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Saskatchewan Industry and Resources

GEOLOGICAL SURVEY OF CANADA   COMMISSION GÉOLOGIQUE DU CANADA

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/eTh, eU/K, and eTh/K; and the ternary radioactive element map, (Broome et al., 1987). This set of maps was produced using data from the digital archives of the Radiation Geophysics Section from airborne surveys conducted between 1974 and 2005. The surveys were flown by the Geological Survey of Canada (GSC) and contracted aircraft, using federal, provincial, and joint federal-provincial government funding. 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 GSC Open Files or Geophysical Series Maps.

Data was collected using 50 litres of sodium iodide detectors, at a nominal terrain clearance of 120 metres along flight lines spaced at between 5000 and 400 metre intervals. The location of those surveys flown with flight lines spaced 1000 metres or less apart are indicated on the map. These surveys exhibit a higher frequency colour texture. 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 214Bi 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, 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, 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 lithotectonic terranes surveyed, the geochemical information provided by variations in potassium, uranium, and thorium concentrations presented in a coloured 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 line 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 glaciofluvial, glaciolacustrine or other re-worked 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 exploration guides for 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 as an associated trace element. 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.

The Radiation Geophysics Section acknowledges Drs. A.G. Darnley, K.A. Richardson, Q. Bristow, and R.L. Grasty for their contributions to program development and technical leadership.

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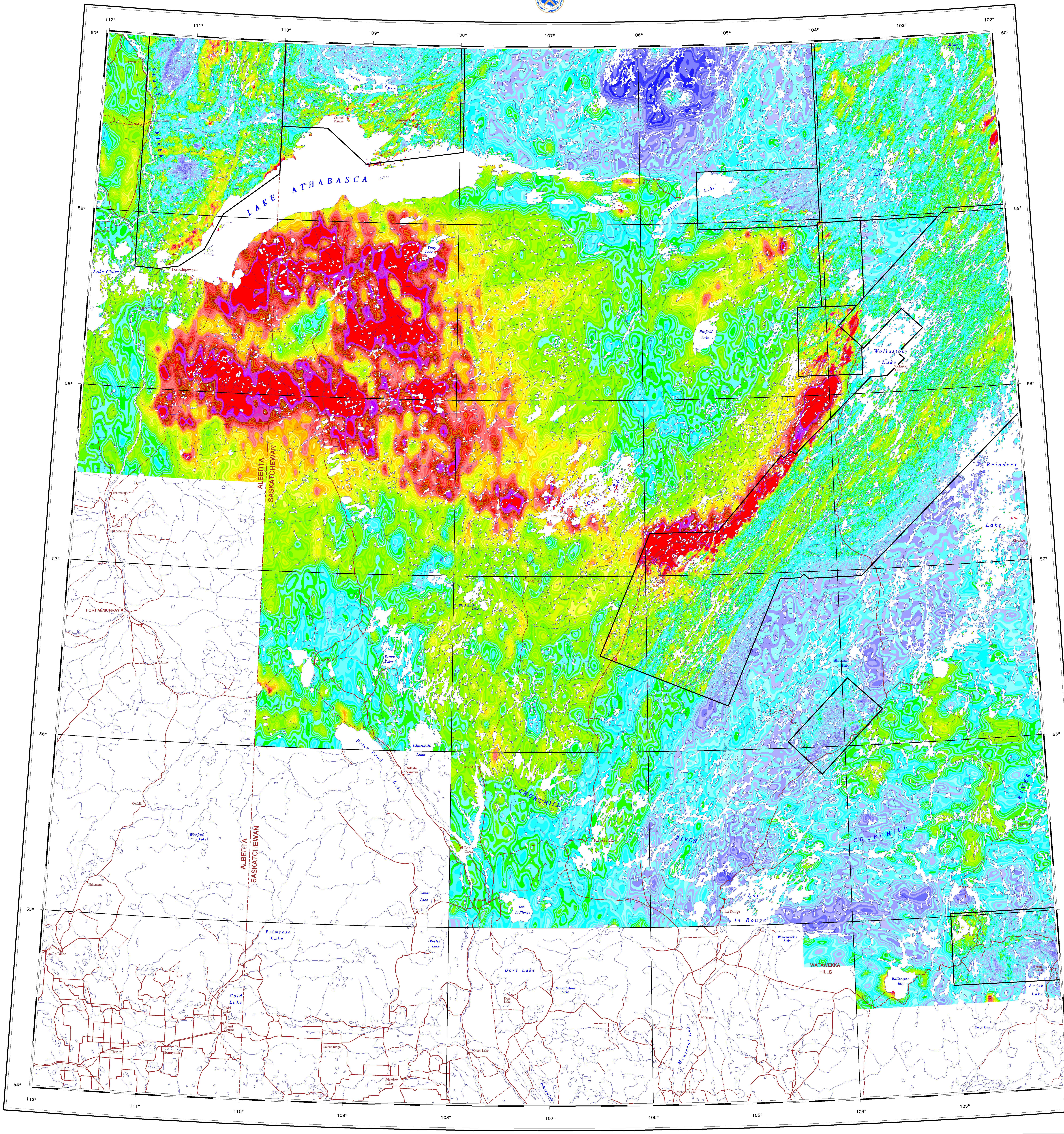
Geophysical compilation by J.M. Carson, P.B. Holman, K.L. Ford,
J.A. Grant, and R.B.K. Shives

