

DESCRIPTIVE NOTES

This Radioactivity Map of the Athabasca Basin Region is one of a set of eight 1:1 000 000 regional compilation maps that include three measured variables (potassium (K), equivalent uranium (eU) and equivalent thorium (eTh)) and five derived products. The derived products include the natural air absorbed dose rate calculated from a linear combination of K, eU, and eTh; the ratios eU/Th, eU/K, and eTh/K; and the secondary radioactive element map (Shives et al., 1997). This set of maps was produced using data from the digital archives of the Radiation Geophysics Section from airborne surveys conducted between 1974 and 2003. The surveys were flown by the Geological Survey of Canada (GSC) and contracted aircraft, using federal, provincial, and other federal-provincial government tenders. Most data were originally published as 1:1 000 000 colour interval maps (Carson et al., 2002a, 2002b, 2002c) and as 1:250 000 or 1:50 000 line contour or colour interval maps and stacked profiles, as GSD Open Files or Geophysical Series Maps.

Data was collected using 50 lines of sodium iodide detectors, at a nominal terrain clearance of 120 metres along flight lines spaced at between 500 and 400 metre intervals. The location of those surveys flown with flight lines spaced 500 metres or less apart are indicated on the map. These surveys exhibit a higher frequency colour feature. The closer line spacing allows increased spatial resolution of radioactive element signatures, supporting more detailed interpretation.

Potassium is measured directly from the 1460 keV gamma ray photons emitted by ⁴⁰K. Uranium and thorium, however, are determined indirectly from gamma ray photons emitted by daughter products (²¹⁴Pb and ²⁰⁸Tl), respectively, assuming equilibrium between daughter and parent isotopes. For this reason, 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, 1950–1850 keV for uranium, 2470–2970 keV for thorium and 400–2970 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, and temperature and pressure variations.

These maps depict radioactivity originating from the upper 30 cm of the earth's surface. The influence of varying amounts of outcrop, overburden, vegetation, soil moisture, and surface water results in measured concentrations that are usually lower than underlying bedrock concentrations.

Throughout the diverse tectonic terranes surveyed, the geochemical information provided by variations in potassium, uranium, and thorium concentrations presented in a colour contour format supports mapping of bedrock and 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 file data, available from the Geological Survey of Canada.

In areas with thin or discontinuous drift cover, the radioactive element patterns provide direct assistance to bedrock geological mapping, depicting both macroscopic lithological variations and cryptic compositional variations (Shives et al., 1995). In areas covered by thicker till and/or glacioluvial, glacioaccretion or other reworked glacial deposits the radioactive element patterns may delineate the types of surficial materials but will reflect local bedrock compositions to a lesser degree, or not at all. Shives et al. (1995, 1997) have shown that radioactive element patterns offer valuable direct and indirect indicators to a variety of mineral commodities. Direct applications include the search for radioactive mineral deposits where uranium and thorium are the primary targets, or where one or more of the radioactive elements are present. Gamma ray spectrometry can also provide valuable indirect applications for mineral exploration when one or more of the radioactive elements is either enriched or depleted as a result of alteration associated with mineralization.

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2002a: Athabasca Gamma Ray Spectrometry Compilation Series, Lake Athabasca, Alberta-Saskatchewan; Geological Survey of Canada, Open File 452, scale 1:1 000 000.

2002b: Athabasca Gamma Ray Spectrometry Compilation Series, Wollaston Lake, Saskatchewan; Geological Survey of Canada, Open File 4283, scale 1:1 000 000.

