



In 2004 and 2005, Fugro 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, Yokeoche First Nation, and five private partners, including Geonorges Resources Inc., Yanket Hax Minerals Ltd., Richfield Ventures Corp., GWR Resources Inc. and Amarc Resources Ltd. The Geological Survey of Canada provided survey supervision and quality control. The purpose of the surveys was to obtain quantitative magnetic, 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 8, 2005 using AS18 350-82 and 350-83 helicopters. C-GEOL and C-FGSC.

**Gamma-ray Spectrometric Data**

The airborne gamma-ray measurements were made with an Explorerium GR600 gamma-ray spectrometer using nine 102 × 150 × 406 mm NaI (Tl) crystals. The main detector array consisted of eight crystals (total volume 32.6 L). One crystal (total volume 4.2 L), shielded by the main array, was used to detect variations in background radiation caused by atmospheric radon. The system continuously monitored the natural potassium peaks 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  $^{40}\text{K}$ , whereas uranium and thorium are measured indirectly via their gamma-ray photons emitted by daughter products ( $^{214}\text{Pb}$  for uranium and  $^{208\text{Tl}}$  for thorium). Although these daughters are far down their respective decay chains, they are assumed to be in equilibrium with their parents; thus gamma-ray emission is proportional to the amount of parent present. This assumption is referred to as secular equilibrium. In  $\mu\text{eU/g}$  and  $\mu\text{eTh/g}$  the energy windows used to measure potassium, uranium and thorium are:

Potassium ( $^{40}\text{K}$ ) 1360 - 1560 keV  
 Uranium ( $^{234}\text{Bq}$ ) 1860 - 1880 keV  
 Thorium ( $^{230}\text{Th}$ ) 2410 - 2510 keV

Gamma-ray spectra were recorded at one-second intervals at a planned in-plane clearance of 100cm or 90cm depending on the survey area and an air speed of 125km/h. The total potassium, uranium and thorium window counts were derived from the recorded 256 channel spectra. During processing, the spectra were energy calibrated, and counts were accumulated into the window energy bins. The total window counts were corrected for background and the resulting 1560-1580 keV window counts were corrected for dead time, and for background activity from cosmic radiation, the activity of the aircraft and atmospheric radon decay products. The window data were then converted to activity concentrations of potassium, uranium and thorium. The effect of altitude from the planned 'normal' detector and for variation of temperature and pressure were determined 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 3.6 cps/ppm (2004) 3.7 cps/ppm (2005)

Corrected data were filtered and interpolated to a 100m grid for the 1:250 000 scale maps and to a 50m grid for the 1:200 000 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 air absorbed dose rate in nanograys per hour was produced from measured counts between 410 and 2810 keV.

**Magnetic Data**  
The helicopter was equipped with a Scintrex CS-2 cesium vapour magnetic sensor mounted in a HM1 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 aural maneuvers were compensated using an RMS AACII Magnetic compensator. Diurnal variations and GPS fluctuations were recorded using a Fuoro 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 2, 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.

**Positional Data**  
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.

