

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 a Cassin Grand Caravel 308 SR aircraft (C-308).

Gamma-ray Spectrometric Data

The airborne gamma-ray measurements were made with an EG&G ORTEC GR800 gamma-ray spectrometer using fifteen $102 \times 102 \times 406$ mm NaI (Tl) 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}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 denser than their parent 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 (^{214}Bi) 1860 - 1860 keV
- Thorium (^{208}Tl) 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 1860 - 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 variations in 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/ppm
- Uranium 11.4 cps/ppm
- Thorium 2.7 cps/ppm

Corrected data were filtered and interpolated to a 100 m grid for the 1:250 000 scale map and to a 50 m grid for a 1:500 000 scale map. The results of an airborne gamma-ray spectrometer survey represent the average surface concentrations that are influenced by varying amounts of organic 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 nanograms per hour was produced from measured counts between 400 and 2810 keV.

Magnetic Data

The Grand Caravel aircraft was equipped with a Scintrex CS-2 cesium vapour magnetic sensor mounted in a sledge 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 AADCII Magnetic compensator. Diurnal variations were recorded using a Fugro CF-1000 magnetic compensator.

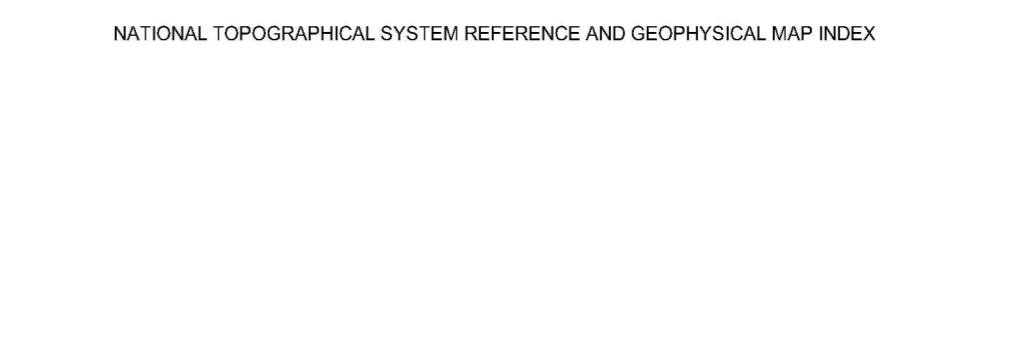
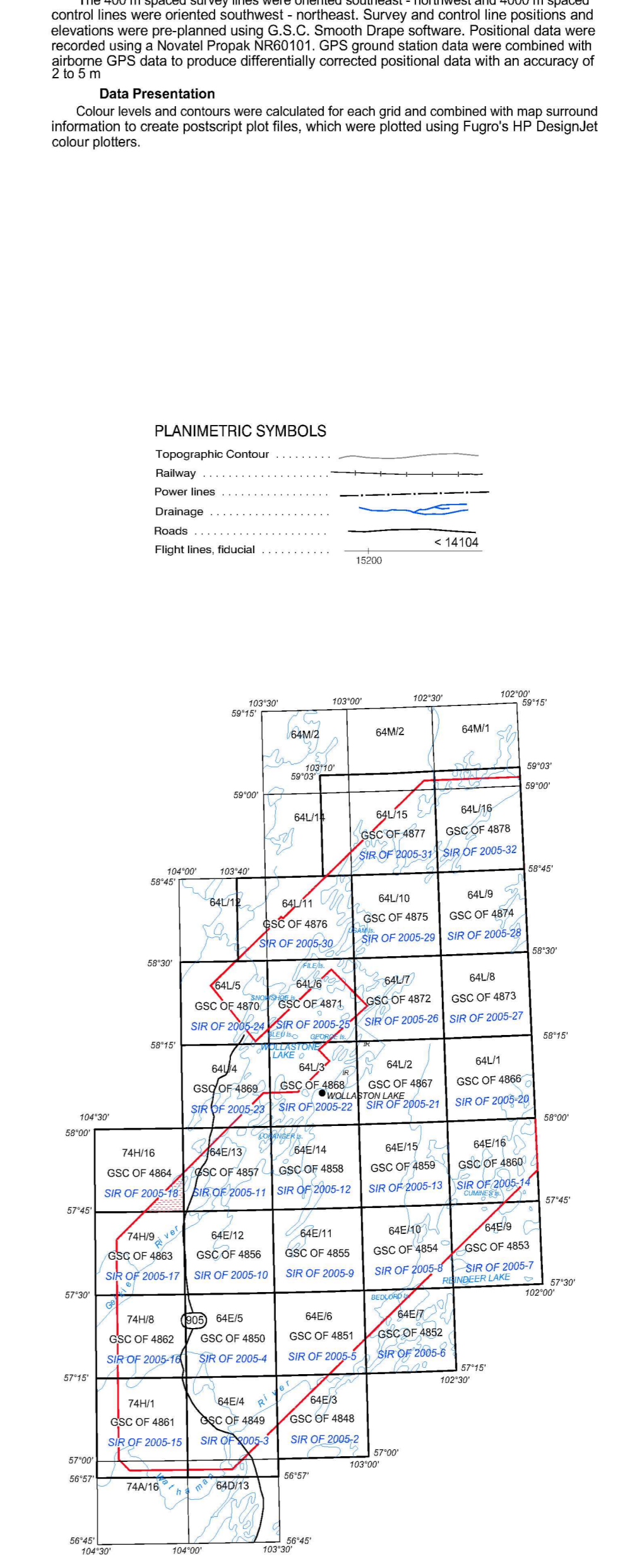
After editing the survey data, low pass filtered diurnal readings were subtracted from each unfiltered aeromagnetic reading. The intersections of traverse and control lines were determined and the differences in the magnetic values were computed, analyzed and manually verified to obtain the leveling correction. The International Geomagnetic Reference Field was calculated and removed using a field data (20040615) 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 final 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 southeast - northwest. Survey and control line positions and elevations were pre-planned using G.S.C. Smooth Drape software. Positional data were recorded using a Novatel Pospak NR60101. GPS ground station data were combined with ground GPS data to produce differentially corrected positional data with an accuracy of 2 to 5 m.

