

PETER LAKE AND WOLLASTON LAKE AREAS, SASKATCHEWAN

In 2004, Fugro Airborne Surveys completed a multi-sensor airborne geophysical survey of the Peter Lake and Wollaston 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 over two seasons: from August 31 to September 29, 2003 and July 15 to September 30, 2004 using Cessna Grand Caravan 208-B Aircraft C-GNCA.

Gamma-ray Spectrometric Data
The airborne gamma-ray measurements were made with an Explorer GR20 gamma-ray spectrometer using fifteen 102 x 102 x 400 mm NaI (Tl) crystals. The main detector array consisted of twelve crystals (total volume 55.4 litres). These crystals (total volume 12.8 litres) shielded by the main array, were used to detect variations in background radiation caused by atmospheric radon. The system constantly monitored the radon return peaks 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 208Tl for thorium). Although these daughters are far from 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 (40K) 1370 - 1570 keV
Uranium (238U) 1860 - 1960 keV
Thorium (232Th) 2410 - 2610 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 Single 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 1860 - 1960 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 background activity from cosmic radiation, the radioactivity of the aircraft and atmospheric radon decay products. The window counts were then corrected for spectral scattering in the ground, air and detectors. Corrections for elevations 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.

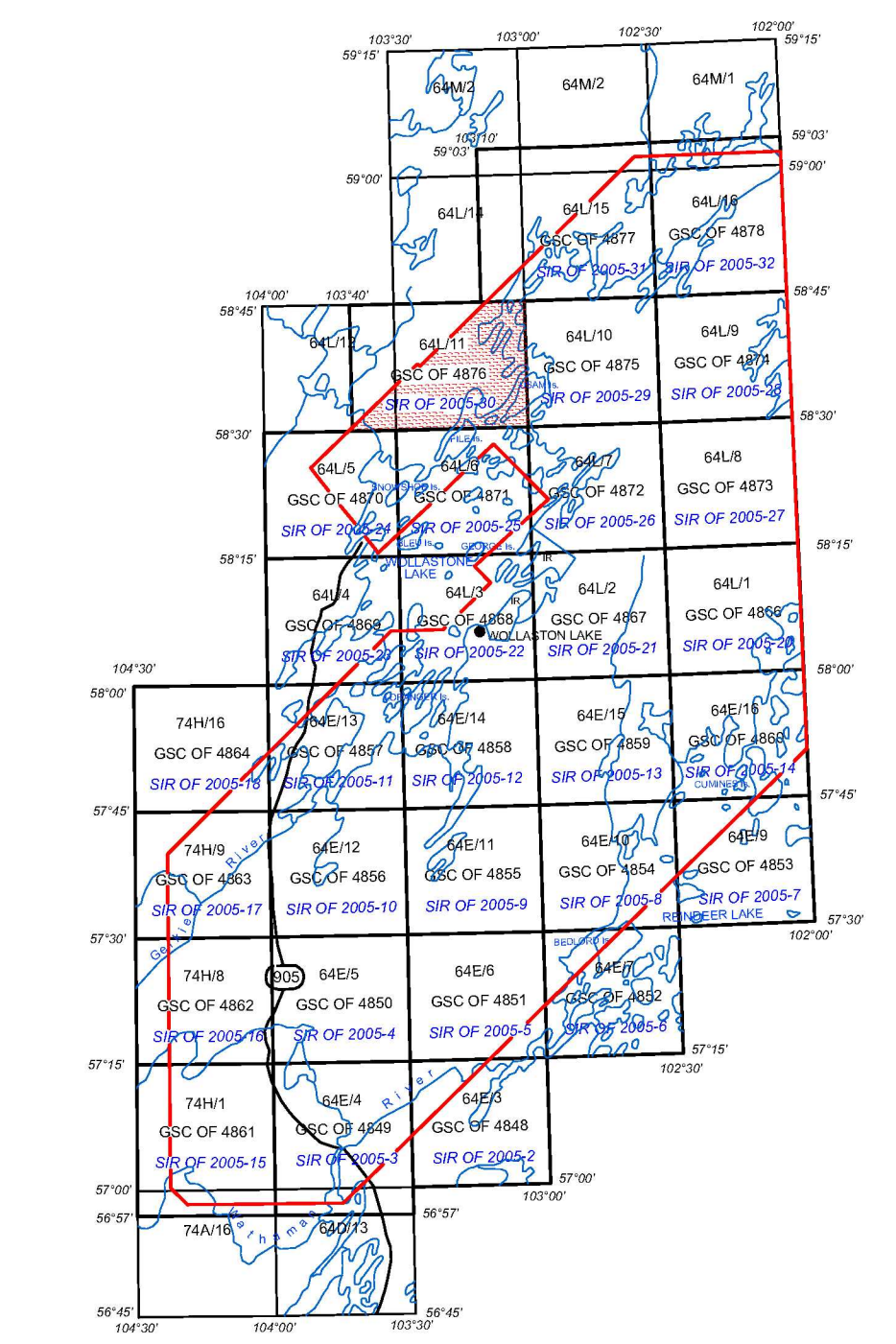
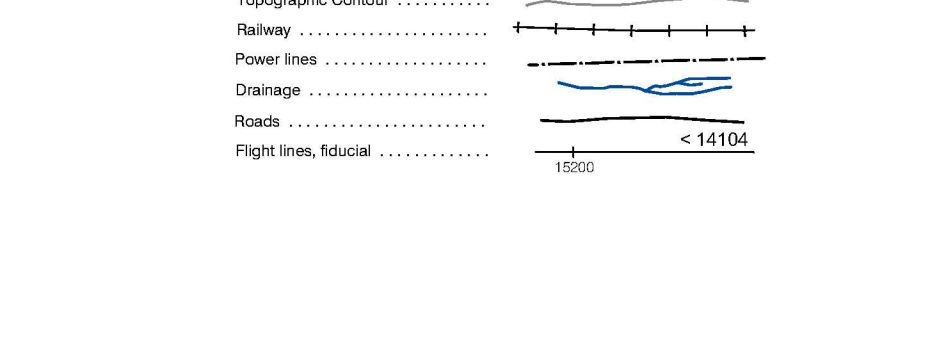
Potassium 90.5 cps/µg
Uranium 11.4 cps/µg
Thorium 5.7 cps/µg
Corrected data were filtered and interpolated to a 100 m grid for the 1:250 000 scale maps and to a 50 m grid for the 1:50 000 scale maps. The results of an airborne gamma-ray spectrometer survey represent the average surface concentrations that are influenced by varying amounts of radon, 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 Grand Caravan aircraft was equipped with a Scintrex CS-2 cesium vapour magnetic sensor mounted in a slinger to the rear of the aircraft. The system recorded readings every 0.1 seconds with a noise level of less than 0.1 nT. Magnetic interference caused by aircraft maneuvers were compensated using an RMS AADCIII Magnetic compensator. Diurnal readings were recorded using a Fugro C-1 cesium vapour magnetometer.
After editing the survey data, low pass filtered diurnal readings were subtracted from each unfiltered aeromagnetic reading. The interactions of traverses 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 file (IGRF04R15) and an altitude of 545 m for each data point. The corrected magnetic data was interpolated to a 100 m grid using a minimum curvature algorithm. The first vertical derivative grid was calculated from the corrected base magnetic intensity grid using a FFT based frequency domain filtering algorithm.

