

Minerals of Alberta Map: Methodology

AER/AGS Map 655 Information Document

Minerals of Alberta Map: Methodology

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Abstract

The Minerals of Alberta map presents a current view of non-energy mineral resources in the province and the extents of prospective areas for the exploration of undiscovered resources. Resources included are minerals, subsurface brines, and other materials naturally occurring in rocks and sediments. Minerals or materials included are ammolite, bentonite, boron, bromine, calcium/magnesium chloride, clay, cobalt, copper, diamonds, dolomite, fly ash, gold, gypsum, humalite, iodine, iron, lead, limestone, lithium, magnetite, marl and/or tufa, metallurgical coal, molybdenum, nickel, peat, phosphate, potash, pumicite, rare-earth elements, salt, sand/gravel, shale, silica sand, sodium sulphate, silver, stone, sulphur, thorium, titanium, uranium, vanadium, zinc, and zirconium. The intent of the map is to inform industry, government, and the public of Alberta's mineral deposits and potential, and raise awareness of economic development opportunities. This publication serves as an update to the previously published Minerals of Alberta map (AER/AGS Map 590), with the addition of newly available data.

The map highlights select locations with current and past production, as well as the locations of selected exploration projects that are deemed by the authors to have the potential to become mineable in the future, if conditions are favourable. The details about these selected producers, past producers, and projects were compiled from publicly available information including mineral assessment reports, industry technical reports, academic papers, and government publications and datasets.

The map also highlights areas deemed prospective for the exploration of minerals from a geological perspective. Prospective areas were outlined using geological maps, three-dimensional geological models, mineral occurrence datasets, geochemical and geophysical data, mineralogical data, mineral agreements and dispositions, mineral resource estimates, and satellite imagery. Information was derived from government, academia, and industry publications. These areas constitute regions for the exploration of undiscovered resources outlined at a provincial scale. No attempt was made to quantify or rank overall mineral prospectivity, probability of extraction, or potential.

The Minerals of Alberta map is a simplified cartographic view of more detailed digital datasets with extensive tabular information.

The Minerals of Alberta map and digital files that are included with this publication are:

- 1) AER/AGS Map 655: Minerals of Alberta (PDF format)
- 2) AER/AGS Digital Data 2025-0010: Selected Producers, Past Producers, and Exploration Projects of Alberta (tabular data, tab-delimited format)
- 3) AER/AGS Digital Data 2025-0008: Prospective Areas for Mineral Exploration in Alberta (GIS data, polygon features)

This map information document provides the project overview, objectives, data sources, methodology, and descriptions of the Minerals of Alberta map and accompanying digital files.

This work was completed under the Mineral Grant provided by the Government of Alberta dated June 22, 2021.

Summary by Commodity

A summary of mineral commodities present in Alberta and prospective areas for exploration is provided below. The Minerals of Alberta map PDF version includes only a selection of these descriptions.

Geological units mentioned here are described in the Alberta Table of Formations, the Bedrock Geology of Alberta map, and the Surficial Geology of Alberta map, which are available at the Alberta Geological Survey's website <https://ags.aer.ca>.

Ammolite has been extracted by surface collecting or open-pit mining for jewelry and specimen collection in the province since the 1960s. Currently, ammolite is extracted by mechanized open-pit mining near Lethbridge. Prospective areas for ammolite are the Upper Cretaceous Bearpaw Formation shale beds along river valleys in southern Alberta.

Bentonite has been mined west and southeast of Edmonton and near Drumheller for use as a drilling mud additive, foundry sand, iron ore pellets, pet waste absorbent, agricultural/chemical carriers, geotechnical barriers, and cosmetics. Bentonite is found in the Cretaceous Wapiti Formation in the northwest (Swan Hills project). Prospective areas for bentonite are in near-surface Upper Cretaceous Horseshoe Canyon, Bearpaw, Paskapoo, and Wapiti formations throughout Alberta.

Bromine, boron, and iodine are commonly found in formation brines, particularly those associated with deep Devonian and Cretaceous aquifers in Alberta. Bromine is typically concentrated in high calcium and magnesium brines, boron is often concentrated in lithium-enriched brines, and iodine is frequently associated with hydrocarbon-bearing zones. These elements are classified as critical minerals due to their essential roles in various industries, including drilling, pharmaceuticals, agriculture, and electronics.

Building stone is mined in west-central to southwestern Alberta. Rock types include shale, sandstone, granite, limestone, and dolomitic siltstone.

Calcium/magnesium chloride and associated compounds containing potassium and bromine are found in calcium-rich formation brines. Currently, calcium/magnesium chloride is extracted from brines pumped to the surface from the Middle Devonian Keg River and Winnipegosis formations (Calling Lake, Mitsue, and Sunnynook mines). Primary uses include anti-icing, de-icing, dust control, road stabilization, and in manufacturing oilfield fluids. Prospective areas for calcium/magnesium chloride include the Upper Devonian Beaverhill Lake Group in southern Alberta, and the Middle Devonian Elk Point Group in north-central Alberta.

Clay and shale were extracted at various times for manufacturing bricks, ceramics (e.g., tile, pottery, and crockery), and lightweight aggregate. Today, clay and shale are mainly produced from surface industrial pits for construction and cement manufacturing near Edmonton and Calgary.

Copper occurs in different types of deposits associated with other metals throughout Alberta. Copper-silver occurrences were found in stratabound, stringer, and disseminated occurrences in quartzite, quartz arenite, and green argillite conglomerate of the Mesoproterozoic Grinnell Formation, and less frequently in the Mesoproterozoic Appekunny, Siyeh, Sheppard, Gateway, and Roosville formations in the Rocky Mountains and Alberta Rocky Mountain Foothills. The Grinnell Formation is highly prospective for copper-silver because mineable deposits occur within an equivalent stratigraphic unit in Montana.

Copper-gold occurrences are reported in sulphide-bearing amphibolite within the Paleoproterozoic Slave granitoid in the Precambrian shield of northeastern Alberta of which the most prospective area is along the Leland Lakes shear zone. Copper-lead-zinc occurrences have been documented in tholeiitic-alkali basalts in the Rocky Mountains southwest of Lethbridge. Small-scale copper, lead, and zinc mining occurred between 1900 and 1910 in a basaltic dike at Coppermine Creek, now within Waterton Lakes National Park. Prospective areas for copper-lead-zinc deposits are in the Mesoproterozoic Purcell Group lavas and intrusions in southwestern Alberta.

Diamonds are found in kimberlite and related ultrabasic alkaline rocks, which occur as clusters of pyroclastic and volcanoclastic rocks, as well as dikes and sills of Late Cretaceous to Paleocene age.

Prospective areas for diamonds are within the known diamond-bearing kimberlite fields in the Buffalo Head Hills and Calling Lake area, where alluvial diamond occurrences were previously found, as well as where the chemistry of kimberlite-indicator minerals (such as garnet, clinopyroxene, olivine, ilmenite, and chromite), collected from glacial and alluvial sediments, suggest a nearby kimberlite source.

Fly ash powder was produced as a by-product of coal-fired power generation. Although coal-fired power generation has ceased in Alberta, fly ash is still available from stockpiles to use in the manufacturing of cement and concrete for building construction and cementing of oil and gas wells. Fly ash may also contain concentrations of rare-earth elements.

Gold occurs in different types of deposits throughout Alberta. Gold occurs in placer deposits as very fine grains (i.e., flour gold) usually in association with other economic metals such as silver and platinum-group elements (PGE). Placer gold is often found along a stretch of the North Saskatchewan River near Edmonton. Elsewhere in Alberta, placer gold occurs in active streambed sediments in the Peace, Athabasca, and Red Deer rivers and preglacial sand and gravel in northern and central Alberta, and paleoplacer gold occurs in clastic sedimentary rocks in central and southwestern Alberta. Placer gold is currently being recovered as a by-product in two sand and gravel operations west of Edmonton. Gold, accompanied by base metals, occurs in quartz-tourmaline veins, stockworks, and masses, spatially related to granitoids or shear zones in metasedimentary rocks in northeastern Alberta. Prospective areas for gold–base metal deposits are in the Paleoproterozoic Waugh Lake complex and in the Leland Lakes shear zone in the Canadian Shield. Gold, silver, and PGE geochemical anomalies have been reported in the Upper Devonian Waterways and Lower Cretaceous McMurray formations northeast of Fort McMurray.

Gypsum deposits are widespread in the province and occur as extensive beds or lenses in Devonian and Triassic evaporite units. However, no development has occurred because of depth or remoteness of the resource. Prospective areas for gypsum are in near-surface Devonian Elk Point Group and Fort Vermilion Formation strata in the northeast.

Humalite is extracted from open-pit, sub-bituminous coal mines and processed into liquid and dry soil conditioners and drilling fluid additives. Prospective areas for humalite are in shallow coal zones of the Upper Cretaceous Horseshoe Canyon Formation in central to southern Alberta.

Iron-vanadium ironstone deposits were evaluated by industry in northwestern Alberta (Clear Hills project) for producing carbonyl iron powder and vanadium electrolyte. Several other iron-rich ironstone occurrences were found near the surface in the region surrounding Clear Hills. Prospective areas for the exploration of additional iron-vanadium ironstone deposits are in the Upper Cretaceous Bad Heart and Dunvegan formations in northwestern Alberta.

Lead-zinc occurrences were found in carbonate rocks at surface in the Rocky Mountains, most notably the Oldman River occurrence near the border with British Columbia in southwestern Alberta. Other occurrences in carbonate rocks were found in core from oil and gas wells in northwestern Alberta. Prospective areas for lead-zinc deposits include Devonian carbonate platform strata near documented lead-zinc occurrences in northwestern Alberta, and Cambrian and Devonian carbonate platforms cropping out in the Rocky Mountain fold-and-thrust belt. The existence of hydrothermal dolomitization, spatially related to reefs or regional structures, is another important factor when considering the prospectivity for carbonate-hosted lead-zinc deposits. Other types of lead-zinc occurrences were reported in siliciclastic rocks in the Mesoproterozoic Grinnell, Siyeh, and Sheppard formations in the mountains of southwestern Alberta. Alberta is considered prospective for lead-zinc because mineable lead-zinc deposits occur within equivalent stratigraphic units of the Western Canada Sedimentary Basin in British Columbia and the Northwest Territories.

Limestone and/or dolomite are mined from several locations in the Rocky Mountains, Foothills, and in the Fort McMurray area. Limestone is used to manufacture high-calcium quicklime (for cement), hydrated lime, pulverized limestone, screened limestone, building stone, and crushed rock aggregate. Dolomite is primarily used for aggregate, building stone, neutralizer, desulphurization, and filler. Prospective areas for

limestone and dolomite are in Cambrian–Triassic carbonate strata in the Rocky Mountains and Foothills, and in Devonian strata in northeastern Alberta.

Lithium is a dissolved constituent of some oil field brines in Alberta. After hydrocarbon extraction, the remaining lithium-rich brine is typically reinjected into the subsurface as wastewater. In western Alberta, lithium brines have been identified in the Middle to Upper Devonian Swan Hills Formation, Upper Devonian Leduc and Nisku formations, and Wabamun Group. Upper Devonian aquifers extend across geological formation boundaries in some areas. In the northwest, brines from reservoirs in the Middle Devonian Keg River Formation and the Triassic Montney Formation contain lower lithium concentrations. However, these concentrations could become economically viable with improved extraction techniques.

