

**AIRBORNE GEOPHYSICAL SURVEY OF THE
ST. ALBAN'S REGION, NEWFOUNDLAND**
NTS MAP AREA 1M/13 AND PARTS OF 1M/12, 1M/14,
11P/16, AND 2D/04

RATIO OF EQUIVALENT THORIUM TO PERCENT POTASSIUM

MAP 2016-09
OPEN FILE NFD/3272
Map 6 of 10

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ABOUT THE SURVEY

Introduction

This quantitative gamma-ray spectrometric and aeromagnetic airborne geophysical survey of St. Alban's region, Newfoundland, was completed by Geosk Airborne Surveys. The survey was flown from October 16th to November 26th, 2015 using a single Casella 208 Casella (CS-208). The nominal traverse and control line spacing is, respectively, 150 m and 1000 m, and the aircraft flew at a nominal terrain clearance of 125 m at an airspeed between 200 and 270 km/h. Traverse lines were oriented 15° with orthogonal control lines. The flight paths were reconstructed following post-flight differential corrections to the data reported by a Global Positioning System.

Gamma-ray Spectrometric Data

The airborne gamma-ray measurements were made with a Radiation Solutions RS-500 gamma-ray spectrometer using three 102x102x66 mm NaI (Tl) crystals. The main detector array consisted of twelve crystals (total volume 59.4 litres). Three crystals (total volume 13.2 litres), shielded by the main array, were used to detect variations in background radiation caused by atmospheric radon. The system constantly monitored the natural thorium peak for each crystal, and using a Gaussian least squares algorithm, adjusted the gain for each crystal.

Potassium is measured directly from the 1460 keV gamma-ray photons emitted by ⁴⁰K, whereas uranium and thorium are measured indirectly from gamma-ray photons emitted by daughter products (²¹⁴Pb for uranium and ²¹⁴Pb for thorium). Although these daughters are not themselves decay chains, they are assumed to be in equilibrium with their parent gamma-ray spectrometric measurements of uranium and thorium are referred to as equivalent uranium and equivalent thorium, i.e. eU and eTh. The energy windows used to measure potassium, uranium and thorium, respectively, are 1310-1370 keV, 1600-1800 keV, and 2410-2810 keV.

Gamma-ray projects were recorded at one-second intervals. Data processing followed standard procedures as described in IAEA, 1991 and IAEA, 2003. During processing, the spectra were energy calibrated, and counts were accumulated into the windows described above. Counts from the radon detectors were recorded in a 1600-1800 keV window and radon fluxes at energies greater than 3000 keV were recorded in the cosmic window. The window counts were corrected for dead time, background activity from cosmic radiation, inefficiency of the aircraft and atmospheric radon, and other effects. The survey data were then corrected for spectral scattering in the ground, air and detectors. Corrections for deviations from the planned terrain clearance and for variation of temperature and pressure were made prior to conversion to concentration of potassium, uranium and thorium, using factors determined from flights over the Danston, Saskatchewan calibration range.

Corrected data were interpolated to a 37 m grid interval. The results of an airborne gamma-ray spectrometric survey represent the average surface concentrations that are influenced by varying amounts of airborne, overburden, vegetation cover, soil moisture and surface water. As a result the measured concentrations are usually lower than the actual bedrock concentrations. The total air identified dose rate (nanograms per hour) was produced from measured count between 600 and 2010 keV.

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 tail boom and two wing pods of the aircraft. This array of sensors from a horizontal gradiometer with lateral dimensions of 18.2 m and a longitudinal dimension of 11.23 m. Differences in magnetic values at the intersections of control and traverse lines were compared to obtain a mutually levelled set of flight line magnetic data. The International Geomagnetic Reference Field (IGRF) calculated for the average GPS altitude of 300 m for the survey 2015-16 was then removed. Removal of the IGRF, representing the magnetic field of the Earth's core, produces a residual component related essentially to magnetizations within the Earth's crust. The levelled values were then reprojected to a 37 m grid using bicubic splines to guide between the splines.

