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GEOLOGICAL SURVEY OF CANADA | COMMISSION GÉOLOGIQUE DU CANADA

## DESCRIPTIVE NOTES

This Radioactivity Map of New Brunswick is one of eight 1:500 000 regional compilation maps that include three measured variables (potassium, equivalent uranium and equivalent thorium) and five derived products (the natural air absorbed dose rate derived from a linear combination of K, eU and eTh, and eU/eTh, eU/K, eTh/K and ternary radioelement map, (Broome et al., 1987)). These maps were produced using digital archives of the National Gamma Ray Spectrometry Program (NATGAM), from airborne surveys conducted between 1976 and 1999. The surveys were flown by the Geological Survey of Canada (GSC) and contractors for the GSC, as well as for provincial government funding. Most data were originally published as 1:50 000 line contour or colour interval maps and stacked profiles, as GSC Open Files or Geophysical Series Maps.

All reconnaissance (Figure 1) and regional (Provincial map) data were collected using 50 litres of sodium iodide detectors, at a nominal terrain clearance of 120 metres. Figure 1 is compiled from data collected along flight lines spaced 5000 metres apart, oriented northwest-southeast, with tie lines flown at 10 000 metre intervals. Six additional detailed airborne surveys were flown with flight lines spaced between 200 and 500 metres. The locations of these surveys are shown on the provincial map: A) Bathurst, B) Restigouche, C) Kedgewick, D) Holmes Lake, E) Mount Pleasant and F) Cape Spencer. The closer line spacing allows increased spatial resolution of radioactive element signatures, supporting more detailed interpretation. Figure 2 is compiled from the three detailed surveys flown in the Bathurst-Restigouche-Kedgewick areas. Figure 3 is compiled from the detailed Mount Pleasant database survey. Figure 1 and the provincial map display data using the same colour intervals. Figure 2 and 3 display data using independent colour intervals to support more detailed interpretation.

Potassium is measured directly from the 1460 keV gamma ray photons emitted by $^{40}K$. Uranium and thorium, however, are determined indirectly from gamma ray photons emitted by daughter products of $^{238}U$ and $^{232}Th$, respectively. Uranium is measured from photons emitted by $^{214}Bi$ and $^{214}Pb$, and thorium from $^{208}Tl$. Therefore, measurements of uranium and thorium are referred to as equivalent uranium (eU) and equivalent thorium (eTh).

Standard energy windows were used to record the gamma ray counts. These are 1370-1570 keV for potassium, 1660-1860 keV for uranium, 2410-2810 keV for thorium and 400-2810 keV for total radioactivity. Several corrections are applied to the raw window counts prior to conversion to standard concentration units, including: system dead time; background activity from cosmic radiation, the aircraft and atmospheric radon decay products; spectral scattering in the ground, air and detectors; deviations of altitude from the planned terrain clearance; temperature and pressure variations.

These maps depict radioactivity emanating within the upper 30 cm of the earth's surface, influenced by varying amounts of outcrop, overburden, vegetation, and soil moisture and surface water. As a result, measured concentrations are usually lower than underlying bedrock concentrations.

Throughout the diverse lithotectonic terranes surveyed, the geochemical information provided by variations in potassium, uranium and thorium concentrations is useful for mapping bedrock geology, for understanding the nature of surficial geology and mineral exploration, at regional and local scales (Shives et al., 1995). More detailed interpretation is encouraged through the use of the original line data, available from the Geological Survey of Canada.

The radioactive element patterns depicted in this compilation correlate with known geological features in several areas, generally reflecting degree of magmatic differentiation (mafic to felsic) of intrusive rocks and their extrusive equivalents. In the Bathurst area, Devonian granites and felsic volcanic rocks of the Miramichi Terrane, central New Brunswick, various granitic phases within the St. George batholith (McCutcheon, 1990) can be discriminated, in sharp contrast with host lithologies. In the adjacent Mount Pleasant area (Figure 3), endo- and exo-caldera lithologies (McCutcheon, 1990) produce well defined patterns which are reflected in the overlying, locally derived till cover, but are masked completely by a prominent south-trending dispersion of eolotic glacial material (Pronk and Seaman, 2002) in the Cape Spencer area (Figure 3). Within the Mount Pleasant caldera, the Fire Tower Zone, a hydrothermal breccia complex, and a number of small uranium occurrences are associated with discrete eU anomalies. Similar Sn-W and Mo-related eU anomalies occur in central New Brunswick, in the Burnthill-Dungarvon intrusive suites. These eU concentrations produce high eU/eTh ratio anomalies, which are rare elsewhere throughout the Province.

Within bimodal Silurio-Devonian volcanosedimentary sequences in the Jacquet River area in the northern part of the province, a number of uranium occurrences are associated with rhyolite flows and breccias. Locally, there is the effect of epithermal alteration associated with base and precious metals is expressed as a prominent low eTh/K ratio anomaly, produced by strong K enrichment (Shives et al., 1997).

