

An airborne geophysical survey of the Uranium City area, Saskatchewan, was flown by Sander Geophysics 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 data. The survey was flown between September 8 and October 10, 2000 using a Britten-Norman Islander BN22-21 aircraft flying 120 m above the terrain at a mean speed of 220 km/h.

The 500 m spaced survey lines and orthogonal 7000 m spaced control lines were planned using the SIGRAPS system. The survey was divided in two adjacent blocks. Survey lines in the northwest block were oriented north-south, while in the southeast block, survey lines were oriented southeast-northwest. In-flight positional data were recorded using an Omnistar 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 1.2 m.

Potassium is measured directly from the 1460 keV gamma-ray photons emitted by ⁴⁰K. Uranium and thorium must be measured indirectly from gamma-ray photons emitted by daughter products (²¹⁴Pb for uranium and ²¹⁴Pb 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 (eU) and equivalent thorium (eTh).

The airborne gamma-ray measurements were made with an Explorer GR20 gamma-ray spectrometer using fourteen 102 x 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 by reducing statistical noise in the raw data. Energy calibration and 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 counts were recorded in a 2000 keV window. The standard windows used are 1370 - 1570 keV for potassium, 1660 - 1860 keV for uranium, 2410 - 2610 keV for thorium and 400 - 2810 keV for total activity data.

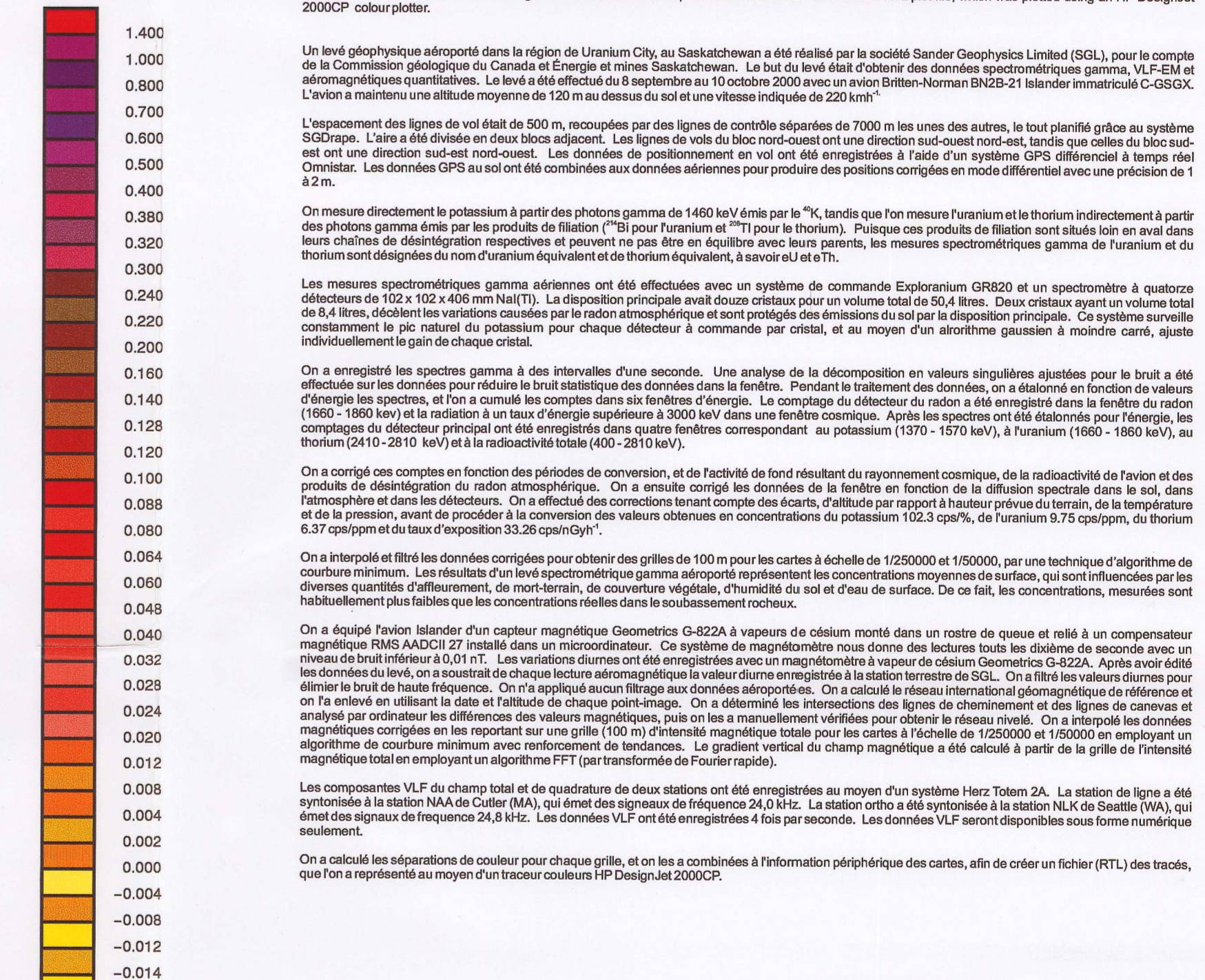
All window counts were corrected for dead time. The standard windows were corrected for background activity from cosmic radiation, the radioactivity of the aircraft and atmospheric radon decay products. The potassium, uranium and thorium window data were then corrected for spectral scattering in the ground, air and detectors. The four standard windows were corrected for deviations of altitude from the planned terrain clearance and for variation of temperature and pressure prior to conversion to standard units. The conversion factors used were 102.3 cps/eU for potassium, 8.75 cps/eU for uranium, 8.37 cps/eU for thorium and 33.26 cps/eU for total activity data.

