

An airborne geophysical survey of the Phelps Lake area, Saskatchewan, was flown by Sander Geophysical Limited (SGL) for the Geological Survey of Canada and Saskatchewan Energy and Mines. The purpose of the survey was to obtain gamma-ray spectrometric, aeromagnetic and VLF-EM data. The survey was flown between August 14 and September 7, 2001 using a Britten-Norman Islander (BN21) aircraft flying 120 m above the terrain at a mean speed of 220 km/h.

The 1000 m spaced, north-west-south-east oriented survey lines and orthogonal 10 000 m spaced control lines were planned using the SIGDrape system. In-flight control data were recorded as an on-board real time differential GPS system. GPS ground station data were combined with airborne GPS data to produce differentially corrected positional data with an accuracy of 1 to 2 m.

Potassium is measured directly from the 1460 keV gamma-ray photons emitted by <sup>40</sup>K. Uranium and thorium must be measured indirectly from gamma-ray photons emitted by daughter products (<sup>214</sup>Pb for uranium and <sup>214</sup>Pb for thorium). Gamma-ray spectrometric measurements of uranium and thorium are referred to as equivalent uranium (U<sub>eq</sub>) and equivalent thorium (Th<sub>eq</sub>).

The airborne gamma-ray measurements were made with an Extranuclear GR20 gamma-ray spectrometer using fourteen 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 from the ground by the main array, were used to detect variations caused by atmospheric radon. The GR20 constantly monitored the natural potassium peak for each crystal, using a Gaussian least squares algorithm to adjust the gain for individual crystals.

Gamma-ray spectra were recorded at one-second intervals. Noise Adjusted Singular Value Decomposition (NASVD) analysis was carried out on 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 six energy windows. Counts from the radon detectors were recorded in a 1600 - 1800 keV window and radon at energies greater than 1900 keV were recorded in the cosmic window. The standard windows used are 1370 - 1570 keV for potassium, 1660 - 1860 keV for uranium, 2410 - 2810 keV for thorium and 400 - 2810 keV for total activity data.

All window counts were corrected for dead time. The standard windows were corrected for background activity from cosmic radiation, the radioactivity of the aircraft and atmospheric radon decay products. The potassium, uranium and thorium window data were then corrected for spectral scattering in the ground, air and detectors. The four standard windows were corrected for deviations of altitude from the planned terrain clearance and for variations of temperature and pressure prior to conversion to standard units. The conversion factors used were 102.3 cps% for potassium, 1660 - 1860 keV for uranium, 9.75 cpsppm for thorium and 33.26 cps%<sup>U<sub>eq</sub></sup> for total air absorbed dose rate.

Corrected data were filtered and interpolated to a 200 m grid for the 1:250 000 and 1:500 000 scale maps using a minimum curvature algorithm technique. 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 aircraft was equipped with a Geometrics G-822A cesium vapour magnetic sensor mounted in a stinger to the rear of the aircraft, connected to an RMS AADCII 27 term magnetic compensator installed in a microcomputer. The magnetometer data were recorded every 0.1 seconds with a noise level of less than 0.1 nT. Diurnal variations were monitored at 0.2 second intervals using a Geometrics cesium vapour base station magnetometer. After editing the survey data, low pass filtered diurnal data were used to correct for diurnal variations. The information Geomagnetic Reference Field was calculated and removed using the date and altitude for each data point. The intersections of traverse and control line were determined and differences in the magnetic values were computer analyzed and manually verified to obtain the leveled network. The corrected magnetic data were interpolated to a 200 m grid for the 1:250 000 and 1:500 000 scale maps using a minimum curvature algorithm with grid level reinterpolation. The magnetic intensity grid was calculated from total magnetic intensity grid using an FFT based algorithm.

VLF total field and quadrature components for two frequencies were recorded using a Herz Totem 2A system. The line station was tuned to station NAA at Cutler, MA, transmitting at 24.0 kHz. The other station was tuned to the 24.8 kHz station NLK at Seattle, WA. VLF data were recorded 4 times per second. VLF data will only be made available with the digital data.

Colour levels were calculated for each grid and combined with map surround information to create an RTL plot file, which was plotted using an HP DesignJet 2000PC colour plotter.