Magnetite and other heavy minerals, such as titanium dioxide, occur in sand and sandstone beds found near surface along the Foothills west of Lethbridge and north of Calling Lake. The Burmis project area located in the Foothills has been explored as a potential source of iron ore for steelmaking, and magnetite for use in the coal industry. The Pelican Mountain project area was explored as a source of titanium oxide. Prospective areas for magnetite and heavy minerals are in the Upper Cretaceous Belly River Group in southwestern Alberta and the Upper Cretaceous Wapiti Formation in north-central Alberta.

Marl and/or tufa are mined in Alberta for cement and agricultural liming. Both marl and tufa contain calcium bicarbonate derived from glacial drift or bedrock; marl generally forms in freshwater at ponded spring discharge sites, and tufa forms at well-drained sites. Marl and tufa are produced from surface industrial pits.

Metallurgical coal is currently mined near Grande Cache. It is primarily used in iron smelting and steel making. An open-pit metallurgical coal mine is proposed in southwestern Alberta (Grassy Mountain project). Prospective areas for metallurgical coal are in bituminous coal fields along the Rocky Mountains and Foothills.

Peat has been harvested in Alberta for horticultural purposes since the 1960s. Active peat harvesting pits exist in many areas of central and northern Alberta. Prospective areas for peat are wetlands throughout northern Alberta that contain partially decomposed organic materials.

Phosphate occurs in sedimentary rock beds that may extend over tens to hundreds of kilometres along the Rocky Mountains and Foothills. Prospective areas are in the Upper Devonian–Mississippian Exshaw Formation, Permian Johnston Canyon and Ranger Canyon formations, Triassic Spray River Group, and Jurassic Fernie Formation. The province is considered highly prospective for phosphate because potentially mineable phosphate beds in British Columbia extend into Alberta.

Potash occurrences were found in oil and gas wells and during mineral exploration drilling. Alberta is prospective for potash because mineable deposits occur within the same strata in Saskatchewan. Prospective areas for potash occur in the Devonian Prairie Evaporite Formation in east-central and southeastern Alberta. In particular, industry has identified potash intersections that warrant further exploration near Provost.

Rare-earth elements (REEs) are documented in various alkaline granite and pegmatite units in the Canadian Shield. Rare-earth elements also occur as a secondary commodity in other mineral deposits such as phosphate and Zn-V-Ni-REE black shales. Prospective areas for REEs are the Mesoarchean–Paleoproterozoic Taltson basement and Marguerite River complexes in the Canadian Shield, Permian–Jurassic phosphate-bearing strata in the Rocky Mountains and Foothills, the Cretaceous Fish Scales Formation in the north, near-surface Zn-V-Ni-REE black shale deposits in the Upper Cretaceous Second White Specks Formation in the northeast, in the Lower Cretaceous Loon River Formation in the northwest, and Jurassic Fernie Formation shales and Devonian–Mississippian shales of the Exshaw and Banff formations in the Rocky Mountains and Foothills. Also, REEs occur in oil sands tailings and coal fly ash.

Salt is used for de-icing, water softening, and preserving food products. Salt is also extracted to create artificial caverns for storage of petroleum products by the upstream petroleum industry in east-central and northeastern Alberta. Prospective areas for salt production and the creation of caverns are in the Lower–Middle Devonian lower and upper Lotsberg, and Prairie Evaporite formations in northeastern and east-central Alberta.

Sand and gravel are the primary source of aggregate in Alberta with over 2500 sand and gravel quarries operated by private companies and public works departments. Primary uses include road construction and maintenance, snow and ice control, abrasives, filtration beds, concrete, and landscaping. Prospective areas for sand and gravel are in preglacial, glaciofluvial, glaciolacustrine, fluvial, and eolian deposits throughout the province.

Silica sand is produced from Lower Cretaceous sandstone in the Peace River area and from unconsolidated sand deposits northeast of Edmonton. Industrial uses include glass, fibreglass, and proppant (for hydraulic fracturing). Prospective areas for silica sand are in the Lower Cretaceous Paddy Member of the Peace River Formation in the northwest, silica-rich unconsolidated sand deposits at shallow depths in central Alberta, the Lower Cretaceous McMurray, Grand Rapids, and Pelican formations in the northeast, and sand dunes and glaciofluvial outwash sediments throughout the province.

Sodium sulphate was mined in southeastern Alberta for manufacturing kraft paper, glass, detergents, textiles, and chemicals, but production stopped in 1991.

Sulphur is extracted during crude oil and natural gas processing. It is primarily used for producing fertilizer and secondarily for metallurgical purposes. It occurs naturally in conventional natural gas, crude bitumen, crude oil, and coal. Current production is largely derived from hydrogen sulphide (H₂S)-rich natural gas. Oil sands deposits also contain significant amounts of sulphur, which is either recovered during upgrading in the form of elemental sulphur or remains in the coke.

Titanium–zirconium–rare-earth elements naturally occur in small quantities in oil sands but they are concentrated during the bitumen extraction process and can potentially be extracted from the tailings. The objective of a current industry project is to design a process to recover titanium, zirconium, and monazite (source of REEs) from the froth treatment tailings before they are discarded.

Uranium occurs extensively in the Athabasca Basin and Canadian Shield, in several types of deposits related to granites, pegmatites, metamorphic rocks, and structures such as unconformities, shear zones, and veins. The most notable occurrence is the Maybelle River project where historical drilling intersected a high-grade uranium zone in the Late Paleoproterozoic Fair Point Formation, along the Maybelle River shear zone and above the unconformity between the Athabasca Group and basement rocks. Since large, mineable, unconformity-related uranium deposits occur in the Athabasca Basin in Saskatchewan, it is expected that similar deposits may also occur in the Alberta side of the basin. Prospective areas for unconformity-related uranium deposits are in the Late Paleoproterozoic–Early Mesoproterozoic Athabasca Group or underlying basement rocks, particularly along shear zones, and in the Mesoarchean–Paleoproterozoic Canadian Shield. Uranium occurrences are also documented in Cretaceous sandstone units south and west of Lethbridge. Prospective areas are in the Upper Cretaceous St. Mary River and Willow Creek formations in southern Alberta.

Vanadium–nickel, molybdenum, and rhenium also naturally occur in oil sands. Elevated concentrations of these elements occur in the organic fraction and are concentrated in waste and by-products, such as petroleum coke and petroleum coke fly ash, during the bitumen upgrading process for both mined and in situ oil sands production.

Zinc–vanadium–nickel–rare-earth elements occur in thin metalliferous horizons in laterally extensive organic-rich marine black shale. Other metals present include copper, cobalt, uranium, and silver. The Buckton near-surface deposit in the Upper Cretaceous Second White Specks Formation north of Fort McMurray was evaluated for copper–zinc–nickel–cobalt sulphides, dry uranium oxide, and REE concentrate. Prospective areas for zinc, vanadium, nickel, REEs, and other base metals are in the Lower

Cretaceous Loon River Formation in the northwest, the Upper Cretaceous Second White Specks Formation in the northeast, the Jurassic Fernie Formation in the west, and the Devonian–Mississippian Exshaw Formation in southwestern Alberta.

1 Introduction

Alberta has a long history of mineral production, beginning with salt trading in the early 1800s. Throughout the years, industrial minerals have been the most significant products in terms of tonnage and production value. In 2024, Alberta produced sand and gravel, silica sand, calcium chloride, peat, shale, sulphur (by-product), limestone and/or dolostone, fly ash, building stone, gold (by-product), marl, coal, humalite, and ammolite. The province's diverse geology also holds other potential resources, including diamonds, uranium, lithium, iron, base metals, and rare-earth elements (REEs), among others. The Minerals of Alberta map serves as a summary of Alberta's mineral resources, aimed at informing industry, government, and the public about the province's mineral resources and raising awareness of economic development opportunities. The original Minerals of Alberta map (AER/AGS Map 590) was published in 2020 (Lopez et al., 2020b), and this current version serves as an update to that publication, with the addition of newly available information.

This Map Information Document outlines the project's methodology and data sources, and the descriptions of the output files used to create the Minerals of Alberta map and its accompanying digital files.

This work was completed under the Mineral Grant provided by the Government of Alberta dated June 22, 2021.

2 Methodology

The methodology used to produce this version of the Minerals of Alberta map closely follows that of the previous edition (Lopez et al., 2020b). The map displays the locations of selected mineral occurrences, as well as the surface and subsurface extents of areas with mineral potential, referred to as prospective areas.

For this project, the selected mineral occurrences include producers, past producers, and exploration projects. Accompanying this map is a set of digital datasets that were used to produce the map, and provide more detailed information than what is displayed visually. These datasets allow users to explore, manipulate, and plot mineral-related data as needed.

Prospective areas were defined using a simple, qualitative multicriteria analysis based on known mineral occurrences, their geological characteristics, and mineral systems knowledge. The criteria used are detailed in Section 2.2. These results are preliminary, and prospective areas may define a larger areal extent than the actual extent of these mineral systems. Future work may refine the extent and characteristics of prospective areas and incorporate quantitative methods for a more comprehensive mineral assessment.

This project relied entirely on publicly available data. Geological and mineral information was sourced from government, academia, and industry publications. Government data came from Alberta Energy and Minerals (AEM), the Alberta Energy Regulator (AER), the Alberta Geological Survey (AGS), and the Geological Survey of Canada (GSC). Academic sources included theses and peer-reviewed articles, whereas industry data were drawn from mineral assessment reports, technical documents, environmental impact assessments, well data, news articles, and websites. These sources represent over a century of mineral exploration and are in a diverse range of data formats. Much of the information required digitization to support further use and analysis. No new field data was collected to verify industry data, and no resource estimates were made.

Work done included the following steps:

- 1) updating mineral occurrences in AGS internal datasets (Lopez et al., 2020a, e) and integrating them into one dataset
- 2) grouping mineral occurrences into classes based on their development or exploration stage and mineral deposit type

- 3) selecting producers, past producers, and exploration projects for inclusion in the Minerals of Alberta map
- 4) updating existing and adding new prospective areas' polygon features (Lopez et al., 2020c)
- 5) subdividing prospective areas based on development or exploration stage
- 6) preparing the cartographic map

The literature review of documented mineral occurrences in Alberta, combined with current knowledge of mineral systems, enabled the classification of most mineral occurrences into mineral deposit types. Given the limited information about the genesis of many metallic occurrences, classifications were primarily based on metal associations with specific host rocks, rather than genetic models.

Prospective areas were delineated using the spatial distribution of mineral occurrences, their geological characteristics, combined with knowledge of mineral systems and interpretations of local geology.

Spatial information data were integrated by deposit type into an ArcGIS® Pro project to define mineral tracts deemed to be prospective areas for mineral exploration. Inputs included geological maps and models, basemap data (e.g., roads, railways), satellite imagery, mineral occurrence datasets, geochemical, geophysical, and mineralogy data, surface dispositions, and mineral agreements.

This work represents a preliminary step towards a more detailed mineral assessment that may be undertaken by the AGS or external stakeholders.