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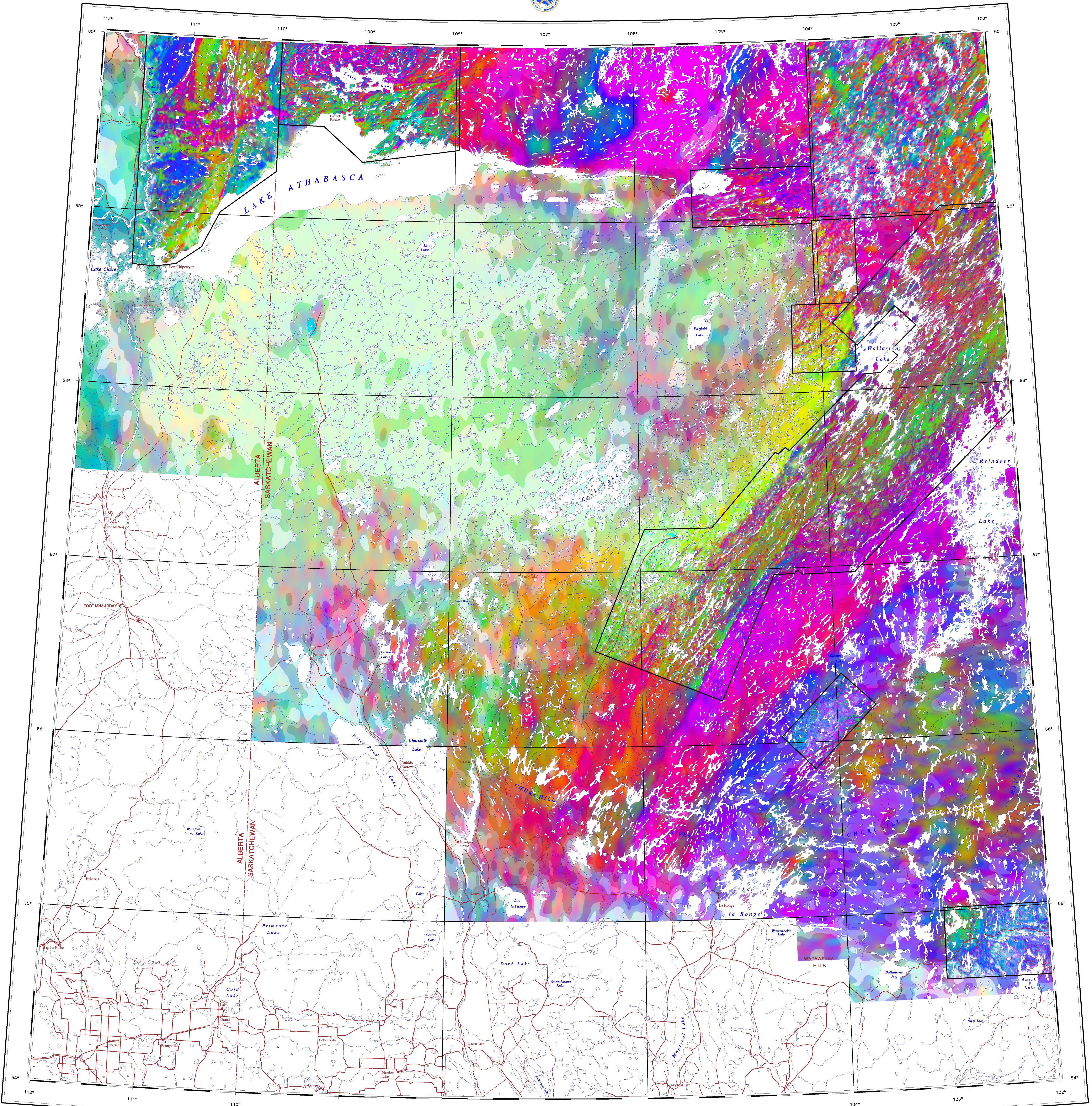
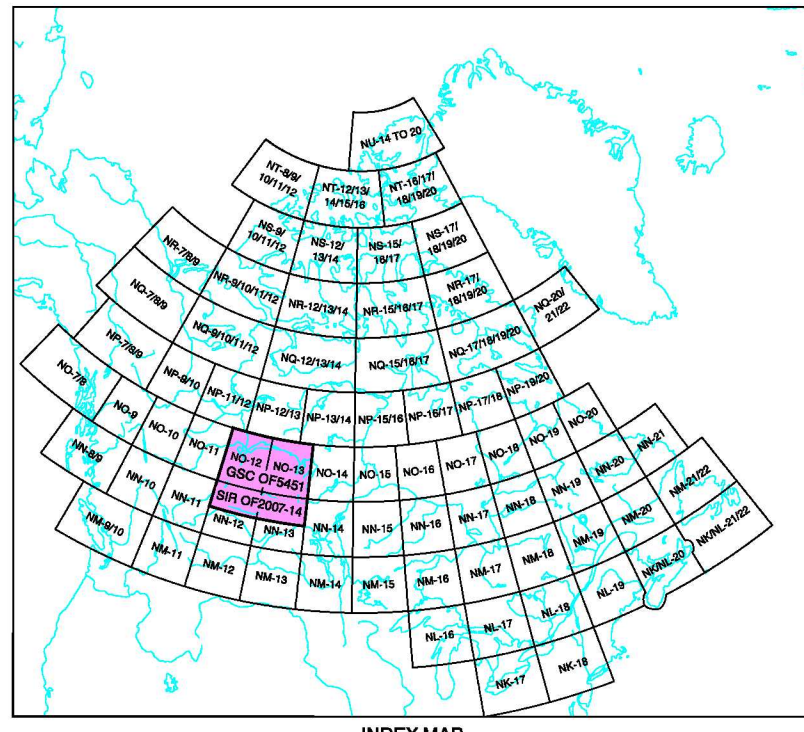
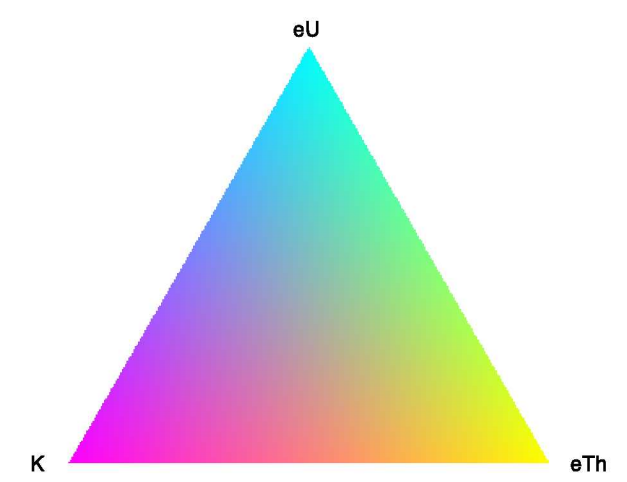
Geophysical compilation by J.M. Carson, P.B. Holman, K.L. Ford, J.A. Grant, and R.B.K. Shives