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 near-surface features of the magnetic field and significantly improves the resolution of crustal and uppermost anomalies. A property of first vertical derivative maps is the coincidence of the zero-value contour with vertical contacts of magnetic units at high magnetic latitudes (Hess, 1963).

Additional Information
Data compilation and map production were performed by Geosk Airborne Surveys, Saskatoon, Saskatchewan. Contract and project management was provided by the Newfoundland and Labrador Department of Natural Resources.

Copies of this map may be obtained from the Geoscience Publications and Information Section, Geological Survey, Department of Natural Resources, Government of Newfoundland and Labrador, PO Box 8700, St. John's, N.L. Canada, A1B 4X6.

This map is subject to revision and modification. Comments to the author concerning errors or omissions are invited.
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References

Hess, P.J. 1963. Gradient measurements in aeromagnetic surveying. *Geophysics*, vol. 30, p. 891-902.

IAEA, 1991. *Handbook of gamma-ray spectrometry*. International Atomic Energy Agency, Vienna, Austria, 1991.

IAEA, 2003. *Gamma-ray spectrometry: principles and practice*. International Atomic Energy Agency, Vienna, Austria, 2003.

IGRF, 2015. *International Geomagnetic Reference Field, 2015*. International Geomagnetic Reference Field Working Group, 2015.

Geosk Airborne Surveys. *Geophysical Survey of St. Alban's Region, Newfoundland*. 2016.

Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.

Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.

Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.

Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.

Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.

Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.

Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.

Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.

Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.

Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.

Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.

