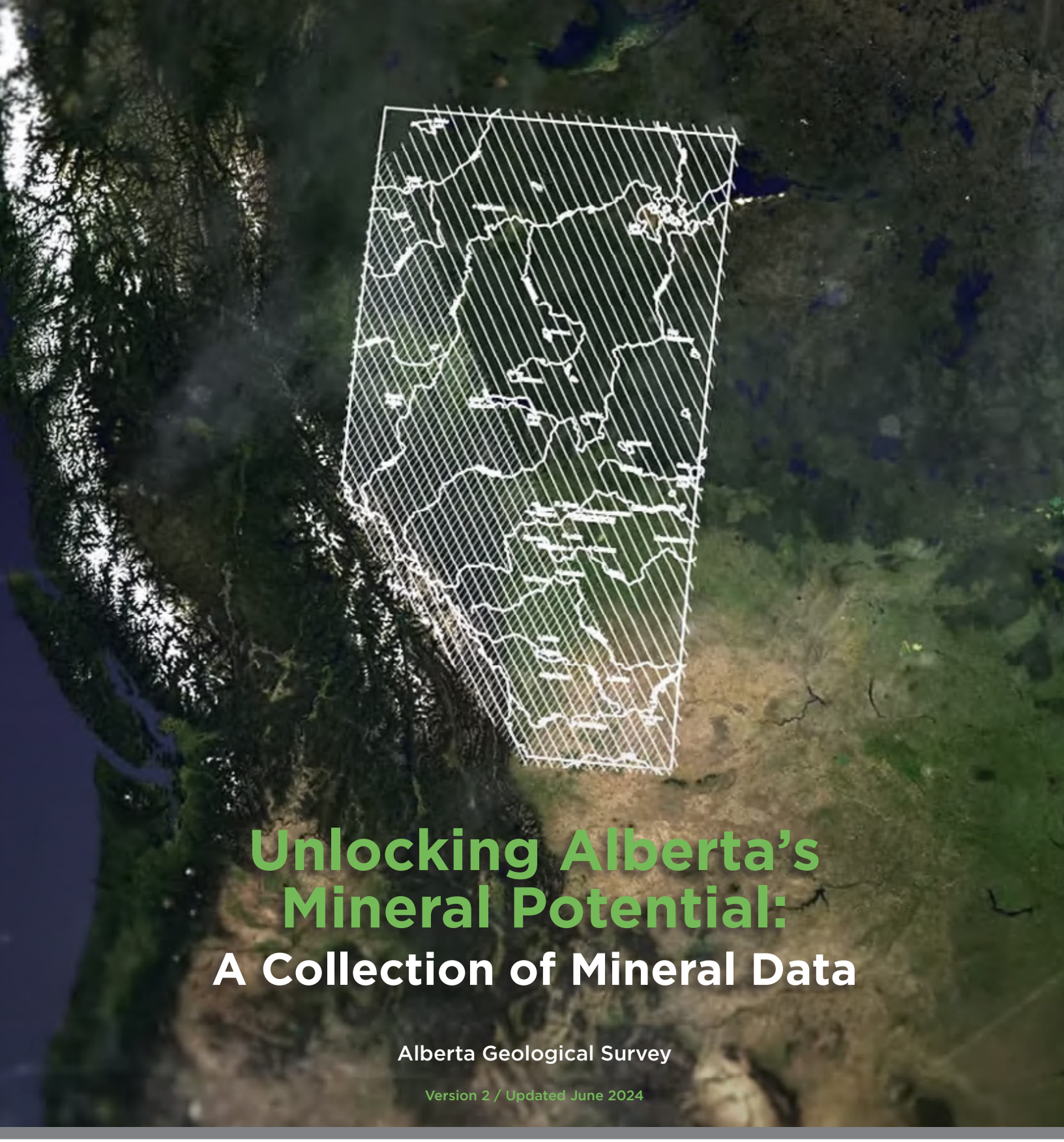

Unlocking Alberta's Mineral Potential:
A Collection of Mineral Data

Alberta Geological Survey

Version 2 / Updated June 2024

Alberta Energy Regulator

AGS
ALBERTA GEOLOGICAL SURVEY

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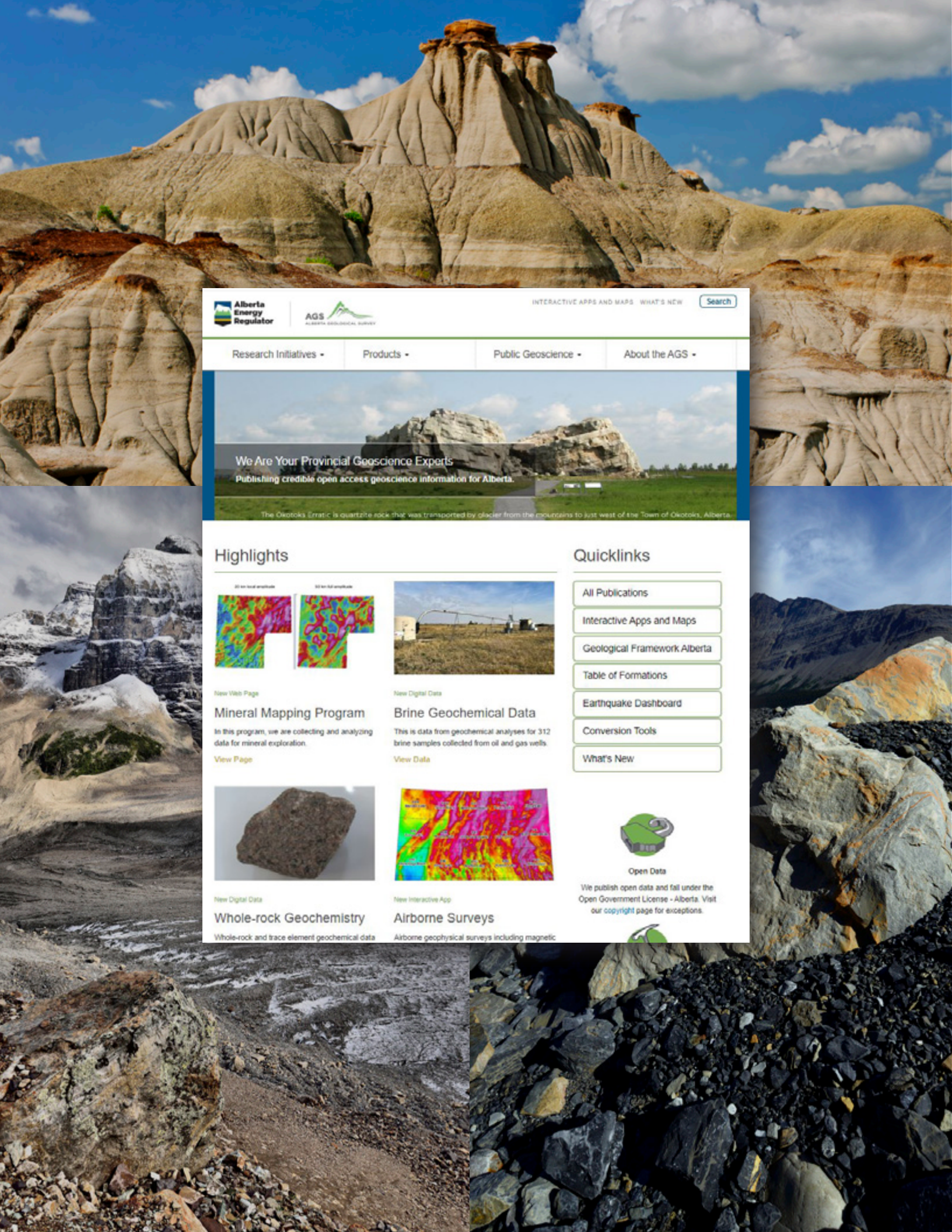
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Our Story

The Alberta Geological Survey (AGS) is a branch of the Alberta Energy Regulator (AER), and we are Alberta's provincial geoscience experts. For over 100 years, we continuously provide the most relevant and up-to-date geoscience information and advice in formats readily accessible to government, industry, and the public. Our products are used by other experts in many areas including resource exploration, sustainable development, regulation, and resource conservation in Alberta.

Research Initiatives

We conduct research in many areas including but not limited to water, minerals, earthquakes, underground storage, and several other areas of geology.

Geological Framework of Alberta

Our GFA is an online GIS tool where users can interact with Alberta's stratigraphy, download data, or integrate their data within our 3D models.

Publications

Our publications range from reports, maps, and data to interactive tools and applications, freely available here on our website.

Public Geoscience

We have products great for learning and exploring geoscience they include Minecraft worlds, 3D printing files, and interactive map applications.

The Mineral Mapping Program

In 2021, the AGS, AER, and Government of Alberta (GoA) partnered to undertake one of the largest geological and geophysical data collection projects in Alberta's history.

Under what is known as the Mineral Mapping Program, we are collecting samples and analyzing various types of data to characterize Alberta's mineral resources. In the initial phase of the program, we focused on publishing raw data. We'll release new interpretive products including reports, interactive maps, and journal publications in the coming months and years.

The data and subsequent interpretive products, will help provide critical information for

- making regulatory decisions regarding mineral applications,
- conducting operations related to minerals,
- increasing knowledge of research institutions, and
- supporting all Albertans in understanding minerals and how development might impact them.

We're pleased to share an overview of the Mineral Mapping Program and how to access the data, which is free for download.

Please visit the AGS website at ags.aer.ca for the most up-to-date datasets and interpretive products such as interactive maps.

Digitization of Mineral Assessment Reports

The Alberta Geological Survey (AGS) is conducting a project to make geoscience information in mineral assessment reports (MARs) readily available to the government, industry, and the public. The project involves digitizing data in MARs into standardized tabular format files accessible through any spreadsheet, database, or GIS software application.