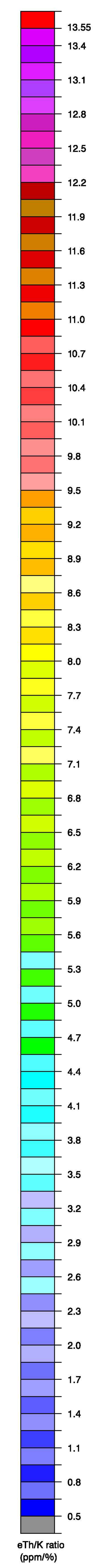
Digital cartography by B. Blanchard Pilon, Data Dissemination Division (DDD)

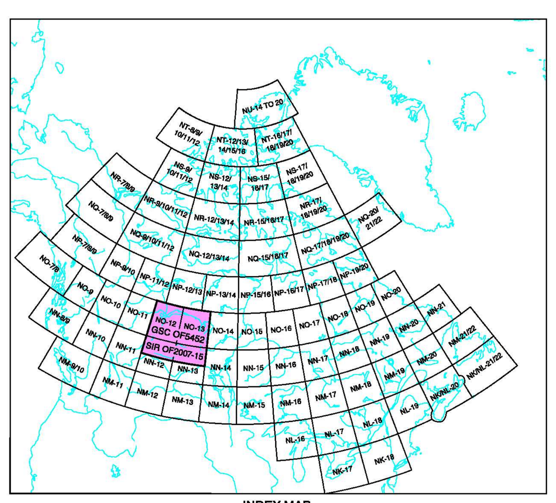
This map was produced from processes that conform to the Scientific and Technical Publishing Services Subdivision (DDD) Quality Management System, registered to the ISO 9001: 2000 standard

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







INDEX MAP

GEOLOGICAL SURVEY OF CANADA OPEN FILE 5452
SASKATCHEWAN INDUSTRY AND RESOURCES OPEN FILE 2007-15

EQUIVALENT THORIUM/POTASSIUM RADIOACTIVITY MAP OF THE ATHABASCA BASIN REGION

SASKATCHEWAN–ALBERTA

Scale 1:1 000 000/Échelle 1/1 000 000

kilometres 25 0 25 50 75 kilomètres

Lambert Conformal Conic Projection	Projection conique conforme de Lambert
Standard Parallels 55°N and 59°N	Parallèles d'échelle conservée : 55° N et 59° N
North American Datum 1983	Système de référence géodésique nord-américain, 1983
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OPEN FILE
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2007

Open files are products that have not gone through the GSC formal publication process.

Les dossiers publics sont des produits qui n'ont pas été soumis au processus officiel de publication de la CGC.

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