Recommendations for Exploration

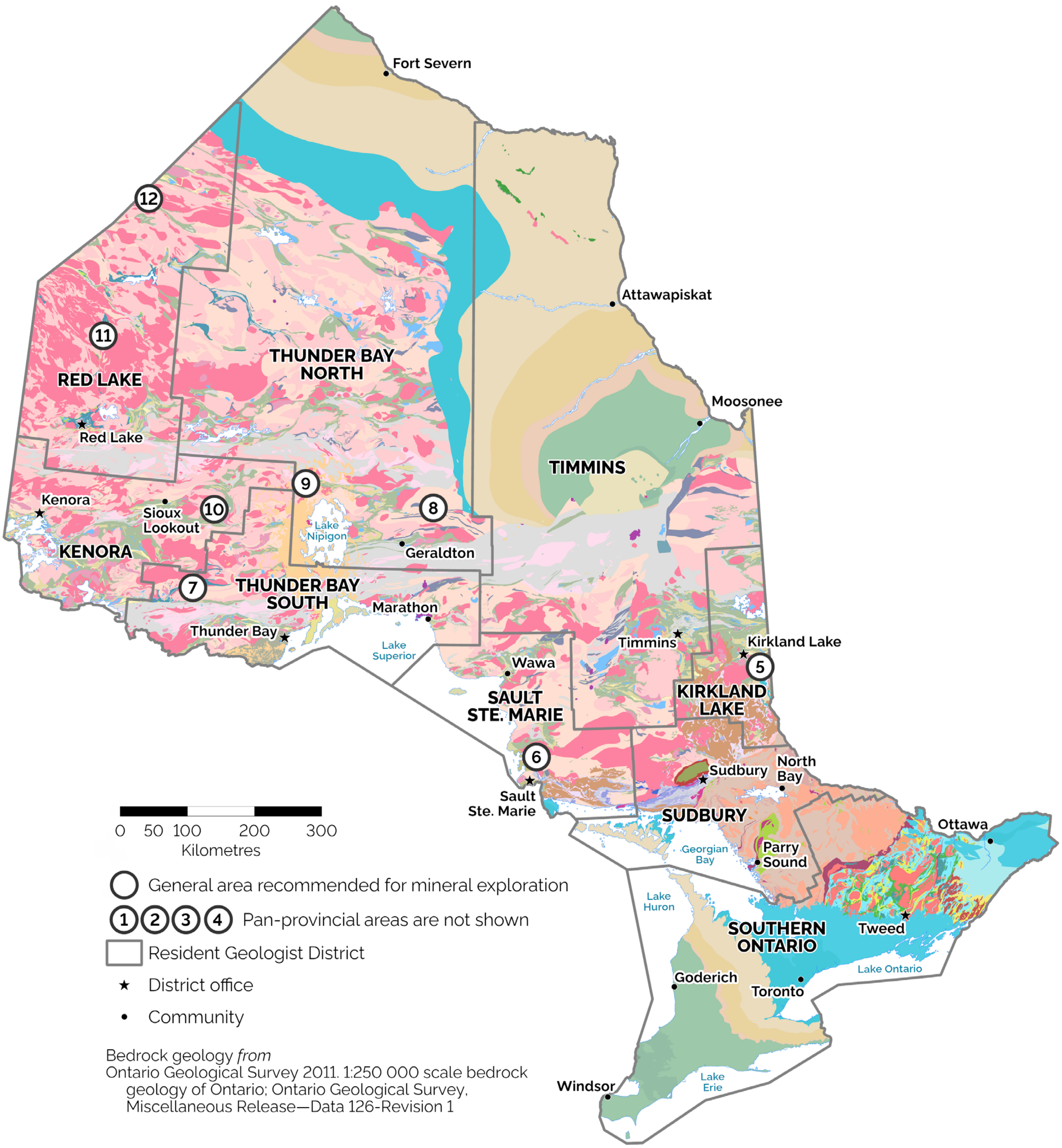
2025–2026

Resident Geologist Program | Ontario Geological Survey | Ministry of Energy and Mines

Ontario Canada

Ontario

Recommendations for Exploration 2025–2026



Front cover photo:

Paul Malegus (Regional Resident Geologist – Red Lake and Kenora districts, Resident Geologist Program) and Justin Rose (Summer Student – Red Lake District, Resident Geologist Program) examining the contact between aplite and pegmatite while looking for lithium potential near the Allison Lake batholith, Jubilee Lake area, east of Red Lake, Ontario. Credit: Rebecca Price, Resident Geologist Program.

Ontario Geological Survey
Resident Geologist Program
Recommendations for Exploration 2025–2026

The Ontario Geological Survey (OGS) is pleased to issue its 2025–2026 Recommendations for Exploration. These recommendations have been prepared by the dedicated and knowledgeable staff located in the 8 Resident Geologist Program (RGP) offices across Ontario. They have been developed using existing OGS geological and mineral exploration data, along with new information derived from the current year's activities.

Ontario's diverse geology provides excellent opportunities for mineral exploration and development. This year's recommendations span the entire province and are focussed on a wide variety of deposit types and exploration methods. Targeted mineral deposit types and commodities include the following.

- Copper-nickel-platinum group element targets
- Copper and other critical minerals
- Dimension stone
- Gold
- Lithium
- Molybdenum
- Tungsten associated with gold occurrences and in tailings

This year's volume also includes recommendations that highlight prospecting tools and funding opportunities including MiRRO, a new tool for understanding Ontario's mineral potential.

Please review our current Recommendations for Exploration and feel free to discuss these in detail with any of our Resident Geologist Program geoscientists.

Visit the GeologyOntario Hub Web site (www.hub.geologyontario.mines.gov.on.ca) and OGSEarth (www.geologyontario.mndm.gov.on.ca/ogsearth.html) on the Ministry of Energy and Mines Web site to explore the wealth of geoscience and mineral exploration information the Ontario Geological Survey has to offer.

About the Resident Geologist Program

Resident Geologists are the stewards of public geological and mineral exploration information for their districts. They provide a broad range of advisory services on geological topics of interest to the public, to municipal governments and to the mineral industry.

They are the local experts on why geoscience information is important, what information is available and what is happening in exploration.

The program provides primary client services through a network of 8 field offices strategically located across the province.

Our services include

- collecting and maintaining geological data
- monitoring exploration activity
- conducting property examinations
- providing geological and exploration advice

We provide geoscience information to support

- public safety
- environmental planning
- land use planning
- mineral sector investment and economic development

We provide information and training to First Nation Communities regarding prospecting, mineral exploration and mining.

For more information about the Resident Geologist Program please visit the Mines Policy and Sector Development Division Web site at www.ontario.ca/page/geology-and-geoscience.

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Users of OGS products should be aware that Indigenous communities may have Aboriginal or treaty rights or other interests that overlap with areas of mineral potential and exploration.

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Contents

Amyotte, E.G. and Biswas, S. 2026. The coincidence of gold occurrences, geophysical trends and porphyries in the northwestern Sturgeon Lake volcanic rocks: a working exploration model; *in* Recommendations for Exploration 2025–2026, Ontario Geological Survey, Resident Geologist Program, p.43-50.

MiRRO – A New Tool for Understanding Ontario's Mineral Potential

HIGHLIGHTS

- **New data set from the Resident Geologist Program highlights mineral deposits with modern and historical mineral reserves and resources**
- **Available as an interactive dashboard with linkages to the Ontario Mineral Inventory**
- **Allows users to focus their exploration on mineral occurrences with potential for economic extraction**

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The Resident Geologist Program (RGP) monitors and reports on mineral exploration, development and production. Since the 1990s, the RGP has kept a record of mineral deposits not being mined in Ontario through tables in its *Reports of Activities*. These tables contain data on mineral deposits with published, *in-situ* tonnage-grade estimates and/or significant dimensions and grade that are not actively in production. Compiled and updated annually by RGP districts, this information is an important way for the program to define earth resources and guide mineral investment and development in Ontario.

In 2025, data from the "Mineral Deposits Not Being Mined" tables and records on mineral resources/reserves at active mines were comprehensively compiled, categorized, updated and connected to the Ontario Mineral Inventory by the RGP Mineral Inventory Geoscientists to create a new data set, called "Mineral Reserves & Resources of Ontario" or MiRRO, for short. This new compilation allows clients to access all the information previously stored in distinct tables through one central repository.

MiRRO is a compilation of all reported mineral resources or mineral reserves associated with mineral deposits in Ontario. It contains deposits that meet modern reporting standards for the definition of mineral reserves and mineral resources as well as deposits that were outlined before these standards were implemented, which are noted as "Historical" and can be easily filtered out.

MiRRO can be found on the GeologyOntario Hub Web site, in the Available Data section, under "Mineral Reserves and Resources of Ontario" (https://www.hub.geologyontario.mines.gov.on.ca) as an interactive dashboard. This new tool allows for visualization of the data, with an interactive map and the capability to filter the data by production status, reserve/resource commodity and by broad deposit categories (Figure 1).

What are Mineral Resources and Mineral Reserves?

Modern reporting standards for defining and studying reserves and resources are established by the Canadian National Instrument 43-101, Standards of Disclosure for Mineral Projects (NI 43-101), which came into effect in 2001; and within the Australasian Joint Ore Reserves Committee (JORC) Code, which came into effect in 1989, with a revision in 2012.

The Canadian Institute of Mining (CIM) establishes standards for mineral resources and reserves that are incorporated into NI 43-101.

Dorado-Troughton, M., Pettigrew, T.K. and Meyer, G. 2026. MiRRO – A new tool for understanding Ontario's mineral potential; *in* Recommendations for Exploration 2025–2026, Ontario Geological Survey, Resident Geologist Program, p.1-2.

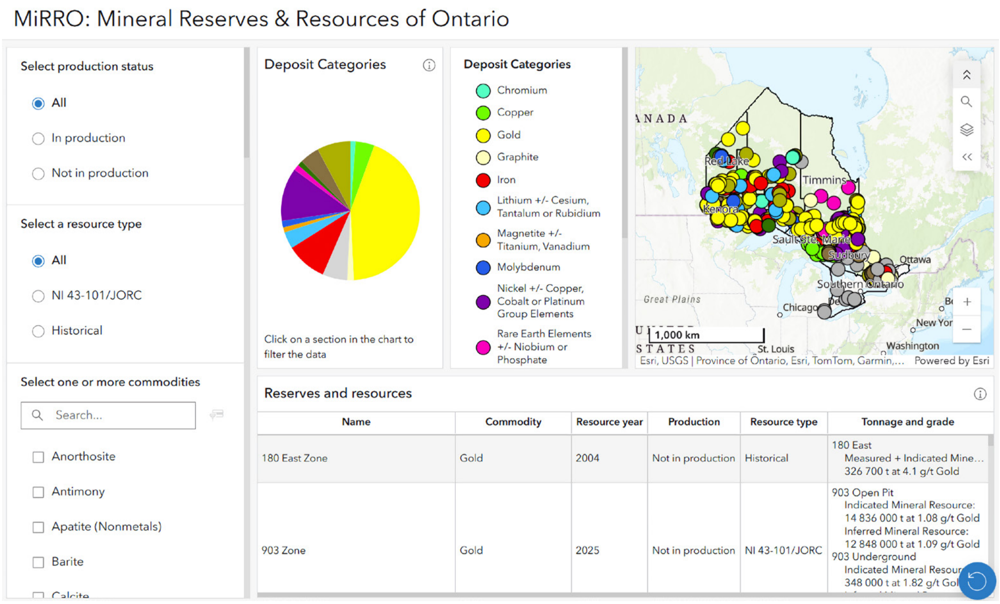

Figure 1. The MiRRO dashboard displays mineral deposits with mineral resources and mineral reserves. Users can filter by production status, resource type, resource commodity or by deposit category and see the information displayed on an interconnected table, map and pie chart.

The CIM Definition Standards can be viewed at the CIM Web site (*see* https://mrmr.cim.org/en/standards/ [accessed November 20, 2025]).

> A Mineral Resource is an occurrence of minerals of economic interest in such form, grade or quality and quantity that there are reasonable prospects for eventual economic extraction. The location, quantity, grade or quality, continuity and other geological characteristics of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge, including sampling.
>
> A Mineral Reserve is the economically mineable part of a Measured and/or Indicated Mineral Resource. It includes diluting materials and allowances for losses, [which may occur when the material is mined or extracted] and is defined by studies at pre-feasibility or feasibility level […]. Such studies demonstrate that, at the time of reporting, extraction could reasonably be justified.

Reserves or resources from before this time were not held to this same standard and are noted as “Historical” within MiRRO.

MiRRO – Explore Ontario’s Mineral Resources and Mineral Reserves

This tool contributes to a geoscience baseline for Ontario and provides a novel way of visualizing, comparing and reviewing deposits with potential for production. Deposits which were previously unfeasible may now warrant renewed exploration due to changes in economic considerations, increased geopolitical importance of certain commodities, or advancements in technology and metallogenic models. Also, the results of work conducted for a previous mineral resource or mineral reserve could lower the financial risk associated with developing a mine.

Inclusion of a deposit within MiRRO does not guarantee the validity or quality of a mineral resource/reserve estimate.

To learn more about a deposit included within MiRRO, the reader is encouraged to examine its associated Ontario Mineral Inventory record(s) and reach out to RGP staff of the district in which the deposit and occurrences are located.

HIGHLIGHTS

- **Increased exploration interest in Ontario**
- **Variety of industrial and critical minerals**
- **Extensive database created by the Ontario Geological Survey**
- **Extensive highway, county, and backroad network**

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Tool Kit for New Prospectors

Over the past 3 years, interest in industrial and critical minerals in Ontario has grown resulting in increased claim registrations by those new to prospecting. In many cases, claims were registered without prior research into the mineral potential of the area. This article provides a tool kit of information to aid a new prospector in making an informed decision on choosing the location and mineral to prospect.

This article assumes a prospector licence has been acquired. If not, a licence can be purchased online through the Mining Lands Administration System (MLAS, https://www.ontario.ca/page/mining-lands-administration-system). Also, it is expected that a prospector or explorationist is familiar with the *Mining Act*, R.S.O. 1990, c. M.14 (https://www.ontario.ca/laws/statute/90m14) and knows well the sections and relevant regulations pertaining to them and their work.

Choosing a Location and Economic Mineral (Commodity)

There are several factors to consider when deciding where to prospect. Some of these factors are discussed here. For simplicity, they have been divided into 2 groups: 1) location and 2) commodity.

1. If the decision of where to prospect is based on location, consider personal experience, physical abilities, finances, and the amount of time available to dedicate to prospecting (Parker 2007). These considerations will determine whether the prospect is close to home, easy to access, or remote. Once a location is chosen, verify that there are available claim cells and if any known restrictions apply to the cells. This can be done through either the publicly accessible MLAS map viewer (Table 1, no. 1) or the prospector version accessible through the prospector's MLAS account. Another consideration is whether there are known economic mineral occurrences or potential for economic minerals to occur in that location.
2. If the decision of where to prospect is based on a commodity or commodities, the geology and geological processes dictate whether there is potential for an economic mineral or minerals to occur in an area. Therefore, it is important to have a basic understanding of how and where the minerals of interest form. The choice of commodity may be based on market value, personal interest, or what minerals potentially occur in a desired location. Whatever the motivation, thorough research on each commodity being considered needs to be done before making a final decision (*see* Table 1, nos. 1 and 2). As mentioned previously, the potential for an economic mineral to be in the chosen location should be determined prior to registering claims. The factors mentioned in 1) should then be considered.

Mancini, L.A. 2026. Tool kit for new prospectors; *in* Recommendations for Exploration 2025–2026, Ontario Geological Survey, Resident Geologist Program, p.3-5.

Early Prospecting, Plans and Permits

Once a claim or claims are registered, examine the area using satellite imagery, topographic maps, geological maps and road maps to determine where to start prospecting in the field (Parker 2007). Early prospecting consists of systematically traversing an area, taking detailed notes, mapping, and grab sampling along the way, and compiling all the data collected from fieldwork and research. A good resource for learning how to prospect is *Discover Prospecting: An Introductory Prospecting Manual* (*see* Table 1, no. 2). Though some of the sections may be outdated, such as Web site links, contact information, and acquiring mining lands; the sections on minerals, rocks, tectonics, mineral deposits, prospecting techniques and exploration techniques still contain valuable information.