MARs are produced by the mineral exploration industry as required by the Government of Alberta's *Metallic and Industrial Mineral Tenure Regulation*. They contain geological, geophysical, geochemical, drilling, and other mineral exploration-related activity data. Over 1000 MARs have been submitted to the Government of Alberta since 1949. The reports are available to the public in PDF form.

The geoscience information in these reports does not follow consistent layouts or naming conventions, making data sharing and the construction of databases cumbersome and time consuming. The digitization of MARs data into a standard tabular data format will facilitate data analysis to support decision making by the public.

One third of the reports were selected for digitization because they contain geological, geochemical, mineralogical, or drilling data, with spatial reference attached. The AGS will use these digitized data to update its internal minerals database, create new publications, and update existing products such as the Alberta Interactive Minerals Map.

Highlights

The AGS is converting data from selected reports into standardized tabular format readily accessible through spreadsheet, database, or GIS software to support public decision-making.

329
out of 1000 reports
were selected for digitization.

The selected reports contain geological, geochemical, mineralogical, or drilling data, with spatial location information available.

Reports contain over 70 years of geoscience information collected by industry across Alberta.

70 years

Visit the Mineral Mapping Program page

Digitization of Alberta's Mineral Assessment Reports Fast Facts

We reviewed:

70
years of reports

473
reports have analytical data and location

329
reports were selected for digitization

244
reports are from the years 2000–2021

30
different commodities

Associated data:

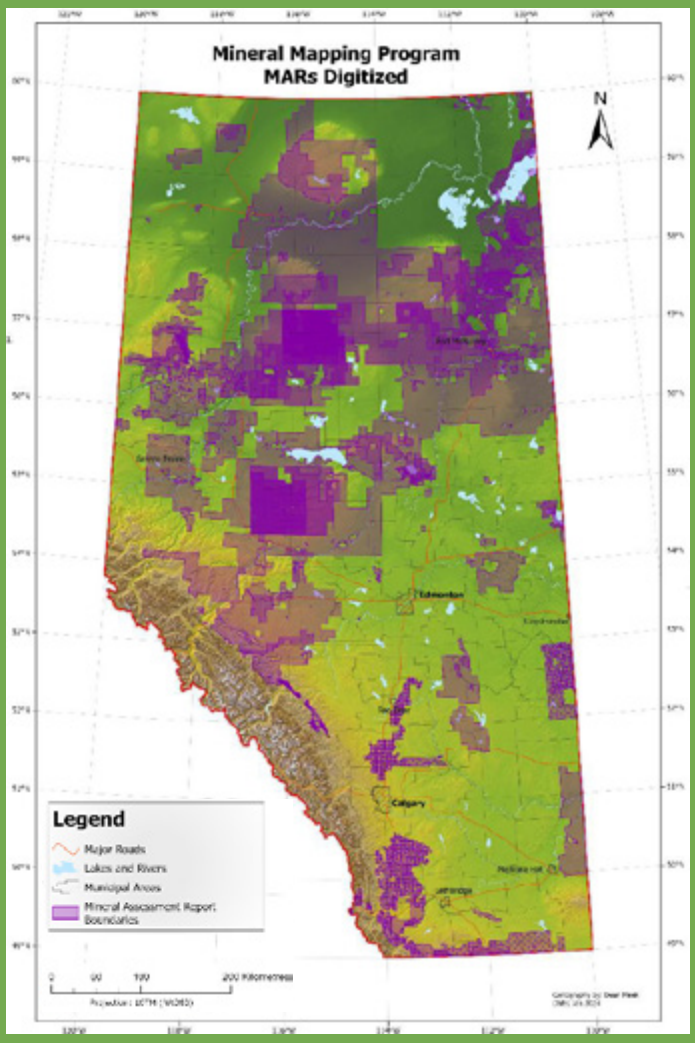
6
AGS compilations in preparation

>2600
boreholes or wells

>70 000
samples

>200 000
metres of drill logs

>850 000
analyte determinations



Airborne Geophysics

Between 2021 and 2023, four airplanes equipped with specialized instruments collected geophysical data about the magnetic and gravitational properties of rock in regions of Alberta where the information was outdated, missing, or incomplete. The AGS will use the information to create new maps and to update the Interactive Mineral Map viewer. The data is now available for download on the AGS website.

Airborne geophysics is often the first step in exploration because magnetic and density data can be used together to identify rock types, potential faults, and fractures in the subsurface geology. Faults and fractures are geological features that can help to reveal mineral resource potential. Until now, this information was incomplete for areas within north-central Alberta and outdated for regions including the Canadian Shield in northeast Alberta and parts of southern Alberta.

The aircraft travelled over 1 000 000 km in a criss-cross pattern. The airplanes overflew the survey areas passing back and forth from east to west, generally, and then north to south, travelling 200 m above the ground. The distance between passes was optimized to ensure that the data set was comprehensive and consistent.

Each plane was equipped with state-of-the-art magnetic and gravity instruments. The instruments are precise and sensitive to environmental conditions like natural fluctuations in weather, both on the ground and in space. In fact, space weather, including magnetic diurnals (the phenomenon responsible for aurora borealis), was accounted for and managed during data collection.

The airborne geophysics program conducted by the AGS is the largest, most advanced survey of its type in modern Canadian history.

Highlights

Airborne geophysics is an environmentally friendly way to survey large areas as it does not disturb the land.

The **weather in space** was accounted for during the survey.

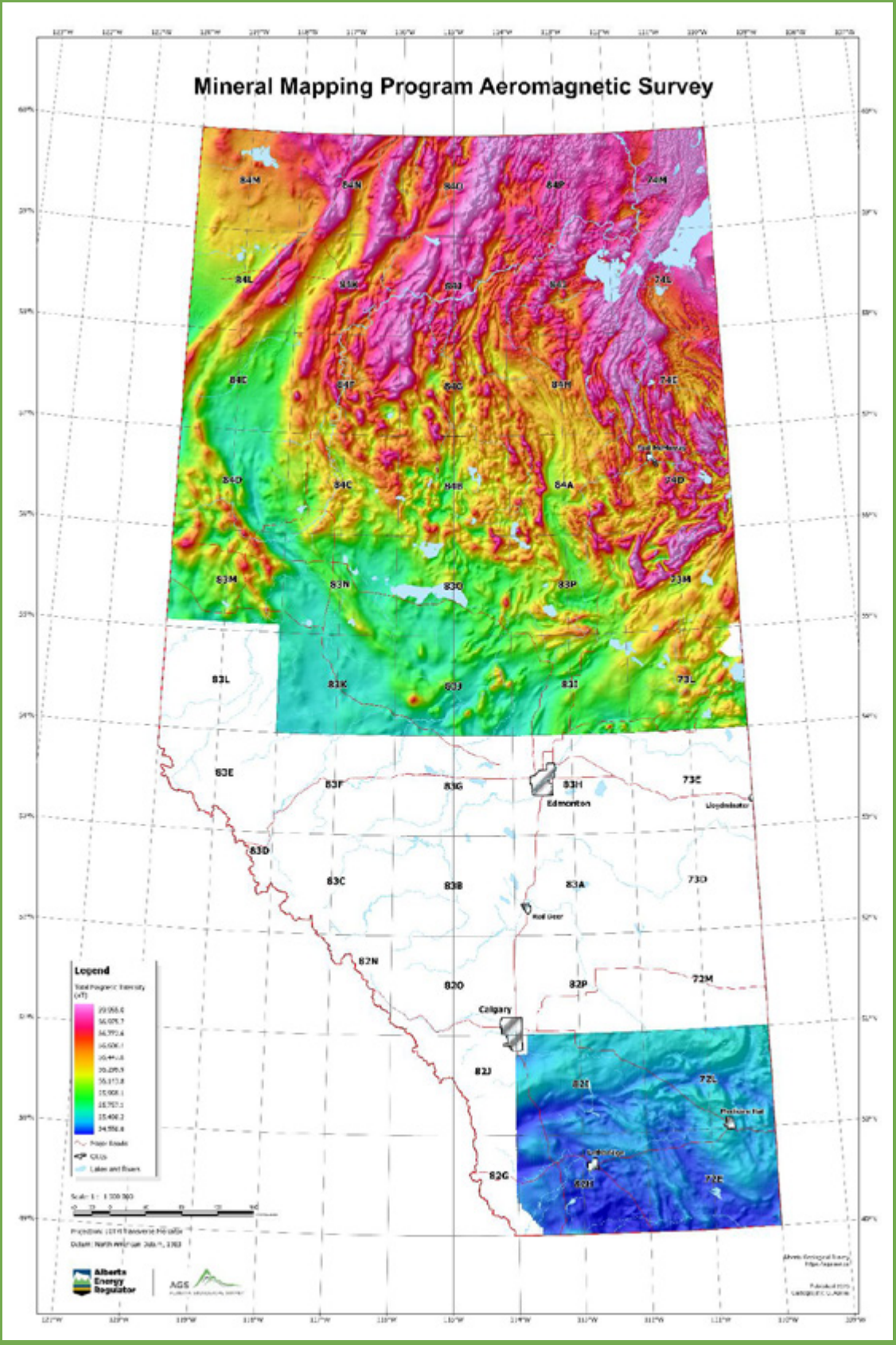
>1 000 000 line-km of new data were collected and filled in missing data for regions including the Canadian Shield in northeast Alberta and north-central Alberta.

Magnetic properties of rocks vary based on composition, current state, and previous geologic history.

Gravitational properties depend on rocks density.

Airborne Geophysics data

New Total Magnetic Intensity from Aeromagnetic Survey



This project is funded by the Department of Energy's *Renewing Alberta's Mineral Future* strategy.

