Uranium Potential in Alberta

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1 Uranium

Uranium (U) is a naturally occurring radioactive element primarily used for nuclear power generation and is recognized as a critical mineral in Canada (Government of Canada, 2024). Uranium is one of the 17 critical minerals with proven prospectivity in Alberta (Alberta Geological Survey, 2025a).

2 Alberta Highlights

Exploration in Alberta over the past 60 years has highlighted the potential for uranium production across the province (Figure 1). Uranium occurs in four main deposit types:

1. unconformity-related uranium of the Athabasca Basin in northeastern Alberta
2. sandstone-hosted uranium of the Western Canada Sedimentary Basin in southern Alberta
3. metalliferous black shales of the Western Canada Sedimentary Basin
4. pegmatites and granitoids of the Canadian Shield in northeastern Alberta

2.1 Unconformity-Related Uranium of the Athabasca Basin in Northeastern Alberta

Unconformity-related uranium deposits consist of pods, veins, and uranium-bearing mineral (e.g., uraninite) replacements of host rocks located close to unconformities between sandstone-dominated formations and Precambrian basement rocks (Jefferson et al., 2007). The Athabasca Basin in northeastern Alberta and northern Saskatchewan is a world-renowned mining district known to host significant quantities of unconformity-related uranium. Most of the known deposits and advanced projects are located in the Saskatchewan portion of the Athabasca Basin, where more than 30 unconformity-related uranium deposits with world-class grades and tonnages have been found (Ruzicka, 1997; Jefferson et al., 2007). To date, one unconformity-related uranium prospect has been discovered in Alberta, the Dragon Lake prospect of the Maybelle River project (Wheatley and Cutts, 2013). Mineralization in this prospect is described as a vein approximately 110 m long, up to 5 m wide, and 1–40 m thick, occurring within both the sandstone (i.e., Fair Point Formation) above the unconformity and the basement rocks below the unconformity and following the northerly trending Maybelle River shear zone. A resource estimate for the Dragon Lake prospect has not been published but intercepts of 4.7% U over 1.7 m and 17.7% U over 5.0 m have been recorded, with a maximum assay value of 54.5% U over a 50 cm interval (Wheatley and Cutts, 2013). Other critical minerals, such as nickel (Ni) and cobalt (Co) are also reported to be present in anomalous concentrations within the mineralized zone at Dragon Lake. Additional mineral occurrences are present along the north shore of Lake Athabasca where the Fair Point Formation outcrops, with samples averaging greater than 5000 ppm U (Lehnert-Thiel and Kretschmar, 1976).

