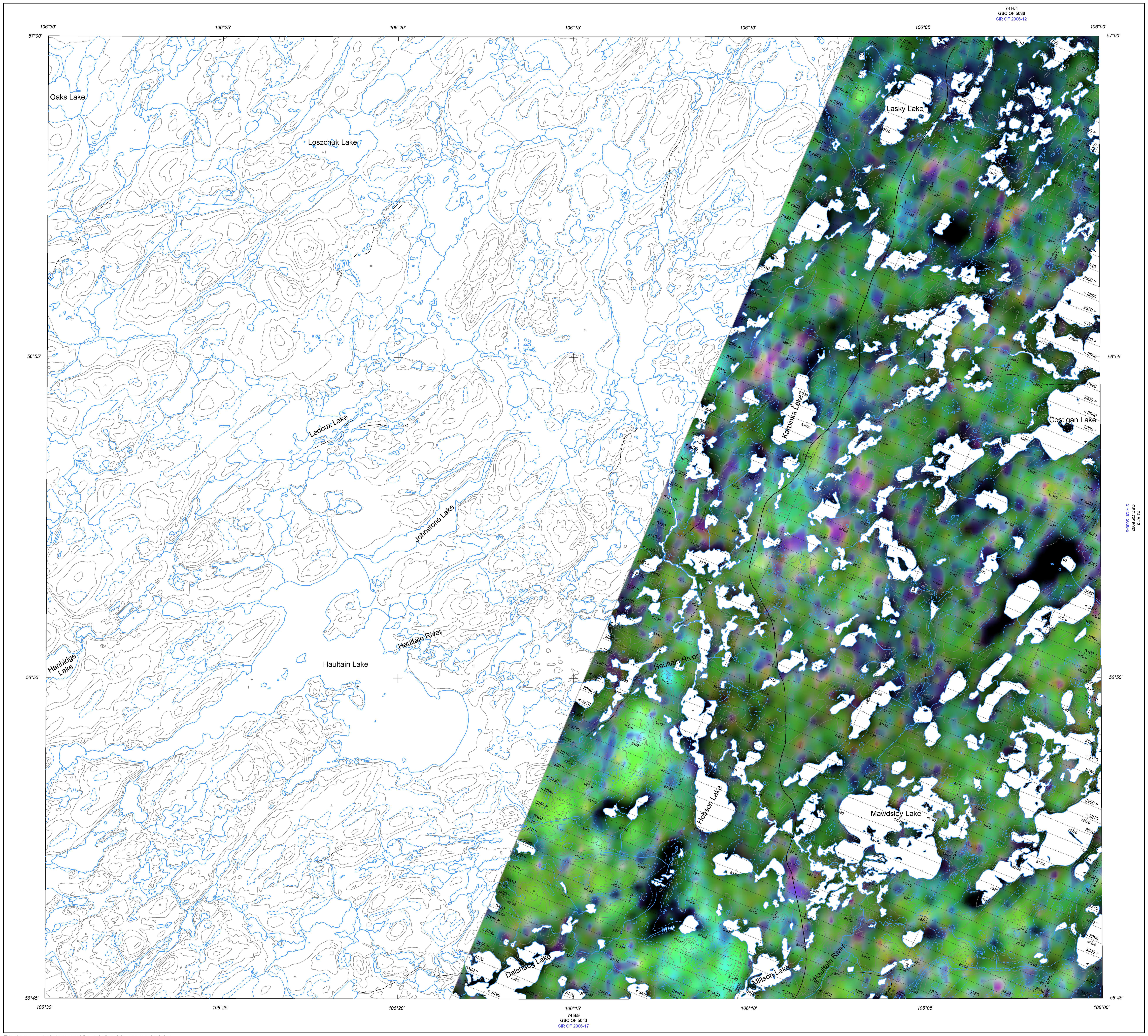
GEOPHYSICAL SERIES
TERNARY RADIOELEMENT MAP

GEOLOGICAL SURVEY OF CANADA   COMMISSION GÉOLOGIQUE DU CANADA



This airborne geophysical survey and the production of this map were funded by the Government of Saskatchewan's Mineral Exploration Incentive Program

HIGHROCK LAKE and UPPER FOSTER LAKE AREAS, SASKATCHEWAN

In 2005, Fugro Airborne Surveys completed a multi-sensor airborne geophysical survey of the Highrock Lake and Upper Foster Lake areas, Saskatchewan, for the Geological Survey of Canada and Saskatchewan Industry and Resources. The purpose of the survey was to obtain quantitative gamma-ray spectrometric and aeromagnetic data. The survey was flown from August 14 to September 20, 2005 using Cessna Caravan aircraft C-GFAV.