Corrected data were filtered and interpolated to a 100 m grid for the 1:250 000 and 1:50 000 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 slipper to the rear of the aircraft, connected to an RMS AADCII 27 bit magnetic compass 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 values were subtracted from the unfiltered magnetometer data. The International Geomagnetic Reference Field was calculated and removed using the date and altitude for each data point. The intersections of traverse and control lines were determined and the differences in the magnetic values were computer analysed and manually verified to obtain the leveled network. The corrected magnetic data were interpolated to a 100 m grid for the 1:250 000 and 1:50 000 scale maps using a minimum curvature algorithm with grid trend reinforcement. The vertical gradient of the magnetic field was calculated from the total magnetic intensity grid using a FFT based method.

VLF total field and quadrature components for two frequencies were recorded using a Herz Tolem 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 RTI plot file, which was plotted using an HP DesignJet 2000CP colour plotter.



LEGEND / LÉGENDE

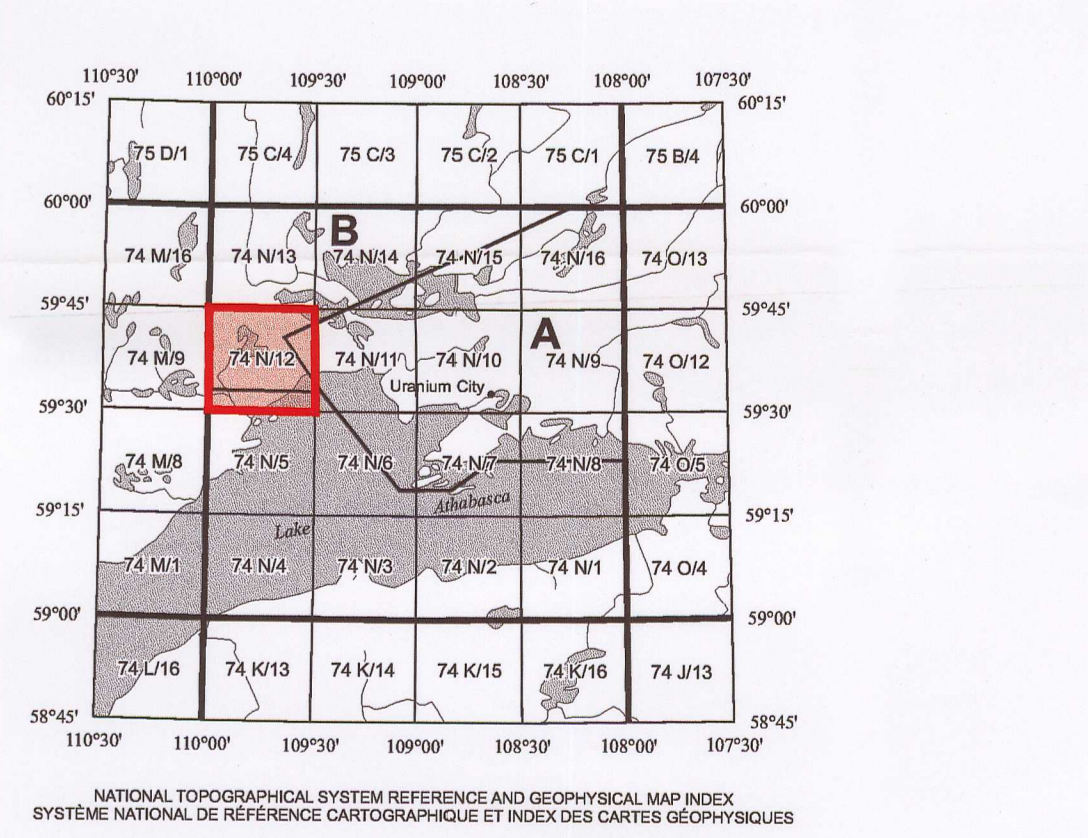
Road / Chemin	.....	Welland / Marais	
Cart track / Chemin de terre	.....	Lake / Lac; Intermittent	