2.1 Mineral Occurrences

Mineral occurrence data comprise selected field sites where geological evidence indicates the presence of a mineral system. These sites may include producing and past-producing mines, deposits, prospects, and anomalies. An up-to-date mineral occurrence dataset was critical for developing the Minerals of Alberta map, as mineral occurrences provide insights into the types of mineral systems present, their relationship to known geological features, and their potential extent. For this project, the AGS conducted a comprehensive internal update of its existing mineral occurrence datasets (Lopez et al., 2020a, e).

2.1.1 Mineral Occurrence Updates

The primary objectives of updating the AGS mineral occurrences datasets were to incorporate new occurrences based on recent data and to reformat the dataset for improved clarity and usability.

Since 2021, the Alberta Mineral Mapping Program has enabled the AGS to collect and publish extensive geological and geophysical data, leading to the identification of numerous new occurrences, which were incorporated into the dataset. Additional occurrences were sourced from mineral assessment reports, industry publications, academic research, and other publicly available materials. Existing entries were also reviewed and updated where outdated information or data gaps were identified.

The inclusion of a field site as a mineral occurrence is inherently subjective and based on a combination of geochemical data, geological and geophysical features, and exploration history. As such, it is beyond the scope of this document to describe every decision to include or exclude field sites from the occurrences dataset. For this project, AGS staff used geochemical cutoffs—derived from academic literature and dataset statistics—as an initial filter to identify potential occurrences. However, inclusion was based on a comprehensive interpretation of all available data. For instance, a sample might exceed geochemical thresholds (based on the mean and standard deviation of a dataset), but be excluded if its lithology was inconsistent with a plausible mineral system. Geological and geophysical data were qualitatively evaluated to support occurrence identification.

In addition to adding new occurrences, the AGS mineral occurrences dataset was amended by merging both metallic (Lopez et al., 2020e) and industrial (Lopez et al., 2020a) mineral datasets into a single, comprehensive resource (AER/AGS Digital Data 2025-0009, Alberta Geological Survey, 2025b). This integration enhances utility and acknowledges that metallic and industrial minerals often coexist within the same mineral system.

The mineral occurrence dataset was also restructured into a relational database with multiple linked tables using primary and foreign keys, enabling more efficient data manipulation and minimizing duplication.

2.1.2 Classification Scheme

Mineral occurrences are classified into the following categories: producer, past producer, project with resource estimate, prospect, showing, anomalies, and failed test (Table 1).

For this project, commodities were selected that have recent, well-documented exploration data or have been explored extensively (Table 2). Some commodities are associated with multiple deposit types, as shown in Table 2. Not all commodities or possible deposit types, identified in the literature, in Alberta were included in this project.

Table 1. Classification of metallic and industrial mineral occurrences in Alberta.

Mineral Occurrence Classification	Description
Producer	Mineral deposit from which ore-grade material is currently being extracted. Public and private surficial dispositions for material extraction are included for completeness and are labelled as industrial pits.
Past producer	Mineral deposit from which ore-grade material has been extracted in the past. Ore reserves and grades may be known from production records.
Project with resource estimate	Property with a mineral concentration that has been drilled or investigated so that the presence of tonnage and grade has been established, has a completed a resource estimation (NI 43-101 compliant or not), and has an active surface disposition or mineral agreement. For industrial minerals, access and recoverability are also favourable. May or may not be undergoing further appraisal or development.
Prospect	Mineral concentration that has been drilled or investigated in some manner (e.g., mapping, trenching, drilling, and/or sampling), which may warrant further exploration. May or may not have an active mineral agreement.
Showing	Concentration of a mineral of economic interest that is also anomalous by some measure, with no specified grade and size, and that may or may not warrant additional study. For industrial minerals, access and recoverability may be unfavourable.
Geochemical anomaly	Location where at least one sample exceeds background concentrations for at least one element.
Geological anomaly	Location where a mineral system feature such as veins, veinlets, pods, pyrite concentration, alteration, gossan, or other is present.
Geophysical anomaly	Location where radiometric, magnetic, electromagnetic, or gravity data differ from surrounding area.
Failed test	Mineral occurrence that has indications of mineral content but has been shown from assays or tests to lack economic mineral potential for the foreseeable future.

Table 2. Summary of commodities in Alberta with deposit types and exploration or development stage.

Commodity	Deposit Types	Exploration or Development Stage
Ammolite	Ammonite	Producers (Aurora-Power Pole, St. Mary River), past producers (Aurora, Kormos, Oxbow, Salberg, St. Mary River, Zone 4), surface collection pits
Bentonite, clays, shale	Clays	Past producers (Drumheller, McLeod River, Onoway, Rosalind), project with resource estimate (Swan Hills bentonite), showings
Bromine, boron, iodine	Bromine-, boron-, and iodine-rich formation brines	Anomalies
Building stone	Stone (granite, quartzite, sandstone, limestone, dolomitic siltstone, travertine, fieldstone, slate, volcanic rock)	Producers (Bay Tree, Beaverdam, Edco Hill, Jura Creek, Lundbreck Falls, Oldman River, Pigeon Mountain, Rundle Stone, Sheep Creek, Spray Falls, Summerview, Victory, Yamnuska, and limestone/dolomite producers), past producers, prospects, showings
Calcium/magnesium chloride	Calcium- and magnesium-rich formation brines	Producers (Calling Lake, Mitsue, Sunnynook), past producers, anomalies
Copper	Stratabound Cu-Ag, structurally controlled Cu-Au, volcanic-hosted Cu-Zn, polymetallic black shale	Past producer (Coppermine Creek), historical prospects (1970s) in southwestern Alberta
Diamond	Kimberlite and ultrabasic intrusions	Prospects (Buffalo Head Hills, Calling Lake)
Fly ash	Stockpiles originally generated as a by-product of historical coal-fired power generation	Producers (Battle River, Genesee, H.R. Milner, Keephills, Sheerness, and Sundance power plants), past producer (Wabamun)
Gold	Placer (and paleoplacer) gold, structurally controlled Cu-Au, structurally controlled lode gold, quartz-tourmaline gold veins, sediment-hosted Au-Ag-platinum-group elements (PGEs)	Producers (by-product of Onoway and Villeneuve sand and gravel extractions), anomalies
Gypsum	Evaporite beds	Prospects, showings
Humalite	Humalite	Producer (WestMET Ag), past producers (Dodds Coal mine, Sheerness Coal mine)
Iron	Ironstone, paleoplacer magnetite and other heavy minerals	Project with resource estimate (Clear Hills)
Lead	Carbonate-hosted Pb-Zn, sediment-hosted Pb-Zn	Past producer (Oldman River mine), prospect (GSL Zinc project)
Limestone and dolomite	Limestone and/or dolomite	Producers (Clearwater, Cougar Ridge, Exshaw, Fish Creek, Fort Hills, Fort McMurray west, Gap, Horizon, McLeod, Muskeg, Parsons Creek, Steepbank, Summit Lake), past producer (Nordegg G), projects with resource estimates (Baseline Ridge, Brazeau, Idlewild Mountain)
Lithium	Lithium-rich oilfield brines	Projects with resource estimates (Boardwalk, Clearwater, Clear Hills, Drumheller, Exshaw West, Fox Creek West, North Rocky, Park Place, Peace River)
Magnetite	Paleoplacer magnetite and other heavy minerals	Project with resource estimate (Stiletto Ridge)
Marl and/or tufa	Marl and/or tufa	Producers (industrial pits), past producer (Radnor)

Commodity	Deposit Types	Exploration or Development Stage
Metallurgical coal	Bituminous coal	Producer (Grande Cache mine), past producer (Cheviot), project (Grassy Mountain)
Nickel	Polymetallic black shale	Project (Buckton), anomalies
Peat	Peatland	Producers (industrial pits)
Phosphate	Phosphate beds	Prospect (Crowsnest), showings, anomalies
Potash	Evaporitic salt deposits	Prospects (Alberta Potash Project - North, Provost)
Pumicite	Volcanic rock	Past producer (Willow Creek)
Rare-earth elements	Pegmatite-hosted polymetallic mineralization, structurally controlled polymetallic mineralization, phosphate beds (sedimentary), polymetallic black shale, oil sands tailings	Project with resource estimate (Buckton), several anomalies in phosphate beds and intrusions in the Canadian Shield
Salt (NaCl and storage)	Evaporitic salt beds (NaCl)	Past producers (Riverview, Lindbergh), storage caverns
Sand and gravel	Sand and gravel	Producers (industrial pits), past producers, project with resource estimate (Richardson)
Shale	Shale	Producers (Drift Pile, Racehorse, Seebe, Kakwa, Fickle Lake), past producers, prospects
Silica sand	Silica sand (quartzite, sandstone, sand sources)	Producers (Peace River Silica, Bruderheim plant), past producer (Bruderheim), project with resource estimate (Firebag)
Sodium sulphate	Evaporitic salt beds (Na ₂ SO ₄)	Past producers
Sulphur	By-product of sour gas fields, crude bitumen	Producers (oil sands / gas plants)
Titanium and zirconium	Paleoplacer heavy minerals, oil sands tailings	Project with resource estimate (Pelican Mountain)
Uranium	Sandstone-hosted uranium, unconformity-related uranium, granite-hosted uranium, structurally controlled uranium, polymetallic black shale	Prospect (Dragon Lake), showings, anomalies
Vanadium	Ironstone, polymetallic black shale, bitumen production and processing	Projects (Clear Hills, Buckton), anomalies in oil sands refineries and upgraders
Zinc	Polymetallic black shale, carbonate-hosted Pb-Zn, sediment-hosted Pb-Zn	Past producer (Oldman River mine), project with resource estimate (Buckton), prospect (GSL Zinc project), showings, anomalies

2.2 Prospective Areas for Mineral Exploration

A prospective area for mineral exploration is defined as a region with favourable geology for the presence of a mineral deposit, making it suitable for exploration. These areas represent mineral tracts with a higher likelihood of containing undiscovered deposits. Prospective areas were delineated by identifying regions around known occurrences that share ore mineralogy and other distinguishing physical and genetic geological characteristics. This process involved compiling extensive publicly available data and reviewing numerous publications to understand the nature of the occurrences and assign them to relevant deposit types that are or may be present in the province. The delineation also required integrating regional and local geological information.

2.2.1 Construction of Prospective Areas

For each deposit type listed in Table 2, a list of prospective geological units was identified as the primary criteria for delineating prospective areas (Table 3). Geological units included stratigraphic units, intrusions, and structures (faults, shear zones, tectonic zones, etc.). The selection of the geological units was based on one or more of the following criteria:

- presence of mineral occurrences
- identification by previous studies as having resource potential
- key geological characteristics conducive to the formation of mineral deposits (Table 3)

The geometry of prospective areas (i.e., polygon outlines) was taken from AGS geological maps (e.g., Pană, 2010; Fenton et al., 2013b; Pană and Elgr, 2013; Prior et al., 2013), publicly available industry maps (usually in map scales larger than AGS maps), or AGS three-dimensional (3D) geological framework of Alberta (GFA) models (Branscombe et al., 2018; Alberta Geological Survey, 2019). The AGS maps and models were the primary data used to define the maximum extent of prospective areas. More detailed geological maps or datasets, where available, were used to refine or subdivide the prospective areas.

