

This airborne geophysical survey and the production of this map were funded by the Saskatchewan Ministry of Energy and Resources and the GEM-Energy Program of the Earth Sciences Sector, Natural Resources Canada.

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MAP LOCATION - LOCALISATION DE LA CARTE

GSC OPEN FILE 6369 / DOSSIER PUBLIC 6369 DE LA CGC  
SMER OPEN FILE 2010-23

GEOPHYSICAL SERIES / SÉRIE DES CARTES GÉOPHYSIQUES  
AIRBORNE GEOPHYSICAL SURVEY OF THE EASTERN ATHABASCA BASIN, SASKATCHEWAN  
LEVÉ GÉOPHYSIQUE AÉROPORTÉ DE LA PARTIE EST DU BASSIN ATHABASCA, SASKATCHEWAN

NTS 74 I/08 Henday Lake / SNRC 74 I/08 Henday Lake

URANIUM / THORIUM

Scale 1:50 000 - Échelle 1/50 000

Authors: Buckle, J.L., Coyle, M., Kiss, F., Carson, J.M., Delaney, G. and Hefford, S.W.

Data acquisition, compilation and map production by Goldak Airborne Surveys, Saskatoon, Saskatchewan. Contract and project management by the Geological Survey of Canada, Ottawa, Ontario.



Scale 1:50 000 - Échelle 1/50 000

Digital versions of this map, corresponding digital profile and gridded data, and similar data for adjacent aeromagnetic and gamma-ray spectrometry surveys can be downloaded, at no charge, from Natural Resources Canada's Geoscience Data Repository at <http://gdr.nrcan.gc.ca>. The same products are available, for a fee, from the Geophysical Data Centre, Geological Survey of Canada, 615 Booth Street, Ottawa, Ontario, K1A 0E9. Telephone: (613) 995-5326, email: [info@geog.nrcan.gc.ca](mailto:info@geog.nrcan.gc.ca).

On peut télécharger gratuitement, depuis la section sur les Données géoscientifiques de Ressources naturelles Canada à l'adresse Web <http://gdr.nrcan.gc.ca>, des versions numériques de cette carte, des données numériques correspondantes en format profil et en format grille, ainsi que des données similaires issues des levés aéromagnétiques et spectrométriques adjacents. On peut se procurer les mêmes produits, moyennant des frais, en s'adressant au Centre de données géophysiques de la Commission géologique du Canada, 615, rue Booth, Ottawa (Ontario) K1A 0E9. Téléphone: (613) 995-5326, courriel: [info@geog.nrcan.gc.ca](mailto:info@geog.nrcan.gc.ca).

Acquisition, la compilation des données ainsi que la production des cartes furent effectuées par Goldak Airborne Surveys, Saskatoon, Saskatchewan. La gestion et la supervision du projet furent effectuées par la Commission géologique du Canada, Ottawa, Ontario.

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Digital topographic data provided by Geomatics Canada, Natural Resources Canada, Ressources naturelles Canada.

Quantitative gamma-ray spectrometric and aeromagnetic airborne geophysical survey of the Eastern Athabasca Basin, Saskatchewan, was completed by Goldak Airborne Surveys. The survey was flown from June 9th to August 11th, 2009 using three Piper PA-31 Navajo aircrafts (C-GJBA, C-GJBB and C-GJBC). The nominal terrain and control line spacings were, respectively, 400 m and 2400 m, and the aircraft flew at a nominal terrain clearance of 120 m an air speed between 200 and 270 km/h. Traverse lines were oriented 135° with orthogonal control lines. The flight path was recovered following post-flight differential corrections to raw data recorded by a Global Positioning System.

The airborne gamma-ray measurements were made with Radiation Solutions RS-500 gamma-ray spectrometers 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 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 <sup>40</sup>K, whereas uranium and thorium are measured indirectly from gamma-rays emitted by daughter products (Bi-214 for uranium and Th-232 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 spectrometric measurements of uranium and thorium are referred to as equivalent thorium, U<sub>eq</sub> and Th<sub>eq</sub>. The energy windows used to measure potassium, uranium and thorium are, respectively: 1370–1570 keV, 1660–1860 keV, and 2410–2810 keV.

Gamma-ray spectra were recorded at one-second intervals. During processing, the spectra were energy calibrated, and the counts were accumulated into the windows described above. Counts from the radon detectors were recorded in a 1660–1860 keV window and radon at energies greater than 3000 keV was recorded in the cosmic window. The window counts were corrected for dead time, background activity from cosmic radiation, reactivity of the aircraft and atmospheric radon decay products. The window data were then corrected for spectral scattering in the ground, air and detectors. Corrections for deviations 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 the Danielson, Saskatchewan calibration range. The factors for potassium, uranium, and thorium are listed in Table 1.

