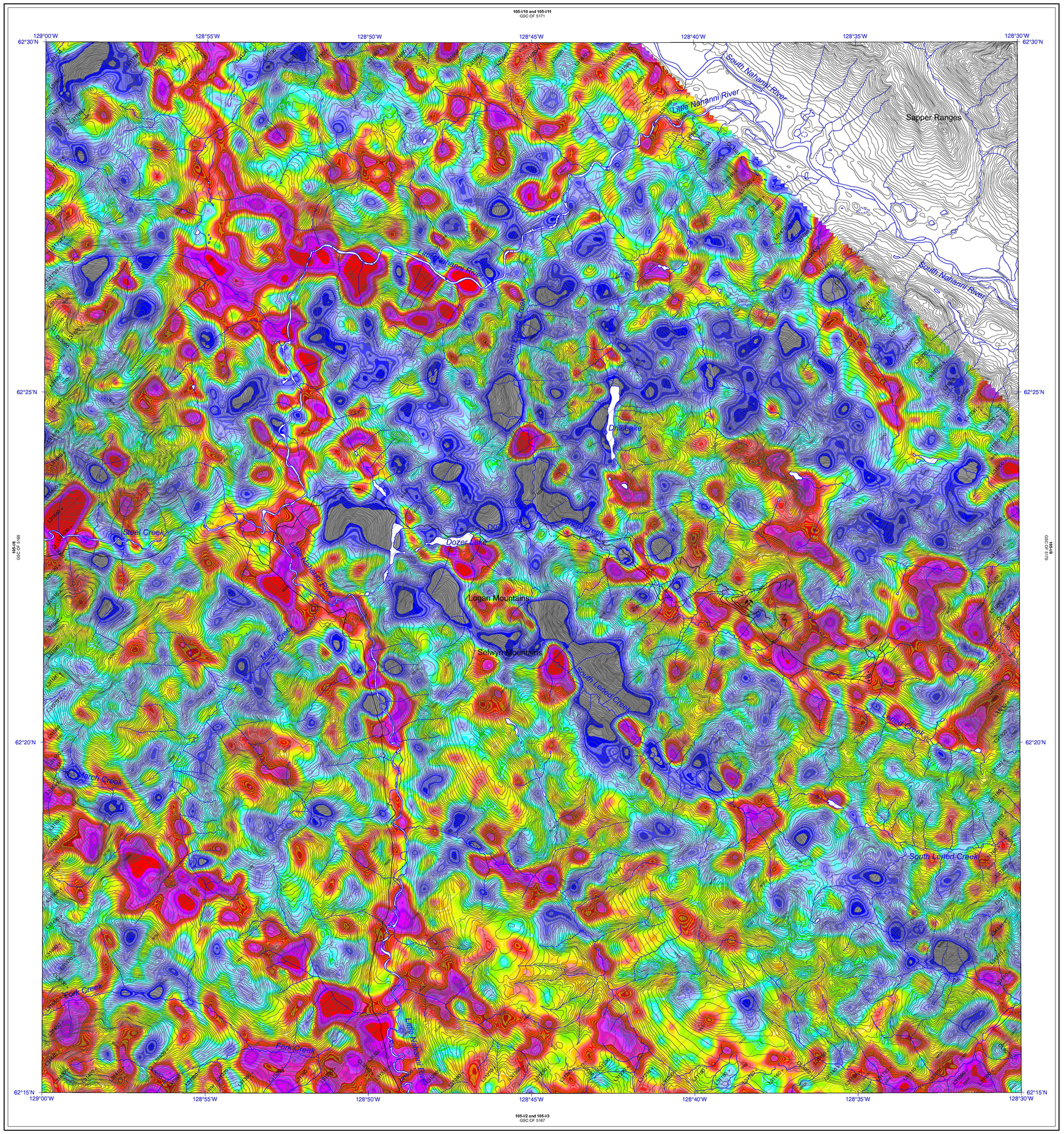
GEOLOGICAL SURVEY OF CANADA COMMISSION GÉOLOGIQUE DU CANADA



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1.060
1.045
1.030
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0.955
0.933
0.908
0.880
0.848
0.812
0.765
0.702
0.600

U/K (ppm/pct)

In 2004 and 2005, Sander Geophysics Limited completed four multi-sensor airborne geophysical surveys in the Nahanni River area of the Northwest Territories for Parks Canada (Prairie Creek, Caribou River and Flat River) and the Government of the Northwest Territories (Sekwi Range). The Geological Survey of Canada provided survey supervision and quality control. The purpose of the survey was to obtain quantitative gamma-ray spectrometric and aeromagnetic data. The survey was flown over two seasons, from August 26 to October 3, 2004 and the second phase from June 13 to August 20, 2005 using the SGL AStar 350 B-3 helicopter, C-GSGH.

Gamma-ray Spectrometric Data
The airborne gamma-ray measurements were made with an Exploranium GR820 gamma-ray spectrometer using nine 102 x 102 x 406 mm NaI (Tl) crystals. The main detector array consisted of eight crystals (total volume 33.6 litres). One crystal (total volume 4.2 litres), shielded by the main array, was 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 ^{40}K, whereas uranium and thorium are measured indirectly from gamma-ray photons emitted by daughter products (^{214}Bi for uranium and ^{208}Tl 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 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 are:

Potassium (^{40}K)	1360 - 1560 keV
Uranium (^{214}Bi)	1660 - 1860 keV
Thorium (^{208}Tl)	2410 - 2810 keV

Gamma-ray spectra were recorded at one-second intervals at a planned terrain clearance of 135 m and an air speed of 120 km/h. Noise Adjusted Singular Value Decomposition (NASVD) analysis was carried out on the full spectrum 256 channel data to reduce statistical noise in the windowed data. 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 1660 - 1860 keV window and radiation at energies greater than 3000 keV was recorded in the cosmic window. The window counts were corrected for dead time, and for background activity from cosmic radiation, the radioactivity of the aircraft and atmospheric radon decay products. The window data were then corrected for spectral scattering in the ground, air and detectors. Corrections for deviations of altitude from the planned terrain clearance and for variation of temperature and pressure were made prior to conversion to ground concentrations of potassium, uranium and thorium, using factors determined from flights over a calibration range near Ottawa.