A 500 m buffer was occasionally applied to simplify complex polygon shapes from maps and models and address cartographic uncertainty. Buffers around point occurrences were also used to define the geometry of a prospective area when map and model information was not available (Table 4). When buffers were unknown, clustered mineral occurrences related to a specific deposit type were used to calculate an average distance between occurrences (e.g., unconformity-related uranium, sandstone-hosted uranium, and granite-hosted uranium deposits) or to define a minimum bounding geometry polygon (e.g., potash, lithium).

Table 3. Prospective areas in Alberta by deposit types, with commodities, geological units, and characteristics. Abbreviations: BUL, Bulletin; fms., formations; GFA, Geological Framework of Alberta; gps., groups; v, version.

Deposit Type	Commodity	Select Geological Units	Key Characteristics	Select References
Ammonite	Ammolite	Bearpaw Fm.	Western Interior Seaway, shale with low sand content, concretions, banks of St. Mary River	Mychaluk, 2009; Prior et al., 2013 (Map 600); Alberta Geological Survey, 2019 (GFA v2)
Bitumen production and processing	Ni, V, Mo, Re	Surface mineable area Athabasca oil sands	Bitumen from oil sands and related waste products	Alberta Energy Regulator, 2018
Bituminous coal	Metallurgical coal	Gates, Gething, and Mist Mountain fms.	Medium- and low-volatile bituminous, higher carbon content than thermal coal	Smith et al., 1994; Alberta Energy Regulator, 2016a–c, 2018
Bromine-, iodine- and boron-rich formation brines	Br, I, B	Br in Beaverhill Lake and Elk Point gps.; I in Bow Island and Viking fms., and Belly River Gp.; B in Beaverhill Lake, Elk Point, and Woodbend gps.	Br, I, B chemical anomalies in formation water	Hitchon et al., 1977, 1995; Hamilton et al., 2005 (Map 224)
Calcium- and magnesium-rich formation brines	CaCl ₂ , MgCl ₂	Beaverhill Lake and Elk Point gps.	Ca and Mg chemical anomalies in formation water	Hitchon et al., 1995; Hamilton et al., 2005 (Map 224)
Carbonate-hosted lead-zinc	Pb, Zn	Cathedral, Grosmont, Keg River, Palliser, Prairie Evaporite, Slave Point, and Waterways fms.	Sphalerite-galena-pyrite, brittle fracturing, carbonate dissolution, stratigraphic and structural control, extensive diagenetic dolomite, saddle dolomite	Pană, 2003, 2006; Davies and Smith, 2006; Hannigan, 2006; Prior et al., 2013 (Map 600); Branscombe et al., 2018 (GFA v1)
Clays	Bentonite	Bearpaw, Horseshoe Canyon, Paskapoo, and Wapiti fms.	Formed by the devitrification of volcanic ash and glass; montmorillonite, illite have ability to swell when exposed to water	Master, 1993; Prior et al., 2013 (Map 600); Dufresne, 2015; Lopez et al., 2020a
Clays	Ceramic clay, expanded aggregate	Kaskapau, Lea Park, Porcupine Hills, and Whitemud (and other nonmarine bedrock) fms.	Plasticity, workability, drying behaviour, maximum firing temperature, fired colour, absorption	Scafe, 1991; Fenton et al., 2013a (Map 601); Prior et al., 2013 (Map 600)
Evaporite beds	Gypsum	Devonian and Triassic strata	Interbedded with anhydrite, karstic surface expression, grade >84% in northeastern Alberta	Godfrey et al., 1993; Hamilton et al., 2005 (Map 224)
Evaporitic salt beds (NaCl)	NaCl, storage caverns	Lotsberg and Prairie Evaporite fms.	Average >75% NaCl and 80 m cumulative thickness, 900 m depth	Grobe, 2000; Hauck, 2020
Evaporitic salt beds (Na ₂ SO ₄)	Sodium sulphate	Salt beds and brines in undrained or poorly drained lakes in southeastern Alberta	Lakes with high dissolved salt content, high evaporation to precipitation ratios and endorheic drainage	Godfrey, 1985; Hamilton et al., 2005 (Map 224)
Evaporitic salt deposits	Potash	Prairie Evaporite Fm.	Sylvite, carnallite, or other potassium salt minerals, thick sections of evaporitic salt	Eccles et al., 2009; Dufresne et al., 2012, 2013; Lopez et al., 2020a; Alberta Geological Survey, 2025a
Granite-hosted uranium	U, Mo, REE	Gneiss, granitoids, and pegmatites	Geochemical anomalies, fertile granitoid basement often within high-strain zones	Paná, 2010 (Map 537); Lopez et al., 2020e
Humalite	Humalite	Horseshoe Canyon Fm.	Degraded organic matter, humic substances (humic acid, fulvic acid, humin, humus, humate), shallow weathered and oxidized sub-bituminous coal and carbonaceous shale	Hoffman et al., 1993; Berhane, 2009; Prior et al., 2013 (Map 600); Alberta Energy Regulator, 2016d
Ironstone	Fe, V	Bad Heart (mostly) and Dunvegan fms.	Iron anomalies, goethite and nontronite ooids, shallow oxygenated marine environment close to a shoreline with limited clastic sediment supply	Olson et al., 1999, 2006; Kafle, 2008, 2009, 2011; Gilles and Johnson, 2012; Prior et al., 2013 (Map 600); Lopez et al., 2020e
Kimberlite and ultrabasic intrusions	Diamond	Birch Mountains and Buffalo Head Hills kimberlites, Sweetgrass Hills intrusions, Mountain Lake volcanic rocks and ultrabasic rock fields	Kimberlite-indicator-mineral count and mineralogy, diamond occurrences	Eccles, 2007, 2011; Banas et al., 2016; Lopez et al., 2020d; Lopez and Weiss, 2020
Limestone and/or dolomite	High-calcium limestone, high-purity dolomite, building stone, aggregate	Cambrian, Devonian, Carboniferous, Permian, and Triassic carbonate strata; high-Ca limestone from Eldon, Livingstone, Mount Head, Mount Whyte, and Palliser fms.; dolomite from Fairholme Gp., Palliser, Turner Valley, and Waterways fms.	Calcite with minimal impurities, especially silica; CaCO ₃ >90% (high-calcium limestone), MgCO ₃ >40% (dolomite); homogeneous	Holter, 1975; Pană and Elgr, 2013 (Map 560); Prior et al., 2013 (Map 600); Eccles et al., 2015; Krueger et al., 2016; Alberta Geological Survey, 2019 (GFA v2), 2025a
Lithium-rich oilfield brines	Li, Li ₂ CO ₃	Keg River, Leduc, Montney, Muskeg River, Nisku, Sulphur Point, Swan Hills, and Winnipegosis fms., Elk Point and Winterburn gps.	Chemical anomalies of Li >50 mg/L, commonly hosted in Devonian reefs	Hitchon et al., 1995 (BUL 62); Eccles and Berhane, 2011; Huff et al., 2011, 2012, 2019; Eccles et al., 2012; Eccles and Dufresne, 2016; Spanjers et al., 2017a, b; Alberta Geological Survey, 2019 (GFA v2); Huff, 2019; Lopez et al., 2020e, f; MacMillan and Binks, 2021; Eccles et al., 2022; Klein et al., 2023; MacMillan, 2023
Marl and/or tufa	Marl and/or tufa	Surficial evaporitic bicarbonate deposits	Associated with groundwater discharge that is enriched in calcium and bicarbonate ions	Macdonald, 1982
Oil sands tailings	TiO ₂ , Zr, REEs	Surface mineable area Athabasca Oil Sands	Concentrated in oil sands tailings	Bicalho et al., 2018; Alberta Government, 2019
Paleoplacer magnetite and other heavy minerals	Magnetite, Fe, Ti, Zr	Belly River Gp. (Burmis Fm.)	Magnetite occurrences and geophysical anomalies, heavy mineral paleoplacer along margin of Western Interior Seaway	Olson et al., 1994; Dufresne, 2003; Prior et al., 2013 (Map 600)

