranium, and thorium peaks. A small cesium-137 source was used to calibrate the responses of the detectors for the upward-looking detectors.

Potassium is measured directly from the 1460 keV gamma photons emitted by K-40, whereas uranium and thorium are measured indirectly from gamma-ray photons emitted by their daughter products (2124 keV for uranium and 2220 keV for thorium). Although these daughters are far down their respective decay chains, they are assumed to be in equilibrium with their parents; thus gamma-ray spectrometric measurements are used to measure the total potassium, uranium and thorium energy windows used to measure potassium, uranium and thorium, are, respectively: 1370-1570 keV, 1660-1860 keV and 2410-2810 keV.

Gamma-ray spectra were recorded at one-second intervals. Data processing followed standard procedures as described in AEA, 1991 and IAEA, 2003. During processing, the spectra were energy calibrated, and counts were accumulated into the windows described above. Counts were converted to counts per second and then to counts per second per square meter. The background was removed in the cosmic window. The window counts were corrected for background activity from cosmic radiation, radioactivity of the aircraft and atmospheric gamma rays. The system continuously adjusted the gain of each crystal by monitoring the natural potassium, uranium, and thorium peaks. The system continuously adjusted the gain of each crystal by monitoring the natural potassium, uranium, and thorium peaks. A small cesium-137 source was used to calibrate the responses of the detectors for the upward-looking detectors.

Corrections were made to the data to 30 m above the ground. The results of an average gamma-ray spectrum were then converted to ground surface concentrations that were influenced by varying amounts of surface cover, moisture and surface water. As a result, the measured concentrations are usually lower than the actual bedrock concentrations. The total air absorbed dose was measured for each flight hour.

**Magnetic Data**  
The magnetic field was sampled 10 times per second using three split-beam cesium vapour magnetometers (sensitivity = 0.005 nT) mounted inside the fuselage and two wingtip pods of the aircraft. This array of sensors forms a horizontal gradiometer with a lateral dimension of 10 m, a vertical dimension of 1 m and a horizontal separation of 10 m between the sensors. The magnetic field data from the traverse lines were computer-analysed to obtain a mutually levelled set of flight-line magnetic data. The International Geomagnetic Reference Field (IGRF) was used to remove the influence of the Earth's magnetic field on the magnetic data. The IGRF is a mathematical model of the magnetic field of the Earth's core, representing the magnetic field of the Earth's core, yields a residual component related essentially to magnetizations within the crust. An empirical vertical component of the magnetic data was calculated by leveraging lateral and longitudinal gradients to better define the vertical signature, which was then interpolated to 50 m grid cells.

The first vertical derivative of the magnetic field is the rate of change of the magnetic field in the vertical direction. Computation of the first vertical derivative removes long wavelength features of the magnetic field and significantly improves the resolution of closely spaced and superimposed features. A primary vertical derivative map is the coincidence of the zero-value contour with vertical sections of magnetism at high magnetic latitudes (Hargreaves, 1985).

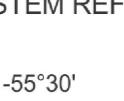
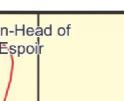
**VLF-EM**  
Very low frequency (VLF) electromagnetic data was measured using a Hart Total 2A VLF-EM receiver mounted in a 2.5 m fiberglass stinger installed on the tail of the aircraft. For this survey, combinations of Line and Otto data from the VLF stations in Cutler, Maine (24.3 kHz), Lamoure, North Dakota (25.2 kHz) and Skeaton, UK (22.1 kHz) provide complete coverage of the survey area for both Total and Quadrature representations of the VLF signal. The signal quality in signal quality from the different stations is apparent in the data as bands of more or less constant data.

**Additional Information**  
Data compilation and map production were performed by Sander Geophysics Limited, Ottawa, Ontario. Contract and project management was provided by the Newfoundland and Labrador Department of Industry, Energy and Technology. Copies of this map may be obtained from the Geological Survey, Department of Industry, Energy and Technology, Government of Newfoundland and Labrador, P.O. Box 6700, St. John's, NL, Canada, A1B 4J6.