Gamma-ray Spectrometric Data

The airborne gamma-ray measurements were made with an Exploranium GR820 gamma-ray spectrometer using fourteen 102 x 102 x 406 mm NaI (Tl) crystals. The main detector array consisted of twelve crystals (total volume 50.4 litres). Two crystals (total volume 8.4 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 K^{40}, whereas uranium and thorium are measured indirectly from gamma-ray photons emitted by daughter products (Bi^{214} for uranium and Tl^{208} 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 (K^{40})	1370 - 1570 keV
Uranium (Bi^{214})	1660 - 1860 keV
Thorium (Tl^{208})	2410 - 2810 keV

Gamma-ray spectra were recorded at one-second intervals at a planned terrain clearance of 125 m and an air speed of 210 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	100.1 cps/%
Uranium	10.5 cps/ppm
Thorium	6.1 cps/ppm

Corrected data were filtered and interpolated to a 100m grid for the 1:250 000 scale maps and to a 50m grid for the 1:50 000 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 Cessna Caravan aircraft was equipped with a Scintrex CS-2 cesium vapour magnetic sensor mounted in a stinger to the rear of the aircraft. The system recorded readings every 0.1 seconds with a noise level of less than 0.01 nT. Magnetic interferences caused by aircraft maneuvers were compensated using a FASDAS Magnetic compensator. Diurnal variations were recorded using a Fugro CF-1 cesium vapour magnetometer.

After editing the survey data, the intersections of traverse and control lines were determined and the differences in the magnetic values were computed, analyzed and manually verified to obtain the leveling network. The International Geomagnetic Reference Field was calculated and removed using a fixed date (2005/08/31) and an altitude of 670m for each data point. 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

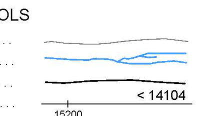
The 400 m spaced survey lines were oriented WNW – ESE and 4000 m spaced control lines were oriented NNE – SSW. Survey and control line positions and elevations were pre-planned using Fugro Airborne Surveys Smooth Drape software. Positional data were recorded using a Novatel Propak NR60101. GPS ground station data were combined with airborne GPS data to produce differentially corrected positional data with an accuracy of 2 to 5 m.

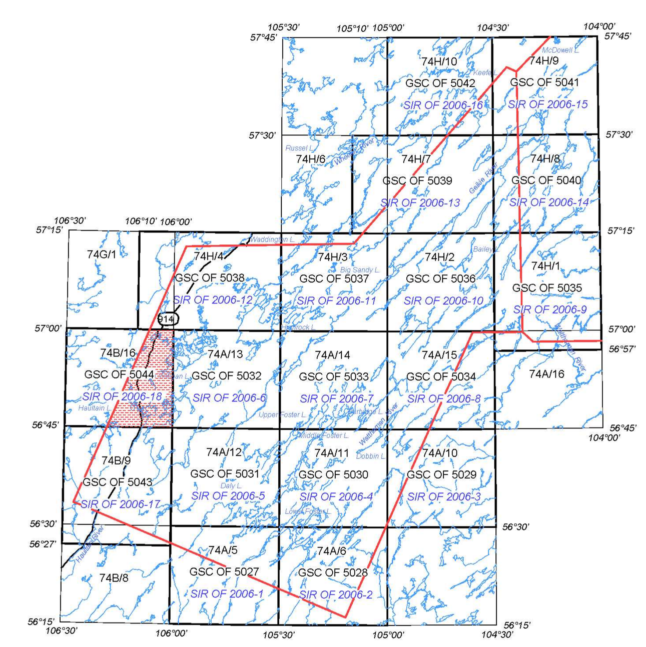
Data Presentation

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

PLANIMETRIC SYMBOLS

Topographic Contour
Drainage
Roads
Flight lines, fiducial





NATIONAL TOPOGRAPHICAL SYSTEM REFERENCE AND GEOPHYSICAL MAP INDEX

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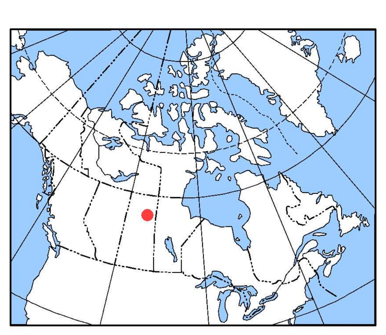
Saskatchewan Industry and Resources

Natural Resources Canada   Ressources naturelles Canada

Canada



MAP LOCATION - LOCALISATION DE LA CARTE

GEOPHYSICAL SERIES - NTS 74B/16 - HAULTAIN LAKE
SASKATCHEWAN

TERNARY RADIOELEMENT MAP

Scale 1:50 000 - Échelle 1/50 000

1000 0 1000 2000 3000 4000

(metres / mètres)

NAD83 / UTM zone 13N

Universal Transverse Mercator Projection
North American Datum 1983

Projection transverse universelle de Mercator
Système de référence géodésique nord-américain, 1983

Digital Topographic Data provided by Geomatics Canada, Natural Resources Canada.

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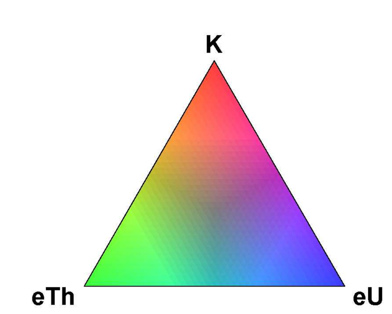

TERNARY RADIOELEMENT MAP

HAULTAIN LAKE
SASKATCHEWAN

NTS 74B/16