Deposit Type	Commodity	Select Geological Units	Key Characteristics	Select References
Peatland	Peat	Surficial organic deposits: peatlands and mineral wetlands	Peatland >40 cm thick, undecomposed to moderately decomposed organic material	Fenton et al., 2013a (Map 601)
Pegmatite-hosted polymetallic mineralization	REE, U, Th	Marguerite River complex, Rutledge River complex, Fishing Creek and Wylie Lake granodiorites, Arch Lake, Colin Lake, and Slave granitoids, Chipewyan and Thesis Lake granites, and Fair Point Fm.	Granitoid gneiss and pegmatite with geochemical anomalies, often linked to planes of weakness associated with polyphase deformation	Dufresne et al., 1994; Smith and Griffith, 2007; Pană, 2010 (Map 537); Lopez et al., 2020e
Phosphate beds (sedimentary)	P ₂ O ₅ , REE	Banff, Exshaw, Fernie, Johnston Canyon, Nikanassin, Ranger Canyon, Sulphur Mountain, and Whitehorse fms., Ishbel, Rocky Mountain, and Spray River gps.	Phosphate showings and P ₂ O ₅ >1%, occurs as nucleated, elliptical, and structureless pellets, intraclasts, and pebbles, and stratiform deposits	Macdonald, 1984, 1987; Godfrey at al., 1993; Pană and Elgr, 2013 (Map 560); Lopez et al., 2020a
Placer and paleoplacer gold	Au, Ag	Glaciofluvial and fluvial deposits	Gold anomalies in stream and alluvial sediments	Lau and Dudek, 1992; Ballantyne and Harris, 1997; Edwards and Budney, 2009; Rukhlov, 2011; Fenton et al., 2013a (Map 601); Lopez et al., 2020e
Polymetallic black shale	Zn, Ni, V, Cu, Co, REE, Y, Li, U, Sc, Mo	Banff, Carlile, Exshaw, Fernie, Labiche, Loon River, Niobrara, Second White Specks, and Shaftesbury fms., Colorado Gp.	Radiogenic and organic-rich marine shale, euxinic to anoxic environment, Zn-V-Mo-Ni association, Mo+Ni+Zn+Sc+V >1500 ppm	Eccles et al., 1998, 2013; Dufresne et al., 2001, 2011; Pană and Elgr, 2013 (Map 560); Prior et al., 2013 (Map 600); Puritch et al., 2014; Rokosh et al., 2016; Alberta Geological Survey, 2019 (GFA v2); Lopez et al., 2020e
Quartz-tourmaline gold veins	Au, W, Mo	Taltson basement complex, Waugh Lake complex, Colin Lake granitoid	W-Mo association in chemical analyses, shear zones in metasedimentary rocks, associated with syn- to late-orogenic granitoids	Godfrey, 1958, 1963; Salat et al., 1994; Pană et al., 2006; Langenberg and Eccles, 2009; Pană, 2010 (Map 537)
Rock (crushed)	Aggregate	Winnipegosis Fm., Belly River Gp.	Hard, dense, strong, and free of soft, porous, or friable particles	Hamilton et al., 2005 (Map 224); Alberta Geological Survey, 2025a
Sand and gravel	Sand and gravel	Surficial sand and gravel; glacial, preglacial, and recent alluvial deposits	Sources of aggregate vary depending on region	Shetsen, 1987; Edwards and Budney, 2009; Fenton et al., 2013b; Pawley et al., 2015
Sandstone-hosted uranium	U	St. Mary River and Willow Creek fms.	Uranium showing and chemical anomalies, alteration of sandstone, redox front	Matveeva and Anderson, 2007; Matveeva and Kafle, 2009, 2010; Matveeva, 2010; Prior et al., 2013 (Map 600)
Sediment-hosted Au-Ag-PGEs ^a	Au, Ag, PGEs, Cu, Mo	McMurray and Waterways fms.	Gossans, calcite-pyrite veins, Au-Ag-PGE and Cu-Mo anomalies	Abercrombie and Feng, 1997; Rukhlov, 2011
Sediment-hosted lead-zinc	Pb, Zn, Ag	Gorman Creek, Grinnell, Shaftesbury, Sheppard, and Siyeh fms.	Presence of stratabound disseminated galena and sphalerite	Eccles et al., 1998; Rukhlov and Pawlowicz, 2011; Pană and Elgr, 2013 (Map 560); Lopez et al., 2020e
Shale ^a	Shale	Banff, Porcupine Hills, and Wapiabi fms., and Belly River Gp.	Same as clay for ceramics	Scafe, 1991
Silica sand (quartzite, sandstone, sand sources)	Silica sand (frac sand, blasting, traction, arenas, filtration, etc.)	Grand Rapids, McMurray, Peace River (Paddy Mb.), and Pelican fms., unconsolidated sand	Fluvial, beach, shoreface, aeolian deposits; mineralogy dominated by quartz; well-sorted and mature deposits SiO ₂ >90%	McLaws, 1980; Edwards et al., 1986; Alberta Geological Survey, 1989; Fenton et al., 2013a (Map 601); Prior et al., 2013 (Map 600); Hannah and Lavender, 2015; Brown, 2016; Alberta Geological Survey, 2019 (GFA v2)
Stone (granite, quartzite, sandstone, limestone, dolomitic siltstone, travertine, fieldstone, slate, volcanic rock)	Building stone	Cardium, Corral Creek, Dunvegan, Paskapoo, Porcupine Hills, St. Mary River, and St. Piran fms., Blairmore and Spray River gps., and other carbonate strata; Chipewyan granite; rock waste from coal mines	Strength, durability, resistance to weathering, abrasion resistance, block size, jointing, abundance, consistent grade, workability, appearance, and impurities (plant and clay matter)	Godfrey et al., 1993; Crocq, 2010; Prior et al., 2013 (Map 600); Krueger et al., 2016; Branscombe et al., 2018; Lopez et al., 2020a; Alberta Geological Survey, 2025a
Stratabound copper-silver	Cu, Ag	Grinnell Fm.	Bornite, chalcocite, and chalcopyrite, outer alteration of host rock to lavender colour (hematite), permeability/porosity of host rock (paleoaquifer), redox front (e.g., pyrite-hematite interface)	Olson et al., 1994; Rukhlov and Pawlowicz, 2011; Pană and Elgr, 2013 (Map 560); Lopez et al., 2020e
Structurally controlled copper-gold	Cu, Au	Leland Lakes shear zone, Taltson basement complex	Geochemical anomalies in shear zone, sulphide showings	Langenberg et al., 1994; Langenberg and Eccles, 2009; Pană, 2010 (Map 537); Lopez et al., 2020e
Structurally controlled lode gold	Au	Rutledge River complex	High-grade metamorphic tectonites, deposition of sulphides into shear zones	Pană, 2010 (Map 537); Rukhlov, 2011
Structurally controlled polymetallic mineralization	U, REEs	Bonny Fault	Geochemical anomalies within high-strain zones	Pană et al., 2006; Pană, 2010 (Map 537)
Structurally controlled uranium	U	Charles Lake shear zone, Rutledge River complex, and Taltson basement complex	Showings, geochemical and geophysical anomalies within high-strain zones	Pană, 2010 (Map 537); Pană and Prior, 2010; Lopez et al., 2020e, 2024
Unconformity-related uranium	U	Athabasca Gp., Maybelle River shear zone, Black Bay Fault, Taltson basement complex	Basement unconformity, redox front, geochemical and geophysical anomalies, chlorite-clays alteration	Mei et al., 2004; Pană, 2010 (Map 537); Wheatley and Cutts, 2013; Annesley and Eccles, 2014; Lopez et al., 2020e
Volcanic-hosted copper-zinc	Cu, Zn	Gabbro intrusion and Purcell lava	Massive chalcopyrite in extension-related setting	Rukhlov and Pawlowicz, 2011; Pană and Elgr, 2013 (Map 560); Lopez et al., 2020e

^a No prospective areas were created for sediment-hosted Au-Ag-PGEs and shale deposits. The user can consult the digital files to evaluate these occurrences.

Table 4. Buffer radius around a mineral occurrence.

Deposit Type	Buffer Radius or Area	Reference
Ironstone	2 km radius	Gilles and Johnson, 2012
Kimberlite and ultrabasic intrusions	30 km	Wilson et al., 2008
Paleoplacer magnetite	Burmis magnetite-bearing sandstone is 1.5 km (length) by 15 m (width); distance between magnetite-bearing beds is 165 m	Dufresne, 2003
Phosphate beds	12 km	Fertoz Limited, 2019
Stratabound copper-silver and volcanic-hosted copper-zinc	4 km	Boleneus et al., 2005
Other metallic and industrial minerals	2.5 km	Wilson et al., 2008

Table 5. Subdivision of prospective areas by level of certainty of mineral data.

Level of Certainty	Exploration or Development Stage	Description
1	No mineral data	Prospective area but no mineral occurrence has been documented for the area or it has failed tests
2	Anomalies	Prospective area with geophysical, geochemical, and/or geological anomalies or other indirect evidence
3	Showings	Prospective area with showings and/or significantly high geochemical anomalies
4	Deposit ^a	Prospective area with a project with a resource estimate (i.e., mineral deposit), past producers with remaining resources, or an active prospect with mineralization but resource estimation is still pending
5	Producer ^b	Mine, quarry area, solution mining well, plant, or industrial pits

^a Includes mineral deposits (i.e., those with a resource estimate) and active mineral prospects with drilling-delineated mineralized intersection(s).

^b Deposit that is currently producing or can produce at a profit.

In cases where a specific geological unit identified in reports was not differentiated in regional maps or 3D GFA models, it was included within a broader, undifferentiated unit. In such instances, the larger unit was used as the prospective area.

Prospective areas represent the extent of geological units favourable for hosting mineral deposits or occurrences. Alternatively, they may define a region buffered around a known mineral occurrence where no further geological information is available.

Not all mineral deposit types described by the literature as being present in Alberta were included in Table 3 or the Minerals of Alberta map. They were excluded due to either a limited number of documented occurrences or insufficient information to properly classify the deposit type. Users may refer to the digital datasets for a comprehensive evaluation of all reported mineral occurrences in Alberta.

2.2.2 Subdivision of Prospective Areas

Prospective areas were classified into five levels based on the development stage or certainty of the mineral occurrence data (Table 5). The lowest level of certainty was assigned to areas without mineral occurrences, whereas the highest was given to areas with active producers. Thus, the certainty of a mineral occurrence increases as mineral development increases towards the establishment of an economic deposit or mine.

3 Digital Files

The digital files for this project include the Minerals of Alberta map as a PDF and two digital datasets. The map provides a cartographic representation of selected mineral occurrences (producers, past producers, and exploration projects) and prospective areas for mineral exploration. The accompanying digital datasets include Prospective Areas for Mineral Exploration in Alberta (polygon data) and Selected Producers, Past Producers, and Exploration Projects (point data). Point data locations are published in tab-delimited tabular data format. Point data locations were derived from various databases, reports, and source maps, and are generally accurate to within ± 1 km. The dataset for selected producers, past producers, and exploration projects is based on the Mineral Occurrences of Alberta dataset (Alberta Geological Survey, 2025b). Prospective areas for mineral exploration are provided as GIS polygon data. These areas were scanned and digitized from georeferenced maps or copied (and buffered) from existing vector GIS data from geological maps and 3D models. The scales of georeferenced maps ranged from 1:5000 to 1:1 000 000, so prospective area boundaries are generally accurate to within ± 1 km. The digital file data should not be used or displayed at scales larger than 1:1 000 000, except for those features that were created from a larger scale source map. The output digital files include the sources and references used to define the point and polygon features, allowing users to assess the location accuracy by reviewing the original input data.

3.1 Minerals of Alberta Map (PDF Format)

For the cartographic view of Alberta's mineral endowment (Figure 1), a selection of data produced for this project was used. Only the most relevant producers and past producers are shown on the Minerals of Alberta map. A subset of the projects and prospects from the mineral occurrence datasets were selected as exploration projects to display on the map (Figure 1). This subset represents those occurrences with a higher level of exploration and development and an active mineral agreement.

Prospective areas for the 42 deposit types used in this project were grouped into 23 categories based on shared commodities to simplify map display (Figure 1). The digital data file (included in this publication) includes a field column 'MAP_Legend' that specifies those deposit types and polygons chosen for display on the map. For the cartographic map view, these areas generally represent the extent of a surface or subsurface geological unit hosting the occurrences. Prospective areas may overlap, as prioritizing or ranking their mineral potential for cartographic representation was beyond the scope of this version. For more detailed information on the prospective areas and to resolve overlapping features, users should refer to the accompanying digital data file.

The following subsections describe the individual output files included in this publication.

