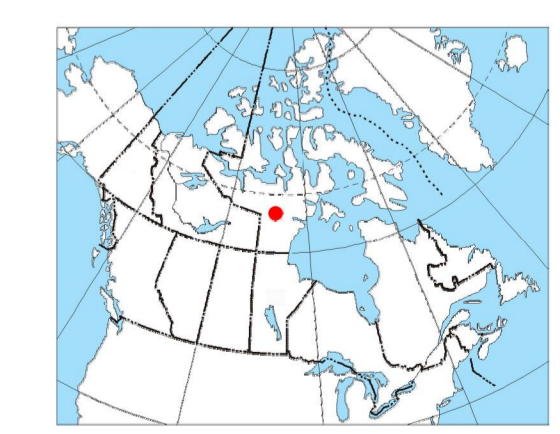


Funding for this project was provided through the Strategic Investments in Northern Economic Development (SINED) program of Indian and Northern Affairs Canada and the Geomagnetic and Energy and Minerals (GEM) program of the Earth Sciences Sector, Natural Resources Canada. Project management and data quality control procedures were carried out by the Geological Survey of Canada (GSC) under the GEM program.

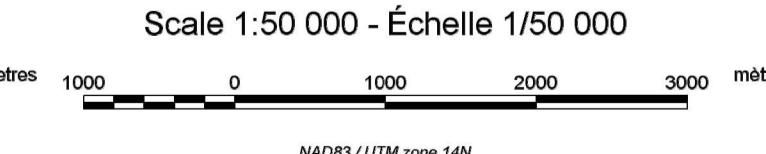
Ce projet est financé par le programme des Investissements stratégiques dans le développement économique du Nord (SINED) Affaires indiennes et du Nord Canada et le programme Géomagnétique et l'énergie et des minéraux (GEM) du Secteur des sciences de la Terre et des Ressources naturelles Canada. La Commission géologique du Canada (CGC) a assuré la gestion du projet et le contrôle de la qualité des données dans le cadre du programme GEM.



GSC OPEN FILE 6529 / DOSSIER PUBLIC 6529 DE LA CGC GEOPHYSICAL SERIES / SÉRIE DES CARTES GÉOPHYSIQUES AIRCORNE GEOPHYSICAL SURVEY OF THE NORTHEAST THELON BASIN, NUNAVUT LEVÉ GÉOPHYSIQUE AÉROPORTE DE LA PARTIE NORD-EST DU BASSIN DE THELON, NUNAVUT

NTS 66 H/10 and 66 H/11 / SNRC 66 H/10 et 66 H/11

NATURAL AIR ABSORBED DOSE RATE TAUX D'ABSORPTION NATUREL DES RAYONS GAMMA DANS L'AIR



Authors: Harvey, B.J.A., Coyle, M., Buckle, J.L., Carson, J.M. and Hefford, S.W.

L'aquisition, la compilation des données ainsi que la production des cartes furent effectuées par Géosciences Airborne, Saskatoon, Saskatchewan. La pression et la supervision du projet furent effectuées par la Commission géologique du Canada, Ottawa, Ontario.



NORTHEAST THELON BASIN GEOPHYSICAL SURVEY, NUNAVUT

Introduction

A gamma-ray spectrometric and aeromagnetic airborne geophysical survey of the northeast Thelon Basin area, Nunavut, was completed by Geotek Airborne Surveys, Inc. between June 2009 and September 2009. The survey was flown on a fixed-wing aircraft (Boeing Stearman) flying at a constant altitude of 125 m at an aspect between 300 and 270 km. The survey was flown on a pre-determined flight surface to minimize differences in magnetic values at the intersections of control and traverse lines.

Gamma-ray Spectrometric Data

The airborne gamma-ray measurements were made with a Radiation Solutions RS-500 gamma-ray spectrometer using fourteen 102x102x406 mm NaI(Tl) crystals. The main detector array consisted of twelve crystals (total volume 4.8 litres) arranged in two columns by the main array, were used to detect variations in background radiation caused by atmospheric radon. The system assembled 1024 channel spectra from the individual NaI(Tl) detectors with no loss of Poisson statistics. Spectrum normalizations are accomplished by dividing the recorded spectra by several natural gamma-ray peaks.