Magnetotelluric (MT) Study

The AGS has released vast 3-D models of deep-seated geological features using a comprehensive magnetotelluric (MT) study. This study included a survey of the Earth's natural electromagnetic field in northcentral Alberta. MT is a method that measures properties of electrical currents to generate 3-D models of geological features. In conjunction with other geological and geophysical data, this data may indicate conditions favourable for the location of kimberlites, which are the typical carriers of diamonds. Kimberlites originate from great depths of more than 150 km in the Earth's mantle. The results of the study including raw and interpretive data and maps, will be freely available on the AGS' website.

Previous MT data was sparse, and the existing 3-D model generated by the data had relatively coarse resolution. To address this issue, state-of-the-art MT monitoring stations were temporarily installed in an area that encompasses the kimberlite fields known in the Buffalo Head Hills and Birch Mountains of Alberta during the fall of 2022. Each station recorded data for 48 hours and gathered information from the Earth's surface to depths of more than 100 km in the Earth's mantle. The station locations were designed on a geometrical grid. In some instances, the remote locations could only be accessed with a helicopter.

As a result of this new work, the 3-D model resolution will be greatly improved with the data collected from the additional MT stations. The MT data analysis was conducted using proven analytical techniques to determine the chemical properties. Other analytical tools will be used to interpret the 3-D resistivity models which helps to compare and explore electrical currents. Early analysis of the data has revealed a striking correlation of MT anomalies with the seismic anomalies in the region.

Highlights

The MT survey is an environmentally friendly way to explore electromagnetic properties of rocks as it does not disturb the land.

In 2022, each temporary monitoring station recorded:

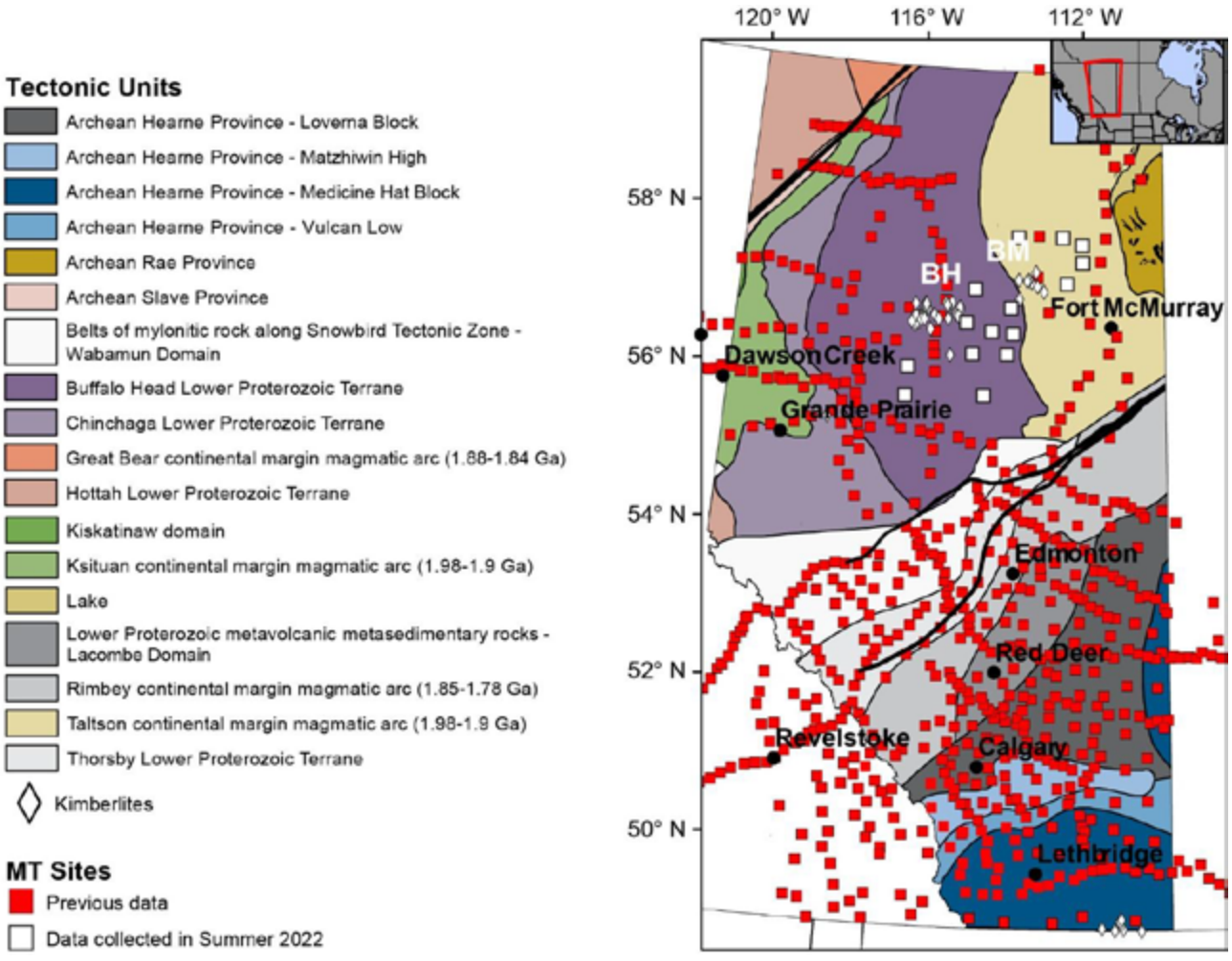
48 hours of continuous data

Data was collected from **100** km and deeper into the Earth's mantle

Early analysis of the data has revealed a striking correlation of MT anomalies with other seismic anomalies in the region.

Visit the Mineral Mapping Program page

In 2022, MT stations recorded data in the Buffalo Head Hills (BH) and Birch Mountain (BM) regions of northern Alberta. The white squares in the map demonstrate locations where new data was collected.



Remote Sensing

High-quality data on mineral potential in the Leland Lakes area in northeast and Clear Hills region of northwest Alberta was obtained from satellite imagery. The satellite imagery will help detect surface rock exposures with the potential to host a variety of commercially valuable minerals. A report on the key findings in the Leland Lakes area is available for download, and work is underway at the nearby Andrew Lake location. These reports will aid in informing future fieldwork by qualified geoscientists.

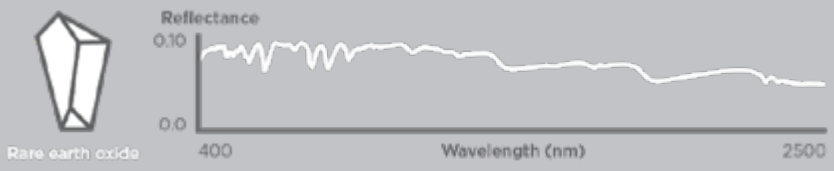
The high-resolution imagery was taken by a constellation of specialized satellites. The satellites are equipped with instruments to record light in the visible, near infrared, and short-wave infrared wavelengths. Each mineral has a unique signature based on specific light wavelength absorption and reflection, allowing geologists to identify them. (Like the leaves on a tree that appear green to the human eye because leaves reflect light with a green wavelength.)

AGS geologists gathered data from areas in Alberta with favourable potential for critical minerals, such as the area around Leland Lakes in northeast Alberta near the Saskatchewan and Northwest Territories boundaries. This region is a potential source of minerals, including uranium and rare-earth elements. Data was also gathered for Clear Hills north of Grande Prairie, where a known iron deposit exists; this will help delineate surface occurrences of iron. Data from high-resolution imagery can be used in conjunction with other geophysical and geological data to aid in mineral exploration.

Highlights

Satellite imagery helps provide information about the vegetation and geology on the land surface, and it is especially helpful to collect data in remote and hard to access locations.

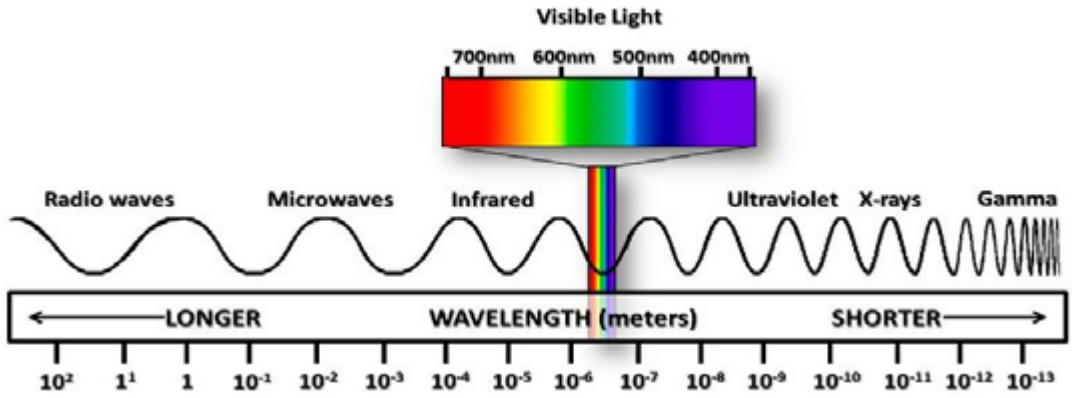
Instruments record light in the visible, near infrared, and short-wave infrared wavelengths. Each mineral has a unique signature based on specific light wavelength absorption and reflection, allowing geologists to identify them.