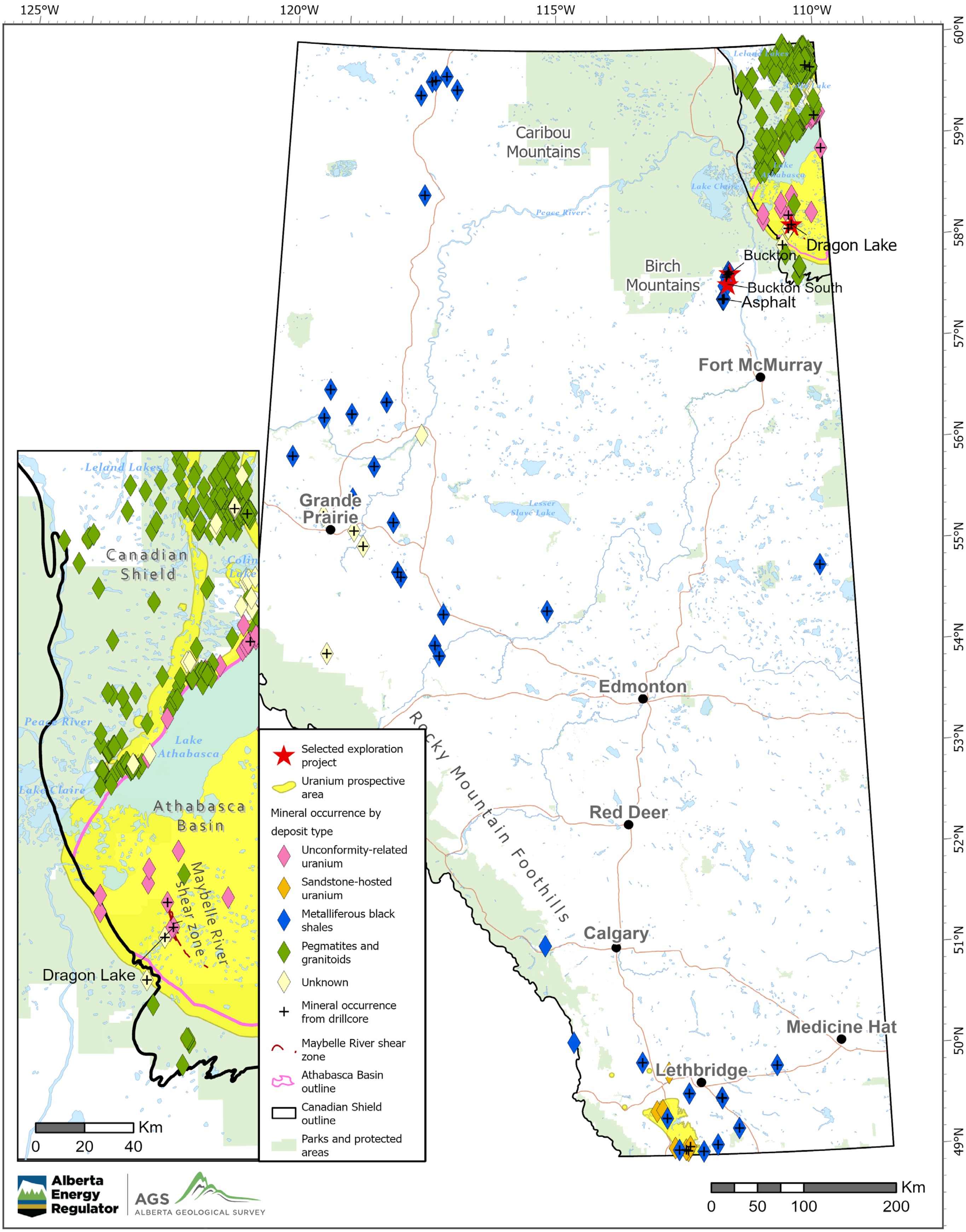
2.2 Sandstone-Hosted Uranium of the Western Canada Sedimentary Basin in Southern Alberta

Sandstone-hosted uranium deposits are broadly classified as stratabound uranium mineralization bodies hosted within sandstone sedimentary sequences (Olson et al., 1994). Several mineral occurrences linked to this deposit type are located in southern Alberta. These include anomalous uranium in core from the Willow Creek Formation (e.g., Hartley 2007, 2011), outcrop samples taken from riverbank exposures of the Willow Creek and St. Mary River formations (e.g., Matveeva, 2010), and mineralized bone fragments within the Willow Creek Formation (e.g., Schulze, 2007). Several key geological features common to sandstone-hosted uranium deposits are recognized in Alberta. These include suitable host rocks, such as continental sedimentary sequences bounded by aquitards, and source rocks for uranium, such as volcanic rock fragments and tuffaceous and volcaniclastic beds, within the host sandstones. Despite being commonly described as low- to medium-grade, low-tonnage deposits, sandstone-hosted uranium can be an attractive deposit type as mineral extraction can take advantage of in situ leaching.