Potassium is measured directly from the 1460 keV gamma-ray photons emitted by ⁴⁰K, whereas uranium and thorium are measured indirectly from gamma-ray photons emitted by daughter products (²¹⁴Pb for uranium and ²¹⁴Pb and ²¹⁴Bi 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 an equivalent uranium and equivalent thorium. Uranium and thorium are measured using energy windows used to measure potassium, uranium and thorium are, respectively, 1370-1570 keV, 1660-1960 keV, and 2410-2810 keV.

Gamma-ray spectra were recorded at one-second intervals. Data processing followed standard procedures as described in IAEA 1991 and IAEA 2003. During processing, the spectra were energy calibrated, and counts were accurate to the window described above. Counts from the radon detectors were recorded in a 1600 x 1600 keV window and radon at energies greater than 2000 keV was recorded in the cosmic window. The window counts were corrected for dead time, background activity from cosmic radon, and activity 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 variations of temperature and pressure were made prior to conversion to ground concentrations of potassium, uranium and thorium, using factors determined from flight over the Devonian, Saskatchewan test strip. The factors for potassium, uranium and thorium are listed in Table 1.

	C-GJBA	C-GJBB	C-GJBG
Potassium (cps/%)	62.22	61.61	79.37
Uranium (cps/ppm)	11.55	12.11	12.39
Thorium (cps/ppm)	5.15	5.03	4.98

Table 1. Gamma-Ray spectrometer sensitivities for each aircraft.

Corrected data were interpolated to a 100 m grid interval. The results of an airborne gamma-ray spectrometer survey represent the average surface concentrations of the 3 natural radionuclides, and are influenced by nature or overburden, presence of outcrops, vegetation cover, soil moisture and surface water. As a result the measured concentrations are usually lower than the actual bedrock concentrations.

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 analyzed 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) for the year 2005.4 was then removed. The residual of 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 emphasizes the magnetic field of crustal origin and is a useful tool for highlighting magnetic units and magnetic contacts. The coincidence of the zero-value contour with vertical contacts of magnetic units of high magnetic latitudes (Hood, 1965).

References

Geotek Airborne Surveys, Inc. 2009. Airborne gamma-ray spectrometry surveying. Technical Reports Series 323, IAEA, Vienna.
International Atomic Energy Agency, 1991. Airborne gamma ray spectrometry mapping using gamma ray spectrometry data. Technical Reports Series 363, IAEA, Vienna.
International Atomic Energy Agency, 2003. Guide lines for radionuclide mapping using gamma ray spectrometry data. Technical Reports Series 363, IAEA, Vienna.

PLANIMETRIC SYMBOLS / SYMBOLES PLANIMÉTRIQUES

Planimetric Symbols	Symboles Planimétriques
Drainage	Drainage
Flight line	Ligne de vol

NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND GEOGRAPHICAL MAP INDEX
SYSTÈME NATIONAL DE RÉFÉRENCE TOPOGRAPHIQUE ET INDEX DES CARTES GÉOGRAPHIQUES

MAP SHEET SUMMARY / SOMMAIRE DES FEUILLETS

Sheet	MAP SHEET
1.	Natural Air Absorbed Dose Rate Taux d'absorption naturel des rayons gamma dans l'air
2.	Potassium
3.	Cesium
4.	Thorium
5.	Uranium / Thorium
6.	Uranium / Potassium
7.	Thorium / Potassium
8.	Triaxial Radiometric Map Diagramme triaxial des radioéléments
9.	Radiometric Total Magnetic Field Composante totale du champ magnétique total
10.	First Vertical Derivative of the Magnetic Field Dérivée première verticale du champ magnétique

OPEN FILE DOSSIER PUBLIC 6529

Publication in this series
Documents de cette série
Ils sont révisés au besoin
et peuvent être révisés sans
avis préalable. Les autres
publications de cette série
peuvent être révisées sans
avis préalable.

2011

Feuille 1 de 10

Recommended citation:
Harvey, B.J.A., Coyle, M., Buckle, J.L., Carson, J.M., and Hefford, S.W., 2011.
Airborne Geophysical Survey of the Northeast Thelon Basin, Nunavut.
GSC Open File 6529.
Ottawa: Geological Survey of Canada, Open File 6529, 10 p.

National Information Systems
Harvey, B.J.A., Coyle, M., Buckle, J.L., Carson, J.M., and Hefford, S.W., 2011.
Données des cartes géophysiques
aériennes de la partie nord-est du bassin de Thelon, Nunavut.
Ottawa: Commission géologique du Canada, Dossier public 6529,
10 pages (100 000).