

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 440 aircraft.

Gamma-ray Spectrometric Data

The airborne gamma-ray measurements were made with an EpiGenium GR20 gamma-ray spectrometer using three 152 × 152 × 400 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 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): 1660 - 1860 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. Near Airborne Signature Analysis (NASA/US) analysis was carried out on the full spectrum 256 channel data to reduce statistical noise in the windows 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 1460 - 1860 keV window and radon at energies greater than 2020 keV was recorded in the cosmic window. The window counts were corrected for dead time, and for background activity from cosmic radon. The radioactivity of the aircraft and atmosphere radon decay products. The window data were then corrected for spectral scattering in the ground, air, and detector. 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: 0.83 cps/eU
Uranium: 1.14 cps/eU
Thorium: 0.7 cps/eTh

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 spectrometric 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 nanograms per hour was produced from measured counts between 400 and 2510 keV.

Magnetic Data

The Grand Caravan aircraft was equipped with a Scripps 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 read rate of 10 Hz. Magnetic references based on the International Geomagnetic Reference Field (IGRF) were used to correct the magnetic data. Diurnal variations were compensated using an RMS AADCI Magnetic compensator. Diurnal variations were determined using a Fugro CF-1 cesium vapour magnetometer.

After editing the survey data, low pass filtered diurnal readings were subtracted from each filtered aeromagnetic reading. The International Geomagnetic Reference Field was 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 (2004/08/15) 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 southwest - northeast. Survey and control line positions and elevations were pre-planned using G.S.C. Smooth Drape software. Positional data were recorded using a Novatel Promap 4600C1 GPS ground station data were combined with airborne GPS data to produce differentially corrected positional data with an accuracy of 2.0 ± 0.1 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.

ISOMAGNETIC LINES

- 500 nT
- 100 nT
- 5 nT
- Magnetic low

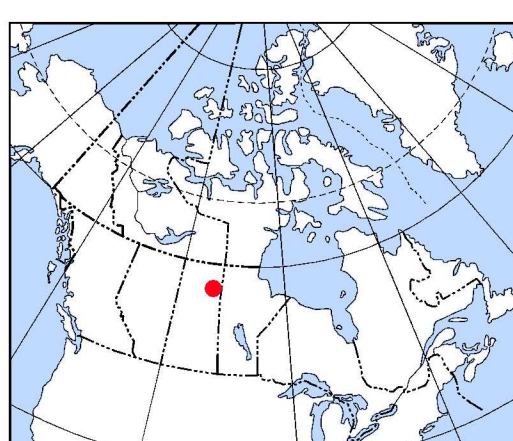
PLANIMETRIC SYMBOLS

- Topographic Contour
- Railway
- Power line
- Drainage
- Roads
- Flight lines, 600m/100m

NATIONAL TOPOGRAPHICAL SYSTEM REFERENCE AND GEOPHYSICAL MAP INDEX

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**GEOPHYSICAL SERIES - 64L/11 - KILLOCK BAY
SASKATCHEWAN
MAGNETIC ANOMALY MAP, RESIDUAL TOTAL FIELD**

Scale 1:50 000 - Échelle 1/50 000

Universal Transverse Mercator Projection
North American Datum 1983
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MAGNETIC ANOMALY MAP, RESIDUAL TOTAL FIELD

**KILLOCK BAY
SASKATCHEWAN
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