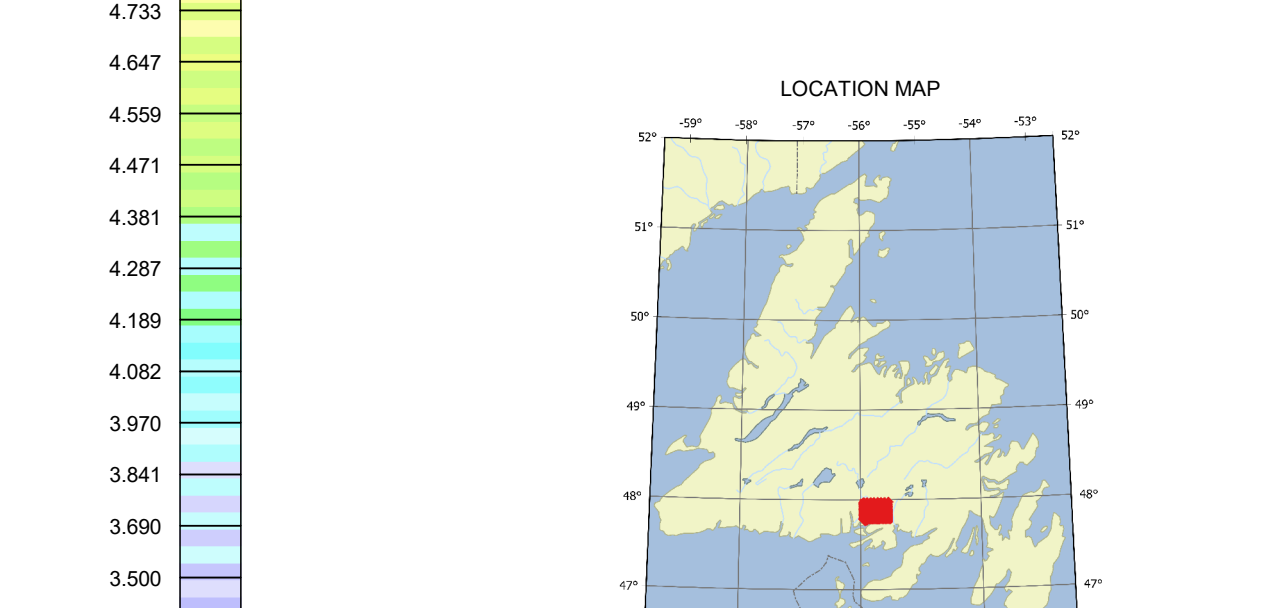
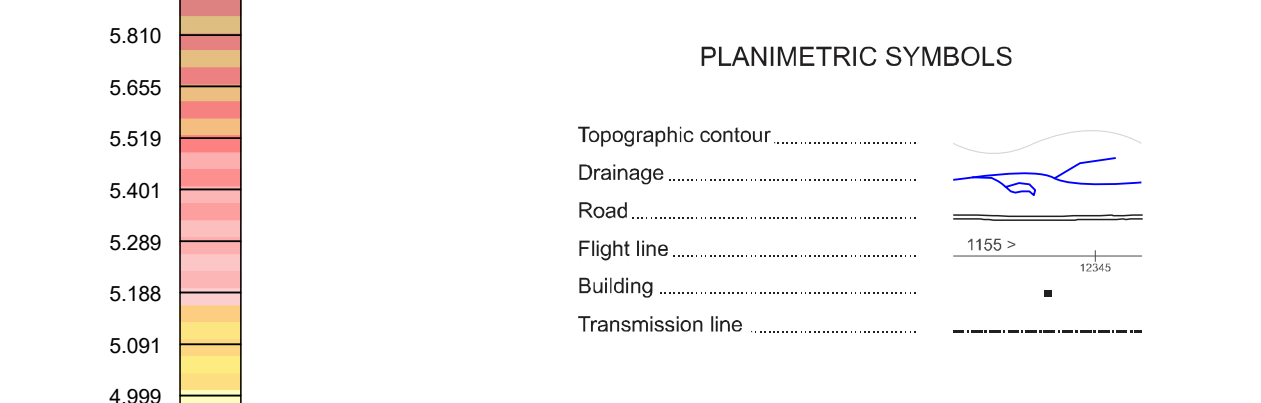
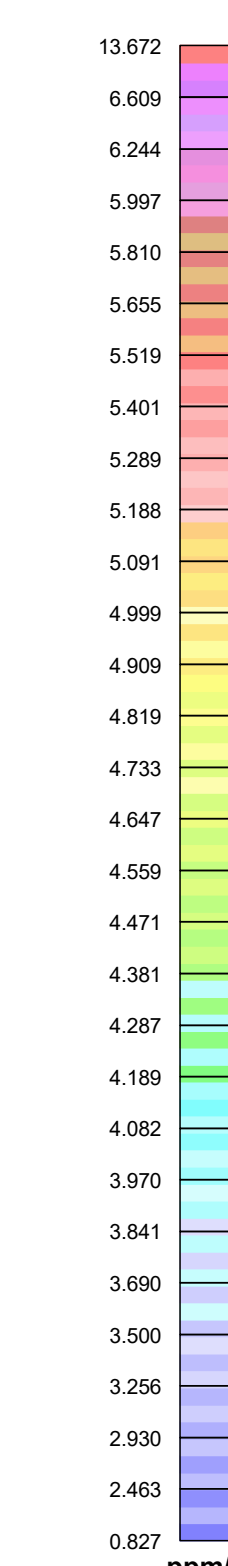
Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.

Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.

Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.

Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.

Geological Survey of Canada. *Geological Map of Newfoundland and Labrador*. 2016.



Recommended Citation
2016 Airborne Geophysical Survey of the St. Alban's region, Newfoundland (NTS Map Area 1M/13 and parts of 1M/12, 11P/16, and 2D/04). Ratio of Equivalent Thorium to Percent Potassium. Geological Survey, Department of Natural Resources, Government of Newfoundland and Labrador. Map 2016-09, Open File NFD/3272.

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