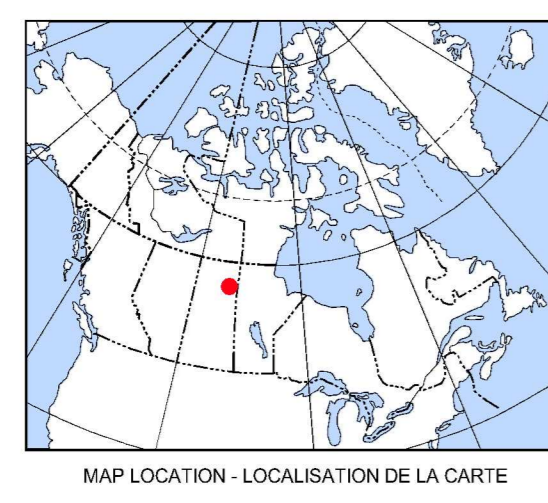
Data Presentation

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 Design/plot colour plotters.



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Geological Survey of Canada Open file 4864,
Saskatchewan Industry and Resources Open file 2005-18
Scale 1:50 000

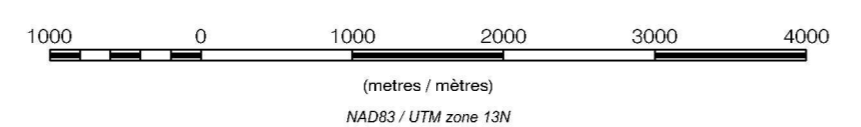
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GEOPHYSICAL SERIES - 74H/16 - POULTON LAKE
SASKATCHEWAN

THORIUM MAP

Scale 1:50 000 - Échelle 1/50 000



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THORIUM MAP

POULTON LAKE
SASKATCHEWAN

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