The greatly increased spatial resolution provided by the three multi-swaeur surveys in the Bathurst-Restigouche-Kedgewick areas (Figure 2) supports radiometric definition of many of the mafic and felsic lithologies within these areas. This is particularly evident in the Bathurst area, where deposits are fingerprinted by magnetic total field and electromagnetic anomalies (Thomas et al., 2000).

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*Geophysical compilation by J.M. Carson, P.B. Holman, K.L. Ford, J.A. Grant, and R.B.K. Shives*

*Digital cartography by J.A.Y. Pratt, Earth Sciences Sector Information Division (ESS Info)*

*This map was produced from processes in conformance with the Cartographic Services Section Quality Management System, Ottawa, registered to the Quality System ISO 9001: 2000 standard*

*Any revisions known to the user would be welcomed by the Geological Survey of Canada*

*Digital base map from data compiled by Geomatics Canada, modified by ESS Info*

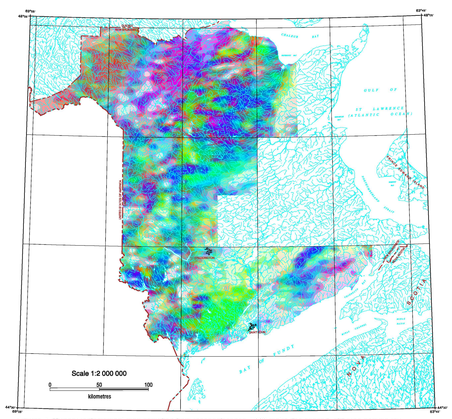


**Figure 1.** Ternary radioelement map compiled from reconnaissance, 5000 metre line spaced, airborne gamma ray spectrometry data.

**Ternary Radioelement Map**

OPEN FILE 4501

AIRBORNE GAMMA RAY SPECTROMETRY COMPILATION

# NEW BRUNSWICK

NEW BRUNSWICK

Scale 1:500 000/Échelle 1/500 000

kilometres 10 0 10 20 30 40 kilometres

Universal Transverse Mercator Projection
North American Datum 1927

Projection transverse universelle de Mercator
Système de référence géodésique nord-américain, 1927

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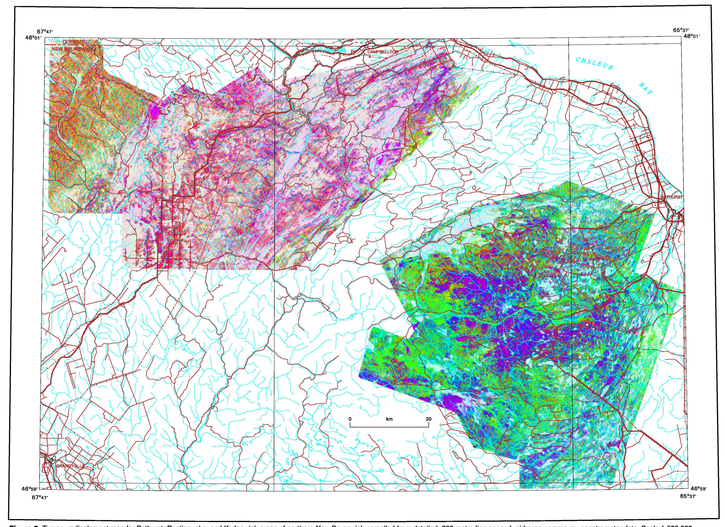



**Figure 2.** Ternary radioelement map for Bathurst, Restigouche, and Kedgewick areas of northern New Brunswick compiled from detailed, 200 metre line spaced, airborne gamma ray spectrometry data. Scale 1:500 000.

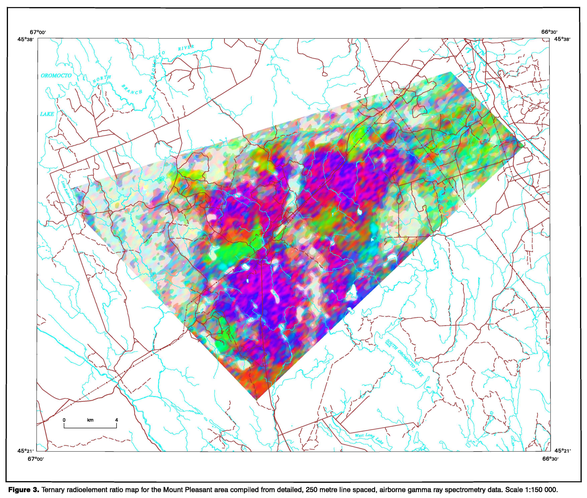
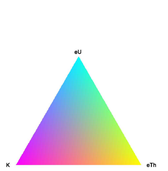
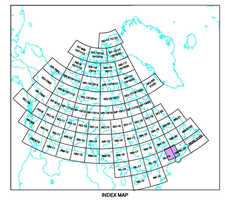



**Figure 3.** Ternary radioelement ratio map for the Mount Pleasant area compiled from detailed, 250 metre line spaced, airborne gamma ray spectrometry data. Scale 1:150 000.

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DOSSIER PUBLIC
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2004

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Les dossiers publics sont des produits qui n'ont pas suivi le cheminement officiel de publication de la CGC.

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