Digital cartography by B. Blanchard Pilon, Data Dissemination Division (DDD)

This map was produced from processes that conform to the Scientific and Technical Publishing Services Subdivision (DSD) Quality Management System, registered to the ISO 9001:2000 standard

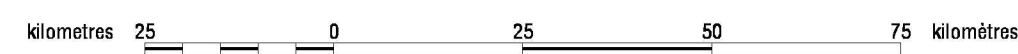
Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Digital base map at the scale of 1:1 000 000 from the Digital Chart of the World (DCW) from Environmental Systems Research Institute (ESRI), with modifications by DDD



GEOLOGICAL SURVEY OF CANADA OPEN FILE 5451
SASKATCHEWAN INDUSTRY AND RESOURCES OPEN FILE 2007-14
TERNARY RADIOELEMENT
RADIOACTIVITY MAP OF THE ATHABASCA BASIN REGION
SASKATCHEWAN-ALBERTA

Scale 1:1 000 000/Échelle 1/1 000 000



Lambert Conformal Conic Projection
Standard Parallels 55°N and 59°N
North American Datum 1983
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Projection conique conforme de Lambert
Parallèles d'échelle conservées: 55°N et 59°N
Système de référence géodésique nord-américain, 1983
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OPEN FILE
DOSSIER PUBLIC
5451
GEOLOGICAL SURVEY OF CANADA
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