

**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

PERCENT POTASSIUM
MAP 2016-06
OPEN FILE NFD/3272
Map 3 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 206 Caravan (C-206). The nominal traverse and control line spacing were, respectively, 150 m and 1000 m, and the aircraft flew at a nominal terrain clearance of 125 m at airspeed between 200 and 210 km/h. Traverse lines were oriented 15° with orthogonal control lines. The flight paths were reconstructed following post-flight differential corrections to the data recorded 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 12.0 litres), located 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 secular equilibrium with their parents. The airborne 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 for measuring potassium, uranium and thorium, respectively, are 1330-1370 keV, 1600-1800 keV, and 2410-2810 keV. Gamma-ray counts 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 region detectors were recorded in a 1600-1800 keV window and ratios of energy greater than 3000 keV was recorded in the cosmic window. The window counts were corrected for dead time, background activity from cosmic radiation, variability of the aircraft and atmospheric radon peaks. The window 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 of gross concentrations of potassium, uranium and thorium, using factors determined from flights over the Dawson, Saskatchewan calibration range.

Corrected data were interpolated to a 37 m grid interval. The results of an airborne gamma-ray spectrometer survey represent the average surface concentrations that are influenced by varying amounts of organic, inorganic, vegetation cover, soil moisture and surface water. As a result the measured concentrations are usually lower than the actual bedrock concentrations. The total air scattered dose rate (nanograms per hour) was produced from measured counts 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 a lateral dimension 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 and analysed to obtain a mutually levelled set of flight line magnetic data. The International Geomagnetic Reference Field (IGRF) (based on the average IGRF altitudes of 200 m for the survey 2015-15-25) 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 interpolated to a 37 m grid using local horizontal gradients to guide between the flight lines.

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 superposed 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).