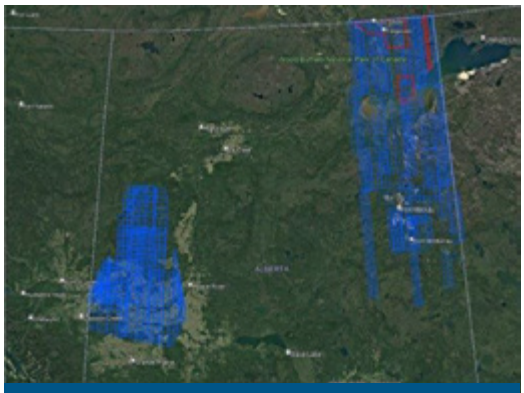
Clear Hills data

Leland Lakes Area data

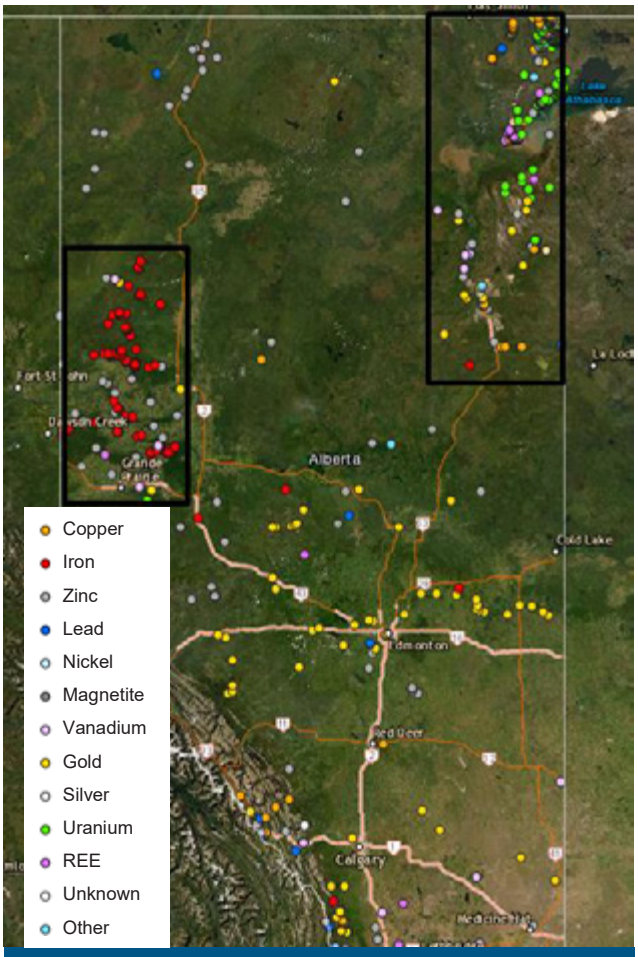
High-resolution satellite imagery collected from northeast and west-central Alberta.



Recent exploration area (2005–2007) east of Bayonet Lake (not shown), with high uranium concentrations associated with pegmatites and yellow chloride staining.



Areas where high-resolution satellite imagery was collected in 2021 (blue) and 2022 (red).



Areas for satellite imagery (black) were selected based on the metallic mineral occurrences (e.g., uranium, rare earth elements, and iron).

Core Scanning

The AGS has published extensive mineral information using advanced photography and scanning technology called hyperspectral imaging (HSI). Using this technology, the AGS has examined more than 50 000 metres (m) of Alberta core samples and has made 35 terabytes of raw data available to the public.

The data will provide new insights into the geology of Alberta, assist in the identification and characterization of mineral occurrences, investigate mineral occurrences that may have been previously overlooked, and highlight areas of interest where further mineral exploration is warranted.

HSI uses a range of electromagnetic radiation frequencies from 400 to 12 000 nanometres (nm), which includes the visible near-infrared (VNIR), short-wave infrared (SWIR), and long-wave infrared (LWIR) frequency bands. The visible light spectrum, for comparison, ranges from 380 nm for violet light to 750 nm for red light.

The traditional method for mineral classification is X-ray diffraction (XRD) analysis. Although this technique is effective for analyzing minerals, it can be time consuming, costly, and (most significantly) destructive. XRD requires samples to be cut from the core with a rock saw, crushed into a fine powder, and then analyzed by XRD equipment to determine the minerals that compose the rock. In contrast, HSI uses a non-destructive approach that does not require cutting the core for a physical sample.

The scanned cores were selected from the core inventory at the Alberta Energy Regulator's Core Research Centre in Calgary and the AGS's Mineral Core Research Facility in Edmonton. Cores were selected based on geospatial distribution and intersected stratigraphic formations.

The raw data are now publicly available and can be reviewed and analyzed by geoscientists, academics, and the mineral exploration industry. The AGS will also analyze the data to create new information products such as interactive maps and interpretive reports. These products will provide insights for a general audience.

Highlights

The AGS has examined more than 50 000 metres (m) of Alberta core samples and has made 35 terabytes of raw data available to the public.

Analysis using HSI is several orders of magnitude faster than XRD.

20 VS **1000 m**

XRD samples analyzed per day

cores scanned per day with HSI

"Hyper" indicates that the target spectrum is beyond visible light.

"Hyperspectral" refers to the wavelength of infrared features (e.g., VNIR, SWIR, LWIR).

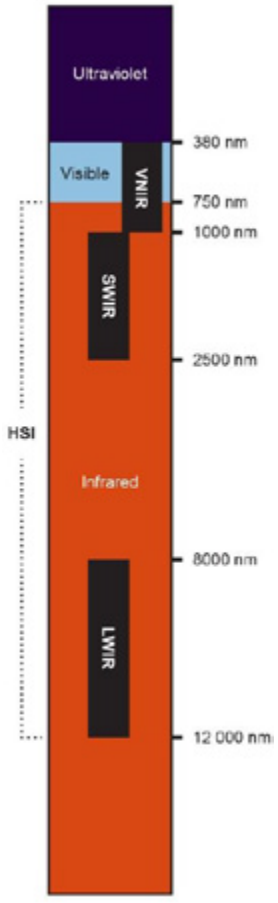
A unique camera is used for each target spectrum (e.g., VNIR, SWIR, LWIR).

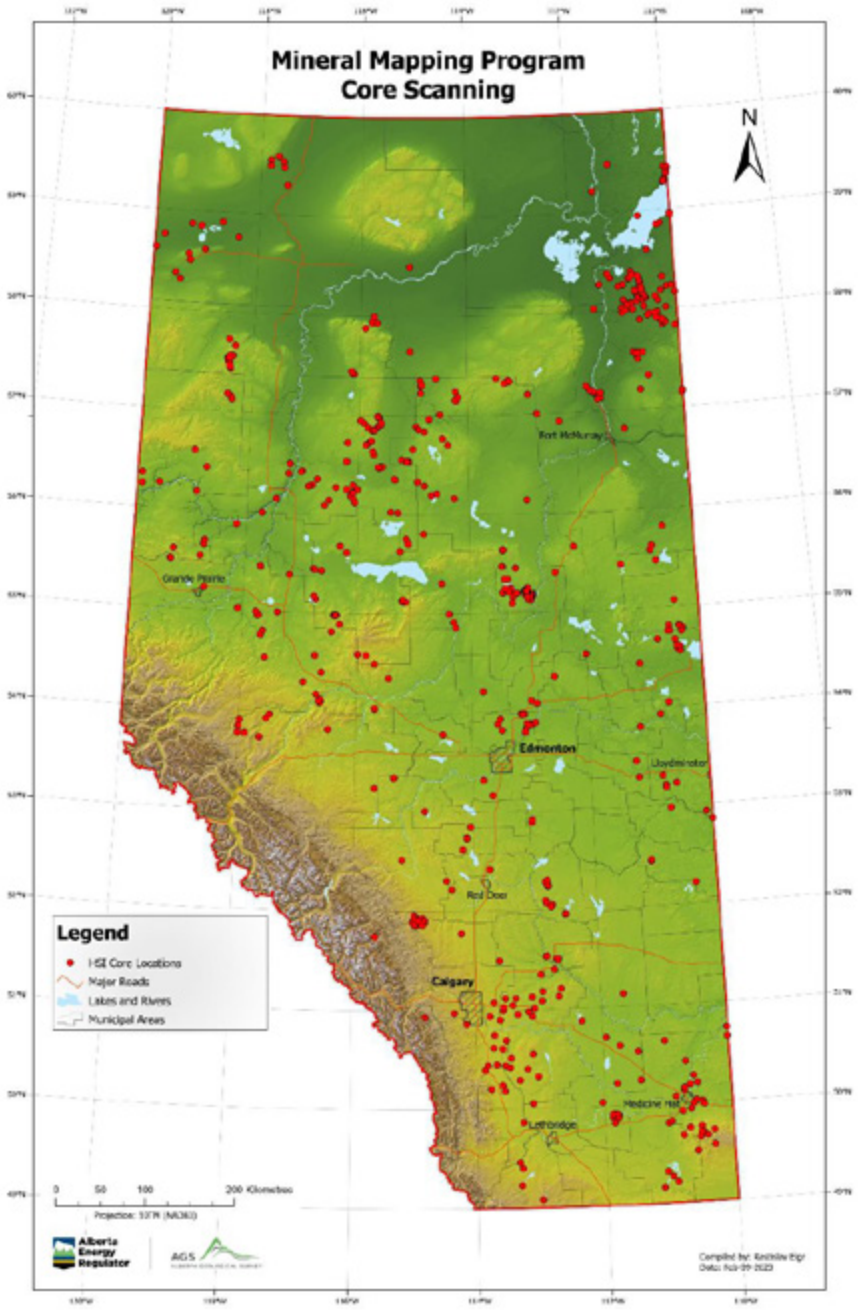
Core Scanning data

Core inventory from AER's Core Research Centre and AGS's Mineral Core Research Facility provides broad geospatial distribution of core intersecting various stratigraphic formations across the province.

HSI Spectrum

HSI uses a range of electromagnetic radiation frequencies from 400 to 12 000 nm, which includes the VNIR, SWIR, and LWIR. The visible light spectrum, for comparison, ranges from 380 for violet light to 750 nm for red light.