Early exploration activities requiring exploration plans and exploration permits include any mechanized work such as work needing a generator, line cutting, stripping, pitting, trenching, drilling, etc. Detailed information on conditions and requirements for carrying out exploration plan and exploration permit activities is found in the *Mining Act*, [O. Reg. 308/12] and the *Provincial Standards for Early Exploration* (*see* Table 1, no. 3).

Recommendations

Before registering claims, it is recommended the prospector research the area. Look for any past work reports, assessment files, geophysical data, maps, theses, etc., using the GeologyOntario Hub Web sites and the Geological Survey of Canada's online library (*see* Table 1, no. 2). The Resident Geologist Program office is also a great source for information. There are 8 offices covering 9 districts. Contact information for each office is listed on the back cover of the Recommendations for Exploration booklet.

Conduct research on the commodity itself. Learn about the regional and local geology of the claims area, host rock of the commodity, mineral associations, geological processes, depositional environment and deposit type.

Lastly, it is important to know the most current version of the Ontario *Mining Act* (*see* Table 1, no. 3).

Table 1. Links to online tools for prospecting and exploration preparation and planning.

No.	Steps	Tools
1	Choosing a prospecting location	**Ontario GeoHub** (https://geohub.lio.gov.on.ca/) Topo/Base maps
		Google Earth (https://www.google.com/intl/en/earth/index.html), ArcGIS (https://www.arcgis.com/), **QGIS** (https://qgis.org/) Satellite images
		GeologyOntario Spatial Search (https://mndm.maps.arcgis.com/apps/webappviewer/index.html?id=66ee0efe4d3c4816963737dbdb890708) Topo maps, geology maps, satellite imagery
		MLAS Map Viewer (https://www.ontario.ca/page/mining-lands-administration-system) Mining lands data, spatial data, availability of lands, topo data, satellite imagery
2	Choosing a commodity	**Recommendations for Exploration** (https://www.geologyontario.mndm.gov.on.ca/recommendations_for_exploration_en.html) Highlights key areas for potential mineral exploration and development
		Report of Activities (https://www.geologyontario.mndm.gov.on.ca/report_of_activities_en.html) Mining activity, exploration activity, Resident Geologist staff activities, property examinations, recommendations for exploration, land use planning
		GeologyOntario (https://geology-ontario-en-mndm.hub.arcgis.com/)
		Spatial Search Mineral Inventory layer and many other layers. Search by attributes and more

No.	Steps	Tools
		Text Search Search by commodity, deposit or property name, report or assessment file titles, geology maps, etc. **OGSEarth** (https://www.geologyontario.mndm.gov.on.ca/ogsearth.html) Data sets in KML format for Google Earth and GIS format for GIS programs (ArcGIS, QGIS, etc). There are several very useful data sets such as OGSFocus, AMIS, OGS GeoData Listings, Ontario Mineral Inventory, geophysical data and more **NRCan Open S&T Repository** (https://ostrnrcan-dostrncan.canada.ca/home) Geological Survey of Canada reports, maps, data sets, etc. https://www.ontarioprospectors.com/publications.html /2009 Publications/*Discover Prospecting: An Introductory Prospecting Manual*
3	Obtaining a prospector licence, claims, plans and permits	**MLAS: Mining Lands Administration System** (https://www.ontario.ca/page/mining-lands-administration-system) How to register and manage mining claims online and apply for a prospector licence ***Mining Act*, R.S.O. 1990, c. M.14** (https://www.ontario.ca/laws/statute/90m14) The Ontario *Mining Act* **Exploration plan submission and permit application guide** *Provincial Standards for Early Exploration* (PDF) (https://www.geologyontario.mndm.gov.on.ca/mines/lands/mining-sequence/provincial_standards_for_early_exploration_en.pdf) Lists activities requiring an exploration plan and exploration permit **Ontario Regulation 308/12** under the *Mining Act* (https://www.ontario.ca/laws/regulation/120308) Conditions and requirements for carrying out exploration plan and permit activities

References

Parker, J.R. 2007. Discover prospecting: an introductory prospecting manual; Ontario Prospectors Association, 202p. https://www.ontarioprospectors.com/publications.html

HIGHLIGHTS

- Government funding opportunity for prospectors in Ontario
- New funding dedicated to prospectors in Ontario

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Unlocking Ontario's Mineral Potential: An Introduction to OJEP's Prospectors Stream

Introduction

The Government of Ontario introduced the Ontario Junior Exploration Program (OJEP) in 2021 to stimulate investment in early-stage mineral exploration through targeted funding. While OJEP is a pan-provincial initiative, it places particular emphasis on supporting opportunities in northern and Indigenous communities. Under the original structure, OJEP provided early exploration companies with up to $200,000 per project, covering 50% of eligible costs, along with an additional $15,000 to fully fund eligible expenses that promote Indigenous employment and business development.

In 2025, Ontario updated the program to accept applications through more dedicated streams for exploration and critical minerals, and added a prospectors stream based on client feedback. The sixth intake of applications, which closed on July 31, 2025, marked the first round under this updated structure. For comprehensive information about the program, including eligibility, the application process, and post-submission steps, please refer to the *OJEP Guide* (https://forms.mgcs.gov.on.ca/dataset/on00865).

Prospectors Stream

Under the updated OJEP program, Ontario's prospectors can now apply for funding to explore in either stream, up to $50,000 per project, with an additional $15,000 from the Indigenous Participation Incentive. This stream provides funding on a first-come, first-serve basis, and to be eligible for this stream, clients need to meet the following criteria:

- **Prospecting Licence**: The applicant must hold a valid Ontario prospector's licence for at least one year before the date of application.
- **Claim Status**: The mining claims where proposed work will be conducted must be in good standing, with the first year of assessment work filed and approved.
- **Claim Ownership**: The applicant must hold a minimum 25% ownership interest in the claim where eligible exploration activities are planned.
- **Independence from Junior Mining Companies**: The applicant must not be affiliated with any junior mining company for claims receiving OJEP funding.
- **Application Limit**: Prospectors may submit only one project application per intake period.

Azadbakht, Z. 2026. Unlocking Ontario's mineral potential: an introduction to OJEP's Prospectors Stream; *in* Recommendations for Exploration 2025–2026, Ontario Geological Survey, Resident Geologist Program, p.6-7.

Recommendations

At the time of publication, the 2025–2026 intake period is closed, but we encourage clients to check the OJEP Web site (https://www.ontario.ca/page/ontario-junior-exploration-program#section-0) regularly for the most up-to-date information.

References

Government of Ontario 2025. Ontario Junior Exploration Program; https://www.ontario.ca/page/ontario-junior-exploration-program#section-0 (Updated August 1, 2025) [accessed November 11, 2025].

HIGHLIGHTS

- **Drift prospecting is a lower cost mineral exploration methodology**
- **Used in areas of thick drift, it is a proxy where bedrock is not accessible**
- **Analysis of till samples can identify geochemical and mineralogical signatures that can be traced back to their potential source**

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Drift Prospecting for Mineral Exploration: An Introduction

Drift prospecting is a lower cost mineral exploration methodology implemented in former glaciated areas of thick drift (such as northern Ontario). As bedrock is not accessible at surface it cannot be directly sampled so a glacial proxy is used. Till (unsorted mixture of sand, silt, clay and gravel), a sediment deposited directly by glaciers, contains pieces of bedrock which were eroded away as the ice moved over an area. By analyzing till samples, it is possible to identify geochemical and mineralogical signatures of interest which can then be traced back to their potential source up-ice. An idealized till section is made up of 3 horizons (Photo 1):

- A-Horizon: forms at or near the surface, composed primarily of topsoil (organic and mineral soil)
- B-Horizon: the zone of accumulation, where minerals having leached from the A-horizon accumulate
- C-Horizon: a mineral horizon that is relatively unaffected by soil forming processes active in the A- and B-horizons

A thorough understanding of ice-flow events in a region is an important tool in tracing these signatures to their source. As a glacier flows over a landscape, it erodes the existing sediment and bedrock and transports it to a location further down-ice. It is important to understand the ice-flow dynamics, including flow direction, as well as the number of events that occurred in an area. A single region can be affected by glacial ice multiple times, and that ice may have come from multiple directions. Therefore, reconstructing these events will help with the understanding of how material from a mineralized source may have been dispersed over an area. This is a dispersal train. A simplified diagram showing this idea is in Figure 1. This shows that the concentration of a mineral of interest is diluted further away from the source and may be spread over a wider swath if multiple ice-flow events occurred in the area.

More detailed information on glacial event reconstructions can be found in many of the Quaternary geology maps or Open File Reports published by the Ontario Geological Survey (OGS). While this article focusses and lists (Table 1) studies specific to the Sudbury Resident Geologist Program (RGP) District, there are many studies (past and ongoing) throughout the province. Those studies can be found using the search tools on the GeologyOntario Hub Web site (www.hub.geologyontario.mines.gov.on.ca), and by contacting the local RGP office, or the authors of this article. Table 1 lists some of the OGS publications in the Sudbury RGP District. The "List of Publications" section contains some of the significant publications within and outside the OGS.

Marich, A.S. and Péloquin, A.S. 2026. Drift prospecting for mineral exploration: an introduction; *in* Recommendations for Exploration 2025–2026, Ontario Geological Survey, Resident Geologist Program, p.8-15.

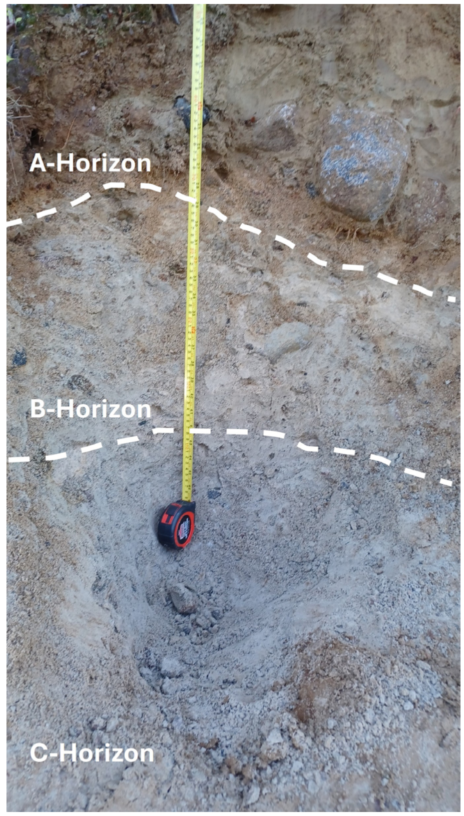

Photo 1. Till section showing horizons. Till sampling as part of a drift prospecting program should be completed within the C-horizon for best results.

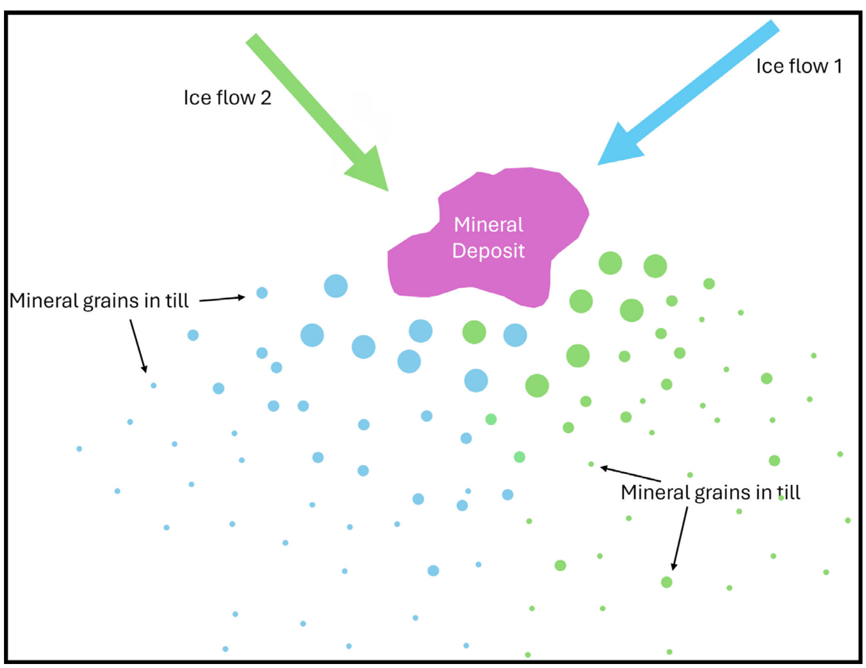

Figure 1. Simplified diagram showing dispersion of mineral grains in till after 2 ice-flow events.

Sampling Protocols

A till sampling survey is ideally completed in an evenly spaced grid. The samples collected should be of the C-horizon portion of till (commonly below 1 m depth) which is the least affected by surface leaching, oxidization and erosion post deposition (*see* Photo 1). Till sitting directly on bedrock is the best till to sample as it is likely to be the most representative of the underlying bedrock. It is important that well-developed unoxidized till is collected as much as possible, but where a well-developed C-horizon isn't available, observations should be made on the character of the sediment which will be useful at the interpretation stage. As per modern OGS protocols (e.g., Bajc 1999, Marich 2021), one large 10 kg sample of till matrix (with the pebbles 1 cm and greater removed) is collected; this is analyzed for heavy minerals, gold grains, kimberlite indicator minerals (KIMs), metamorphic or magmatic massive sulphide indicator minerals (MMSIM®) and other mineral grains of interest; a smaller 3 to 5 kg bag of this matrix is collected for geochemical analysis including trace and major geochemical determinations, grain size and carbonate content. A sample of the pebbles separated from the heavy mineral sample is also collected (3 to 5 kg), and these are kept for lithological determinations. The results from all these analyses are key for the determination of till source. Here it is also important to have a good understanding of bedrock geology of a study area to determine if part of the till is locally derived or contains constituents from rocks further afield (i.e., carbonate component of the till is likely from a source to the far north if a sampling program is conducted in northeastern Ontario).

Data Presentation

The results of the till sample analyses are plotted on maps showing the distribution and relative proportions of each mineral or chemical element. This is then used in association with ice-flow reconstructions to help target potential bedrock sources and/or where further work is warranted.

Table 1. Publicly available Quaternary geology works, Sudbury RGP District. Map Id is keyed to Figure 2.