Potassium	56.5 cps/% (2004)	50.0 cps/% (2005)
Uranium	9.0 cps/ppm (2004)	6.3 cps/ppm (2005)
Thorium	3.7 cps/ppm (2004)	3.2 cps/ppm (2005)

Corrected data were filtered and interpolated to a 100m grid for both the 1:50 000 scale and 1:250 000 scale maps. The results of an airborne gamma-ray spectrometer survey represent the average surface concentrations that are influenced by varying amounts of outcrop, overburden, vegetation cover, soil moisture and surface water. As a result the measured concentrations are usually lower than the actual bedrock concentration. The total air absorbed dose rate in nanograys per hour was produced from measured counts between 400 and 2810 keV.

Magnetic Data
The helicopter was equipped with a Scintrex CS-2 cesium vapour magnetic sensor mounted in a bird suspended 30 m below the aircraft. The system recorded readings every 0.1 seconds with a noise level of less than 0.02 nT. Magnetic interferences caused by aircraft maneuvers were compensated using an RMS AADC II Magnetic compensator. Diurnal variations and GPS fluctuations were recorded using a Sander Geophysics Ground Station Recording System. The International Geomagnetic Reference Field was calculated daily and removed for each flight. The airborne magnetometer data was IGRF corrected, using the location, altitude and date of each point. The IGRF was calculated using the IGRF 2000 model.

The corrected magnetic data was interpolated to a 100m grid using a minimum curvature algorithm. The first vertical derivative grid was calculated from the corrected total magnetic intensity grid using a FFT based frequency domain filtering algorithm.

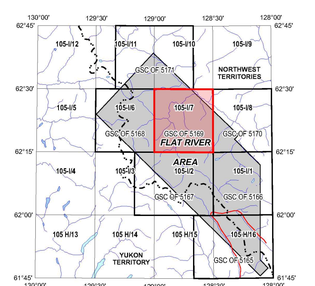
Positional Data
Survey line spacing of 500 m and control line spacing of 4000 m was used for the Prairie Creek, Caribou River and Flat River survey blocks. Survey line spacing of 400 m and control line spacing of 2400 m was used for the Sekwi Range survey block. Survey lines were oriented N-S for the Prairie Creek and Caribou River areas. For the Flat River area survey lines were oriented NW-SE and for the Sekwi Range survey lines were oriented SW-NE. Survey and control line positions were pre-planned using Sander Geophysics Limited, Smooth Drape software. Terrain clearance was monitored by radar altimeter. Positional data were recorded using a dual frequency Novatel Millenium system. GPS ground station data were combined with airborne GPS data to produce differentially corrected positional data with an accuracy of 2 to 5 m.

Data Presentation
Colour levels and contours were calculated for each grid and combined with map surround information to create HP RTL plot files, which were plotted using SGL's HP DesignJet colour plotters.

Project Funding
The Prairie Creek, Caribou River and Flat River surveys were funded by Parks Canada through the Mineral and Energy Resource Assessment Project. The Sekwi Range survey was funded by the Northwest Territories Geoscience Office. Technical expertise and contract administration were provided by the Radiation Geophysics and Regional Geophysics Sections of the Geological Survey of Canada.

PLANIMETRIC SYMBOLS

Topographic Contour .....
Drainage .....
Wetland .....
Permanent Ice .....
Roads .....
Trails .....
Flight Line ..... L1155 > 12345



NATIONAL TOPOGRAPHICAL SYSTEM REFERENCE AND GEOPHYSICAL MAP INDEX
SYSTÈME NATIONAL DE RÉFÉRENCE CARTOGRAPHIQUE ET INDEX DES CARTES GÉOPHYSIQUES

This airborne geophysical survey and the production of this map were funded by Parks Canada through the Mineral and Energy Resource Assessment Project.

Recommended citation:
Carson, J.M., Dumont, R., Potvin, J., Buckle, J., Shives, R.B.K., and Harvey, B. 2007: Geophysical Series - NTS 105-I/7 - Dozer Lake, Northwest Territories; Geological Survey of Canada, Open File 5169; scale 1:50 000.

Parks Canada Parcs Canada

Natural Resources Canada Ressources naturelles Canada

Canada

Location Map

GEOPHYSICAL SERIES - NTS 105-I/7 - DOZER LAKE
NORTHWEST TERRITORIES

URANIUM / POTASSIUM MAP

Scale 1 : 50 000 - Échelle 1 / 50 000

km 1 0 2 4 km

Universal Transverse Mercator Projection
North American Datum 1983
© Her Majesty the Queen in Right of Canada 2007

Projection transverse universelle de Mercator
Système de référence géodésique nord-américain, 1983
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Digital Topographic Data provided by Geomatics Canada, Natural Resources Canada

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5169
GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
2007
SHEET 6 OF 10
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URANIUM / POTASSIUM MAP

DOZER LAKE
NORTHWEST TERRITORIES

NTS 105-I/7