Rock Sampling

The AGS is unlocking some of Alberta's geological secrets through its whole rock lithogeochemical analysis initiative. Data collected from this work will improve our knowledge of Alberta's mineral potential, specifically for critical minerals, by producing high-quality chemical composition data for thousands of rock samples. The three digital data sets are now freely available for download.

Lithogeochemical analysis will identify if the rock has elevated base metals, precious metals, or critical minerals and the locations where these metals are elevated. In addition, the source region of the rock will determine if the area is a candidate for further investigation to assess its economic potential.

The AGS analyzed a large collection of rock samples from the AGS Mineral Core Research Facility (MCRF) in Edmonton.

Rock samples from the Canadian Shield and the Western Canadian Sedimentary Basin (WCSB) were analyzed. Shield samples were taken from the AGS Godfrey collection, which contains more than 18 000 samples collected between 1958 and 1972 in northeastern Alberta. WCSB samples are mostly from Alberta plains and were collected by past AGS teams from surface rock formations found and subsurface core. These collections have not been previously subject to extensive lithogeochemical analysis.

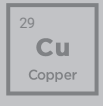
Whole rock lithogeochemical analysis is ongoing, and datasets will be published as they become available. Over the next few years, the AGS will analyze the datasets and produce interpretive reports and interactive maps.

Highlights

Data from this initiative will improve our knowledge of Alberta's mineral potential, specifically for critical minerals, by producing high-quality chemical composition data for thousands of rock samples.

A lithogeochemical analysis is often used to classify rocks based on their chemical composition. The geochemical signatures include details about the rock's origins, the environment in which they were formed, and their alteration history.

The lithogeochemical analysis includes major oxides (e.g., silicon dioxide) and trace elements (e.g., copper).



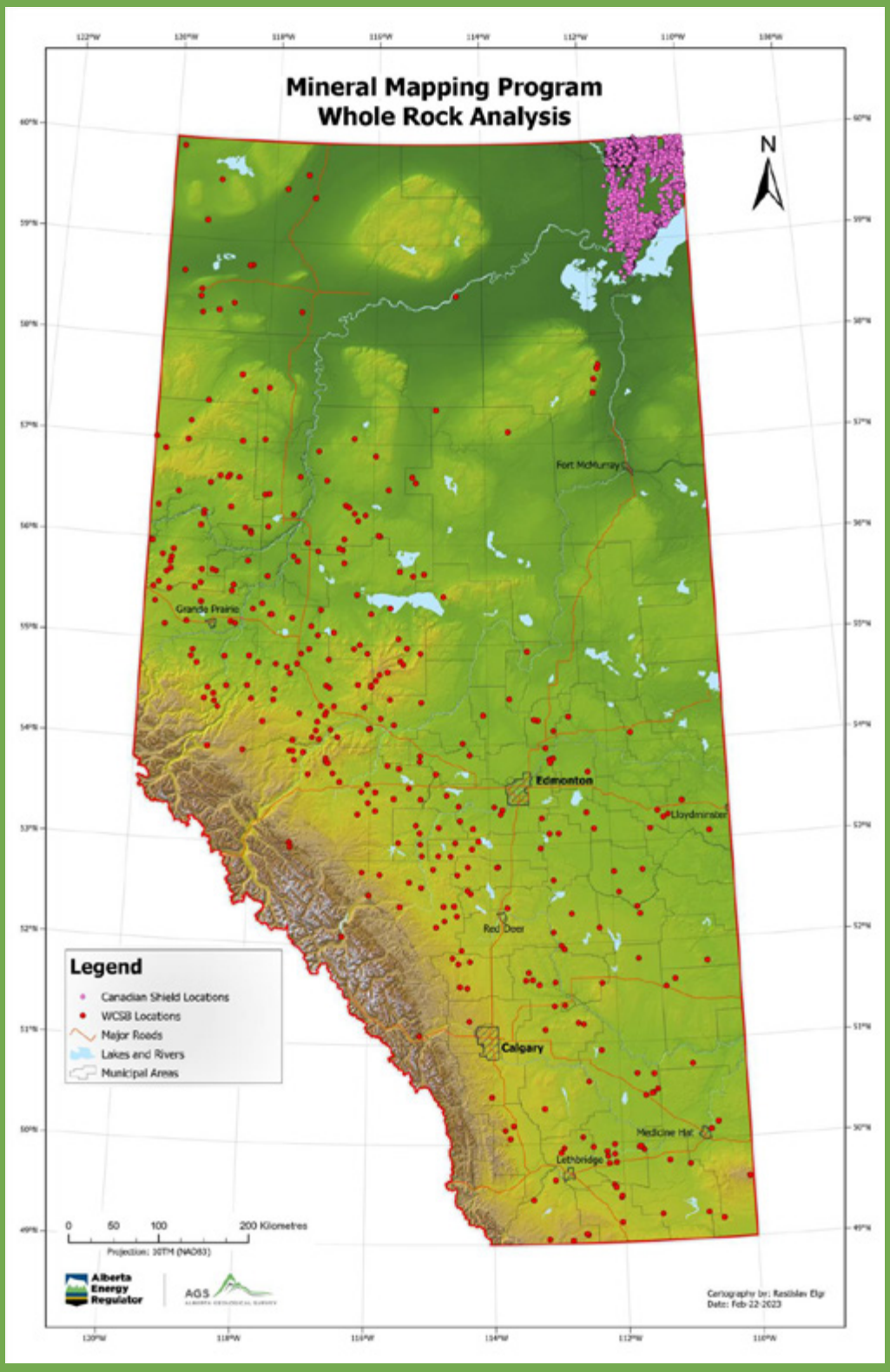
This is the largest collection of whole rock lithogeochemistry from the Canadian Shield in Alberta.

DIG 2023-0015

DIG 2023-0016

DIG 2023-0020

Thousands of rock samples from across Alberta were analyzed for whole rock lithogeochemistry. These samples were collected from the Canadian Shield in north east Alberta and from the Western Canadian Sedimentary Basin.



Powder X-ray Diffraction Analysis of Rock Samples

The AGS has commissioned four digital datasets on the composition of 700 rock samples collected from multiple locations across Alberta. The datasets include bulk mineralogy data for 500 igneous and metamorphic rock samples and bulk mineralogy, clay speciation, and total carbon and sulphur data for 200 sedimentary rock samples. The digital datasets will be available for download from the AGS website.

Mineralogy is the study of the chemical and physical properties of minerals. Rocks are composed of minerals, each mineral having a unique crystalline structure. X-ray diffraction (XRD) analysis was used to obtain bulk mineralogy and clay speciation data. Mineral types can be identified based on how X-rays interact with the crystalline structure of the minerals in a sample. Because clay minerals have a highly complex and variable structure, additional steps were required to prepare the samples for XRD analysis. Samples were treated with chemicals and heated, which helps to distinguish different types of clay minerals when using XRD. The total carbon and sulphur content of each sample was determined by combusting it in a high-temperature furnace, capturing the carbon dioxide and sulphur dioxide gases and measuring them.

Igneous and metamorphic rock samples analyzed for bulk mineralogy were collected from the Canadian Shield in northeastern Alberta. These rocks were formed billions of years ago during the Mesoarchean and Mesoproterozoic eras, making them some of the oldest rock samples in Alberta. The sedimentary rock samples analyzed for bulk mineralogy, clay speciation, and total carbon and sulphur content were collected during previous AGS work on shale gas potential in Alberta. Specific samples were selected for analysis based on their chemical properties, depth below surface, and source location.

Analyses of the digital datasets will help identify patterns in the distribution of critical minerals in Alberta and improve our understanding of the mineral systems in the province. The datasets may also be incorporated into new or existing models and databases to help identify areas of mineral potential or new exploration opportunities.