Map Id	Publication No.[1]	Title	Reference
1	OFR6342	Quaternary Geology and Surficial Media Sampling in Drury and Denison Townships, City of Greater Sudbury	Hashmi (2018a)
1	MRD359	Till Geochemical and Mineralogical Data for Drury and Denison Townships, City of Greater Sudbury	Hashmi (2018b)
1	P3801	Quaternary Geology, Drury and Denison Townships	Hashmi (2016)
2	M2519	Quaternary Geology, North and East Ranges, Sudbury Basin: Western Part	Bajc (1997a)
3	M2520	Quaternary Geology, North and East Ranges, Sudbury Basin: West-Central Part	Bajc (1997b)
4	M2521	Quaternary Geology, North and East Ranges, Sudbury Basin: East-Central Part	Bajc (1997c)
5	M2522	Quaternary Geology, North and East Ranges, Sudbury Basin: Eastern Part	Bajc (1997d)
6	OFR6040	Kimberlite Indicator Minerals from Till Samples in the River Valley-Verner Area, Northeastern Ontario	Tardif and Crabtree (2000a)
6	MRD067	Kimberlite Indicator Minerals from Till Samples in the River Valley-Verner Area, Northeastern Ontario	Tardif and Crabtree (2000b)
7	OFR6421.14	Quaternary Geological Mapping of the Lake Nipissing Basin: New Insights into the Glacial History of Northeastern Ontario	Marich (2025)
7	OFR6405.22	Quaternary Geological Mapping of the Eastern Part of the Lake Nipissing Basin, Northeastern Ontario – An Update Half a Century in the Making	Marich (2023b)
7	OFR6405.17	Geochronological Study of a Saprolite atop the Grenvillian Mulock Pluton near Redbridge, Northeastern Ontario	Easton, Marich and Wall (2023)

Map Id	Publication No.[1]	Title	Reference
7	OFR6390.17	Quaternary Geological Mapping of the Lake Nipissing Basin, Highway 17 Corridor, Northeastern Ontario	Marich (2022)
	MS465	Algoma, Sudbury, Timiskaming and Nipissing, Surficial Geology	Boissoneau (1965)
	M2216	North Bay Area, Nipissing and Parry Sound Districts	Lumbers (1971a)
	R094	Geology of the North Bay Area, Districts of Nipissing and Parry Sound	Lumbers (1971b)
	P0751	Geological series, Quaternary Geology and Industrial Mineral Resources of the Sudbury Area (Western Part), District of Sudbury	Burwasser (1972a)
	P0752	Geological series, Quaternary Geology and Industrial Mineral Resources of the Sudbury Area (Eastern Part), District of Sudbury	Burwasser (1972b)
	M2397	Sudbury, Sudbury Regional Municipality, Quaternary Geology	Burwasser (1977)
	R181	Quaternary Geology of the Sudbury Basin Area, District of Sudbury	Burwasser (1979)
	OFR5600	Quaternary Geology of the Algonquin Park Area	Ford and Geddes (1986)
	M2518	Surficial Geology of Northern Ontario	Sado and Carswell (1987)
	OFR5796	The Quaternary Geology of the Parry Sound-Sundridge Area, Central Ontario	Kor (1991)
	M2555	Quaternary Geology of Ontario, East-Central Sheet	Barnett, Henry and Babuin (1991b)
	P3399	Surficial Geology of the Regional Municipality of Sudbury	Barnett and Bajc (1999)
	EDS014-REV	Quaternary Geology, Seamless Coverage of the Province of Ontario	Ontario Geological Survey (2000)
	OFR6033	Geochemical Response of Surficial Media, North and East Ranges, Sudbury Basin	Bajc and Hall (2000a)
	MRD061	Data Release, Geochemical Response of Surficial Media, North and East Ranges, Sudbury Basin	Bajc and Hall (2000b)
	OFR6043	Regional Modern Alluvium Sampling Survey of the Temagami-Marten River Area, Northeastern Ontario	Allan (2001a)
	MRD072	Regional Modern Alluvium Sampling Survey of the Temagami-Marten River Area, Northeastern Ontario	Allan (2001b)
	MRD082	Results of Modern Alluvium Sampling, Chapleau Area, Northeastern Ontario: Operation Treasure Hunt - Kapuskasing Structural Zone	Ontario Geological Survey (2001b)
	MRD136	Geochemical Data for Selective Leach Signatures over Kimberlites and Other Targets	Burt and Hamilton (2004)
	MRD153	Ontario Geochemistry and Indicator Mineral Database	Ontario Geological Survey (2005)
	OFR6370.13	Quaternary Geology Mapping in the “Great Clay Belt” of Northeastern Ontario	Marich (2020)
	OFR6405.31	Aggregate Resources Inventory of the North Bay Area, Central Nipissing District, Northeastern Ontario	Handley (2023)
	MRD401	Ambient Groundwater Geochemical and Isotopic Data for Northeastern Ontario, 2016–2018	Dell and Hamilton (2024)

[1] Reports, maps and data can be found online by entering the Publication No. in the search tools at the GeologyOntario Hub Web page (https://www.hub.geologyontario.mines.gov.on.ca)

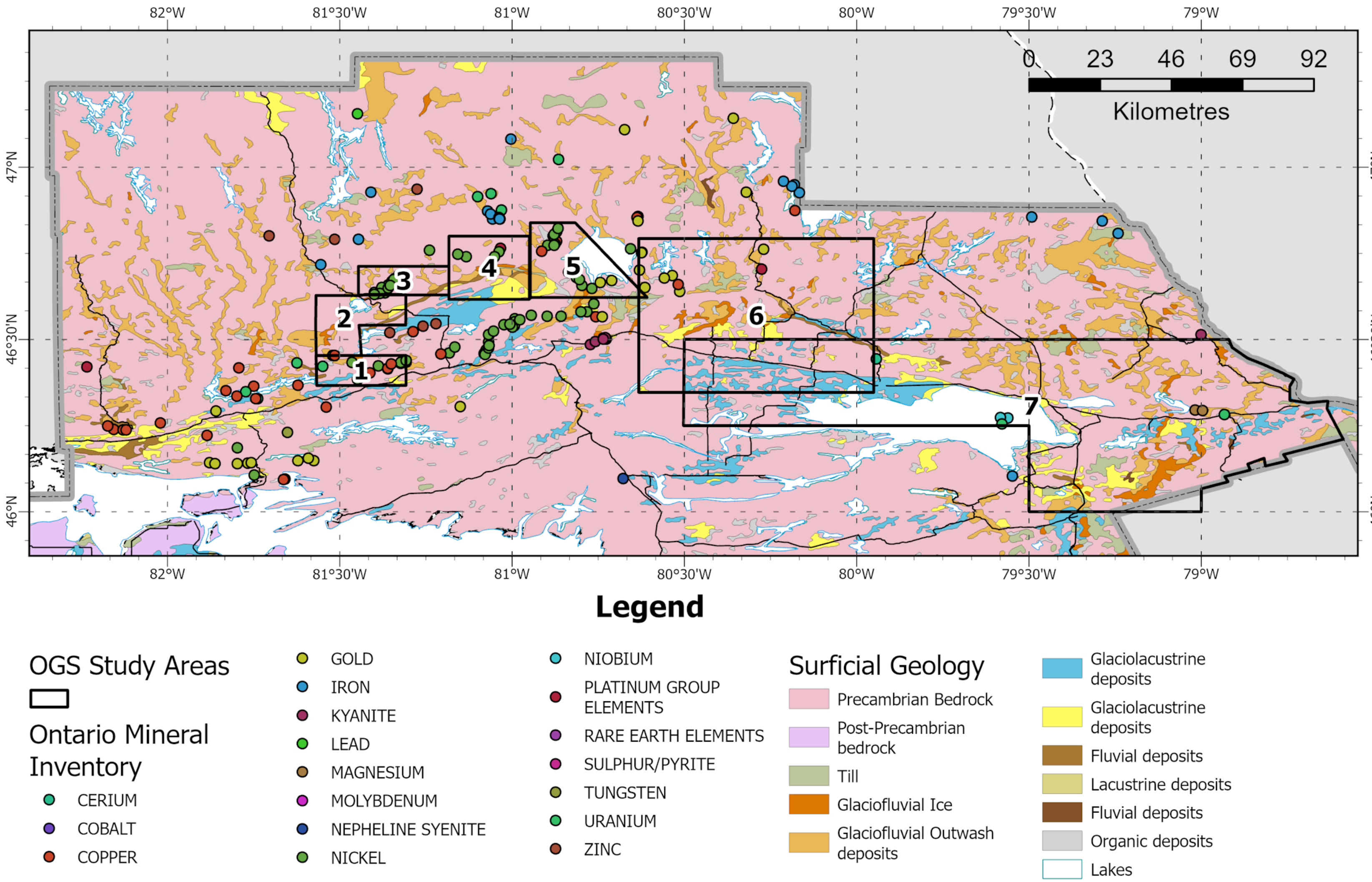

Figure 2. Quaternary geology map of the north part of the Sudbury RGP District, showing the location of Ontario Mineral Inventory mineral prospects and mines (Ontario Geological Survey 2025), and areas with significant Quaternary geology studies (keyed to Table 1). Quaternary geology *from* Ontario Geological Survey (2000).

Ontario Geological Survey: Data and Expertise

The Ontario Geological Survey Quaternary geoscientists have been actively mapping and analyzing glacial deposits for decades (see, for examples, Table 1 and Figure 2). The data is publicly available using the search tools on the GeologyOntario Hub Web site (www.hub.geologyontario.mines.gov.on.ca) which include text-based and spatial searches, and OGSEarth (www.geologyontario.mndm.gov.on.ca/ogsearth.html), a Google Earth™ mapping service (with .kml files) for viewing public geoscience data and information in a geographic context. The OGS geoscientists on staff are available to provide guidance on glacial history, the development of drift prospecting programs, as well as training on sampling protocols.

Recommendations for Exploration

As glacial dispersion trains can be far reaching, commonly beyond the extent of an exploration property, reviewing and compiling the regional publicly available data in an area is the first step. Property-scale drift prospecting should be carried out using the “Sampling Protocols” section above. Again, OGS Quaternary geoscientists can help with survey development and training.

List of Publications

Allan, S.E. 2001a. Regional modern alluvium sampling survey of the Temagami–Marten River area, northeastern Ontario; Ontario Geological Survey, Open File Report 6043, 194p.

——— 2001b. Regional modern alluvium sampling survey of the Temagami–Marten River area, northeastern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 72.

Averill, S.A. 2001. The application of heavy indicator mineralogy in mineral exploration with emphasis on base metal indicators in glaciated metamorphic and plutonic terrains; *in* Drift Exploration in Glaciated Terrain, The Geological Society of London, Special Publication No.185, p.69-81.

Bajc, A.F. 1996. Quaternary geology, Cal Graphite area, southern Ontario; Ontario Geological Survey, Map 2646, scale 1:20 000.

——— 1997a. Quaternary geology, north and east ranges, Sudbury Basin: western part; Ontario Geological Survey, Map 2519, scale 1:20 000.

——— 1997b. Quaternary geology, north and east ranges, Sudbury Basin: west-central part; Ontario Geological Survey, Map 2520, scale 1:20 000.

——— 1997c. Quaternary geology, north and east ranges, Sudbury Basin: east-central part; Ontario Geological Survey, Map 2521, scale 1:20 000.

——— 1997d. Quaternary geology, north and east ranges, Sudbury Basin: eastern part; Ontario Geological Survey, Map 2522, scale 1:20 000.

——— 1999. Results of regional humus and till sampling in the eastern part of the Shebandowan greenstone belt, northwestern Ontario; Ontario Geological Survey, Open File Report 5993, 85p.

Bajc, A.F. and Hall, G.E.M. 2000a. Geochemical response of surficial media, North and East Ranges, Sudbury Basin; Ontario Geological Survey, Open File Report 6033, 286p.

——— 2000b. Data release geochemical response of surficial media, North and East Ranges, Sudbury Basin; Ontario Geological Survey, Miscellaneous Release—Data 61.

Bajc, A.F. and Henry, A.P. 1991. Quaternary geology of the Huntsville–Bracebridge area, southern Ontario, Ontario; Ontario Geological Survey, Open File Map 161, scale 1:50 000.

Bajc, A.F. and Paterson, J.T. 1992a. Quaternary geology of the Penetanguishene and Christian Island areas, southern Ontario; Ontario Geological Survey, Open File Map 194, scale 1:50 000.

——— 1992b. Quaternary geology of the Gravenhurst area, southern Ontario; Ontario Geological Survey, Open File Map 195, scale 1:50 000.

Barnett, P.J. and Bajc, A.F. 1999. Surficial geology of the Regional Municipality of Sudbury; Ontario Geological Survey, Preliminary Map P.3399, scale 1:100 000.

Barnett, P.J., Henry, A.P. and Babuin, D. 1991. Quaternary geology of Ontario, east-central sheet; Ontario Geological Survey, Map 2555, scale 1:1 000 000.

Benn, D.I. and Evans, D.J.A. 2010. Glaciers and glaciation, 2nd ed.: Routledge, London, 802p.

Boissoneau, A.N. 1965. Algoma, Sudbury, Timiskaming and Nipissing, surficial geology; Ontario Department of Lands and Forests, Map 465, scale 1:506 880.

Burt, A.K. and Hamilton, S.M. 2004. Geochemical data for selective leach signatures over kimberlites and other targets; Ontario Geological Survey, Miscellaneous Release—Data 136.

Burwasser, G.J. 1972a. Quaternary geology and industrial mineral resources of the Sudbury area (western part), District of Sudbury; Ontario Geological Survey, Preliminary Map P.751, scale 1:50 000.

——— 1972b. Quaternary geology and industrial mineral resources of the Sudbury area (eastern part), District of Sudbury; Ontario Geological Survey, Preliminary Map P.752, scale 1:50 000.

——— 1977. Sudbury, Sudbury Regional Municipality, Quaternary geology; Ontario Geological Survey, Map 2397, scale 1:50 000.

——— 1979. Quaternary geology of Sudbury Basin, District of Sudbury; Ontario Geological Survey, Geological Report 181, 103p.

Cowan, W.R. and Sharpe, D.R. 2007a. Surficial geology, Bruce Peninsula, southern Ontario; Ontario Geological Survey, Map 2679, scale 1:100 000.

——— 2007b. Surficial geology of the Bruce Peninsula, southern Ontario; Ontario Geological Survey, Open File Report 6211, 34p.

Dell, K.M. and Hamilton, S.M. 2024. Ambient groundwater geochemical and isotopic data for northeastern Ontario, 2016–2018; Ontario Geological Survey, Miscellaneous Release—Data 401.

Easton, R.M. 1992. The Grenville Province and the Proterozoic history of central and southern Ontario *in* Geology of Ontario; Ontario Geological Survey, Special Volume 4, Part 2, p.715-904.

Easton, R.M., Marich, A. S. and Wall, C.J. 2023. Geochronological study of a saprolite atop the Grenvillian Mulock pluton near Redbridge, northeastern Ontario; *in* Summary of Field Work and Other Activities, 2023, Ontario Geological Survey, Open File Report 6405, p.17-1 to 17-7.

Ford, M.J. and Geddes, R.S. 1986. Quaternary geology of the Algonquin Park area; Ontario Geological Survey, Open File Report 5600, 87p.

Handley, L.A. 2023. Aggregate resources inventory of the North Bay area, Central Nipissing District, northeastern Ontario; Ontario Geological Survey, Open File Report 6405, p.31-1 to 31-9.

Harrison, J.E. 1972. Quaternary geology of the North Bay–Mattawa region, Ontario–Quebec; Geological Survey of Canada, Preliminary Map 3-1971, scale 1:125 000.

Hashmi, S. 2016. Quaternary geology, Drury and Denison townships; Ontario Geological Survey, Preliminary Map P.3801, scale 1:20 000.

——— 2018a. Quaternary geology and surficial media sampling in Drury and Denison townships, City of Greater Sudbury; Ontario Geological Survey, Open File Report 6342, 133p.

——— 2018b. Till geochemical and mineralogical data for Drury and Denison townships, City of Greater Sudbury; Ontario Geological Survey, Miscellaneous Release—Data 359.

Kor, P.S.G. 1991. The Quaternary geology of the Parry Sound–Sundridge area, central Ontario; Ontario Geological Survey, Open File Report 5796, 158p.

Lumbers, S.B. 1971a. North Bay area, Nipissing and Parry Sound districts; Ontario Department of Mines, Map 2216, scale 1:126 720.

——— 1971b. Geology of the North Bay area, districts of Nipissing and Parry Sound; Ontario Geological Survey, Geological Report 94, 112p.

Marich, A.S. 2020. Quaternary geology mapping in the “Great Clay Belt” of northeastern Ontario; *in* Summary of Field Work and Other Activities, 2020, Ontario Geological Survey, Open File Report 6370, p.13-1 to 13-12.

——— 2021. Quaternary geology mapping in the Great Clay Belt of northeastern Ontario: A study of sediments and glacial landforms along the Highway 11 Corridor from Kapuskasing to Iroquois Falls; Ontario Geological Survey, Open File Report 6369, 57p.

——— 2022. Quaternary geological mapping of the Lake Nipissing Basin, Highway 17 corridor, northeastern Ontario; *in* Summary of Field Work and Other Activities, 2022, Ontario Geological Survey, Open File Report 6390, p.17-1 to 17-9.

——— 2023a. Drumlins, De Geers, and deltas – lidar and landform interpretations within the Lake Nipissing Basin, northeastern Ontario; abstract *in* Geological Association of Canada–Mineralogical Association of Canada– Society for Geology Applied to Mineral Deposits, Annual Meeting, Sudbury, Ontario, May 25–27, Abstracts, v.46, Geoscience Canada, v.50, p.180.

——— 2023b. Quaternary geological mapping of the eastern part of the Lake Nipissing Basin, northeastern Ontario – An update half a century in the making; *in* Summary of Field Work and Other Activities, 2023, Ontario Geological Survey, Open File Report 6405, p.22-1 to 22-10.

——— 2025. Quaternary geological mapping of the Lake Nipissing Basin: new insights into the glacial history of northeastern Ontario; *in* Summary of Field Work and Other Activities, 2025, Ontario Geological Survey, Open File Report 6421 p.14-1 to 14-8.

McClenaghan, M.B. and Kjarsgaard, B.A. 2001. Indicator mineral and geochemical methods for diamond in glaciated terrain in Canada; *in* Drift Exploration in Glaciated Terrain, The Geological Society of London, Special Publication no.185, p.83-123.

Ministry of Natural Resources and Forestry 2022. Ontario digital terrain model (Lidar-derived) - Lake Nipissing 2020 DTM; Ministry of Natural Resources and Forestry, Provincial Mapping Unit, Peterborough, Ontario, available on Ontario GeoHub.

