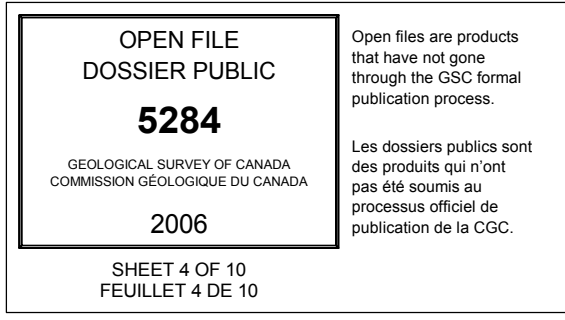
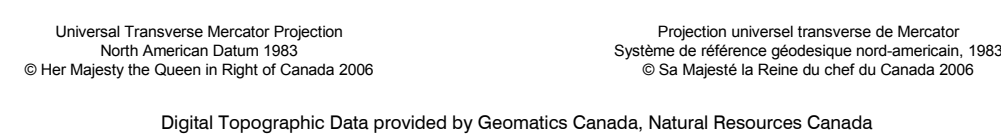


## THORIUM



## THORIUM

93N/6, 93N/7, 93N/10, 93N/11



In 2004 and 2005, Puget Airborne Surveys completed nine multi-sensor airborne geophysical surveys in the central region of British Columbia for the Geological Survey of Canada, the British Columbia and Yukon Chamber of Mines, Yekochie First Nation, and five industry partners, including Serengeti Resources Inc., Yarrowee Hot Minerals Ltd., Richfield Ventures Corp., GWR Resources Inc. and the Geological Survey of Canada. The surveys were conducted using a survey aircraft equipped with a magnetometer, a gamma-ray spectrometer, a laser altimeter, and a global positioning system (GPS) to provide accurate geographic data. The purpose of the surveys was to obtain quantitative gamma-ray spectrometric and aeromagnetic data. The surveys were flown over two seasons, from September 18 to November 17, 2004 and June 15 to August 5, 2005 using ASAR 350-82 and 350-83 helicopters, C-GREL and C-PGSC.

The airborne gamma-ray measurements were made with an Eplanorcan GR820 gamma-ray spectrometer using nine 102 × 102 × 406 mm NaI(Tl) crystals. The main detector array consisted of eight crystals arranged in a 2 × 4 grid, with a ninth crystal mounted below the center of the array, was used to detect variations in background radiation caused by atmospheric radon. The system continuously monitored the natural potassium 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 emission at 40K, whereas uranium and thorium are measured indirectly by gamma-ray photons emitted by daughter products [2148]. Potassium is measured for 200 s, although these durations are far from their respective decay chains, they are assumed to be in equilibrium with their parents; thus gamma-ray activity is proportional to the parent activity. The energy crystal used to measure potassium is an equivalent thorium, i.e.  $\text{LaBr}_3$  and  $\text{CeBr}_3$ . The energy crystal used to measure potassium, uranium and thorium are:

Potassium ( $^{40}\text{K}$ ) 1360 - 1560 keV  
Uranium ( $^{234}\text{Bi}$ ) 1660 - 1860 keV  
Thorium ( $^{208}\text{Tl}$ ) 2410 - 2810 keV

Gamma-ray spectra were recorded at one-second intervals at a planned terrain clearance of 1200 m or 50 m depending on the survey area and an air speed of 125 km/h. The total, potassium, uranium and thorium window counts were derived from the recorded 256 channel spectra. During post-flight processing, spectra were energy calibrated and the background was subtracted using the methods described above. Counts from window detectors were recorded in a 1600 - 1800 keV range to detect 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 converted to activity concentrations of potassium, uranium and thorium, using the known 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 57.3 cps/% (2004) 56.9 cps/% (2005)  
Uranium 6.7 cps/ppm (2004) 8.4 cps/ppm (2005)  
Thorium 3.8 cps/ppm (2004) 3.7 cps/ppm (2005)

Corrected data were fitted and interpolated to a 100m grid for the 1:250 000 scale maps and to a 50m grid for the 1:20 000 and 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 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 absorbed dose rate in nanograys per hour was produced from measured counts between 410 and 2810 keV.

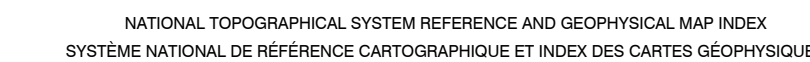
The helicopter was equipped with a Sointrex CS-2 cesium vapour magnetic sensor mounted in a HMI high-resolution single sensor stinger mounted system. The system recorded readings every 0.1 seconds with a noise level of less than 0.01 nT. Magnetic interferences caused by aircraft maneuvers were compensated using an RMS AADCII Magnetic compensator. Diurnal variations and GPS fluctuations were recorded using a Fugro CF1 base station.

After editing the survey data, 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 Reference Field was calculated and removed using a fixed date of August 6, 2005 and an altitude of the differentially corrected GPS height for each data point. The corrected magnetic data was interpolated to a 50m 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.

Line spacing and direction for survey and control lines were selected for each block to ensure the best intersection of local geological features. Terrain clearance was monitored by radar altimeter. Positional data were recorded using a dual frequency Novatel Millennium system. GPS groundstation data were combined with airborne 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 HP DesignJet colour plotters.



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Geological Survey of Canada, Open File 6284;  
scale 1:50 000.

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