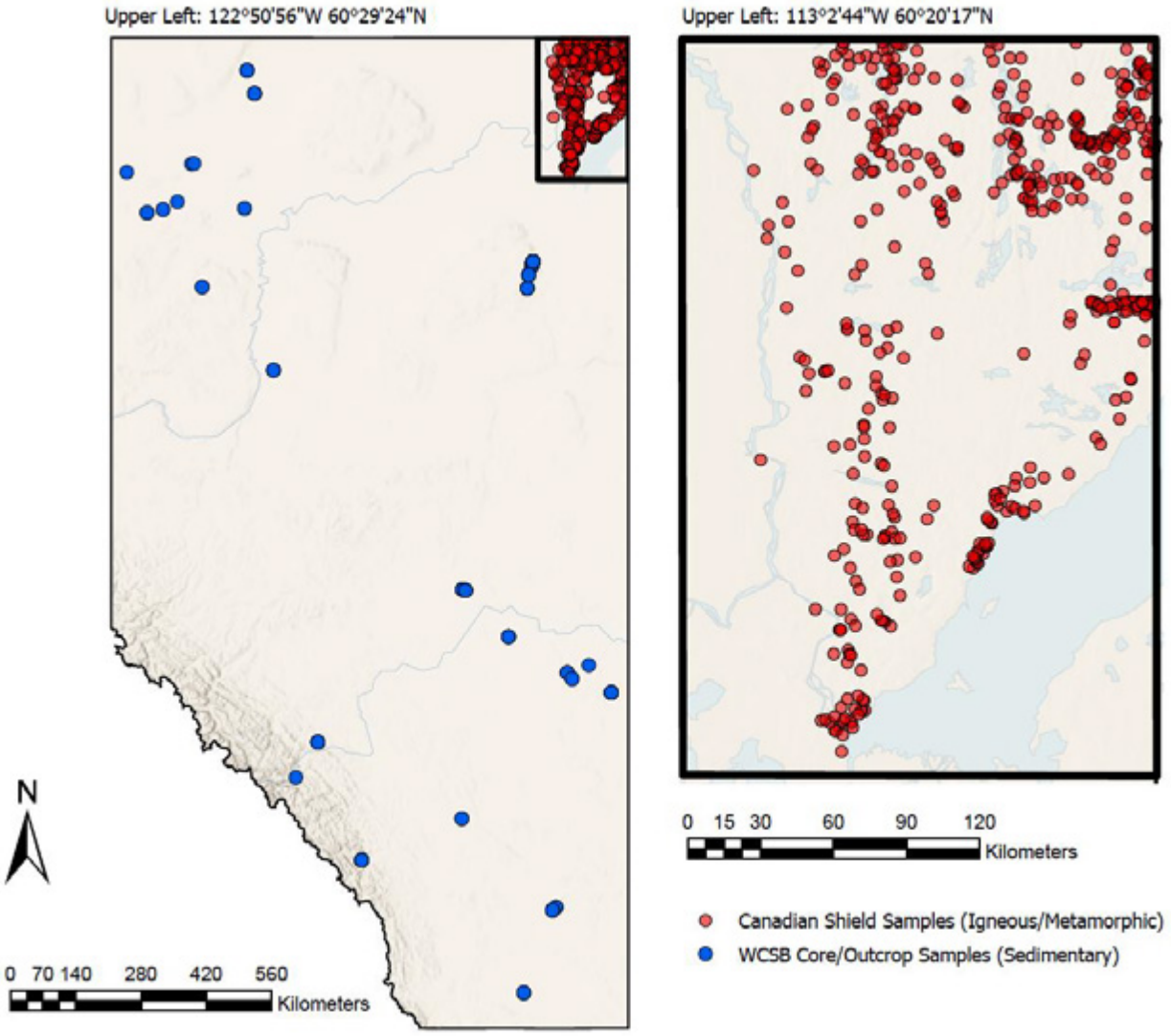
Highlights

X-ray diffraction (XRD) analysis was used to obtain bulk mineralogy and clay speciation data which will help identify patterns in the distribution of critical minerals in Alberta and improve our understanding of the mineral systems in the province.

Swelling clays are so named because they expand when exposed to water. This behaviour affects the volume and permeability of geological units, and can have a significant impact on structure, slope stability, contaminant mobility in the environment, and the proportion of the resource that can be recovered.

Visit the Mineral Mapping Program page

Rock samples were collected and analyzed from various locations across Alberta.



Igneous and metamorphic rock samples were collected from the Canadian Shield in northeast Alberta and were deposited during the Mesoarchean era. The sedimentary rock samples were collected from various locations within the Western Canadian Sedimentary Basin (WCSB) and range in age from the Devonian period to the Cretaceous period.

Till and Stream Sediment Sampling

The AGS commissioned a till and stream sediment sampling study. The study results are available for download. A till and stream sediment survey is a type of prospecting that involves collecting and analyzing sediment samples of glacial till and stream sediments. Till sediments are rock debris deposited across the landscape by the flow of glacial ice sheets, such as the Laurentide Ice Sheet and Cordilleran Ice Sheet, during an ice age. Stream sediment is derived from local bedrock sources and surrounding glacial sediments.

Till and stream sediment data is used as a tool to trace the minerals from specific sample locations back to their source locations in the search of mineral deposits. Understanding the direction of ice flow and the position of the debris as it was transported through the ice sheets and ultimately deposited as till is key to retracing the source of mineral anomalies found in glacial and stream sediments. In Alberta, this includes variations in the flow of the Laurentide Ice Sheet as it advanced into and retreated from the province, in combination with the flow of the Cordilleran Ice Sheet, which advanced from the mountains, converging with the Laurentide Ice Sheet and deflecting it.

AGS Geologists coordinated the largest till and stream sediment collection project in Alberta's history. Geologists chose three areas of interest to conduct sampling based on historical ice-flow patterns in a semiregular grid pattern. Samples were collected and analyzed in labs for their geochemical properties and indicators of mineral deposits. Additional till sampling is currently on-going and results will be published as they become available.

Highlights

This till and stream sediment survey complements hundreds of data points published by the AGS since 1969.

14 field crews

700 locations

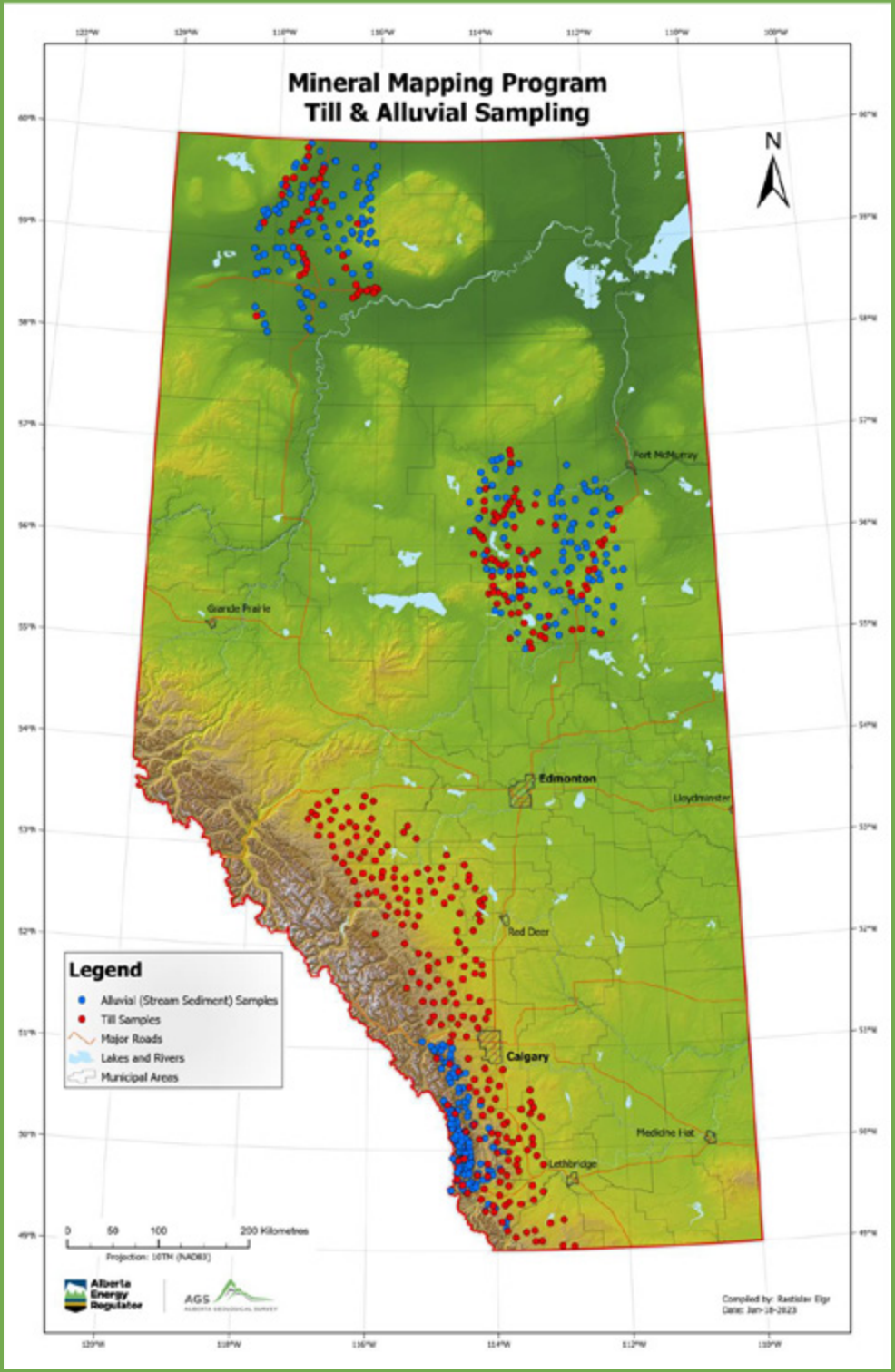
1200 samples

Till and stream sediment sampling has already been proven useful as it helped reveal potential diamond deposits within Alberta in the 1990s and 2000s.

(AGS Bulletin 065 [https://ags.aer.ca/publication/bul-065], pages 4, 20, 57)

Till and Stream Sediment Sampling data

Till and stream sediment sample locations in Alberta.



Indicator Mineral Sample Processing

A study to evaluate the presence of indicator minerals in glacial till and stream sediment samples from across Alberta was conducted. The study results will be available for download from the AGS website. Indicator minerals are found in glacial till and stream sediment and provide important clues about mineral deposits, such as diamonds, gold, various metals, and rare-earth elements. Evaluating indicator minerals from till and stream sediments aids in mineral exploration.

Hundreds of new and archived till and stream sediment samples were analyzed for mineral indicator grains. The archived samples from the Mineral Core Research Facility in Edmonton were collected across Alberta in the 1990s and were initially studied to evaluate kimberlite potential. (Kimberlites are volcanic igneous rocks that may host diamonds.) Geologists collected the new samples from specific areas of interest where knowledge gaps exist.

Researchers and technicians at a qualified laboratory extracted the mineral indicator grains from the samples using a proven methodology that separates the grains based on their density. A process similar to gold panning was used to separate heavier indicator minerals from lighter material through repeated rounds of washing and sifting. Once separated, the extracted mineral indicator grains from the sample are counted. A high count of indicator grains may suggest a mineral deposit is present under the glacial till in the sample area.

Highlights

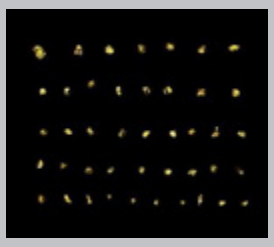
Indicator minerals are found in glacial till and stream sediment and provide important clues about mineral deposits, such as diamonds, gold, various metals, and rare-earth elements.