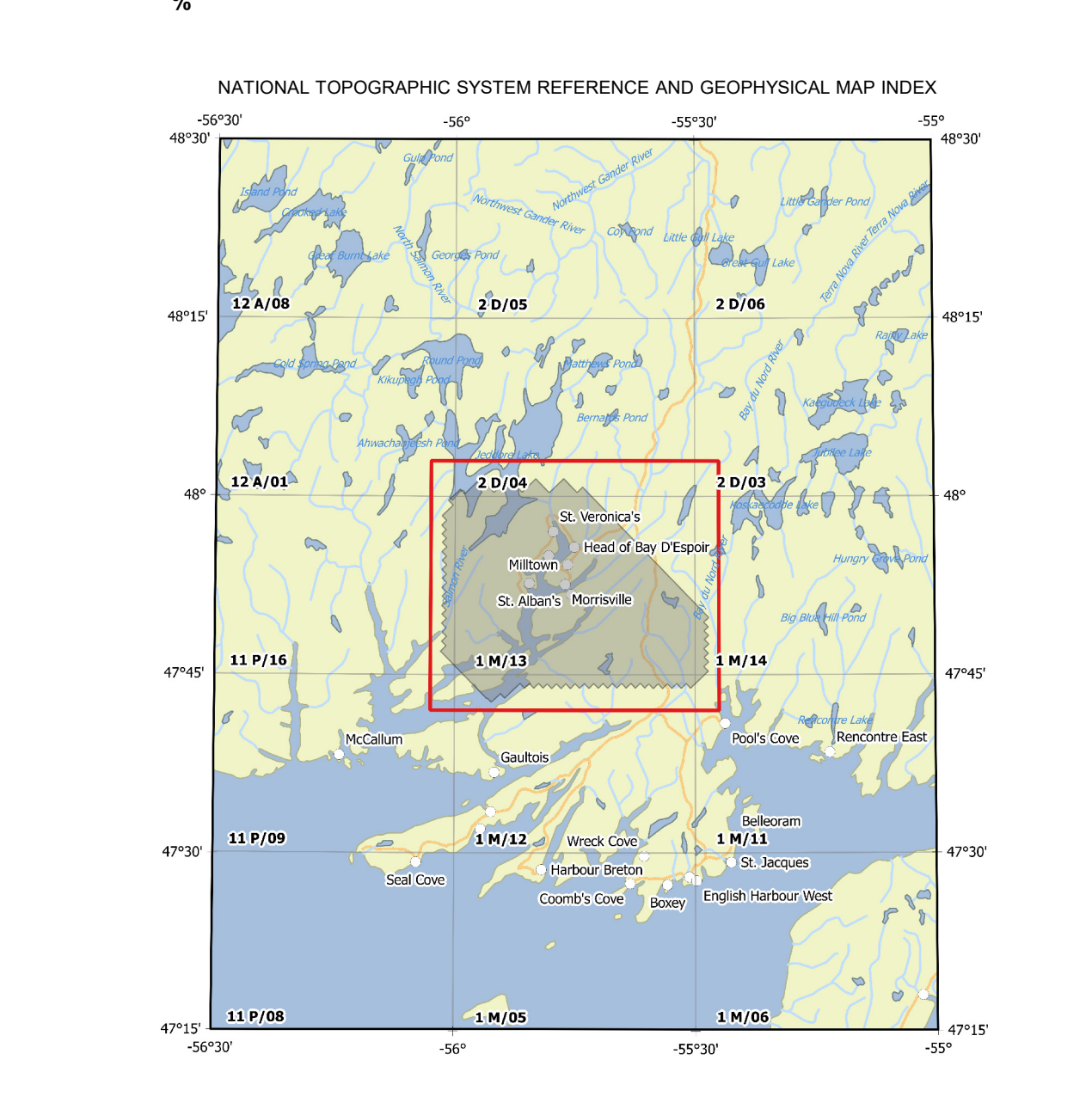
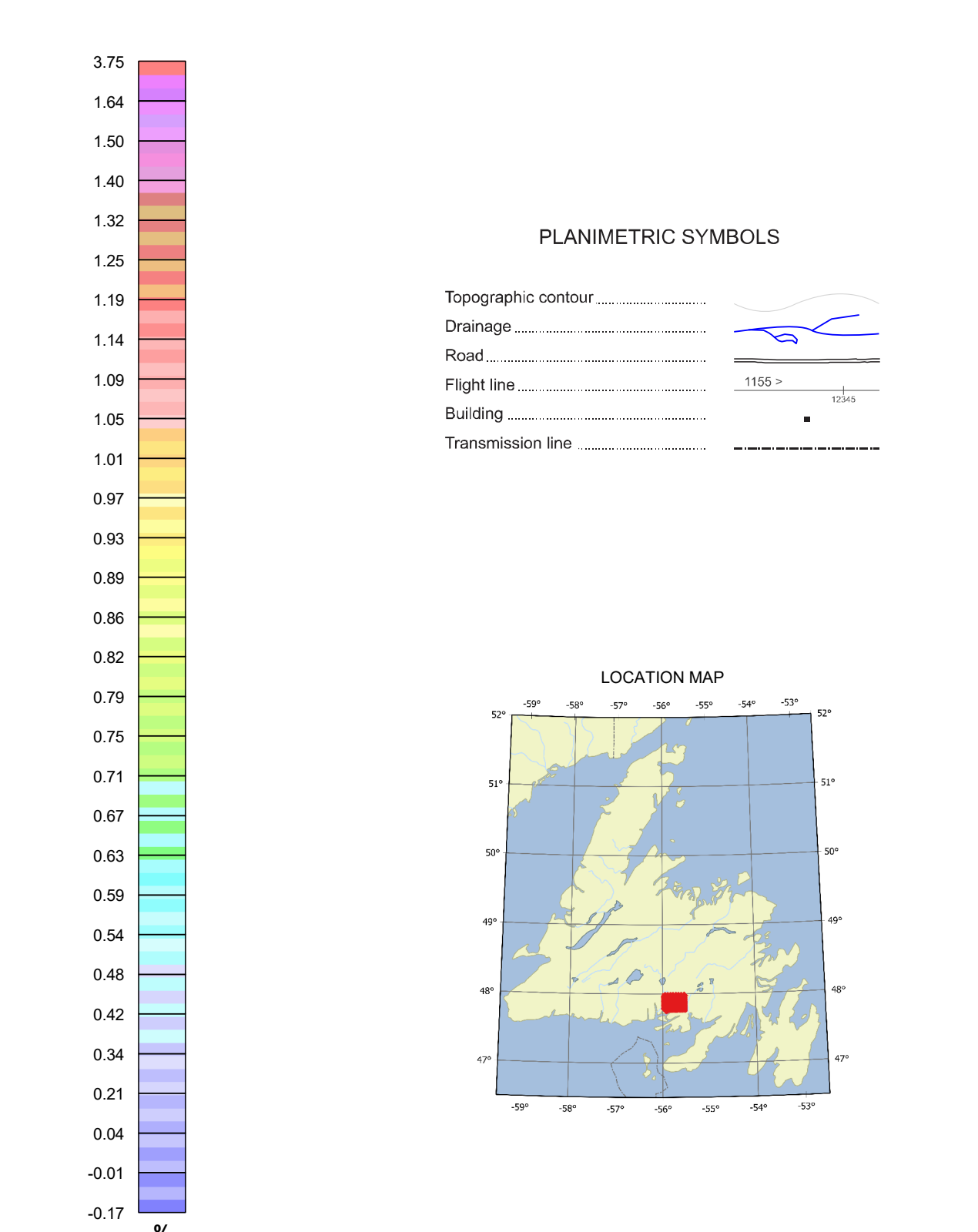
Additional Information

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, NL, Canada, A1B 4X6.

This map is subject to revision and modification. Comments to the author concerning errors or omissions are invited. Department Website: <http://www.nfld.gov.ca/>
Geological Survey Website: <http://www.nfld.gov.ca/geosk/index/Geosk.html>
E-mail: pub@gnr.gov.ca

References

Hess, F.J. 1963. Gradient measurements in aeromagnetic surveying. *Geophysics*, vol. 30, p. 891-892.



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