**LEGEND / LÉGENDE**

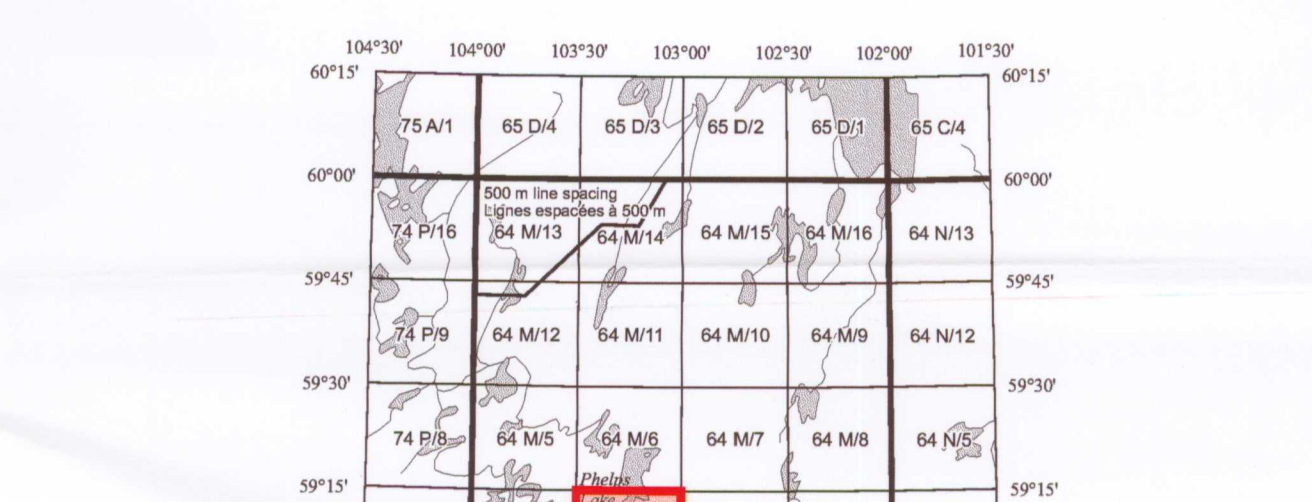
- Welland / Marais
- Lake / Lac; Intermittent
- Watercourse / Cours d'eau
- Flooded area / Région inondée
- Esker / Esker
- Elevation contour / Courbes d'élévation
- Depression contour / Courbes de dépression
- Flight Line / Ligne de vol

Digital cartographic base information supplied by Information Services Corporation of Saskatchewan. Elevation contour interval 10 metres.

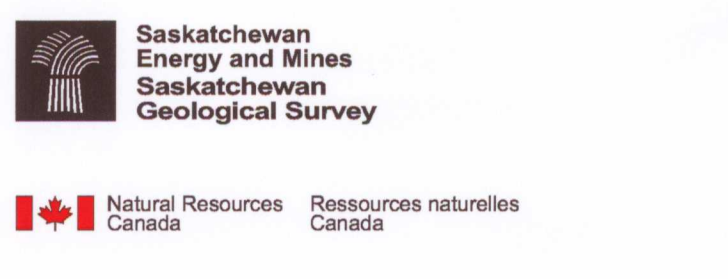
L'information cartographique numérique a été fournie par Information Services Corporation of Saskatchewan. Équidistance des courbes d'élévation 10 mètres.

**Recommended citation:**  
Carson J.M., Holman P.B., Shives R.B.K., Ford K.L., Harper C.T., Slimmon W., 2001; Magnetic First Vertical Derivative Map, Bickerton Lake, Saskatchewan; NTS 64M/3, Geological Survey of Canada, Open File 3951\_30, Scale 1:50 000

**Notation bibliographique conseillée:**  
Carson J.M., Holman P.B., Shives R.B.K., Ford K.L., Harper C.T., Slimmon W., 2001; Carte de la dérivée première verticale du champ magnétique, Bickerton Lake, Saskatchewan; SNRC 64M/3, Commission géologique du Canada, Dossier Public 3951\_30, Echelle 1/50 000

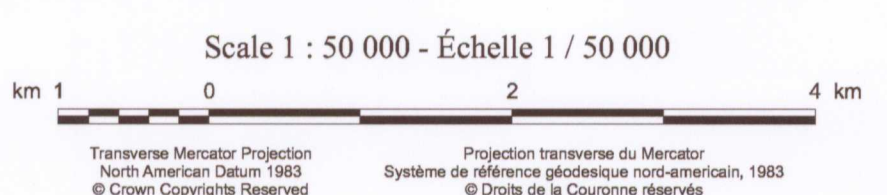


Project funded by Geological Survey of Canada through the Targeted Geoscience Initiative and by Saskatchewan Northern Affairs. Ce projet a été financé par la Commission géologique du Canada par l'entremise de l'Initiative géoscientifique ciblée et aussi financé par Saskatchewan Northern Affairs.



MAGNETIC FIRST VERTICAL DERIVATIVE MAP  
CARTE DE LA DÉRIVÉE PREMIÈRE VERTICALE DU CHAMP MAGNÉTIQUE

BICKERTON LAKE  
SASKATCHEWAN  
NTS / SNRC 64M/3



Open File  
Dossier Public  
**3951\_30**  
Geological Survey of Canada  
Commission géologique du Canada  
Ottawa  
2001

SEM Open File 2001-2  
Map 30 of 160

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