Trail / Sentier	.....	Watercourse / Cours d'eau	
Power transmission line / Ligne électrique	.....	Flooded area / Région inondée	
Runway / Piste d'atterrissage	.....	Esker / Esker	
Bridge / Pont	.....	Sand / Sable	
Built-up area / Agglomération	.....	Elevation contour / Courbes d'élévation	
Man-made feature / Trait anthropologique	.....	Depression contour / Courbes de dépression	
Building / Bâtiment	.....	Flight Line / Ligne de vol	
Dam / Barrage	.....	

Digital cartographic base information supplied by Information Services Corporation of Saskatchewan.
Élévation contour interval 15 metres.

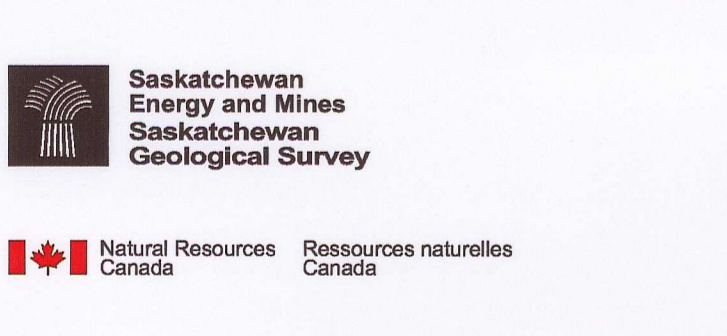
Information cartographique numérique a été fournie par Information Services Corporation of Saskatchewan.
Équidistance des courbes d'élévation 15 mètres.

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Carson J.M., Holman P.B., Shives R.B.K., Ford K.L., Ashton K., Slimmon W., 2001. Magnetic First Vertical Derivative Map, Harper Lake, Saskatchewan; NTS 74N/12, Geological Survey of Canada, Open File 3853_70, Scale 1:50 000

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

HARPER LAKE
SASKATCHEWAN
NTS / SNRC 74N/12

Open File
Dossier Public
3953_70
Geological Survey of Canada
Commission géologique du Canada
Ottawa
2001

SEM Open File 2001-4
Map 70 of 110



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