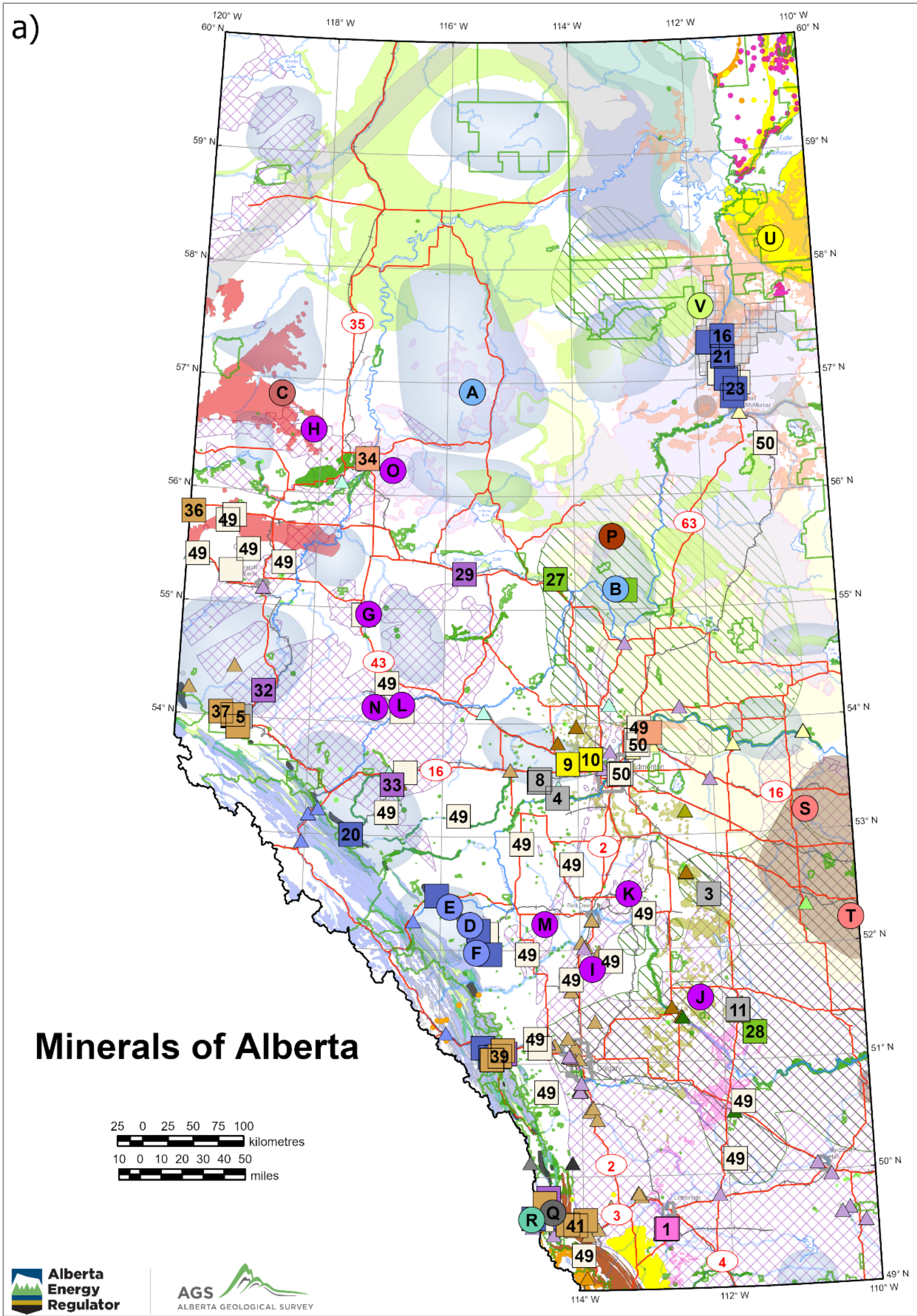


Figure 1. (a) Minerals of Alberta map, showing selected producers (squares), past producers (triangles), and exploration projects (circles) and prospective areas. Green lines represent park boundaries. (b) Legend for Minerals of Alberta map.

b) PRODUCERS

Ammolite	<div></div> 1	Aurora-Power Pole
	<div></div> 2	St. Mary River
Fly ash <i>(produced from stockpiles, originally generated as a by-product of historical coal-fired power generation)</i>	<div></div> 3	Battle River (Forestburg) power plant
	<div></div> 4	Genesee power plant
	<div></div> 5	H.R. Milner power plant
	<div></div> 6	Keephills power plant
	<div></div> 7	Sheerness power plant
	<div></div> 8	Sundance power plant
Gold (placer) <i>(by-product of sand and gravel production)</i>	<div></div> 9	Onoway
	<div></div> 10	Villeneuve
Humalite	<div></div> 11	WestMET Ag
Limestone and/or dolomite	<div></div> 12	Clearwater
	<div></div> 13	Cougar Ridge (Prairie Creek)
	<div></div> 14	Exshaw
	<div></div> 15	Fish Creek (Nordegg)
	<div></div> 16	Fort Hills
	<div></div> 17	Fort McMurray west
	<div></div> 18	Gap
	<div></div> 19	Horizon
	<div></div> 20	McLeod (Cadomin)
	<div></div> 21	Muskeg
	<div></div> 22	Parsons Creek
	<div></div> 23	Steepbank
	<div></div> 24	Summit Lake
Metallurgical coal	<div></div> 25	Grande Cache
Calcium chloride	<div></div> 26	Calling Lake
	<div></div> 27	Mitsue
	<div></div> 28	Sunnynook
Shale	<div></div> 29	Drift Pile
	<div></div> 30	Racehorse
	<div></div> 31	Seebe
	<div></div> 32	Kakwa
	<div></div> 33	Fickle Lake
Silica sand	<div></div> 34	Peace River Silica
	<div></div> 35	Bruderheim plant
Building stone	<div></div> 36	Bay Tree
	<div></div> 37	Beaverdam
	<div></div> 38	Edco Hill
	<div></div> 39	Jura Creek
	<div></div> 40	Lundbreck Falls
	<div></div> 41	Oldman River
	<div></div> 42	Pigeon Mountain
	<div></div> 43	Rundle Stone
	<div></div> 44	Sheep Creek
	<div></div> 45	Spray Falls
	<div></div> 46	Summerview
	<div></div> 47	Victory
	<div></div> 48	Yamnuska
Sulphur <i>(by-product of oil and gas processing)</i>	<div></div> 49	Gas plant
	<div></div> 50	Oil sands processing plant
Sand, gravel, peat, or marl and/or tufa	<div></div>	Industrial pit

PAST PRODUCERS

Ammolite	<div></div>
Bentonite	<div></div>
Building stone	<div></div>
Calcium/magnesium chloride	<div></div>
Clay	<div></div>
Copper	<div></div>
Fly ash	<div></div>
Humalite	<div></div>
Lead-zinc-silver	<div></div>
Limestone and/or dolomite	<div></div>
Marl and/or tufa	<div></div>
Metallurgical coal	<div></div>
Pumicite	<div></div>
Salt and storage caverns	<div></div>
Silica sand	<div></div>
Sodium sulphate	<div></div>

SELECTED EXPLORATION PROJECTS

Diamond	<div></div> A	Buffalo Head Hills
	<div></div> B	Calling Lake
Iron-vanadium	<div></div> C	Rambling Creek-North Whitemud River ^a
Limestone and/or dolomite	<div></div> D	Baseline Ridge
	<div></div> E	Brazeau
	<div></div> F	Idlewilde Mountain
Lithium	<div></div> G	Boardwalk ^a
	<div></div> H	Clear Hills ^a
	<div></div> I	Clearwater ^b
	<div></div> J	Drumheller ^a
	<div></div> K	Exshaw West ^a
	<div></div> L	Fox Creek West ^a
	<div></div> M	North Rocky ^a
	<div></div> N	Park Place ^a
	<div></div> O	Peace River ^a
Magnetite (heavy minerals)	<div></div> P	Stiletto Ridge
Metallurgical coal	<div></div> Q	Grassy Mountain
Phosphate	<div></div> R	Crowsnest
Potash	<div></div> S	Alberta Potash Project - North
	<div></div> T	Provost
Uranium	<div></div> U	Dragon Lake
Zinc-vanadium-nickel-REEs	<div></div> V	Buckton ^a
^a NI 43-101 compliant resources. ^b NI 43-101 compliant resources with potential economic viability supported by a preliminary economic assessment.		

SELECTED PROSPECTIVE AREAS

<div></div> Ammolite	<div></div> Magnetite
<div></div> Bentonite	<div></div> Metallurgical coal
<div></div> Calcium/magnesium chloride	<div></div> Phosphate
<div></div> Copper	<div></div> Potash
<div></div> Diamond	<div></div> Rare-earth elements (REEs)
<div></div> Gold	<div></div> Salt (NaCl and storage caverns)
<div></div> Gypsum	<div></div> Silica sand
<div></div> Humalite	<div></div> Titanium-zirconium-REEs
<div></div> Iron-vanadium	<div></div> Uranium
<div></div> Lead-zinc	<div></div> Vanadium-nickel
<div></div> Limestone and/or dolomite	<div></div> Zinc-vanadium-nickel-REEs
<div></div> Lithium	
For clarity, prospective areas are not displayed on the map but are available in the digital dataset (Alberta Geological Survey, 2025c): aggregate, boron, bromine, building stone, ceramic clay, iodine, marl and/or tufa, peat, sand and gravel, shale, and sodium sulphate.	

3.2 Selected Producers, Past Producers, and Exploration Projects of Alberta (Tabular Data, Tab-Delimited Format)

The updated Mineral Occurrences of Alberta dataset (AER/AGS Digital Data 2025-0009, Alberta Geological Survey, 2025b) was used to generate a subset of occurrences for display on the Minerals of Alberta map. This subset (AER/AGS Digital Data 2025-0010, Alberta Geological Survey, 2025d) includes selected current producers (Figure 2), past producers (Figure 3), and exploration projects that are considered significant in scope and development (Figure 4). All records in this subset are part of the full Mineral Occurrences of Alberta dataset, which users can consult for additional details. A tab-delimited overview of the selected occurrences is included in this publication for easy plotting and reference.

3.3 Prospective Areas for Mineral Exploration in Alberta (GIS Data, Polygon Features)

A prospective area represents a region with geology that is favourable for the exploration of a specific mineral deposit. In most cases, prospective areas represent the extent of favourable geological units, sometimes constrained by conditions such as depth. Alternatively, they may consist of a buffer around a known mineral occurrence.

A total of 6876 polygons were constructed for 42 deposit types covering over 50 commodities. A selection of prospective areas, grouped into 23 commodity categories, is displayed on the Minerals of Alberta map (Figures 1 and 5).

Attributes of the prospective areas included in the digital file are listed in Table 6. These areas are subdivided by geological unit, depth, and certainty level. Examples of the subdivision of prospective areas by certainty level are illustrated in Figure 6. Key characteristics and buffer criteria used to delineate prospective areas are summarized in Tables 3 and 4.

In some cases, geological units of interest were not differentiated in regional maps or 3D provincial models, resulting in prospective areas that are larger than intended. For example, the Mount Head Formation in southwestern Alberta—favourable for high-calcium limestone used in cement production—is grouped into the broader Rundle Group. As a result, the prospective areas for high-calcium limestone are larger than intended. Where possible, 3D provincial models and geological maps were used together to better constrain the extent of the units of interest.

The data were compiled from a variety of sources, including maps and reports. No attempt was made to verify the consistency of testing and observation methods across these reference materials.

Overlaps occur among polygons representing different deposit types. As a result, polygons for one deposit type may be partially or fully obscured by those of another. This is because multiple deposit types can occur within the same geological unit (e.g., phosphate and polymetallic black shale in the Fernie Formation), or within the same map area but in different stratigraphic levels (e.g., polymetallic black shale in Cretaceous strata above lithium-rich brines in Devonian strata). Topology was applied only within deposit type polygon data, not across types. To resolve overlapping polygons, more detailed information on the prospective areas is found in the accompanying digital data file.

Some prospective areas lack associated mineral occurrence data but are still considered prospective based on favourable geological settings or characteristics (Table 3). These areas represent data gaps and may warrant future field exploration.

