Natural Resources Canada / Ressources naturelles Canada
GEOLOGICAL SURVEY OF CANADA / COMMISSION GÉOLOGIQUE DU CANADA

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 Spectrometry Program (NATGAM), from airborne surveys conducted between 1976 and 1990. The surveys were 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 250 metre line spaced 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 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 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. Throughout the diverse lithotectonic terranes surveyed, the geochemical information provided by variations 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, 1985; O'Reilly et al., 1988; Ford, 1993) have shown that these high eU/eTh ratios distinguish magmatically evolved 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, 1985). Sharp increases in eU and eTh concentrations along the northwest contact of the Davis Lake Pluton delineate tills derived from Meguma metasedimentary rocks in the northwest, and the granites in the southeast. Along the southeast contact of the pluton, 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) Liscomb Pluton, D) Big Indian Lake, E) Ship Harbour, F) Tantallon.

Base Map Sources: The Province of Nova Scotia is based on a 1:500 000 Universal Transverse 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

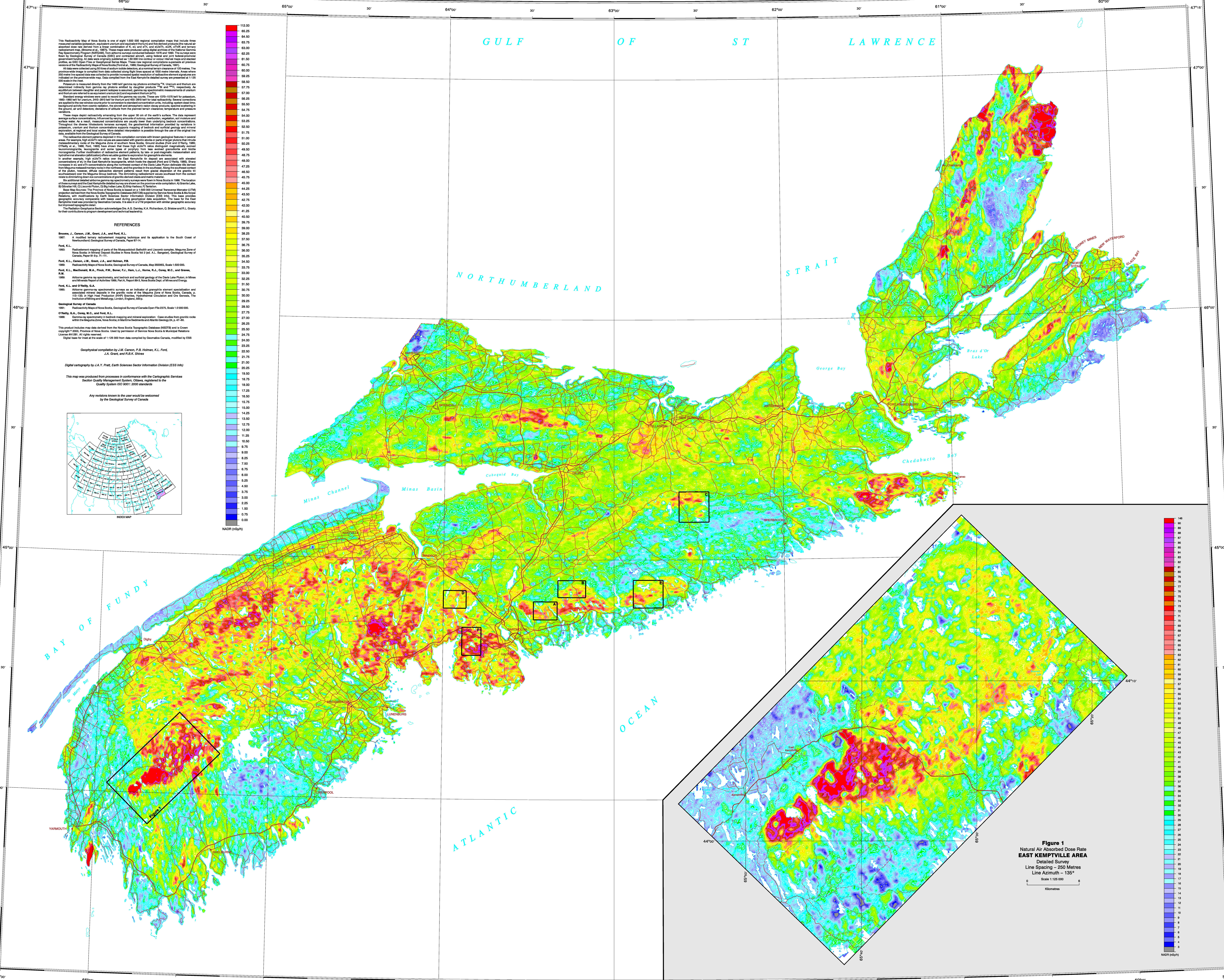

Figure 1
Natural Air Absorbed Dose Rate
EAST KEMPTVILLE AREA
Detailed Survey
Line Spacing – 250 Metres
Line Azimuth – 135°
Scale 1:125 000
0 6
Kilometres

Natural Air Absorbed Dose Rate

OPEN FILE 4464

AIRBORNE GAMMA RAY SPECTROMETRY COMPILATION

NOVA SCOTIA

NOVA SCOTIA

Scale 1:500 000/Échelle 1/500 000

kilometres 10 0 10 20 30 40 kilomètres

Universal Transverse Mercator Projection
North American Datum 1927

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

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