Ontario Geological Survey, 2000. Quaternary geology, seamless coverage of the province of Ontario; Ontario Geological Survey, ERLIS Data Set 14 – Revised.

——— 2001. Results of modern alluvium sampling, Chapleau area, northeastern Ontario–Kapuskasing structural zone; Ontario Geological Survey, Miscellaneous Release—Data 82.

——— 2005. Ontario geochemistry and indicator mineral database; Ontario Geological Survey, Miscellaneous Release—Data 153.

——— 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release—Data 126 – Revision 1.

——— 2025. Ontario Mineral Inventory; Ontario Geological Survey, online database. www.hub.geologyontario.mines.gov.on.ca [accessed October 2025]

Reid, J.L. 2002. Modern alluvium data release, Mattawa–Cobalt corridor, northeastern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 102.

——— 2003. Modern alluvium data release, Sault-Ste. Marie–Espanola area, northeastern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 121.

——— 2004. Modern alluvium data release, Cobalt–Elk Lake area, northeastern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 124.

Sado, E.V. and Carswell, B.F. 1987. Surficial geology of northern Ontario; Ontario Geological Survey, Map 2518, scale 1:200 000.

Tardif, N.P. and Crabtree, D.C. 2000a. Kimberlite indicator minerals from till samples in the River Valley–Verner area, northeastern Ontario; Ontario Geological Survey, Open File Report 6040, 61p.

——— 2000b. Kimberlite indicator minerals from till samples in the River Valley–Verner area, northeastern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 67.

5

Tungsten in Central Kirkland Lake District: Reprocess and Explore

HIGHLIGHTS

- **Tungsten is a critical mineral important in our daily lives**
- **Tungsten is associated with gold-bearing quartz veins**
- **Over a dozen documented tungsten occurrences in Kirkland Lake District**

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Introduction

Tungsten (W), also known as wolfram, is a silvery-grey, lustrous metal. The name is derived from the Swedish *'tung sten'* meaning heavy stone. Tungsten is important in our daily lives. It has the highest melting point of any metal (3422°C), making it ideal for high-temperature applications, such as in the aerospace and defense industries, where materials need to withstand extreme heat. Tungsten is one of the densest elements, with a density of 19.3 g/cm^3, giving it excellent mechanical strength and toughness, a quality essential for use in heavy machinery and equipment. As a very hard (up to 9.5 on the Mohs scale) and wear-resistant metal, it is commonly alloyed with carbon powder to produce tungsten carbide which is immensely hard and makes excellent cutting and drilling tools, abrasives and wear-resistant coatings. Due to its high thermal conductivity, tungsten is used for conducting heat in high-temperature applications, such as in the production of heat sinks for electronic devices. Tungsten is highly resistant to chemical corrosion and is therefore suitable for use in corrosive environments such as in chemical and petrochemical industries, as well as in the production of electrical wires. Tungsten also has a low coefficient of thermal expansion (it expands very little when heated). This property makes it suitable for use in applications where dimensional stability is critical, such as in precision instruments and tooling. Calcium and magnesium tungstates are widely used in fluorescent lighting (https://periodic-table.rsc.org/element/74/tungsten [accessed November 26, 2025], and https://geologyscience.com/ore-minerals/tungsten-w-ore/ [accessed November 26, 2025].

Tungsten is classified as a critical mineral due to its essential role in various high-tech applications along with its supply chain vulnerabilities. Tungsten is recognized as a critical mineral in Ontario and Canada and also in the European Union, and Australia (Government of Canada 2022). Most of the tungsten production globally is concentrated in just a few countries, particularly China, which accounts for over 80% of global output and over one-half of known global reserves (Poulin, Rasmussen and Adlakha 2025).

Deposit Types

Tungsten deposit types depend on factors such as depth of emplacement, wall rock lithologies and structural controls. Tungsten ore is predominantly mined from granite-associated (contact metamorphic) skarn and vein (including porphyry) deposits. Most tungsten deposits are genetically and spatially associated with highly fractionated, reduced, peraluminous "S-type" granites that are derived from the melting of sedimentary rocks.

Suma-Momoh, J. 2026. Tungsten in central Kirkland Lake District: reprocess and explore; *in* Recommendations for Exploration 2025–2026, Ontario Geological Survey, Resident Geologist Program, p.16-20.

Melting of the sediments may occur at low- to mid-crustal levels, but must attain temperatures (e.g., >650°C) that allow tungsten-bearing minerals (e.g., muscovite, biotite, rutile, titanite, magnetite) to release tungsten into the melt (Romer and Kroner 2016). The higher temperatures needed for melting of some of these minerals imply that mantle-derived heat may be important in the formation of many tungsten deposits (Rasmussen et al. 2023). Once released from the source rocks into the melt, tungsten typically behaves as an incompatible element, preferring to remain in the melt versus partitioning into rock-forming minerals, leading to an enrichment of tungsten in the melt as the magma differentiates or becomes more felsic through normal crystallization processes (Poulin, Rasmussen and Adlakha 2025). For a general classification of tungsten deposit types, the author refers the reader to Little 1959.

Tungsten in Central Kirkland Lake District

Little (1959, p.157) gives a summary statement about tungsten occurrences of Ontario:

> The tungsten occurrences of Ontario are in the Precambrian rocks of the Canadian Shield. All such occurrences are scheelite in quartz veins in or near gold camps, but in those veins that contain appreciable scheelite, gold is sparse or absent. The scheelite-bearing veins appear, for the most part, to have been formed at higher temperatures than those containing gold. The production of scheelite concentrate in Ontario has been entirely from gold mines. Scheelite production has been relatively small except for Hollinger mine [Timmins District] which in 1940-43 and 1952 produced concentrate containing more than 200 tons of WO_3.

Granite-associated skarn deposits are uncommon in the Kirkland Lake District due in part to the low-grade metamorphism and typical lack of limestone around the granitic stocks and batholiths. To date, there is no known primary tungsten deposit in the District. However, tungsten is documented in the Ontario Mineral Inventory database (OMI, Ontario Geological Survey 2025) as a secondary commodity for some defined Mineral Occurrences, Developed Prospects, Past Producing, and Producing mines in central Kirkland Lake District (Table 1); and in these instances, gold is generally the primary commodity. Little (1959) also reported additional tungsten in 3 past-producing gold mines in central Kirkland Lake District (Bidgood, MDI32D04SW00073, and Morris-Kirkland, MDI32D04SW00033 in Lebel Township, and Omega, MDI32D04SE00017 in McVittie Township, *see* Ontario Geological Survey 2025).

Most gold deposits in the Kirkland Lake District are distributed along 2 distinctive but roughly parallel east–west linear trends: the Destor–Porcupine and the Larder Lake–Cadillac deformation zones (Knight 1925). The deposits display early quartz-carbonate auriferous veins and evidence for a later event that introduced native gold (Hattori 1993). Figure 1 shows tungsten distribution in central Kirkland Lake District. Except for the northerly Kiryan occurrence and the Iris Mine prospect, tungsten is associated with gold-bearing quartz veins within the Timiskaming volcano-sedimentary assemblage which follows closely the Larder Lake–Cadillac deformation zone from Powell Township in the west to McGarry Township in the east.

Table 1. Gold mineral properties associated with tungsten in central Kirkland Lake District.

Property	OMI	Primary Commodity	Secondary Commodity	Township	OMI Category
Belrosa	MDI32D04SW00030	Gold, Tungsten		Lebel	Occurrence
Boston Bulldog	MDI32D04SW00392	Tungsten	Gold	Boston	Occurrence
Chaput	MDI42A01SE00148	Gold	Copper, Tungsten, Silver	Teck	Occurrence
Gibson	MDI42A01SE00152	Gold	Tungsten	Teck	Occurrence
Iris Mine	MDI32D05NW00158	Gold	Tungsten	Harker	Developed Prospect
Jomi	MDI42A01SE00128	Gold	Tungsten	Otto	Occurrence

Property	OMI	Primary Commodity	Secondary Commodity	Township	OMI Category
Kerr-Addison Mine	MDI32D04SE00011	Gold	Silver, Copper, Tungsten	McGarry	Past Producing Mine
Killoran	MDI42A01SE00154	Copper	Gold, Molybdenum, Tungsten	Teck	Occurrence
Kiryan	MDI42A01NE00104	Gold	Zinc, Tungsten, Lead	Grenfell	Occurrence
Upper Canada	MDI32D04SW00057	Gold	Silver, Tungsten, Molybdenum	Gauthier	Past Producing Mine
Young-Davidson Mine	MDI41P15NE00017	Gold, Silver	Molybdenum, Tungsten	Powell	Producing Mine

OMI, Ontario Mineral Inventory database, accessible at the GeologyOntario Hub Web site, www.hub.geologyontario.mines.gov.on.ca (Ontario Geological Survey 2025)

Recommendations

1. The grade and abundance of tungsten in the tailings of the developed prospect, past-producing, and producing mines could be geochemically and metallurgically tested to ascertain whether the containing tungsten can be economically extracted. Grades in vein deposits typically range from 0.3 to 1.5% WO_3. Stockwork deposits that can be mined using bulk mining methods have grades as low as 0.1% WO_3 (Sinclair 1996). In Teck Township (Town of Kirkland Lake) Fulcrum Metals plc is currently conducting metallurgical studies on the tailings of the past-producing Teck-Hughes and Sylvanite mines with the aim to reprocess and extract economic metals from the tailings. Teck-Hughes and Sylvanite have a combined estimate of about 10 million tons of mine waste and have the potential to become sustainably sourced multi-commodity assets with gold, silver, gallium and tellurium identified to date (Fulcrum Metals plc, news release, April 22, 2025).
2. Anyone conducting mineral exploration for tungsten-related gold deposits or tungsten-bearing gold-quartz veins in the Kirkland Lake District should be aware of the 4 primary tungsten-bearing/indicator minerals. Scheelite (calcium tungstate, $CaWO_4$) is usually pale yellow, buff or brownish and has a white streak. It is the only tungsten-bearing mineral that fluoresces. Pure scheelite fluoresces bluish white, but with the addition of molybdenum replacing tungsten, the fluorescent colour changes with increasing molybdenum content, through white and yellowish white to yellow. Wolframite (iron-manganese tungstate, $(Fe,Mn)WO_4$ is dark greyish or brownish black. Ferberite (iron tungstate, $FeWO_4$) is typically black and is weakly magnetic. Hubnerite (manganese tungstate, $MnWO_4$) has a yellowish brown to reddish brown colour with a resinous lustre. In exploration, scheelite is favoured due to its relative abundance and ease of recovery and identification as it fluoresces under shortwave ultraviolet light. Significant mesothermal vein (or stockwork) mineral associations to look for include pyrite, arsenopyrite, chalcopyrite, galena, sphalerite, and tellurides. From the OMI database, there are 7 documented tungsten mineral occurrences in Kirkland Lake District (see Table 1 and Figure 1). These properties demand to be further explored in light of the projected critical need of the metal.

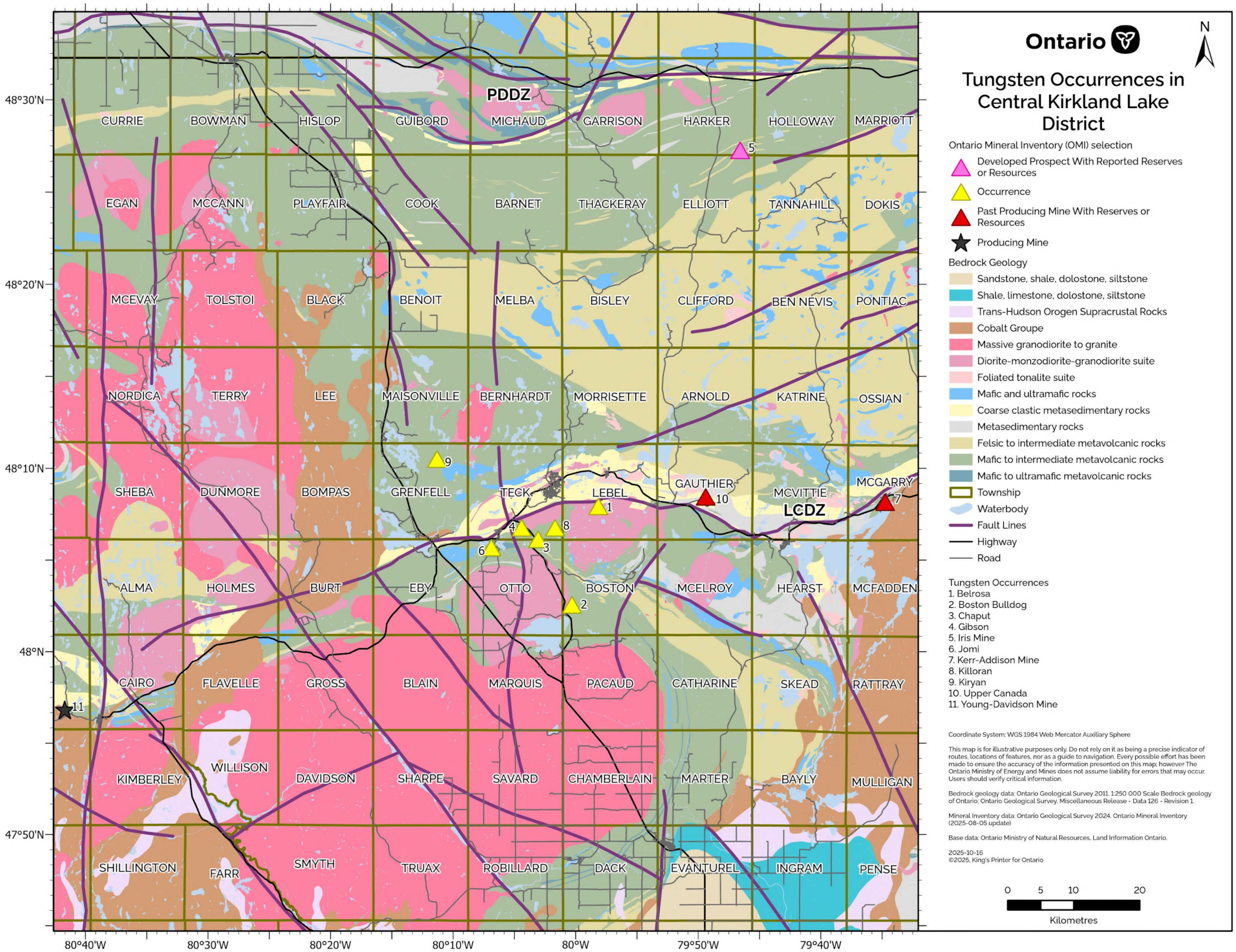

Figure 1. Geology map of central Kirkland Lake District showing locations of tungsten occurrences documented in the Ontario Mineral Inventory database (*from* Ontario Geological Survey 2025). PDDZ = Porcupine–Destor deformation zone, LCDZ = Larder Lake–Cadillac deformation zone. *Modified from* Ontario Geological Survey 2011.

References

Government of Canada. 2022. The Canadian Critical Minerals Strategy; Natural Resources Canada, 58p. https:/www.canada.ca/en/campaign/critical-minerals-in-canada/canadian-critical-minerals-strategy.html [accessed November 26, 2025]

Hattori, K. 1993. Diverse metal sources of Archaean gold deposits: evidence from in situ lead-isotope analysis of individual grains of galena and altaite in the Ross and Kirkland Lake deposits, Abitibi greenstone belt, Canada; Contributions to Mineralogy and Petrology v.113, p.185-195.

Knight, C.W. 1925. Lightning River gold area; Ontario Department of Mines, Annual Report, v.33, pt.3, p.41-49.

Little, H.W. 1959. Tungsten deposits of Canada; Economic Geology Series no.17, Geological Survey of Canada, 251p. https://emrlibrary.gov.yk.ca/gsc/economic_geology_series/17/egs_17.pdf [accessed November 26, 2025]

Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release—Data 126 – Revision 1.

——— 2025. Ontario Mineral Inventory; Ontario Geological Survey, online database (October 2025 update). https://www.hub.geologyontario.mines.gov.on.ca/

Poulin, R.S., Rasmussen, K.L. and Adlakha, E.E. 2025. Canada's got your tung? A wealth of opportunity; Facets, v.10, p.1-16. https://www.facetsjournal.com/doi/10.1139/facets-2025-0041 [accessed November 26, 2025]

Rasmussen, K.L., Falck, H., Elongo, V., Reimink, J., Luo, Y., Pearson, D.G., Ootes, L., Creaser, R.A. and Lecumberry-Sanchez, P. 2023. The source of tungsten-associated magmas in the northern Canadian Cordillera and implications for the basement; Geology, v.51, p.657-662.