	C-GJBA	C-GJBB	C-GJBC
Potassium (cps/kV)	82.22	81.81	79.37
Uranium (cps/ppm)	11.95	12.11	12.38
Thorium (cps/ppm)	5.15	5.03	4.96

Tableau 1. Sensibilités des spectromètres gamma pour chaque avion.

Corrected data were filtered and interpolated to a 100 m grid interval. 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 concentrations. The total air absorbed dose rate in nanograys per hour was produced from measured counts between 400 and 2810 keV.

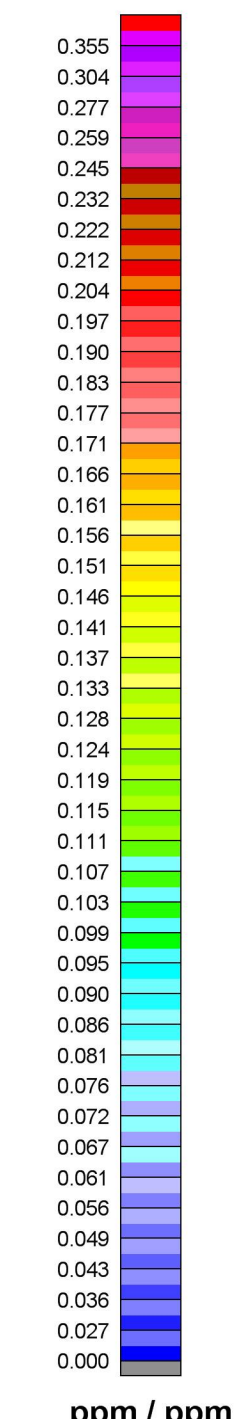
Magnetic Data

The magnetic field was sampled 10 times per second using a split-beam cesium vapour magnetometer (sensitivity = 0.005 nT) rigidly mounted to the aircraft. Differences in magnetic values at the intersections of control and traverse lines were computer-analysed to obtain a mutually levelled set of flight-line magnetic data. The levelled values were then interpolated to a 100 m grid. The International Geomagnetic Reference Field (IGRF) defined as the average GRS altitude of 566 m for the year 2005.53 was then removed (the IGRF representing the magnetic field of the Earth's core, produces a residual component related essentially to magnetizations within the Earth's crust).

The first vertical derivative of the magnetic field is the rate of change of the magnetic field in the vertical direction. Computation of the first vertical derivative removes long-wavelength features of the magnetic field and significantly improves the resolution of closely spaced and superposed anomalies. A property of first vertical derivative maps is the coincidence of the zero-value contour with vertical contacts at high magnetic latitudes (Hood, 1965).

References/Références

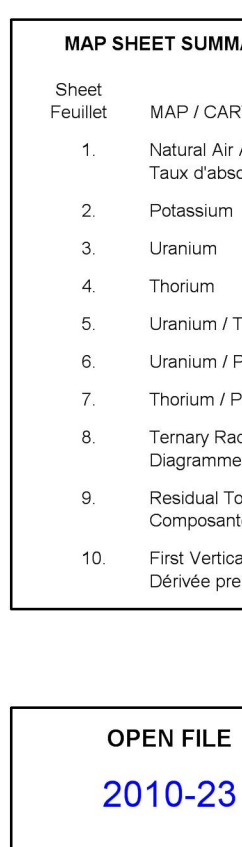
Hood, P.J. 1965. Gradient measurements in aeromagnetic surveying. *Geophysics*, 30, p. 891-902.



PLANIMETRIC SYMBOLS  
Drainage  
Highway  
Flight line

SYMBOLS PLANIMÉTRIQUES  
Drainage  
Autoroute  
Ligne de vol

NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND GEOPHYSICAL MAP INDEX  
Système national de référence cartographique et index des cartes géophysiques



MAP SHEET SUMMARY / SOMMAIRE DES FEUILLETS

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1	Natural Air Absorbed Dose Rate Taux d'absorption naturel des ions gamma dans l'air
2	Potassium
3	Uranium
4	Thorium
5	Uranium / Thorium
6	Uranium / Potassium
7	Thorium / Potassium
8	Terrary Reassignment Map Diagramme ternaire des réaffectations
9	Residual Total Magnetic Field Composante résiduelle du champ magnétique total
10	First Vertical Derivative of the Magnetic Field Dérivée première verticale du champ magnétique

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SHEET 5 OF 10  
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