Positional Data
The 400 m spaced survey lines were oriented southeast - northwest and 4000 m spaced control lines were oriented southwest - northeast. Survey and control line positions and elevations were pre-planned using C.S. Smith Design software. Positional data were recorded using a Novatel Prolog NR50101 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 postscript plot files, which were plotted using Fugro's HP DesignJet colour plotters.

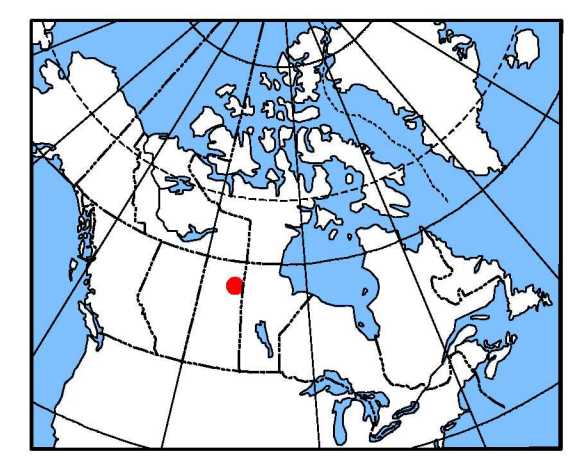
PLANIMETRIC SYMBOLS



NATIONAL TOPOGRAPHICAL SYSTEM REFERENCE AND GEOPHYSICAL MAP INDEX

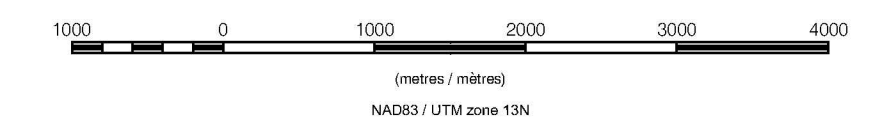
Recommended citation:
Ford, K.L., Carson, J.M., Dumont, R., Povich, J., Shives, R.B.K., Delaney, G. and Sillimon, W.
2005. Geophysical Series - NTS 64L/11 - Killock Bay, Saskatchewan.
Geological Survey of Canada Open file 4876.
Saskatchewan Industry and Resources Open file 2005-30
Scale: 1:50 000.

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



**GEOPHYSICAL SERIES - 64L/11 - KILLOCK BAY
SASKATCHEWAN
TERNARY RADIOELEMENT MAP**

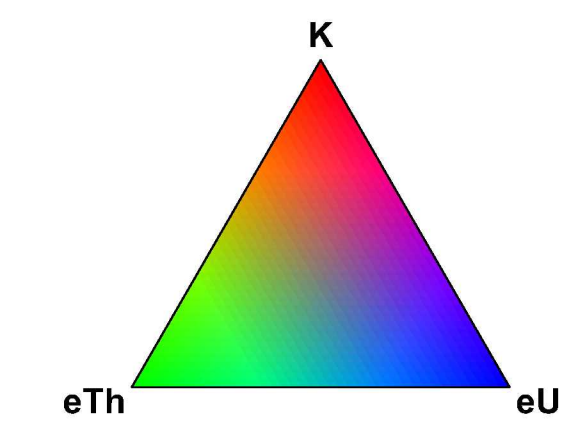
Scale 1:50 000 - Échelle 1/50 000



UNIVERSAL TRANSVERSE MERCATOR PROJECTION
NAD83 / UTM zone 17N
PROJECTION TRANSVERSE UNIVERSALE DE MÉRIDIEN
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**TERNARY RADIOELEMENT MAP
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