Romer, R.L. and Kroner, U. 2016. Phanerozoic tin and tungsten mineralization—tectonic controls on the distribution of enriched protoliths and heat sources for crustal melting; Gondwana Research, v.31, p.60-95. doi.org/10.1016/j.gr.2015.11.002

Sinclair, W.D. 1996. Vein-stockwork tin, tungsten; *in* Geology of Canadian Mineral Deposit Types, (ed.) O.R. Eckstrand, W.D. Sinclair and R.I. Thorpe, Geological Survey of Canada, Geology of Canada, no.8, p.409-420.

Critical Minerals Potential in Shields Township, Sault Ste. Marie District

HIGHLIGHTS

- **Historical copper occurrences, minor gold-uranium-lead-rare earth elements (REE) and mineral assemblages of barite, pyrite, chalcopyrite, molybdenite, chlorite, epidote, and hematite replacing magnetite indicate potential for critical mineral exploration**
- **Historical drill cores record andesite-containing xenoliths of porphyry and mafic schist which may suggest volcanic-hydrothermal overprint in an area bounded by east-west faults and high magnetic anomaly where new assay data returned >1.2% copper**
- **Historical ground radiometric survey and assay data indicate high Cu, Th, K, U and light REE in felsic and alkaline intrusions suggesting possible genetic link between intrusions, hydrothermal alteration, and mineralization**

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Geology

Shields Township hosts limited known occurrences of copper along with reported assays of high potassium, thorium, uranium, iron, minor light rare earth elements (LREEs), and traces of gold which were discovered through historical exploration activities including prospecting, diamond drilling, assaying, and geological and geophysical surveying (GDIF 132 *see* Ontario Geological Survey 1984). Much of the township is underlain by the Archean gneissic tonalite suite, which is in contact with massive granodiorite to granite to the northwest and Keewatin mafic to intermediate metavolcanic rocks and associated iron formations to the south (Giblin and Leahy 1977, Ontario Geological Survey 2011). The area has been intruded by northwest-trending Mesoproterozoic Sudbury mafic dikes (ca. 1235–1238 Ma; Ontario Geological Survey 2011), a northeast-trending dike of unknown age and affiliation, and intersected by Wolfe Lake fault at the northwest and 2 east-trending faults at the central and southern parts of the township (Figure 1; Giblin and Leahy 1977; Ontario Geological Survey 2011).

Exploration History

A detailed account of exploration activities in Shields Township can be found in the Ontario Geological Survey publication GDIF 132 (Ontario Geological Survey 1984), including more recent activities available through the GeologyOntario Hub Web site (https://www.hub.geologyontario.mines.gov.on.ca/) (Tables 1, 2 and 3).

Shields Township has 2 occurrences for copper, 2 discretionary occurrences for copper and iron, and 2 abandoned mine sites for copper and iron which are documented in the Ontario Mineral Inventory database (OMI) (*see* Tables 1 and 2; Figure 1). Historical trenching, prospecting, geophysical surveys, diamond drilling, and assay analyses were carried out by Pitch-Ore Uranium Mines (1955) at the Wolfe Lake occurrence in the northwest part of the township (MDI41K16SE00046, Ontario Geological Survey 2025). Multiple north-trending trenches across the northwest-trending Wolfe Lake fault zone (*see* Figure 1) exposed dioritic units with yellow uranium stains, stringers of quartz veins, and disseminated pyrite and chalcopyrite (Nichols 1955). Magnetic survey to the east of Wolfe Lake showed a narrow linear northwest magnetic high correlated with diabase dike emplaced along the Wolfe Lake fault zone, and the dike was interpreted to be faulted and displaced further south (Nichols 1955). Although no significant radioactivity was detected during ground surveying, drill core analyses revealed brecciated diorite and mafic metavolcanic units, intruded by younger granitic (possibly aplite)

Maity, B.K. 2026. Critical minerals potential in Shields Township, Sault Ste. Marie District; *in* Recommendations for Exploration 2025–2026, Ontario Geological Survey, Resident Geologist Program, p.21-27.

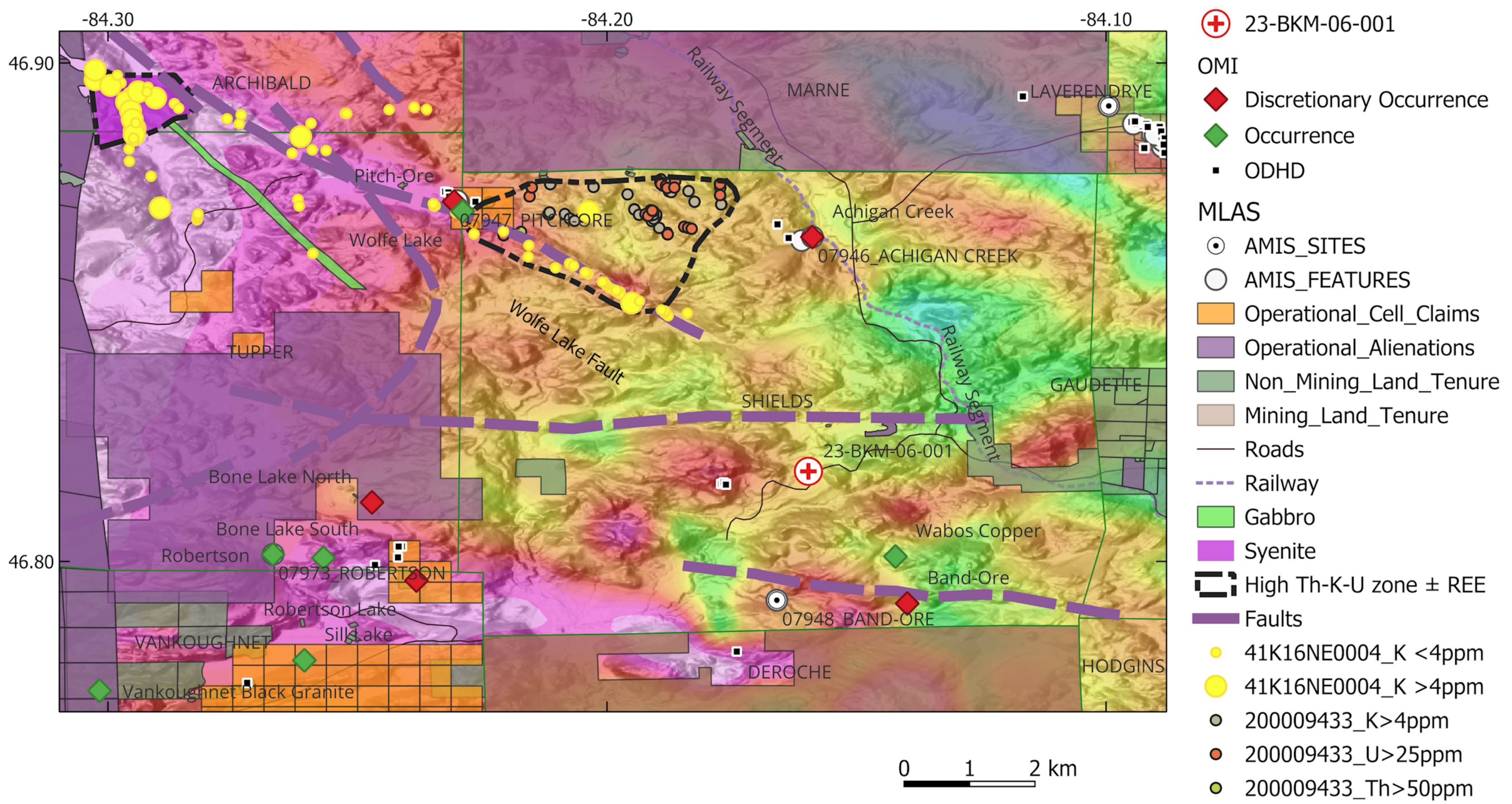

Figure 1. Total field magnetic image superimposed over shaded relief map of Shields Township and adjoining area showing the present status of land claims and patents, location of drill holes, abandoned mine sites and features, mineral occurrences (OMI), and the location of sample 23-BKM-06-001 (Tables 1-4). Magnetic anomaly data *from* Ontario Geological Survey 2003. Shaded relief map *from* Ontario Elevation Mapping Program, Ministry of Natural Resources 2025. Geology, lineaments, and sample location data *modified from* assessment files indicated in the legend, Giblin and Leahy 1997; Ontario Geological Survey 2011. Latitude and longitude co-ordinates, in decimal degrees, are shown on the vertical and horizontal axes, respectively, are provided using North American Datum 1983 (NAD83) in Universal Transverse Mercator Zone 16.

rocks, containing zones of silicification, hematitization and carbonatization, where narrow zones (approximately 1 foot or less) of radioactivity at depths varying between 45 and169 feet in multiple drill holes were associated with magnetic high anomalies (Nichols 1955). Diamond drilling in the Wolfe Lake property reported granite, diorite and felsic porphyritic units with variable degrees of hematitic and chloritic alterations, and sulphide mineralization (Pitch-Ore Uranium Mines Ltd. 1955). A steeply dipping narrow 100 to 115/85NE sheared body of quartz-chlorite-magnetite-altered ironstone exhibited banded quartz stockwork related to brittle deformation, chlorite-amphibole, and disseminated pyrite-chalcopyrite-magnetite. Grab samples from this ironstone returned assays of greater than 0.2 to 1.2% Cu, which is inversely related to the generally elevated Fe, V, Sc, Y, and Co contents in the ironstone samples (North 1995). Along the southeast extension of Wolfe Lake fault, grab samples from gneiss, granite, and gabbro exhibit chlorite-carbonate-hematite alteration with disseminated pyrite and magnetite, and 2 samples exhibit elevated potassium contents of approximately 4 wt% K (North 1995; Figure 1). The northwest extension of Wolfe Lake fault near the boundary of Archibald and Tupper townships, relatively elevated LREE contents (52 to 73 ppm La, 80 to180 ppm Ce) were reported from a subcircular syenitic intrusion and from a granitic float (North 1995; Figure 1).

Table 1. Summary of Ontario Mineral Inventory (OMI) data from Shields Township compiled from the GeologyOntario database (available *from* GeologyOntario Hub Web page (https://www.hub.geologyontario.mines.gov.on.ca/) [accessed October 27, 2025]).

MDI Identifier	Occurrence Status	Name(s)	Primary Commodities	Latitude (DD)	Longitude (DD)
MDI41K16SE00002	Discretionary	Achigan Creek	Copper	46.86507	-84.1589
MDI41K16SE00004	Discretionary	Band-Ore, Campbell-Murdoch, Shields-Deroche	Iron	46.79154	-84.1398
MDI41K16SE00003	Discretionary	Pitch-Ore, Wolfe Lake	Copper, Uranium	46.87219	-84.2306
MDI41K16SE00045	Occurrence	Wabos Copper	Copper	46.80098	-84.1422
MDI41K16SE00046	Occurrence	Wolfe Lake	Copper	46.87024	-84.2289

Abbreviations: DD, decimal degrees

Table 2. Summary of abandoned mines and features in Shields Township compiled from the AMIS database, (available *from* GeologyOntario Hub Web page https://www.hub.geologyontario.mines.gov.on.ca/ [accessed October 27, 2025]).

AMIS ID	Site Name	Primary Commodity	Latitude DD	Longitude DD
7946	Achigan Creek	Copper	46.86508	-84.1588
7947	Pitch-Ore	Copper	46.87221	-84.2306
7948	Band-Ore, Campbell-Murdoch, Shields-Deroche	Iron	46.79221	-84.166

Abbreviations: AMIS, Abandoned Mines Information System

To the east of Wolfe Lake and south of Prough Lake, ground radiometric survey returned up to 7.8% K, 42.1 ppm Th, 26.2 ppm U in syenites, and up to 10.8% K, 85 ppm Th, and 46.1 ppm U in granites, although pegmatitic intrusions from the survey area were relatively poor in these elements (Forbes 2011; Figure 1).

At the Idziak Copper property in the northern part of Shields Township, a 12- to 15-foot wide northwest-trending and steeply dipping (variable between 70NE to 70SW) mineralized shear zone was correlated with a northwest to north-northwest trending magnetic high anomaly, where Keewatin massive andesite to chlorite-altered hornblende schist was intruded by syenitic porphyry or granodioritic rock (Barrett 1966). Mineralization in the volcanic rocks along the width of the shear zone was mainly restricted to chalcopyrite, bismuth, and gold, whereas sulphides associated with fracture-filled quartz veins are restricted to 6 to 12 feet within the zone (Barrett 1966).

Assay analyses of grab samples from a quartz-sulphide vein returned over 2.17 to 12.48% Cu and 0.04 oz/ton Au, whereas spectrographic analyses indicated 0.05 to 0.50% Bi, and samples from sheared metavolcanic rock returned 0.67 to 1.01% Cu. A 15-foot trench cut across the shear zone returned an average of 0.67% Cu, whereas a syenite body to the west side of the shear zone was reported to yield assays of 2.01% Cu exposed over 3 feet (Barrett 1966; MDI41K16SE00002, Ontario Geological Survey 2025). Diamond drilling of 4 holes (Holes 1-4) to a total of 437 feet was completed on the property in 1964 (Pollard 1964). Drill-hole logs recorded variably altered porphyry stockworks and Keewatin chlorite-carbonate altered basaltic schist, both of which were also observed as xenoliths in a younger intrusive andesite phase. Drill holes 1-3 logged variable amounts of disseminated sphalerite, pyrite, chalcopyrite along with calcite, barite, and abundant magnetite (Pollard 1964).

In the central part of the township, 4 shallow holes D1-4 (41 to 76 feet) drilled in 1966 at the eastern edge of a subcircular high relief representing a magnetic anomaly (*see* Figure 1), encountered Archean quartz diorite to granodiorite and Keewatin basaltic units, both intruded by younger aplite dikes and quartzite. Hole D-1 encountered vein-altered quartz diorite and brecciated quartzite at a depth of 27.0 to 27.5 feet, although no mineralization was reported from any of these holes (Pollard 1966).

Lake sediment geochemical data from Shields Township returned 48 to 158 ppm Zn, 14 to 54 ppm Cu, 2 to 8 ppm Pb, and 1 to 5 ppm Mo (Ontario Geological Survey 1979).

Table 3. Summary of assessment work conducted in Shields Township, compiled from the OAFD database, (available from GeologyOntario Hub Web page https://www.hub.geologyontario.mines.gov.on.ca/ [accessed October 27, 2025]).

Assessment File No. (Reference)	Performed For	Year From	Year To	File Identifiers	Work Type
41K16SE0025 (Pollard 1966)	J. Pollard	1966	1966	SHIELDS10B1	PDRILL (Diamond Drilling)
41K16SE0024 (Barrett 1966)	B. Idziak	1966	1966	0011A1	GEOL (Geological Survey / Mapping), MAG (Magnetic / Magnetometer Survey), MCOMP (Miscellaneous Compilation and Interpretation)
41K16SE0029 (Pollard 1964)	B. Idziak	1964	1964	SHIELDS10A1	PDRILL (Diamond Drilling)
41K16SE0028 (Nicholls 1955)	Pitch-Ore Uranium Mines Ltd	1955	1955	0011B1	MAG (Magnetic / Magnetometer Survey), RAD (Radiometric)
41K16SE0023 (Pitch-Ore Uranium Mines Ltd. 1955)	Pitch-Ore Uranium Mines Ltd	1955	1955	0010C1	ASSAY (Assaying and Analyses), PDRILL (Diamond Drilling)

Abbreviations: OAFD, Ontario Assessment File Database

RGP Field Visit and Assay Analyses

A field trip was conducted in June 2023 in Shields Township. At the location of sample 23-BKM-06-001, an outcrop of foliated (078/30S), chlorite-altered, diorite was intruded by a 10 inch wide 020 trending, subvertical quartz vein that exhibited disseminated chalcopyrite and malachite (Photo 1). A sample from the mineralized quartz vein, analyzed at the Geoscience Laboratories in Sudbury, returned an assay of greater than1.2% Cu, 81 ppm Zn, 4.5 ppm Ag, and 4.2 ppm Au (Table 4). The base metal contents in this sample are comparable to the assay data reported for other samples from Shields Township that exhibit elevated copper contents.

Table 4. Trace element geochemistry (in ppm) of mineralized quartz vein containing sulphide and carbonate, for sample 23-BKM-06-001, collected during 2023 field trip and analyzed using GeoLab method IML-101 (ICP–MS after aqua regia digest).