A process similar to gold panning was used to separate heavier indicator minerals from lighter material through repeated rounds of washing and sifting.

Hundreds of new and archived till and stream sediment samples were analyzed from mineral indicator grains.

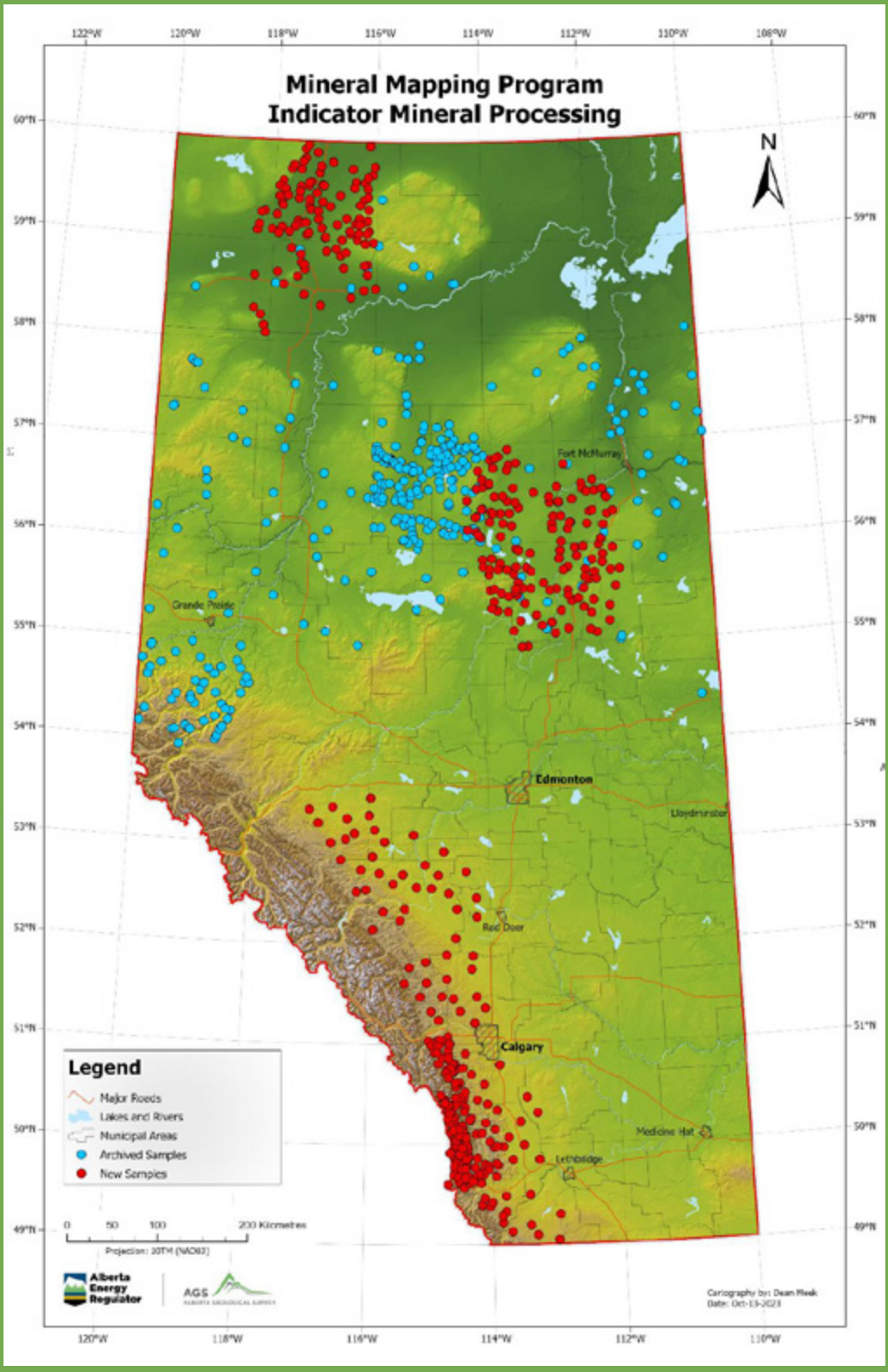
>900
samples were analyzed

A high count of indicator grains may suggest a mineral deposit is present under the glacial till in the sample area. Gold below.



Scan for interactive map and previously published data

Hundreds of till and stream sediment samples from across Alberta were analyzed for mineral indicator grains.



Electron Microprobe Analysis of Indicator Minerals in Alberta

The AGS has commissioned electron microprobe analysis (EMPA) of indicator mineral grains. The dataset includes the geochemical composition of over 9800 indicator mineral grains picked from nearly 700 stream and glacial sediment samples collected from various locations across the province during past and current AGS projects. The data from the analysis will be available for download from the AGS website.

Electron microprobe analysis is a technique that uses specialized instruments to focus a beam of electrons on a mineral sample. The electron beam ionizes the atoms in the sample, causing them to emit electrons and X-rays corresponding to specific elements in the sample. The X-rays are used to identify the type and concentration of elements within a sample.

The geochemistry of indicator mineral grains helps researchers to determine the type of minerals system in which these grains were formed and how they have been altered over time. Indicator minerals include ore, accessory, and alteration minerals characteristic of certain mineral deposit types. Indicator minerals can be classified as kimberlite indicator minerals (KIMs), magmatic/metamorphosed massive sulphide indicator minerals (MMSIMs®*), or rare earth element (REE)-bearing minerals, depending on their composition and source. Indicator minerals are included in sediments as glaciers or streams erode the bedrock. Studying the distribution of specific indicator minerals in sediments helps pinpoint the location of bedrock mineral deposits, such as kimberlite pipes.

Previous EMPA projects at the AGS focused on KIMs; however, by including MMSIMs and REE-bearing minerals in this study, we can investigate the potential for a wider array of critical mineral deposits in Alberta.

Highlights

Studying the distribution of specific indicator minerals in sediments helps pinpoint the location of bedrock mineral deposits, such as kimberlite.

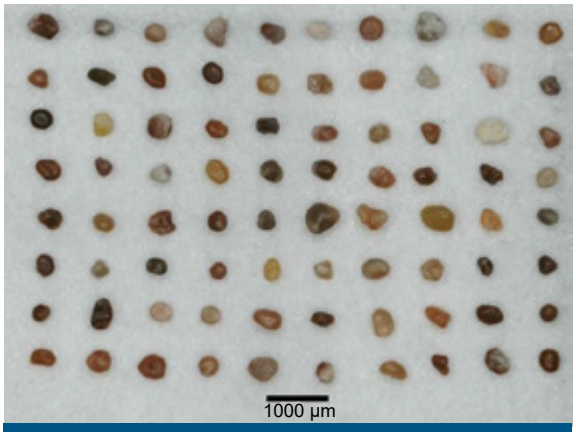
Kimberlite indicator minerals may indicate the presence of kimberlites, which are igneous rocks that form deep within the Earth's mantle and have the potential to host diamonds.

Magmatic/metamorphosed massive sulphide indicator minerals are heavy, coarse-grained minerals resistant to weathering. These minerals tend to be enriched in magnesium, manganese, aluminium, and chromium and can indicate the presence of base metal deposits.

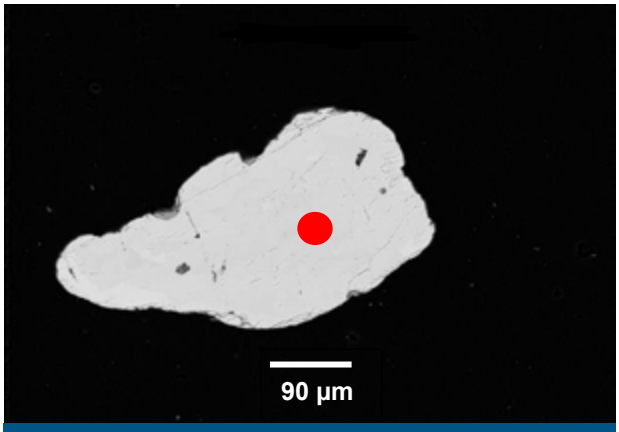
Visit Mineral Mapping Program page

*MMSIM is a registered trademark of Overburden Drilling Management (ODM) Limited, Nepean, Ontario.

This dataset includes the geochemical composition of 9862 indicator mineral grains picked from nearly 700 stream and glacial sediment samples collected from various locations across the province.



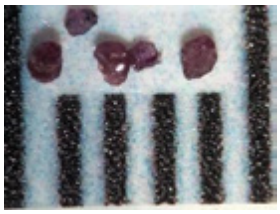
Florencite and monazite grains mounted for microprobe analysis.



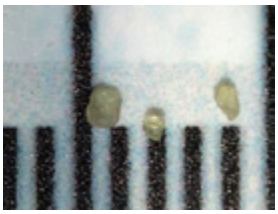
Electron microprobe image of a monazite grain, annotated with the spot location where the data was collected.

Kimberlite Indicator Mineral Grain Types Examples

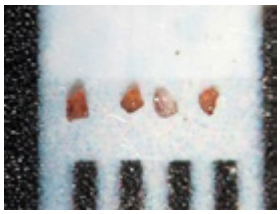
Scale card intervals in images below are 1 mm



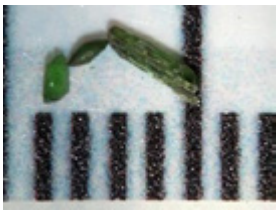
Peridotitic garnet



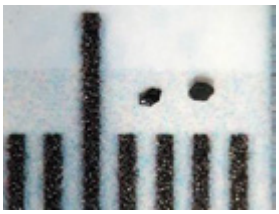
Forsterite



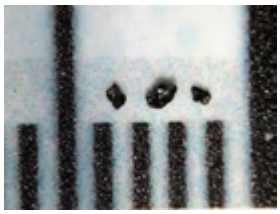
Orange mantle garnet



Chromium-rich diopside



Chromite



Ilmenite

Brine Geochemical Data

The AGS analyzed the geo-chemical make-up of brine samples from about 250 producing oil and gas wells from across Alberta. The results are now freely available for download. Brine, which is highly salty water produced along with oil and gas, can host various minerals, including elements like metals. Minerals have important uses in everyday life and can be used for ingredients in daily use items such as batteries, TVs, and hospital equipment. The quantity and type of dissolved minerals in brines is linked to where they are found underground. The AGS's analysis of the brine samples provides valuable information about Alberta's brine-hosted mineral potential.

