

**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 Casper Grand Caravan 208 B aircraft C-50CA.

**Gamma-ray Spectrometric Data**

The airborne gamma-ray measurements were made with an Elicor/Ortec GR200 gamma-ray spectrometer using thinned  $102 \times 102 \times 406$  mm NaI (TI) crystals. The main detector array consisted of twelve crystals (total volume 50.4 litres). Three crystals (total volume 12.6 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  $^{40}\text{K}$ , whereas uranium and thorium are measured indirectly from gamma-ray photons emitted by daughter products ( $^{214}\text{Pb}$  for uranium and  $^{214}\text{Pb}$  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 ( $^{40}\text{K}$ ) 1370 - 1570 keV
- Uranium ( $^{238}\text{U}$ ) 1860 - 1960 keV
- Thorium ( $^{232}\text{Th}$ ) 2410 - 2510 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 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 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 90.5 cps/µg  
Uranium 11.4 cps/ppm  
Thorium 5.7 cps/ppm

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 terrain, 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 determined from measured counts between 400 and 2610 keV.

**Magnetic Data**

The Grand Caravan aircraft was equipped with a Scribner 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 interference caused by aircraft maneuvers were compensated using an RMS AACDI Magnetic compensator. Diurnal variations were recorded using a Fugro CF-1 cesium vapour magnetometer.

After editing the survey data, low pass filtered diurnal readings were subtracted from each unfiltered geomagnetic reading. 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 Field was calculated and removed using a field date (20040815) 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 total 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 G.S.C. Smooth Drone software. Positional data were recorded using a Novatel ProPak 4000/101 GPS ground station data were combined with geotagging 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**

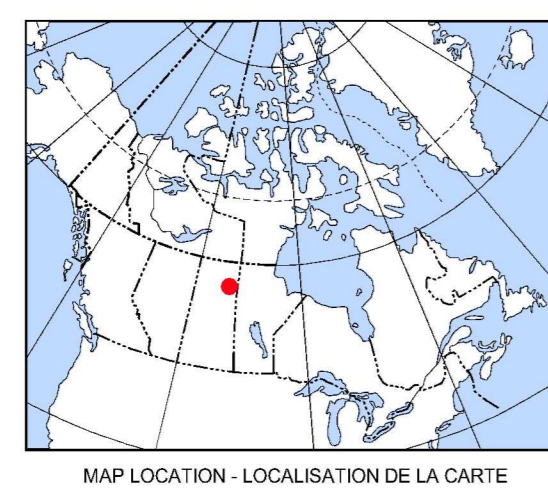
- Topographic Contour
- Railway
- Power lines
- Drainage
- Roads
- Flight lines, 95.0m

**Positional Data**

**NATIONAL TOPOGRAPHICAL SYSTEM REFERENCE AND GEOPHYSICAL MAP INDEX**

Recommended citation:  
Ford, K.L., Carson, J.M., Dumont, R., Potvin, J., Shives, R.B.K., Delaney, G., and Slimmon, W.  
2005. Geophysical Series: NTS 64L/10 - Wellbelove Bay, Saskatchewan.  
Geological Survey of Canada Open file 4875.  
Saskatchewan Industry and Resources Open file 2005-29  
Scale 1:50 000

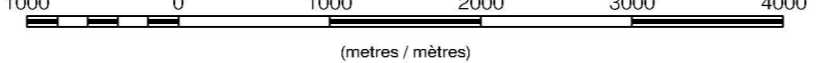
This airborne geophysical survey and the production of this map were funded by the Government of Saskatchewan's Mineral Exploration Incentive Program



**GEOPHYSICAL SERIES - 64L/10 - WELLBELOVE BAY  
SASKATCHEWAN**

**THORIUM MAP**

Scale 1:50 000 - Échelle 1/50 000



UNIVERSAL TRANSVERSE MERCATOR PROJECTION  
NAD 83 / UTM zone 12N  
PROJECTION TRANSVERSE UNIVERSELLE DE MERIDIEUN  
Système de référence géodésique nord-américain 1983  
© Her Majesty the Queen in Right of Canada 2005 © Sa Majesté la Reine en chef du Canada 2005  
Digitized topographic base information provided by Saskatchewan Industry and Resources.

**OPEN FILE DOSSIER PUBLIC 4875**  
2005  
SHEET 4 OF 10  
FEUILLE 4 OF 10

Open file are products that have not gone through the GSC formal publication process.  
Les documents publics sont des produits qui n'ont pas été soumis au processus officiel de publication de la GSC.

**SASKATCHEWAN INDUSTRY and RESOURCES**  
OPEN FILE 2005-29  
SHEET 4 OF 10

**THORIUM MAP  
WELLBELOVE BAY  
SASKATCHEWAN  
NTS 64L/10**