Sample ID units	Ag ppm	As ppm	Au ppm	Bi ppm	Cd ppm	Co ppm	Cu ppm	Hg ppm	In ppm	Ir ppm	Mo ppm
23-0117-0001	4.5	1.4	4.292	2.35	0.83	8.5	>12000	<0.08	0.553	<0.003	1.3
Sample ID units	**Ni** ppm	**Pb** ppm	**Pd** ppm	**Pt** ppm	**Sb** ppm	**Se** ppm	**Sn** ppm	**Te** ppm	**Tl** ppm	**Zn** ppm	
23-0117-0001	19	42.8	0.53	0.013	0.24	14.4	0.32	0.7	0.04	81	

Abbreviations: ppm, parts per million; Geo Lab, Ontario Geological Survey Geoscience Laboratories (Sudbury, Ontario)

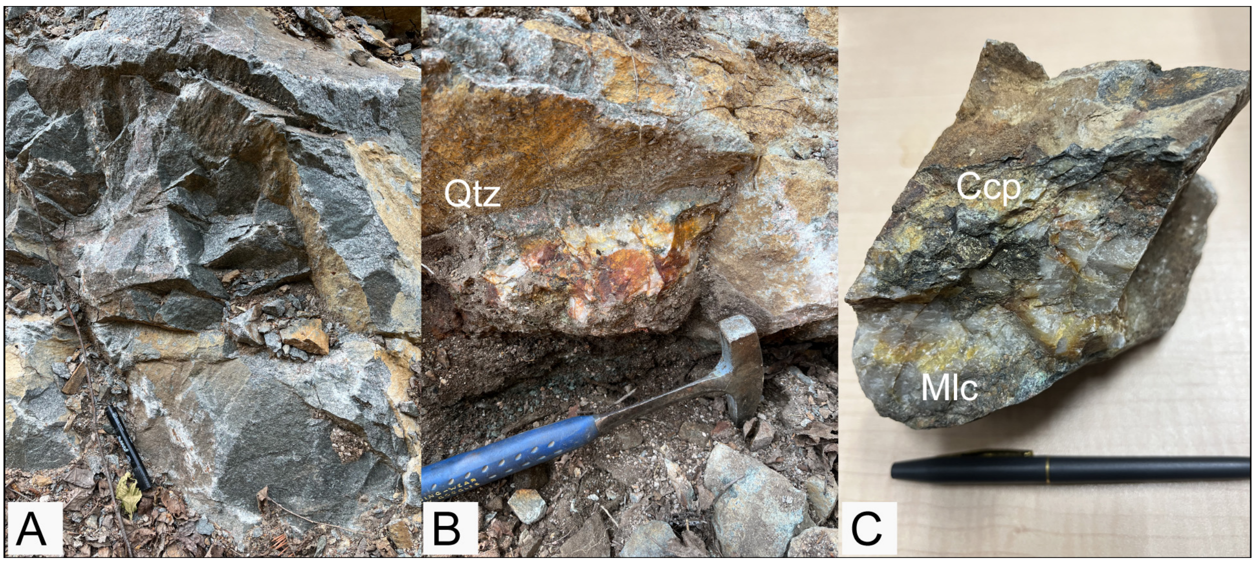

Photo 1. Field photographs of **A)** diorite (black marker is 13 cm in length) intruded by **B)** quartz vein (Qtz) with rusty stains, disseminated chalcopyrite and malachite (hammer is 35 cm in length), and **C)** a hand specimen (pen is 10 cm in length) of quartz vein showing disseminated chalcopyrite (Ccp) and malachite (Mlc) observed in outcrop during 2023 field visit in Shields Township.

Summary and Recommendations

- Shields Township exhibits multiple magnetic anomalies associated with a range of felsic to alkaline intrusive and mafic to intermediate metavolcanic rock types, steeply dipping shear zones, and hydrothermal alteration zones, often associated with magnetic and ground radiometric anomalies, and high concentrations of base metals with elevated K, Th, U, and LREE contents that warrant further exploration.
- Felsic and alkaline plutonic intrusions along Wolfe Lake fault zone in the northwest part of the Shields and adjacent Archibald townships, which contain elevated light rare earth elements, U, Th, and K are recommended for further investigation.
- In the Wolfe Lake area, abundant barite, pyrite, chalcopyrite, molybdenite, chlorite, epidote, and hematite replacing magnetite may indicate intrusion-related and/or shear-related hydrothermal alteration leading to high concentration of Cu and elevated Ag, Au, Zn, Fe contents. These alteration zones are often associated with high magnetic anomalies and fault zones that are recommended for further investigation.

- In the northcentral part of Shields Township near Achigan Creek and Idziak property area, moderate to high Cu contents were recovered from mafic metavolcanic and syenitic rocks and high Cu with minor Au and Bi in quartz-sulphide veins along a 12- to 15-foot wide steeply dipping northwest shear zone. Drill-hole data from this area indicate vein-altered porphyry stockwork and chlorite-altered mafic schist, both of which were also recorded as xenoliths in younger andesitic flow. This area is located over a broad northwest magnetic high and should be investigated further for shear-related and volcanic-hydrothermal alteration related base and precious metal mineralization.
- The shallow drill holes D1-4 in southcentral part of the township located over a magnetic anomaly have intersected Keewatin basaltic schist and vein-altered porphyry-quartz diorite which were further intruded by andesite, suggesting volcanic-hydrothermal alteration. Although no assay data was available from these drill cores, sample 23-BKM-06-001 located further east returned more than 1.2 ppm Cu. The shaded relief map of an ovoid high topography underlying the magnetic anomaly, bounded by east-west faults to the north and south (as mapped by Giblin and Leahy 1977; *see* Figure 1), along with subsurface lithological information suggest potential link between east-west faulting, hydrothermal alteration, and base metal mineralization in the area.
- Most of the Shields Township, and parts of Tupper and Archibald townships near Wolfe Lake area, are available for claim staking. Furthermore, availability of funding opportunity for critical minerals prospecting and exploration under Ontario Junior Exploration Program (https://www.ontario.ca/page/ontario-junior-exploration-program) provides excellent opportunity to explore the area.

References

Barrett, W.C. 1966. Idziak Copper property report; work *performed for* B. Idziak, Shields Township, Sault Ste. Marie Mining Division; Sault Ste. Marie District Geologist's office, assessment file 41K16SE0024, 9p.

Forbes, J.H. 2011. 2011 Report of radiometric survey on Shields Township; work *performed for* Pro Minerals Inc., District of Algoma, Ontario, Sault Ste. Marie Mining Division; Sault Ste. Marie District Geologist's office, assessment file 20000006597, 31p.

Giblin, P.E. and Leahy, E.J. 1977. Geological compilation series, Batchawana sheet, districts of Algoma and Sudbury, Sault Ste. Marie Mining Division; Ontario Geological Survey, Preliminary Map P.302—Revised, scale 1:126 720.

Ministry of Natural Resources and Forestry 2025. Ontario Digital Terrain Model (Lidar-Derived), 2024 Ontario Elevation Mapping Program Lidar updates, https://geohub.lio.gov.on.ca/maps/mnrf::ontario-digital-terrain-model-lidar-derived/about. [accessed November 20, 2025].

Nichols, E.B. 1955. Report of magnetic and scintillometer survey on property of Pitch-Ore Uranium Mines Limited, Tupper and Shields townships, District of Algoma, Ontario; Sault Ste. Marie District Geologist's office, assessment file 41K16SE0028, 19p.

North, J. 1995. Report on geological reconnaissance, prospecting, lithogeochemical sampling, petrographic descriptions, and interpretation of the Wolfe Lake property; work *performed for* WMC International Ltd; Tupper, Shields, Archibald, and Marne townships, Sault Ste. Marie Mining Division, Ontario; District of Algoma, Ontario; Sault Ste. Marie District Geologist's office, assessment file 41K16NE0004, 83p.

Ontario Geological Survey 1979. Regional lake sediment and water geochemical reconnaissance data, eastern shore Lake Superior, Ontario, NTS 41K, 41N; Ontario Geological Survey, Open File Report 5266, 75p.

——— 1984. Shields Township, District of Algoma, Geological Data Inventory Folio 132; *compiled by* the staff of the Resident Geologist's office, Sault Ste. Marie, 16p., 2 maps.

——— 2003. Single Master gravity and aeromagnetic data for Ontario, ASCII, Excel and Access formats; Ontario Geological Survey, Geophysical Data Set 1035.

——— 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release—Data 126 - Revision 1.

——— 2025. Ontario Mineral Inventory; Ontario Geological Survey, online database (October 2025 update). www.hub.geologyontario.mines.gov.on.ca

Pitch-Ore Uranium Mines Ltd. 1955. Diamond drilling report no. 10, Township of Shields, District of Algoma, Ontario; Sault Ste. Marie District Geologist's office, assessment file 41K16SE0023, 23p.

Pollard, J.G. 1964. Diamond drilling report; work *performed for* B. Idziak, Shields Township, Sault Ste. Marie Mining Division; Sault Ste. Marie District Geologist's office, assessment file 41K16SE0029, 8p.

——— 1966. Diamond drilling report; work *performed for* B. Idziak, Shields Township, Sault Ste. Marie Mining Division; Sault Ste. Marie District Geologist's office, assessment file 41K16SE0025, 8p.

HIGHLIGHTS

- **Several clusters of molybdenum anomalies in lake sediment occur within granitic terranes, situated near the contact with mafic metavolcanic rocks and along northeast-trending lineaments**
- **Granitoid rocks are largely underexplored**
- **Recommended areas are open for claim acquisition**

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Molybdenum Potential in the Atikokan Area

Molybdenum (Mo) is rising in importance owing to China's recent announcement in February 2025 to restrict exports on molybdenum, along with 4 other critical minerals: tungsten, tellurium, bismuth and indium (https://www.reuters.com/world/china/china-expands-critical-mineral-export-controls-after-us-imposes-tariffs-2025-02-04/#). Molybdenum is used for missile components, nuclear reactors, steel alloys, lubricants and high-temperature electronics.

The demand for molybdenum has grown in the past 4 years with the price of molybdenum showing a steady increase from less than US$15/lb prior to 2021 to the current price of more than US$32/lb (Figure 1).

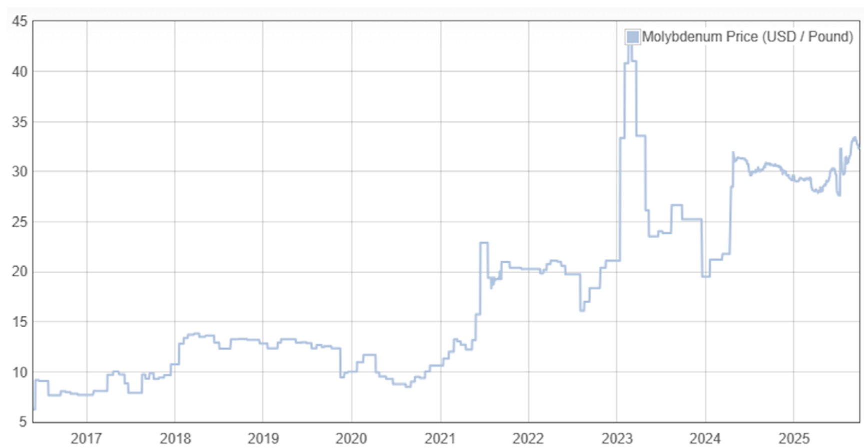


Figure 1. Graph showing steady rise of molybdenum prices in the past 4 years, September 26, 2025 (https://www.dailymetalprice.com/metalpricecharts.php?c=mo&u=lb&d=2400).

Crown land available for registering new claim cells in the Thunder Bay South District is somewhat limited to granitic terranes. Historically, granitic rocks are underexplored because the potential for finding economic deposits were considered low; however, molybdenum mineralization is most often hosted by granitic rocks. Typically, exploration for molybdenum is more favourable along the margins and contacts of granitic bodies, associated with fracture systems, quartz veins, shear zones and pegmatitic dikes. This article highlights underexplored granitoid rocks with potential for molybdenum mineralization, indicated by 2 clusters of molybdenum lake sediment anomalies approximately 40 km and 55 km northeast of Atikokan, outlined with red circles in Figure 2.

In 1999, the Ontario Geological Survey published a lake sediment geochemical survey covering the Atikokan area (Dyer 1999a, 1999b).

Campbell, D.A. 2026. Molybdenum potential in the Atikokan area; *in* Recommendations for Exploration 2025–2026, Ontario Geological Survey, Resident Geologist Program, p.28-31.

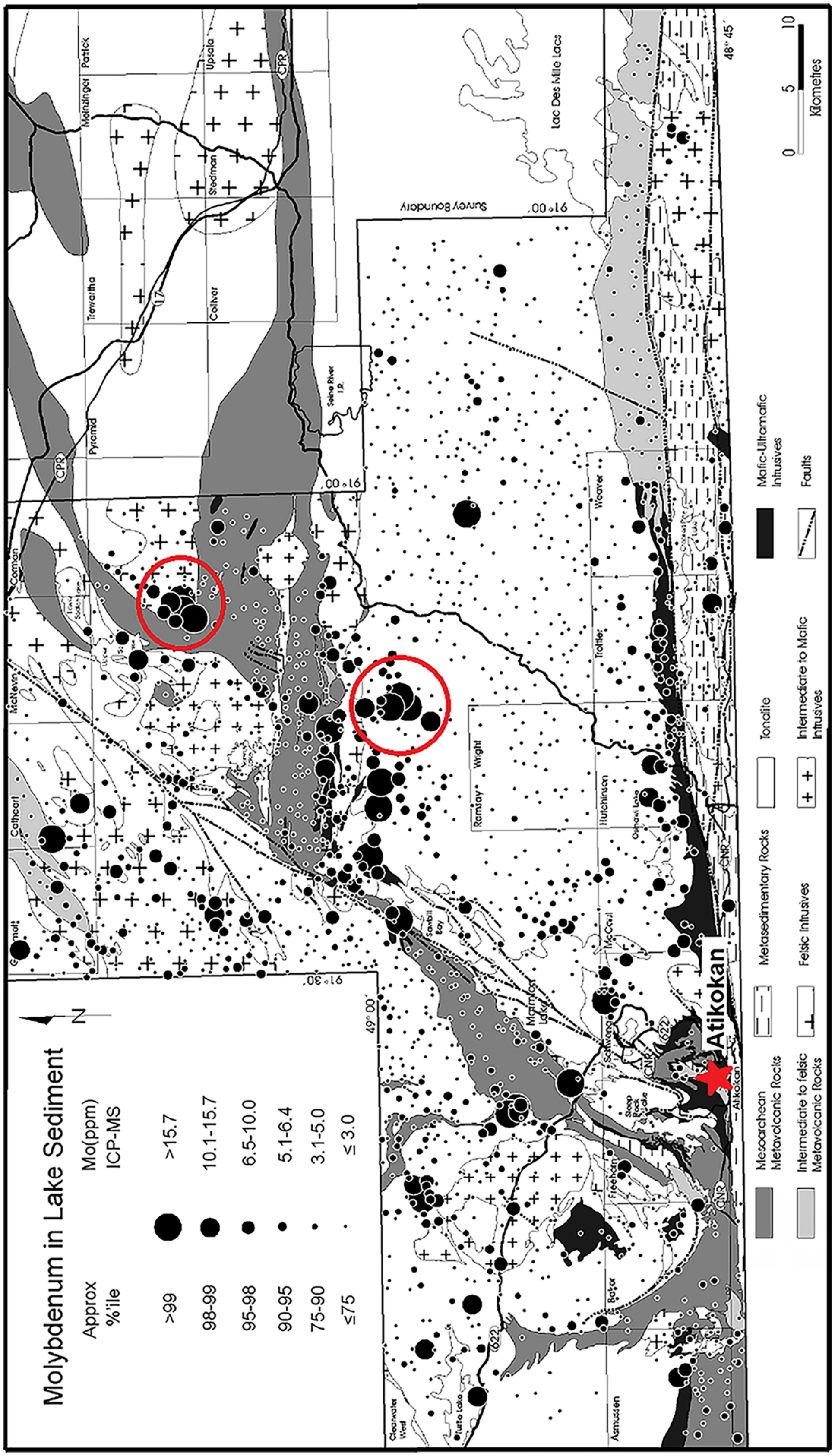
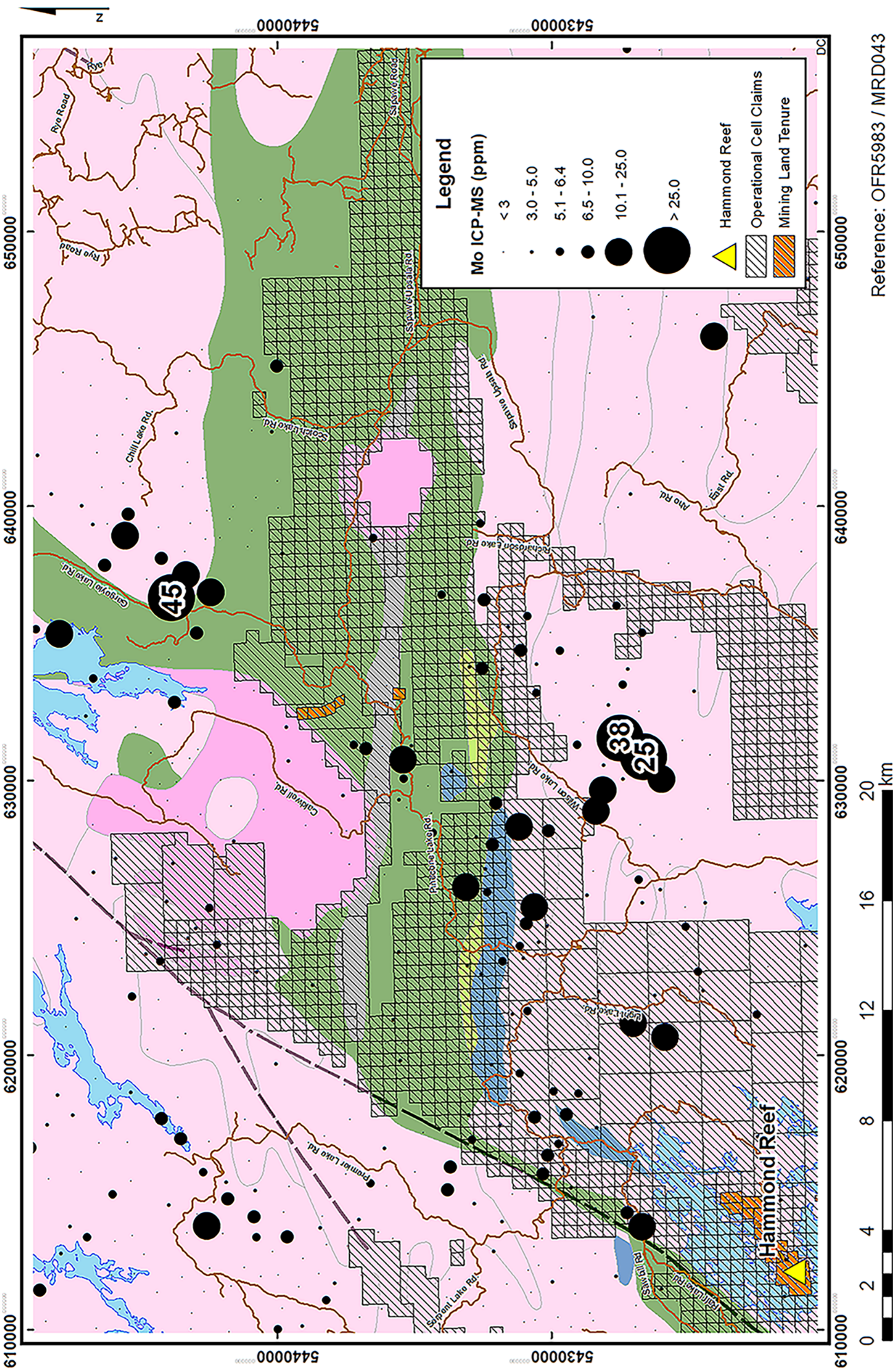