Samples were extracted from oil and gas wells where brines are currently produced during normal operations and sent to a lab for analysis. Wells were selected to ensure that the samples represented the subsurface conditions and were collected from geological formations spanning different periods. Over half of the samples were collected from Devonian-aged formations because of the greater potential for minerals such as lithium. The samples were collected from depths between 400 m and 3200 m, and the average collection depth was about 1500 m.

The tests were intended to describe the geochemistry (integrated geology and chemistry) of each sample. The results provided information about the type and concentration of minerals and trace metals found in the brine samples. The lab also tested the brines for naturally occurring isotopes of elements like hydrogen and oxygen, which reveals information about the source and movement of brines within and between geological formations.

The AGS's analyses of properties like trace metals and isotopes are the largest such data set in Alberta and will continue to grow in the future. In addition to the raw data now available, the AGS will produce public reports about Alberta's brine-hosted mineral potential.

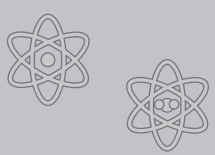
Highlights

Brine-hosted minerals are found in saline (salt) water and extracted through wells.

The **Devonian era** represents a period spanning between about 419 and 358 million years ago.

Trace metals are metallic elements that occur naturally in low concentrations.

Isotopes are different forms of an element (including metals) that have the same number of protons but different numbers of neutrons.



Brine Geochemical data

Brine samples were collected from about 250 producing oil and gas wells across Alberta. Here's what that looks like.

Sample locations of well sites across the province.

Collecting a produced brine sample at a separator.

A brine sample.

A wellsite that was sampled.

Devonian Analogue Investigation

The AGS conducted an analogue investigation of the Devonian reefs in western Canada by studying select outcrops of geologic formations in the Rocky Mountains using drone technology. An analogue investigation involves studying present-day geological features in one area to understand similar geological formations in other areas that are not easily accessed, and to make informed predictions about their inherent characteristics. High-resolution datasets will be available on our website, free for download.

Interest in the highly permeable Devonian reef systems is fueled by prospectors exploring the suitability of formations for subsurface development like deep-geothermal energy, brine-hosted minerals, and carbon-capture utilization and storage (CCUS). However, data for modeling such formations are limited.

Fortunately, exposed Devonian aged formations, including reef margins within the Fairholme Platform, can be studied in regions of the Front Ranges of the Rocky Mountains in Alberta. Between 2022 and 2023, AGS scientists used specialized drone technology to capture high-resolution imagery of the north Fairholme reef margins at Cripple Creek, Hummingbird, and White Rabbit near Nordegg, Alberta.

Drone technology allowed scientists to sample previously inaccessible areas, resulting in 10 new datasets and the creation of new 3D digital models. The digital models are complimented by georeferenced field photographs, sample descriptions, petrography, and geochemistry.

Additionally, the datasets collected support our understanding of analogous strata in the Leduc Formation.

The AGS will release several data products in usable file formats in 2024 and 2025 including:

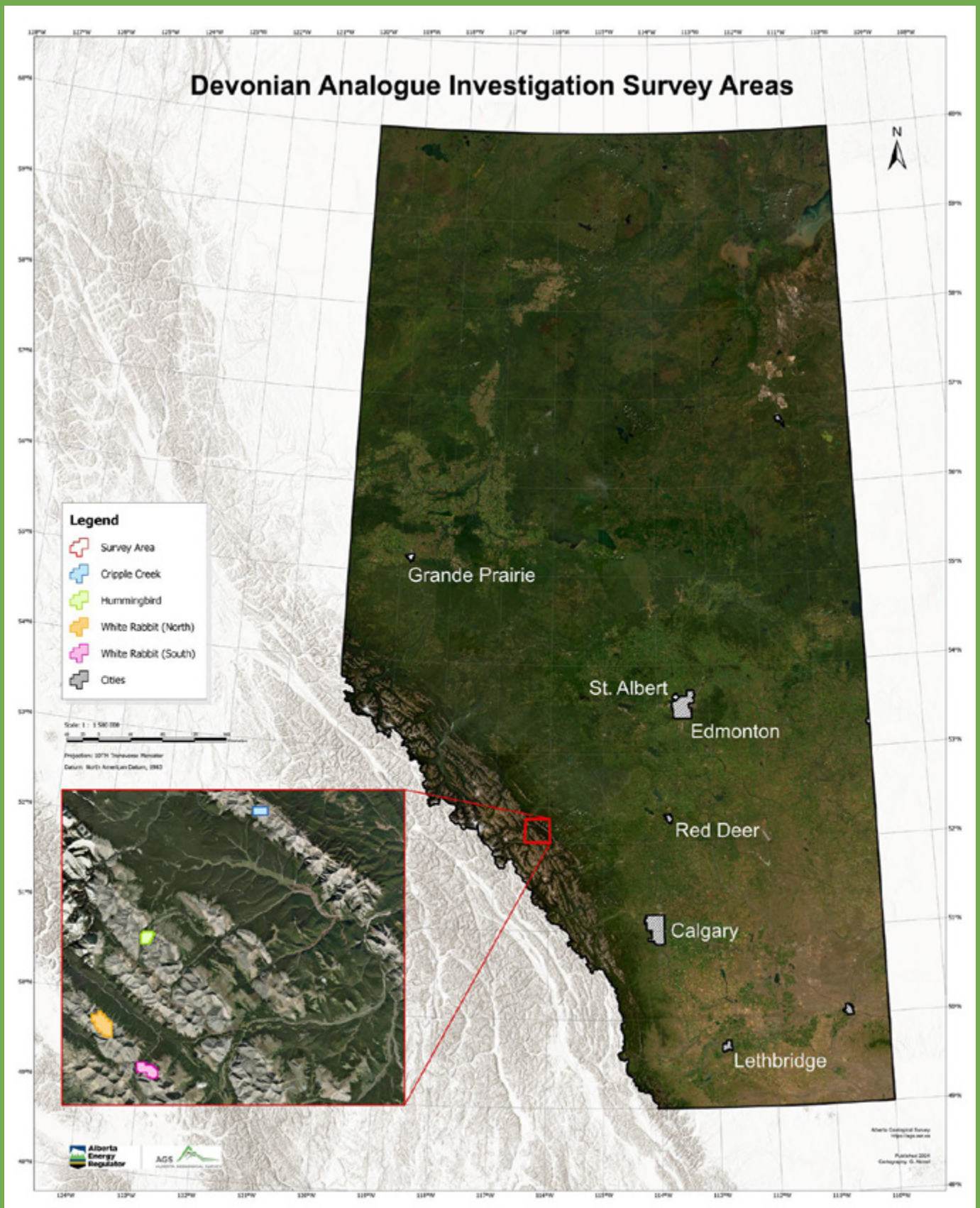
- Four georeferenced digital outcrop models at centimeter scale resolution of the reef margins within the Fairholme Platform.
- Six high-resolution, georeferenced digital outcrop models for special sections of reef margins used to characterize facies transitions, stratal geometries, and vuggy porosity distribution at a centimeter or better scale.
- Map layers showing the vuggy pore systems including details of pore system properties.

Highlights

During the Devonian Age 370 million years ago, Alberta was covered with extensive coral and sponge reefs like those in Australia's Great Barrier Reef.

"Vugs" are giant holes left in formations from dissolved reef structures.

Visit the Mineral Mapping Program page


Devonian Analogue Investigation Survey Areas
N
Legend
Survey Area
Cripple Creek
Hummingbird
White Rabbit (North)
White Rabbit (South)
Cities
Grande Prairie
St. Albert
Edmonton
Red Deer
Calgary
Lethbridge
Alberta Energy Regulator
AGS

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General Inquiries: **1-855-297-8311**

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Edmonton, Alberta T6B 2X3

LinkedIn | X (formerly Twitter) | YouTube

Mineral Core Research Facility

Capital Industrial Park
4504 Eleniak Road (63 Avenue)
Edmonton, Alberta T6B 2S1

The AGS operates the Mineral Core Research Facility (MCRF), which houses more than 58 572 metres of mineral core and 17 000 rock samples primarily extracted from the exposed Canadian Shield in northeastern Alberta. The provincial government collects these samples from companies working under mineral permits, as required by the *Metallic and Industrial Minerals Regulations* section of the *Mines and Minerals Act*.

The MCRF also has an excellent library collection of geoscience information including more than 150 journals and 25 000 books and documents, which is available to government agencies, industry, students, and the public.

Core Research Centre

3545 Research Way NW (University Research Park)
Calgary, Alberta T2L 1Y7

Our Core Research Centre (CRC) is a world-class storage and research facility. It holds a vast collection of geological materials from and information on most of the oil and gas wells drilled in Alberta. The CRC's collection provides the most complete drilling history of a defined geographical area in the world—with drill cuttings and well cores dating back to 1911 and 1925, respectively.

Here, you'll find:

- more than 1.55 million boxes of well core;
- more than 20 million vials of drill-cutting samples, representing an estimated 84 million metres drilled; and
- daily drilling reports from over 417 000 wells.

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