2.3 Metalliferous Black Shales of the Western Canada Sedimentary Basin

Highly metalliferous black shales have combined metals (Mo+Ni+Se+V+Zn) concentration greater than 1500

Figure 1. Location of uranium mineral occurrences (Morley et al., 2025), select exploration projects, and areas of prospectivity (Alberta Geological Survey, 2025b), with an inset map of northeastern Alberta to show the Canadian Shield area in more detail.



ppm, and are identified globally as an important source of a wide array of critical minerals including uranium (Johnson et al., 2017). In Alberta, there are 94 identified occurrences of highly metalliferous black shales, located in drillcore and outcrop, with 39 of these occurrences containing greater than 50 ppm uranium (Morley et al., 2025; see Table 1 for select occurrences). There are two historical inferred resources in the Birch Mountains region of northeastern Alberta, with elevated concentrations of six critical minerals, including uranium, which is hosted within the Upper Cretaceous Second White Specks and Labiche (Lea Park) formations. Other identified occurrences of uranium in metalliferous black shales have been reported in the Devonian–Mississippian Exshaw and Lower Cretaceous Loon River formations.

2.4 Pegmatites and Granitoids of the Canadian Shield in Northeastern Alberta

A total of 171 uranium occurrences has been reported in the pegmatites and granitoids of the Taltson basement complex and the Taltson magmatic zone across the Canadian Shield in Alberta (Morley et al., 2025; see Table 2 for select occurrences). To date, most exploration in the area has focused on its uranium potential, with more than 80 mineral assessment reports submitted to the Government of Alberta outlining exploration activity on the shield since the late 1960s. Structures present in the Canadian Shield (e.g., faults, shear zones) play an important role in enhancing the uranium concentration within pegmatites and granitoids in this area, serving as pathways for fluid flow and metal mobilization (Godfrey, 1963; Edwards et al., 1991; N.O. Montenegro, R.P. Hartlaub, M.B.K. Belosevic, E.C. Morley and D.M. Meek, work in progress, 2026).

Table 1. Summary of uranium resources and select occurrences in metalliferous black shales in Alberta.

Name	Location	Stratigraphic Unit (formation)	Description	Recoverable U_3O_8 Historical Inferred Resource (kt)	Recoverable U_3O_8 Historical Indicated Resource (kt)
Buckton zone[a]	Birch Mountains	Second White Specks, Labiche (Lea Park)	Mineral deposit (partially within wildland provincial park)	33.38	2.07
Buckton south zone[b]	Birch Mountains	Second White Specks, Labiche (Lea Park)	Mineral deposit	4.99	No estimate
Asphalt zone[c]	Birch Mountains	Second White Specks	Two boreholes intersected 7.2 and 11.4 m thick shale horizons with up to 110 ppm U	No estimate	No estimate
Unnamed[d]	Caribou Mountains	Loon River	Samples of shale from boreholes with up to 75 ppm U	No estimate	No estimate

[a] Dufresne et al., 2011; Eccles et al., 2012; Eccles et al., 2013a, b; Puritch et al., 2013
[b] Eccles et al., 2013c
[c] Sabag, 1998
[d] Meek et al., 2023

Table 2. Summary of select uranium occurrences in the Canadian Shield in northeastern Alberta.

AGS Occurrence ID[a]	Location	Geological Unit	Lithology	U (ppm)	Source
074M 0263	Bonny Fault	Taltson basement complex	Sheared gneiss	19 300	Smith and Griffith (2007)
074M 0242	Cherry Lake	Colin Lake granitoid	Pegmatite	6699	Hart (1967)
074M 0118	Roderick Lake	Wylie Lake granodiorite	Pegmatite	5597	Allan (1978)
074L 0041	Lake Athabasca	Rutledge River complex	Gneiss	4420	Dahrouge and Smith (2007)
074M 0078	Cherry Lake	Taltson basement complex	Sheared gneiss	4240	Thorpe (1969)
074M 0273	Andrew Lake	Taltson basement complex	Sheared gneiss	4110	Pană and Prior (2010)
074M 0112	Burstall Lake	Fishing Creek granodiorite	Granitoid	2790	McConnell et al. (1976)

[a] Unique identifier specific to Morley et al. (2025)

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