Figure 2. Molybdenum anomalies in lake sediment are represented by black dots and anomalous areas are shown highlighted with red circles (*modified from* Dyer 1999a).



Reference: OFR5983 / MRD043

Figure 3. Regional geological map (geology *from* Ontario Geological Survey 2011) showing molybdenum lake sediment anomalies (ppm, ICP–MS) represented by black dots (Dyer 1999b). Archean metavolcanic rocks are shown in various shades of green; metasedimentary rocks, in grey; mafic to ultramafic intrusive rocks, in blue; and granitoid rocks, in various shades of pink. Recommended molybdenum lake sediment anomalous areas open for staking, while registered claim cells are shown by black hatch lines. Universal Transverse Mercator (UTM) co-ordinates in North American claim Datum 1983 (NAD83), Zones 15. Map *created by* D. Campbell.

Two distinct clusters of lake sediment anomalies are outlined in Figure 2. Samples within these clusters returned the 3 highest molybdenum values (45.5, 38.4 and 25.6 ppm Mo) in the Atikokan survey which are represented by the larger black dots labeled with their analytical values (Figure 3). These anomalies are situated within granitic rocks and may indicate potential for molybdenum mineralization. Lidar indicates both clusters are coincident with northeast-trending structural lineaments and the northern cluster is situated at the contact with mafic metavolcanic rocks of the Lumby Lake greenstone belt. Both these areas are open for claim acquisition at the time of writing (*see* Figure 3).

References

Dyer R.D. 1999a. Atikokan area high density lake sediment and water geochemical survey, northwestern Ontario: new Au and PGE exploration targets; Ontario Geological Survey, Open File Report 5986, 79p.

——— 1999b. Lake sediment and water geochemical data from the Atikokan–Lumby Lake area, northwestern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 43.

Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release—Data 126 – Revision 1.

HIGHLIGHTS

- **The area north and east of Nakina is host to several lake sediment anomalies that suggest potential for base and precious metal mineralization**
- **Relationship between regional magnetic data and bedrock geology is equivocal and allows for possibility of unrecognized Archean mafic rocks**

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Copper, Gold and Platinum Group Element Targets and Potential for Unrecognized Mafic Rocks in the Nakina Area

A granitoid-dominated portion of the eastern Wabigoon subprovince, approximately 10 km by 50 km, hosts several copper±gold±platinum group element (PGE) targets. Despite excellent access via logging roads, lakes and rivers, this area has poorly understood bedrock geology and no historical mineral exploration. There are few mining claims in the area at the time of writing. The area is recommended for exploration due to significant metal-in-lake sediment anomalies, potential for re-interpretation of bedrock geology, and ease of access.

Two lake sediment surveys have been undertaken in the Nakina area (Ontario Geological Survey 2000a; Handley and Dyer 2018), the former of which outlined more than 2 dozen multi-element anomalies that have not been followed up by mineral explorationists. The reader is referred to Ontario Geological Survey (2000a) for proportional dot maps and detailed context. Locations and elements of interest highlighted in this article are shown in Figure 1 and are as follows.

1. Alph Lake (Au-PGE-Cu)
2. Pistol Lake (Cu-Ag-PGE)
3. Stayner Lake (Cu-Ag)
4. Prairie Lake (Au-PGE)
5. Jobrin Lake (Au)

High-resolution airborne magnetic data is not available for the recommended area. Bedrock geology has been mapped at reconnaissance scale (e.g., Innes 1969; Stott 1984; Stott, McConnell and Mason 1984) and is largely interpreted from geophysics; potential exists for significant revision of interpreted structural architecture and distribution of lithologies. Magnetic mafic dikes make it difficult to interpret the bedrock geology in much of the recommended area without boots-on-the-ground work.

Location and Nature of Anomalies

All percentile values in this section refer to the entire provincial lake sediment geochemistry data set (Ontario Geological Survey 2020). Anomalous areas below correspond to numbered locations included in Figure 1.

Jonsson, J.R.B. 2026. Copper, gold and platinum group element targets and potential for unrecognized mafic rocks in the Nakina area; *in* Recommendations for Exploration 2025–2026, Ontario Geological Survey, Resident Geologist Program, p.32-36.

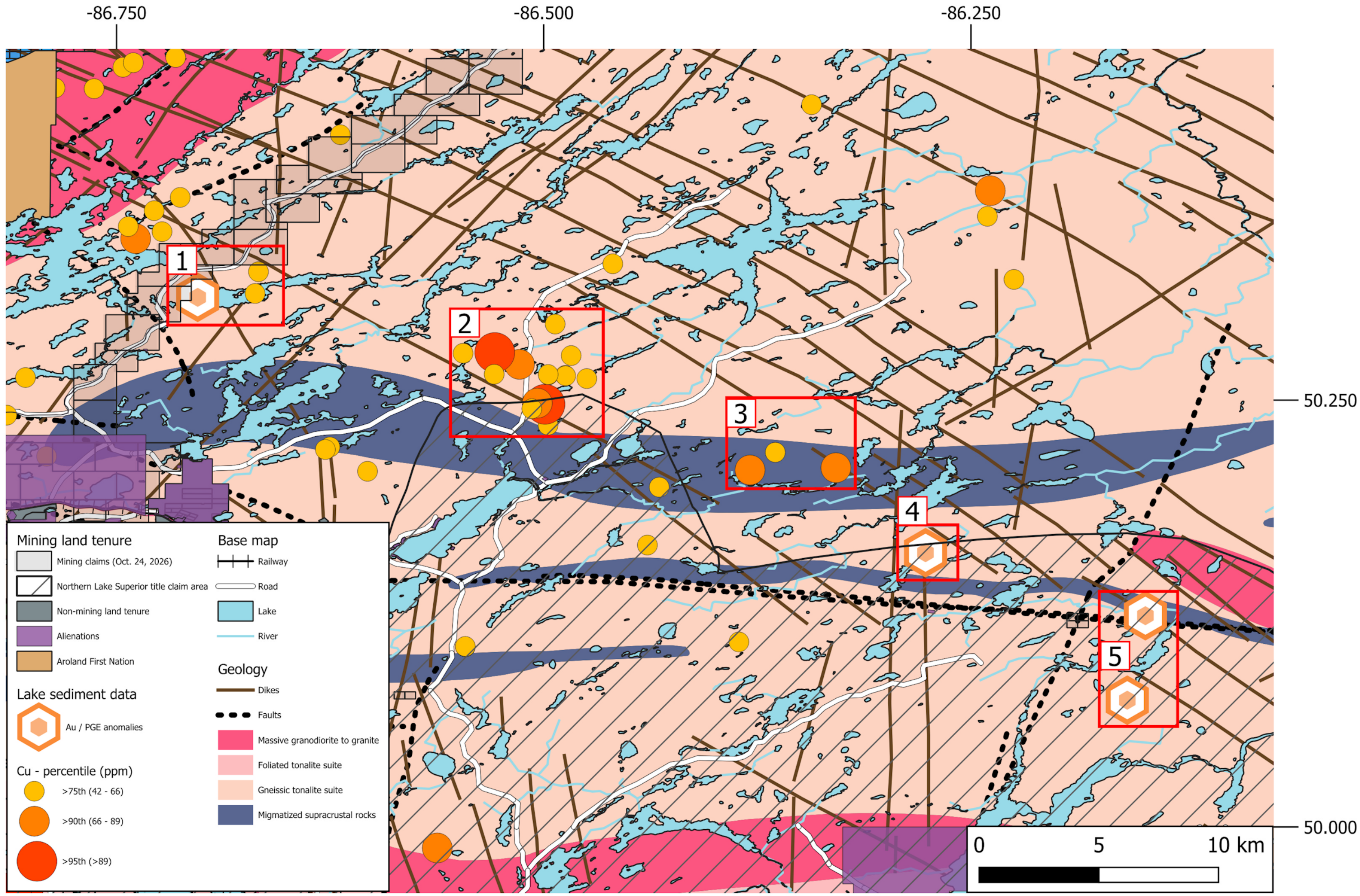

Figure 1. Recommended areas for exploration (red boxes) overlain on bedrock geology (*from* Ontario Geological Survey 2011), and lake sediment geochemistry data *from* Ontario Geological Survey (2000a, 2020). Latitude and longitude co-ordinates in World Geodesic System 1984 (WGS84).

1. A small, unnamed lake near the western margin of **Alph Lake** (Area 1) yielded a single sample containing highly anomalous gold (12.88 ppb Au; >99th percentile) and platinum (8.96 ppb Pt; >98th percentile). The sample is one of several in the Alph Lake area that contains anomalous copper.
2. The **Pistol Lake** area (Area 2) comprises a 5 km by 6 km area (approximate) of copper-in-lake sediment anomalies (14 samples >75th percentile, including 2 samples >90th percentile and 2 samples >95th percentile). Several of these sites are coincident with elevated silver, gold, zinc, and/or platinum group elements.
3. The **Stayner Lake** area (Area 3) comprises a sparsely sampled 5 km by 5 km area (approximate) that includes multiple copper (3 samples >75th percentile) and/or silver (3 samples >75th percentile) anomalies.
4. **Prairie Lake** (Area 4) yielded a single sample containing 39.41 ppb Pt (>99.9th percentile; 17th highest value of 39 571 samples in the provincial lake sediment geochemistry data set) coincident with 6.78 ppb Au (>95th percentile).
5. Small unnamed lakes to the south and north of **Jobrin Lake** (Area 5) yielded highly anomalous gold (north lake, 8.07 ppb Au, >98th percentile; south lake, 7.65 ppb Au, >95th percentile). The south lake also yielded anomalous platinum (4.57 ppb Pt, >95th percentile).

Using lake sediment data for mineral exploration requires proper context for interpretation and many factors (e.g., catchment basin characteristics, surficial geology, effects of metal scavenging, metal solubility modifiers; *see* Bourdeau and Dyer 2023) must be considered. Sample locations discussed in this article have generally comparable loss on ignition, pH, iron, and manganese values to other sites in the same surveys, suggesting that the anomalies are not false positives generated by metal scavenging or irregular solubility.

Ontario Geological Survey (2000a) reported that lake pH levels in the entire Nakina–Longlac area are unusually high, likely owing to the widespread carbonate drift in the area. It is noted by the author that these alkalic conditions hinder metal mobility and that subtle anomalies in this survey area may be more significant than in areas with lower lake pH.

Another factor underscoring the significance of the anomalous areas outlined in this article is that most are underlain by granitoid rocks, which have low background base and precious metal values in comparison to the mafic rocks that dominate greenstone belts.

Geology and Recommendations

Alph Lake

Bedrock underlying the Alph Lake anomaly is mapped as tonalite gneiss. Bedrock mapping in this area has only been done at reconnaissance scale (Stott 1984), and includes a regional northwest-trending structure 2.5 km west of the lake sediment anomaly. A prominent magnetic high beneath Esnagami Lake appears to extend east toward the Alph Lake lake sediment anomaly where it may be obscured by the magnetic signature of a Marathon dike (Stott and Josey 2009; Ontario Geological Survey 2017). This east-trending feature may be an unrecognized mafic body, and its intersection with the northwest-trending structure could be a prospective location for exploration.

Ground exposure directly around the sample site is excellent due to the presence of a recent forestry block, and lidar and airphotos suggest that bedrock exposure to the immediate west, southwest, and northeast of the anomaly is very good. Streams flow east-northeast in the immediate vicinity of this anomaly; prospecting and surficial sediment sampling are recommended to the west-southwest in the direction of the fault, as well as up-ice to the northeast.

Pistol Lake

Reconnaissance bedrock mapping (Stott 1984; Stott, McConnell and Mason 1984) in the Pistol Lake area records unsubdivided felsic to intermediate intrusive rocks. Regional magnetic data appears to align with existing bedrock mapping. The area was visited by Ontario Geological Survey geologists on October 2nd and 15th, 2025. Observed lithologies were in general agreement with maps (tonalite gneiss, metasedimentary schist/paragneiss/migmatite, diabase), although little bedrock was seen in the area directly south of the anomalous area mapped as “migmatized supracrustal rocks” (Ontario Geological Survey 2011) or “foliated to gneissic amphibolites” (Stott, McConnell and Mason 1984). A diabase dike belonging to the Matachewan swarm was observed near the centre of the anomalous area. It is variably quartz-chlorite-sericite±carbonate veined, locally pervasively altered, and contains up to 1% pyrite. It is unlikely to be the source of the lake sediment anomalies due to its low sulfide mineral content, the size of the anomalous area in comparison to the approximately 20 m wide dike, and the general lack of mineral potential in Proterozoic diabase dikes in this area. Samples were taken for analysis and results are pending.