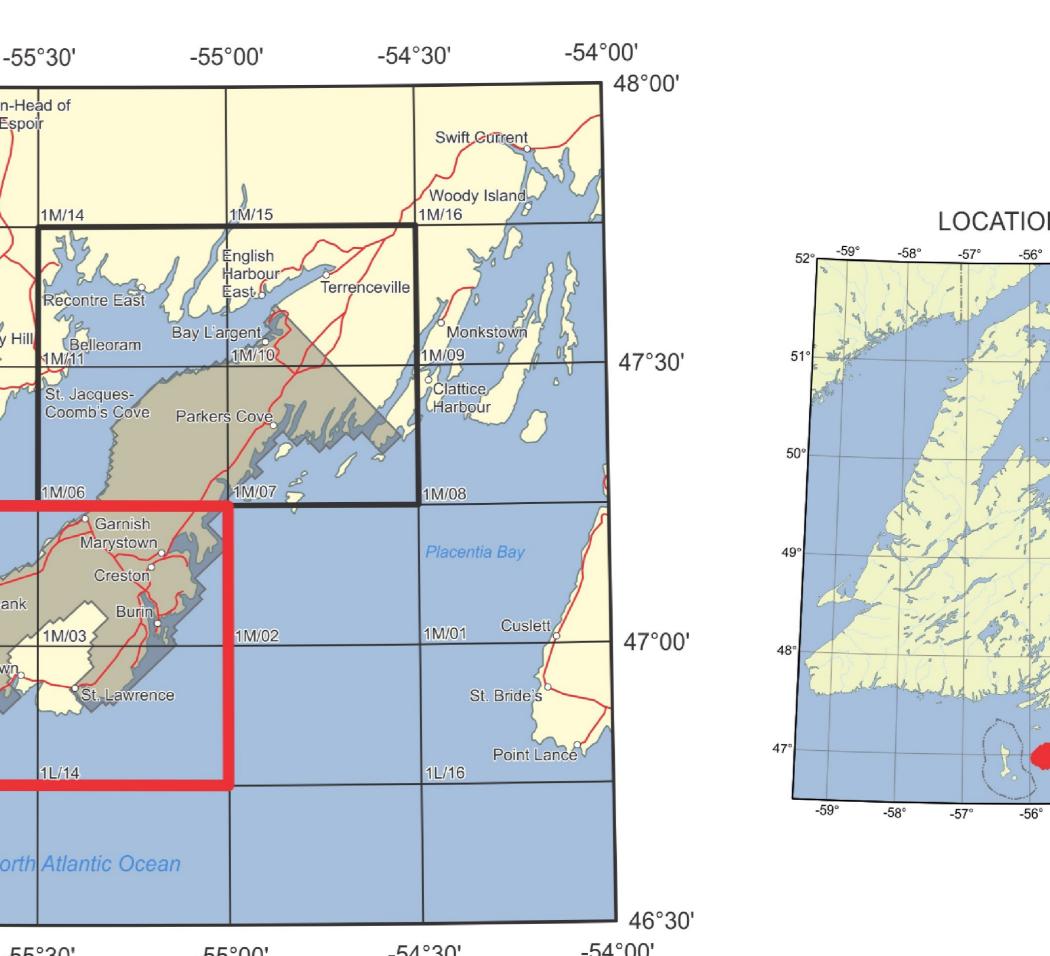
This map is subject to revision and modification. Comments to the author concerning errors or omissions are invited. Department Home: <https://www.gov.nl.ca/en>  
Geological Survey website: <https://www.gov.nl.ca/etmines/>  
E-mail: [pub@gov.nl.ca](mailto:pub@gov.nl.ca)

**Reference**  
Hargreaves, P.J. 1985. Gradient measurements in aeromagnetic surveying. *Geophysics*, vol. 30, p. 891-902.

**PLANIMETRIC SYMBOLS**

Topographic contours.....	
Drainage.....	
Road.....	
Flight line.....	
Buildings.....	
Transmission line.....	

NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND GEOPHYSICAL MAP INDEX



**Recommended Citation**  
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