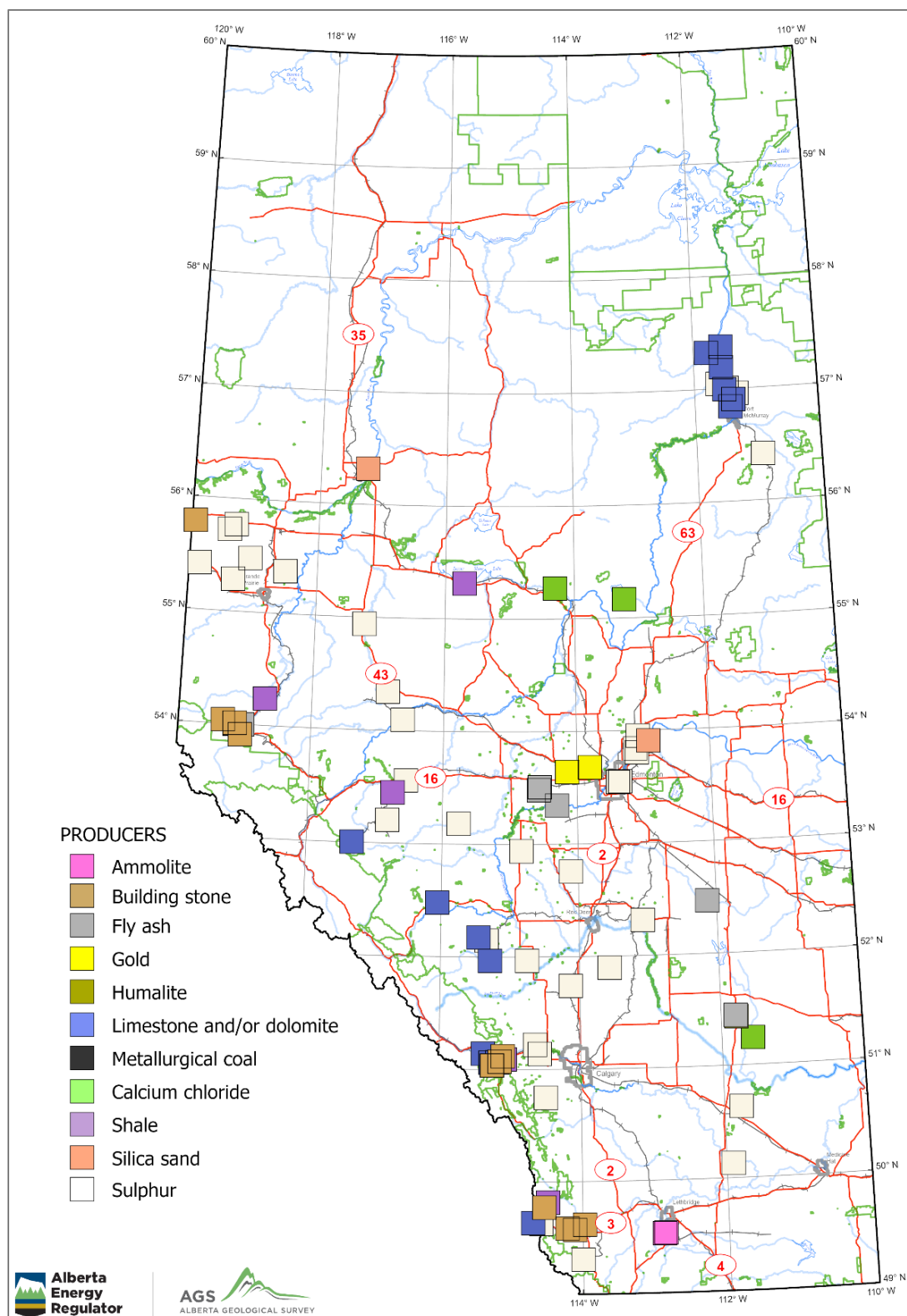


Figure 2. Location of selected mineral producers in Alberta. The producers of the following commodities are not displayed on the map but are available in the digital dataset (Alberta Geological Survey, 2025d): sand, gravel, peat, and marl and/or tufa. Green lines represent park boundaries.

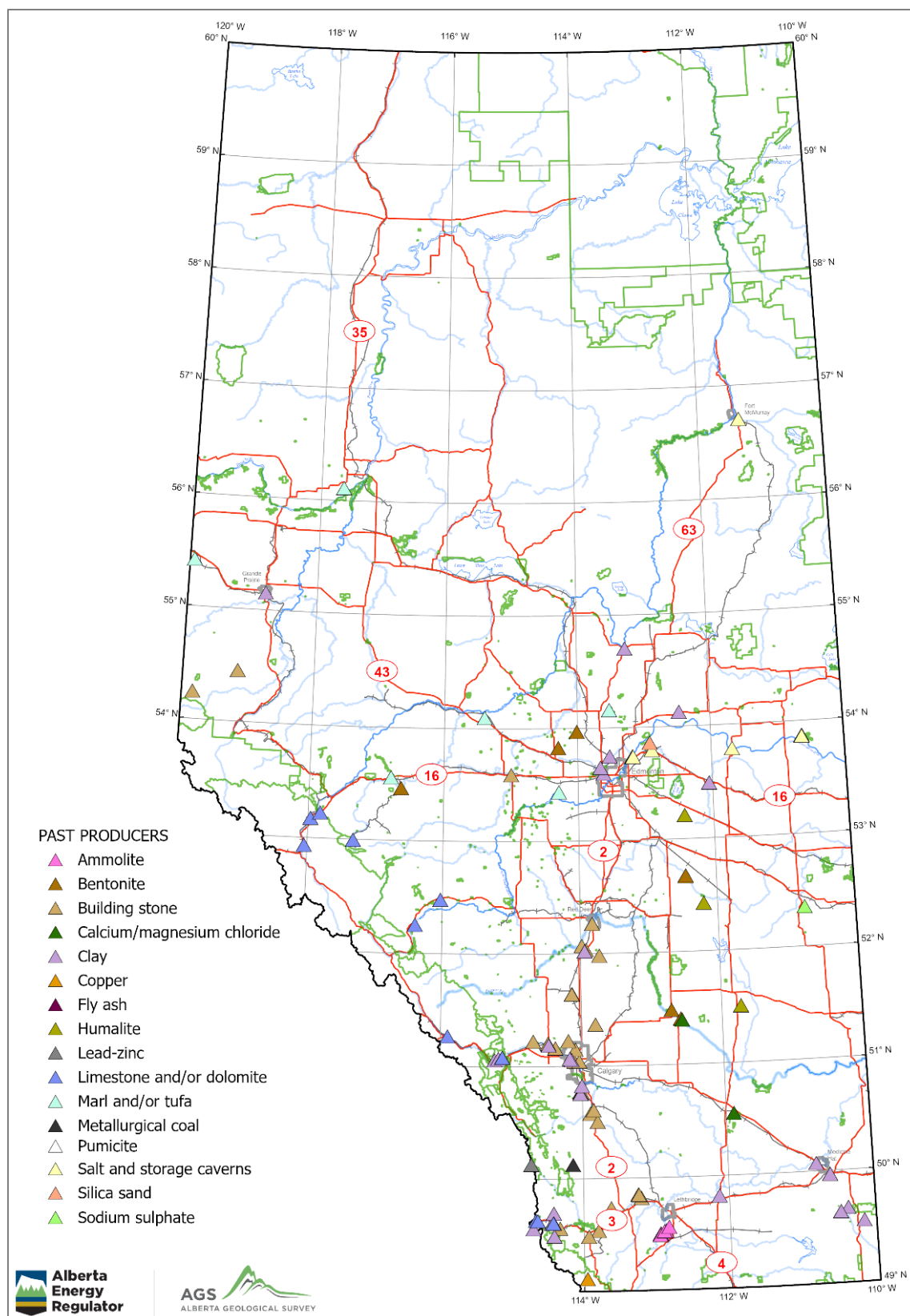


Figure 3. Location of selected past producers of minerals in Alberta. Green lines represent park boundaries.

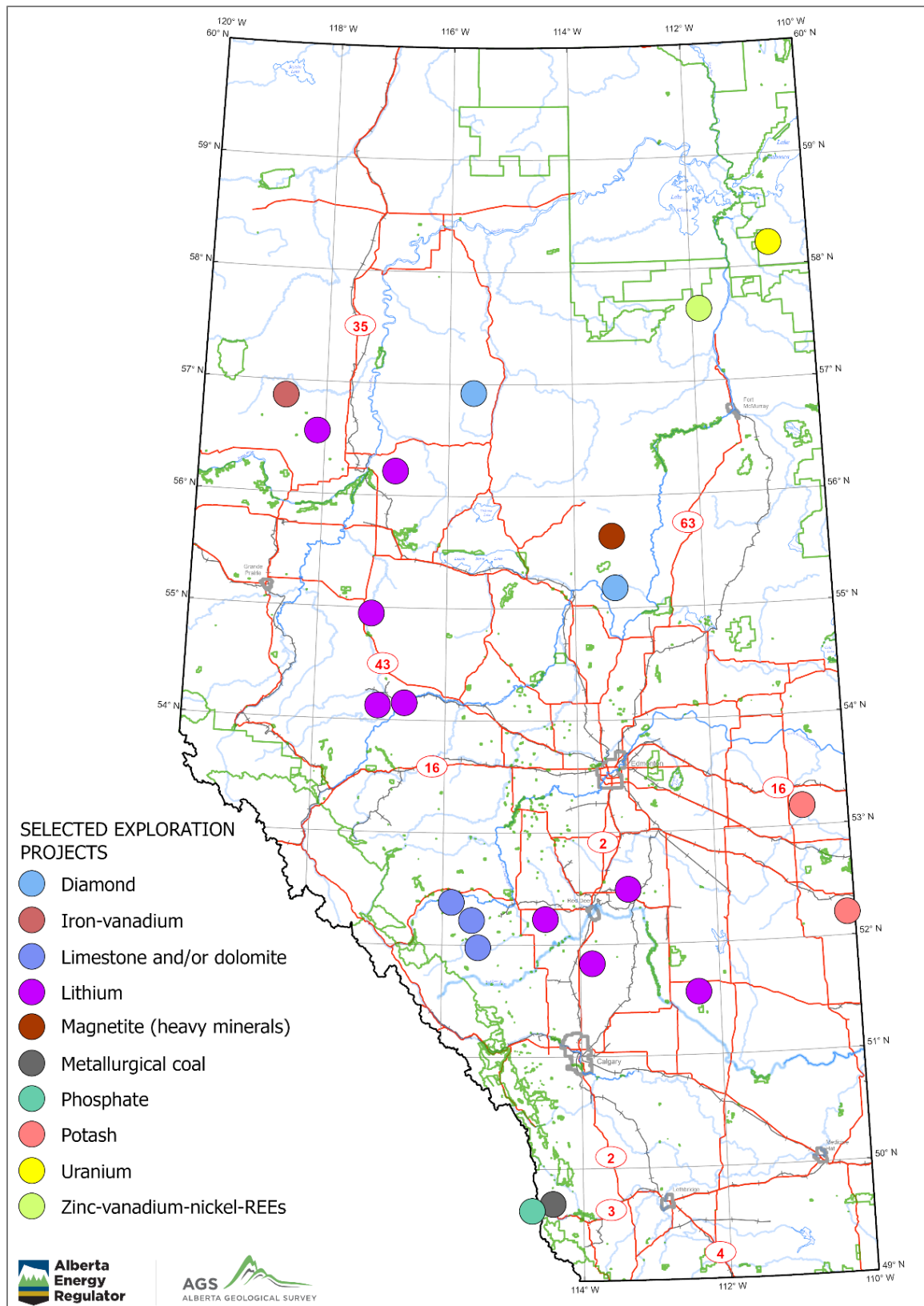


Figure 4. Location of selected mineral exploration projects in Alberta. Green lines represent park boundaries. Abbreviation: REEs, rare-earth elements.

