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NATGAM

This Radioactivity Map of Nova Scotia 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 Spectrometer Program (NGSP). The NGSP consisted of approximately 150 000 km of high sensitivity data flown by Geological Survey of Canada (GSC) and contracted aircraft, using federal and joint federal-provincial government funding. All 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. These new regional compilations supersede all previous versions of the Radioactivity Maps of Nova Scotia (Ford et al., 1989; Geological Survey of Canada, 1991).

All data were collected using 50 litres of sodium iodide detectors, at a nominal terrain clearance of 120 metres. The province-wide image is compiled from data collected along flight lines spaced at 1000 metre intervals. Areas where a more detailed radioelement data was collected to provide increased spatial resolution of radioactive element signatures are indicated on the province-wide map. Data compiled from the East Kemptville detailed survey are presented at 1:125 000 scale in the inset.

Potassium is measured directly from the 1460 keV gamma ray photons emitted by $^{40}K$. Uranium and thorium are determined indirectly from gamma ray photons emitted by daughter products $^{214}Bi$ and $^{208}Tl$, respectively. As equilibrium between daughter and parent isotopes is assumed, gamma ray spectrometric 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 spectra. 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 spectrometer data to remove unwanted background counts, 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 from the upper 30 cm of the earth's surface. The data represent average surface concentrations, influenced by varying amounts of outcrop, overburden, vegetation, soil moisture and surface water. As a result, measured concentrations are usually lower than underlying bedrock concentrations. Despite this, the data reflect bedrock lithology and can be used to delineate geological units. The variation in potassium, uranium and thorium concentrations supports mapping of bedrock and surficial geology and mineral exploration, at regional and local scales. More detailed interpretation is possible 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. For example, high eU/eTh ratio values are associated with granitic stocks or parts of larger plutons that intrude metasedimentary rocks of the Meguma Zone of southern Nova Scotia. Ground studies (Ford and O'Reilly, 1988; Ford et al., 1989; Ford et al., 1992) have established that these areas are underlain by peraluminous two-mica leucomonzogranite, leucogranite and some types of porphyry from less evolved granodiorite and biotite monzogranite. Further modification of radioactive element patterns, by late- or post-magmatic metasomatism and hydrothermal alteration (albitization) offers valuable guides to exploration for granophile elements.

In another example, high eU/eTh ratios over the East Kemptville tin deposit are associated with elevated concentrations of eU in the East Kemptville leucogranite, which hosts the deposit (Ford and O'Reilly, 1988). Sharp increases in eU and eTh concentrations along the northwest contact of the Davis Lake Pluton delineate this dome-shaped, composite intrusion. Although the surficial expression of the pluton is largely obscured by glacial deposits, however, diffuse radioactive element patterns result from glacial dispersion of the granitic till southeastward over the Meguma Group bedrock. The diminishing radioelement values southeast from the contact relate to diminishing down-ice concentrations of granitic-derived clasts and matrix material.

Six additional detailed airborne gamma ray spectrometry surveys were flown in Nova Scotia in 1986. The location of these surveys and the East Kemptville detailed survey are shown on the province-wide compilation: A) Granite Lake, B) Gibraltar Hill, C) Lascomb Pluton, D) Big Indian Lake, E) Ship Harbour Lake, F) Halifax.

The base for this product is derived from the Nova Scotia Topographic Database (NSTDB) 1:500 000 Universal Tranverse Mercator (UTM) projection derived from the Nova Scotia Topographic Database (NSTDB) supplied by Service Nova Scotia & Municipal Relations, with modifications by Earth Sciences Sector Information Division (ESS Info). This base provides geographic accuracy comparable with bases used during geophysical data acquisition. The base for the East Kemptville inset was provided by Geomatics Canada. It is also in a UTM projection with similar geographic accuracy but improved topographic detail.

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Digital base for inset at the scale of 1:125 000 from data compiled by Geomatics Canada, modified by ESS

*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 standards*

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

INDEX MAP

K (%)
4.80
2.10
2.10
2.00
1.90
1.90
1.85
1.80
1.75
1.70
1.65
1.60
1.50
1.50
1.45
1.40
1.30
1.30
1.25
1.20
1.15
1.10
1.00
1.00
0.95
0.90
0.80
0.80
0.75
0.70
0.65
0.60
0.50
0.50
0.45
0.40
0.35
0.30
0.20
0.20
0.10
0.10
0.05
0.00

**Figure 1**
Potassium
**EAST KEMPTVILLE AREA**
Detailed Survey
Line Spacing - 250 Metres
Line Azimuth - 135°
Scale 1:125 000
0 6
Kilometres

3.11
2.68
2.62
2.56
2.50
2.44
2.38
2.32
2.26
2.20
2.14
2.08
2.02
1.96
1.90
1.84
1.78
1.72
1.66
1.60
1.54
1.48
1.42
1.36
1.30
1.24
1.18
1.12
1.06
1.00
0.94
0.88
0.82
0.76
0.70
0.64
0.58
0.52
0.46
0.40
0.34
0.28
0.22
0.16
0.10
K (%)

**Potassium**
OPEN FILE 4465
AIRBORNE GAMMA RAY SPECTROMETRY COMPILATION
# NOVA SCOTIA
NOVA SCOTIA

Scale 1:500 000/Échelle 1/500 000
kilometres 10 0 10 20 30 40 kilometres

Universal Tranverse Mercator Projection
North American Datum 1927
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Projection transverse universelle de Mercator
Système de référence géodésique nord-américain, 1927
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DOSSIER PUBLIC
4465
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2003

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