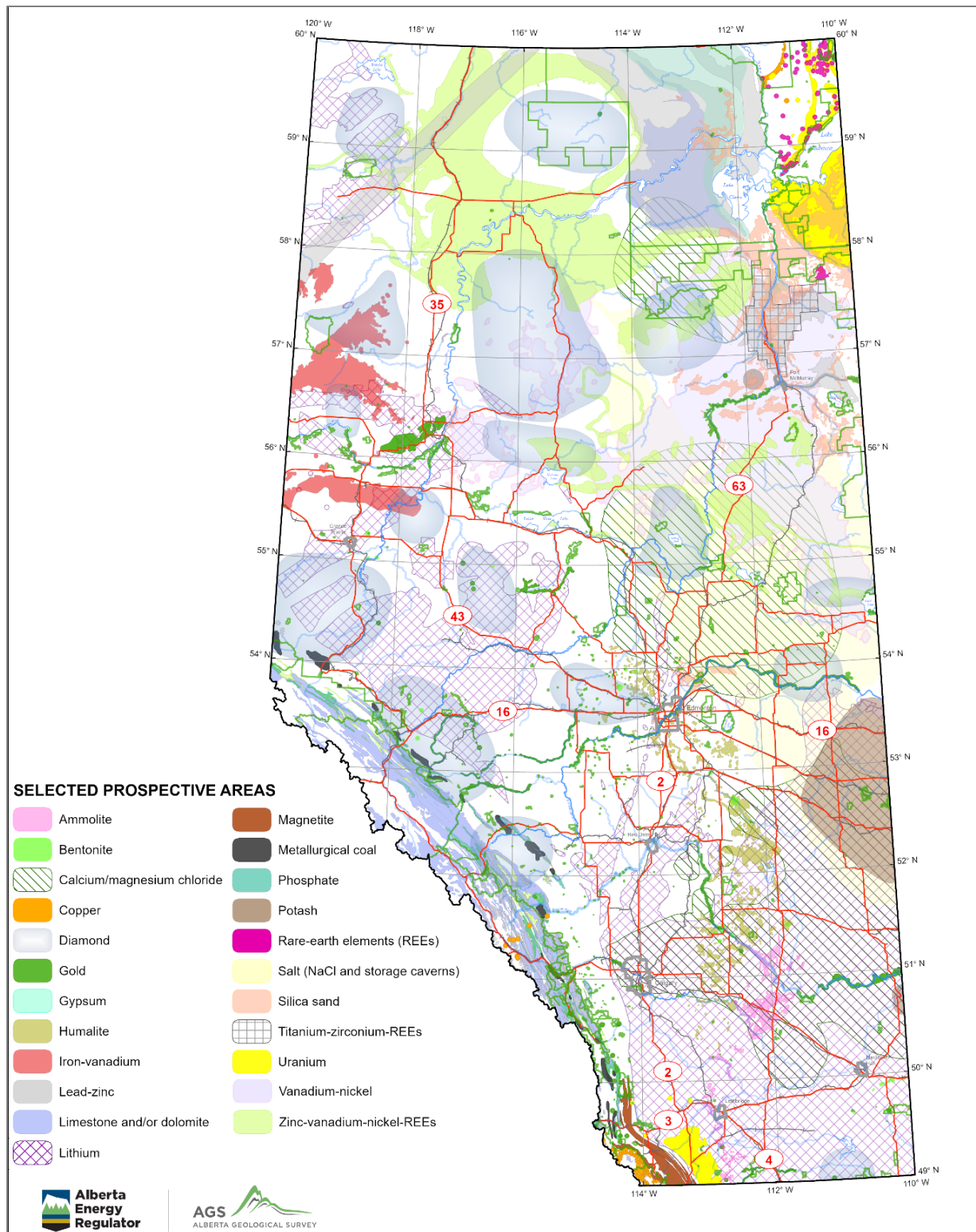


Figure 5. Selected prospective areas for mineral exploration in Alberta grouped by primary commodity. The following prospective areas are not displayed on the map but are available in the digital dataset (Alberta Geological Survey, 2025c): aggregate, boron, bromine, building stone, ceramic clay, iodine, marl and/or tufa, peat, sand and gravel, shale, and sodium sulphate. Green lines represent park boundaries.

Table 6. Attributes of Prospective Areas for Mineral Exploration in Alberta digital data file (Alberta Geological Survey, 2025c).

Attribute Name	Description
Geo_Region	Geological region: Mountains and Foothills, Plains, or Shield
Name	Name of exploration property, geographic area, project, or mine
Alt_Name	Alternate name of exploration property, geographic area, project, or mine
Dep_Type	Deposit type based on mineral deposit profiles summary (Table 3)
Comm_Group	Commodity group (ammonite, industrial minerals, metallic minerals, mineral by-products of energy resources, sand and gravel, metallurgical coal, peat, and humalite)
Commodity	List of individual commodities
Econ_Use	List of potential end uses mentioned by authors in Alberta for a particular commodity, or alternatively, a general use
Poly_Def	Process step and criteria used to construct polygon
Prime_Src	Primary map source used to construct polygon shape. For complete references, see the text file (Prospective_Areas_for_Mineral_Exploration_in_Alberta_References.txt) included with this digital dataset
Geo_Unit	Geological unit hosting deposits/occurrences or with the potential to host deposits/occurrences (for exploration)
Exposure	Indicates if polygon is at subsurface, surface, surface/subsurface, or unknown. Blanks indicate data were not captured.
References	Literature used to support polygon attribute information. For complete references, see the text file (Prospective_Areas_for_Mineral_Exploration_References.txt) included with this digital dataset
Certainty	Certainty level referring to exploration or development stage of an area: 5: producing 4: deposit 3: showings 2: anomalies 1: no mineral data
Occ_Buff_m	Mineral occurrence (point) buffer, in metres
Shp_Buff_m	Polygon buffer, in metres
Depth_fr_m	Depth to the top of a prospective area, in metres
Depth_to_m	Depth to the base of a prospective area, in metres
Min_Assoc	Mineral or metal association of occurrences within a prospective area
Remarks	Remarks
Map_Legend	Prospective area legend used to group polygons for Minerals of Alberta map PDF version
Last_Updat	Date that a record was last changed or modified
Publisher	Organization that published the dataset

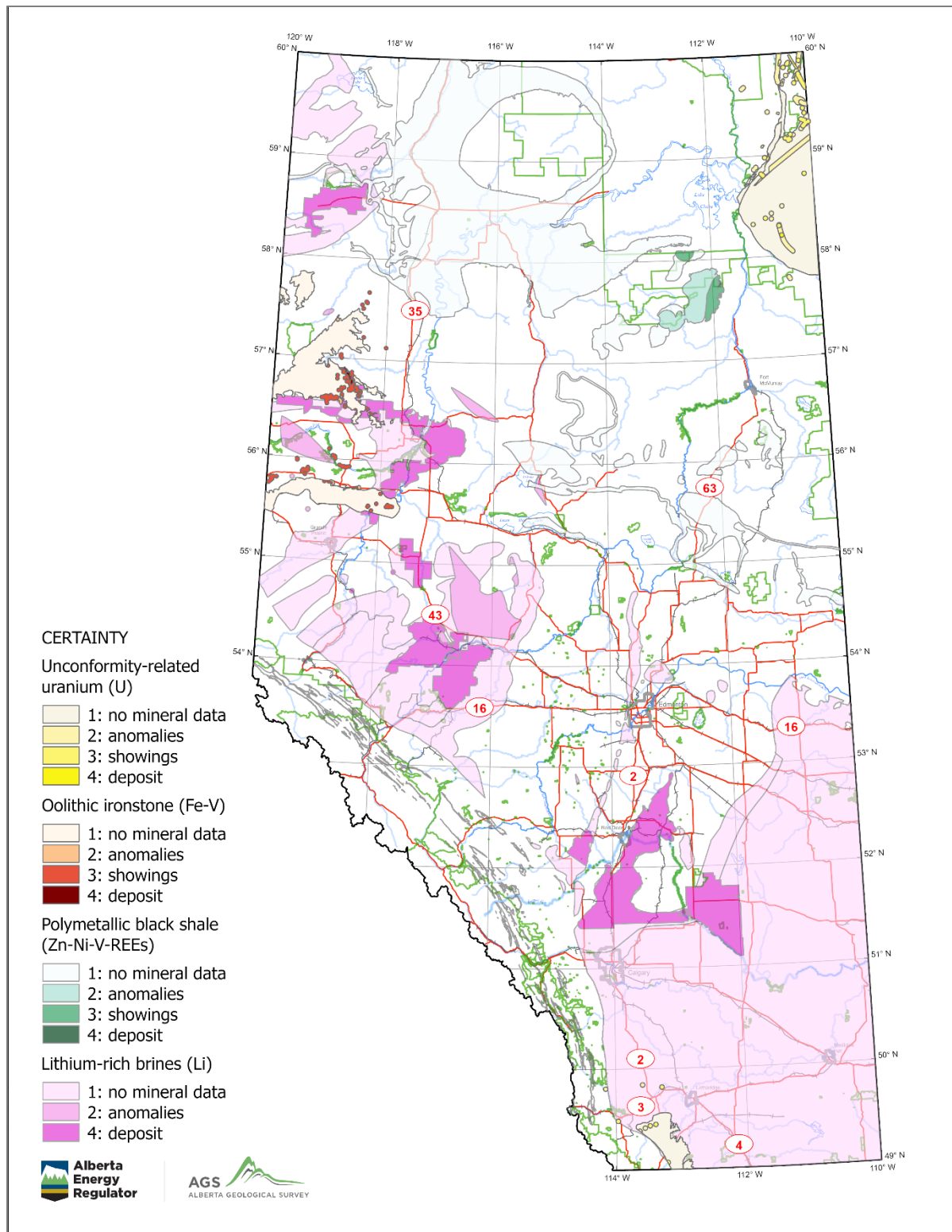


Figure 6. Example of prospective areas for mineral exploration for four deposit types subdivided by their certainty level (based on exploration or development stage), Alberta. Green lines represent park boundaries. Abbreviation: REEs, rare-earth elements.

4 Conclusions

The Minerals of Alberta map serves as the provincial repository for mineral data, illustrating the geographic distribution of known mineral resources and the extent of areas with potential for undiscovered mineral deposits. It features selected current producers, past producers, exploration projects, and prospective areas grouped by primary commodities. Materials included are metallic and industrial minerals, diamonds, ammolite, metallurgical coal, humalite, and sand and gravel, as well as metals and industrial minerals that may be recoverable as by-products of industrial processes.

The map presents select data from more comprehensive datasets that contain additional information, such as additional commodities (e.g., peat, stone, bromine, iodine, boron, and marl and/or tufa), mineral occurrences, and detailed subdivisions and attributes of the prospective areas for mineral exploration.

Prospective areas for mineral exploration represent regions with the potential to host undiscovered resources. Their boundaries may be revised as more detailed geological information becomes available.

The accompanying digital files include tabular data and GIS features needed to reproduce the locations of mineral deposits and prospective exploration areas. These files can be downloaded from <https://ags.aer.ca/>.

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