Ice-flow directions are reported by Barnett, Yeung and McCallum (2013) as west-southwest (in agreement with striations observed at 40 to 45° in the field), and local stream flow direction is northeast. Prospecting and surficial sediment sampling are recommended in these directions from the centre of the anomalous area. Lidar and airphotos indicate excellent bedrock exposure in these directions, aided by logging.

“Foliated to gneissic amphibolites” (Stott, McConnell and Mason 1984) are mapped upstream of the anomalous area but were not observed in the field. These may be a source of the anomaly, particularly in the area between Cordingley and Lower Twin lakes.

Stayner Lake

The Stayner Lake anomalous area was visited by Ontario Geological Survey geologists on October 1st, 2025. Reconnaissance bedrock mapping (Innes 1969) records unsubdivided metasedimentary and metavolcanic migmatites. Observed lithologies consisted of metasedimentary rocks including schist, paragneiss, migmatite, and anatectic magnetite-bearing potassic pegmatite. No prospective rocks were observed in the 1.5 by 4 km (approximate) logged area directly west of Stayner Lake; prospecting and surficial sediment sampling are recommended for the well-exposed area directly north of this logged area, and for the upstream area to the west-southwest.

It is possible that unrecognized mafic rocks exist in or near this anomaly, especially to the north and/or east where the regional magnetic signature is obscured by northwest-trending mafic dikes.

Prairie Lake

The Prairie Lake anomaly is underlain by foliated tonalite (Ontario Geological Survey 2011) or unsubdivided metasedimentary and metavolcanic migmatites (Innes 1969). Regional magnetic data indicate an east-trending magnetic high passing through the southern half of Prairie Lake that is interpreted as a belt of metamorphosed supracrustal rocks. Additionally, approximately 4 km southwest of the sample site, a major east-trending fault is crossed by a stream that drains into Prairie Lake. These should both be targeted as potential sources for the anomaly.

Recent logging provides good access to the southern part of Prairie Lake, but outcrop cover appears to be poor. Surficial sediment sampling is recommended; lake and stream sediment samples should be taken in Prairie Lake and surrounding waterbodies to better determine the source for this highly anomalous sample value.

Jobrin Lake

The Jobrin Lake anomalies are underlain by foliated tonalite (Ontario Geological Survey 2011) and/or unsubdivided metasedimentary and metavolcanic migmatites (Innes 1969). The regional magnetic signature is dominated by northwest-trending faults; this and the lack of detailed bedrock mapping provide the opportunity for reinterpretation of the bedrock geology.

Because ice flow and stream flow are both to the south/southwest, the bedrock source (if distal) is likely to the north/northeast. The northern anomaly is adjacent to a major east-trending structure, which should be the focus of exploration. It is also located approximately 2 km east (downstream) of a major north-northwest trending structure. Outcrop exposure appears to be good on the north and south sides of the fault.

Conclusion

Consultation of Quaternary geology resources for the area (e.g., Cooper 1981a, 1981b; Ontario Geological Survey 2000b; Barnett, Yeung and McCallum 2013) is essential in targeting bedrock sources for these anomalies. Although the study doesn't cover the targets in this article, Thorleifson and Kristjansson (1993) is an excellent resource on the surficial sediment distribution of the broader area. Lidar (https://geohub.lio.gov.on.ca/maps/lio::forest-resources-inventory-leaf-on-lidar/about) and watershed (OWIT, https://www.ontario.ca/page/ontario-watershed-information-tool-owit) data will also be useful in planning exploration.

References

Barnett, P.J., Yeung, K.H. and McCallum, J.D. 2013. Surficial geology of the Nakina area south, northern Ontario; Ontario Geological Survey, Preliminary Map P.3767, scale 1:100 000.

Bourdeau, J.E. and Dyer, R.D. 2023. Regional-scale lake-sediment sampling and analytical protocols with examples from the Geological Survey of Canada; Geological Survey of Canada, Open File 8980, 41p.

Cooper, A.J. 1981a. Nakina, NTS 42L/SE, data base map, northern Ontario engineering geology terrain study; Ontario Geological Survey, Map 5125, scale 1:100 000.

——— 1981b. Nakina, NTS 42L/SE, mineral exploration capability map, northern Ontario engineering geology terrain study; Ontario Geological Survey, Map 5126, scale 1:100 000.

Handley, L.A. and Dyer, R.D. 2018. Lake sediment and water geochemical data from the Nakina–Marshall Lake area, northwestern Ontario; Ontario Geological Survey, Miscellaneous Release—Data 364.

Innes, D.G. 1969. Caramat sheet, districts of Cochrane, Thunder Bay and Algoma, geological compilation series; Ontario Geological Survey, Preliminary Map P.0551, scale 1:126 720.

Ontario Geological Survey 2000a. Nakina–Longlac area lake sediment survey: Operation Treasure Hunt—Area B; Ontario Geological Survey, Open File Report 6035, 144p.

——— 2000b. Quaternary geology, seamless coverage of the Province of Ontario; Ontario Geological Survey, ERLIS Data Set 14—Revised.

——— 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release—Data 126 – Revision 1.

——— 2017. Ontario airborne geophysical surveys, magnetic data, grid data (ASCII and Geosoft® formats), magnetic supergrids; Ontario Geological Survey, Geophysical Data Set 1037—Revised.

——— 2020. Lake geochemistry of Ontario—2019; Ontario Geological Survey, Lake Geochemistry of Ontario—2019, online database, https://www.geologyontario.mines.gov.on.ca/persistent-linking?publication=LakeGeochemON [accessed October 23, 2025].

Stott, G.M. 1984. Compilation series, Ogoki Lake sheet, Thunder Bay and Cochrane districts; Ontario Geological Survey, Preliminary Map P.274—Revised, scale 1:26 720.

Stott, G.M. and Josey, S.D. 2009. Proterozoic mafic (diabase) dikes and other post-Archean intrusions of northwestern Ontario, north of latitude 49° 30′; Ontario Geological Survey, Preliminary Map P.3606, scale 1:1 000 000.

Stott, G.M., McConnell, C.D. and Mason, J.K. 1984. Compilation series, Geraldton sheet, Thunder Bay and Cochrane districts; Ontario Geological Survey, Preliminary Map P.0241, scale 1:126 720.

Thorleifson, L.H. and Kristjansson, F.J. 1993. Quaternary geology and drift prospecting, Beardmore–Geraldton area, Ontario; Geological Survey of Canada, Memoir No. 435, 146p.

HIGHLIGHTS

- **The Caribou Lake pluton is a compelling, high-volume target for dimension stone, decorative stone aggregates and residential stone products**
- **Polishing indicates good potential for attractive "black granite" production**
- **Excellent local infrastructure to the pluton and proximal cross-country rail service**

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Caribou Lake Pluton as Dimension Stone: Gabbros not just for Cu-Ni-PGE!

Geological investigations by the Ontario Geological Survey (OGS) Resident Geologist Program (RGP), and exploration industry tend to focus primarily on environments which can host precious- and base-metals, and industrial minerals. Dimension stone opportunities are rarely considered outside of southern Ontario, with the exception of current and past-producing dimension stone quarries within the Kenora and Thunder Bay South (Lake Superior region) RGP districts, respectively.

In 2024 and 2025, staff of the Thunder Bay North RGP District sampled mafic intrusions at the western end of the Caribou–Marshall Lake greenstone belt, east of Caribou Lake (Churchley 2025). The 2024 sampling focussed on the Ni-Cu-PGE potential of the area as recommended by S. Churchley (Churchley 2025). The Caribou Lake pluton (CLP) is approximately 8.5 km by 4.5 km in size, a medium-grained, massive to weakly foliated hornblende to pyroxene gabbro and is associated with a dike swarm of similar composition (Sage et al. 1974; Sutcliffe, Bivi and Kavanagh 1981).

The dimension stone industry requires convenient and easy access to their quarries making the CLP an excellent candidate for potential extraction. The CLP is located north of Armstrong (Figure 1) and is accessed via the all-season Airport Road which continues onto the Big Lake Road for approximately 24 km. The Big Lake Road bisects the pluton providing excellent access for stone evaluation activities. Armstrong provides a potential distribution hub for quarried material because of its proximity to the Canadian National (CN) rail line, the Trans-Canada Highway and port facilities located in Thunder Bay to facilitate shipping of stone products.

The CLP would be termed a "black granite" by the stone industry as the term granite is used for light-coloured intrusive igneous rock while black granite refers to dark stone such as gabbro or mafic volcanic rocks (LeBaron et al. 1990; Hinz, Landry and Gerow 1994). Black granites continue to be a prized dimension material for architectural and landscaping purposes.

The CLP gabbro sampled displays a uniform dark grey to black colouration in hand sample (Photo 1a); and acquires a high polish with a pleasant silver/black hue when cut and polished (Photo 1b). Trace pyrite and magnetite up to 15% are also present but this is not considered to be an issue due to magnetite's weathering resistance (LeBaron et al. 1990).

Paju, G.F. 2026. Caribou Lake pluton as dimension stone: gabbros not just for Cu-Ni-PGE!; *in* Recommendations for Exploration 2025–2026, Ontario Geological Survey, Resident Geologist Program, p.37-42.

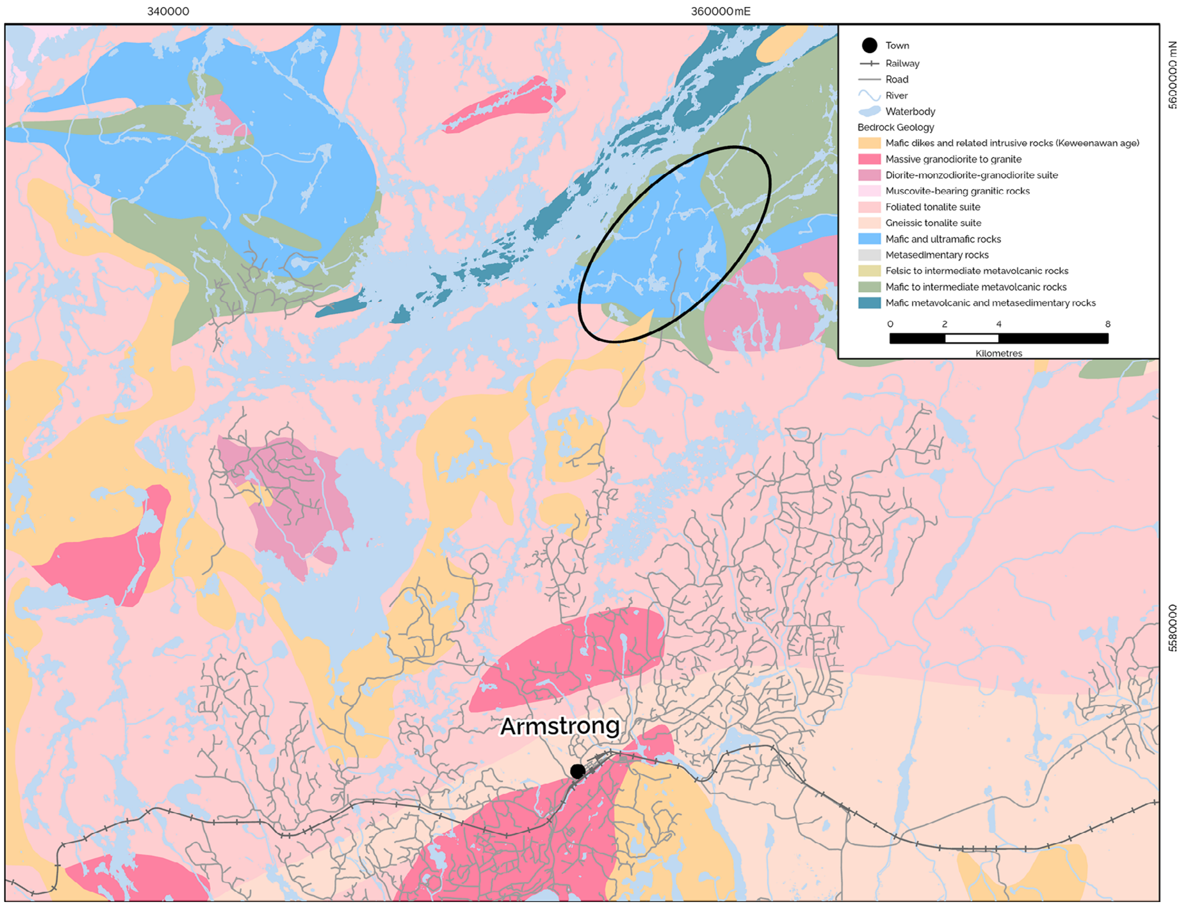

Figure 1. Map showing the location and regional geology of the Caribou Lake pluton (black ellipse). Geology *from* Ontario Geological Survey (2011). Universal Transverse Mercator (UTM) co-ordinates in North American Datum 1983 (NAD83), Zone 16.

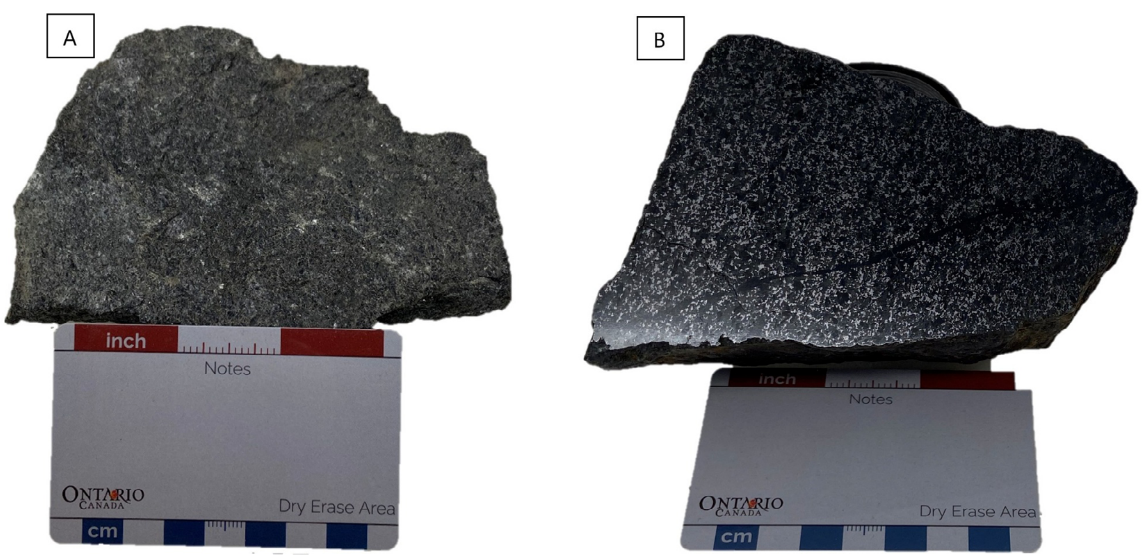

Photo 1. A) Unpolished hand sample of the Caribou Lake pluton; **B)** cut and polished hand sample of the Caribou Lake pluton. Photos by G. Paju, 2025

The CLP gabbro appears homogenous in grain size (medium) and lacks pervasive alteration though localized alteration zones were observed as 15 to 20 cm wide zones of metamorphic amphibole associated with mafic mineral-bearing alteration veins (likely chlorite).

A comparative example of a northwestern Ontario black granite would be the Marathon Black Granite (MDI42D16SW00031; Ontario Geological Survey 2025) located in McCoy Township approximately 7 km north-northwest of Marathon.

The Marathon Black Granite is an iron-rich augite syenite (Walker et al. 1993) of the Coldwell alkalic complex and is generally black to olive-brown in colour, coarse grained and massive. This syenite takes on an excellent polish with areas having a lighter translucent brown colouration due to mineral grain boundaries and orientation (Photo 2).

Preliminary investigation of the CLP revealed that the exposed upper 3 m of outcrop is fractured (Photos 3 and 4C) with sheeting ranging from 0.35 m to 1.91 m (Photos 4A and 4B). The most desirable joint pattern for the dimension stone industry consists of 2 subvertical, roughly orthogonal sets and a horizontal set, referred to as sheeting. The minimum spacing required is about 2 m for vertical and 1 m for horizontal joints, as quarry blocks are generally at least 1 m by 2 m by 1.5 m in size (LeBaron et al. 1990). Further investigation in other areas of the CLP and at depth are recommended to locate suitable material for quarry blocks.

Despite this observed potential limitation in the upper exposed areas of the CLP, there is still useable stone depending on the product required, as the upper layer may have applications for construction material, road-surfacing aggregate, decorative aggregate or products within the residential construction market. Within the residential construction market, the increasing popularity of resin-stone composites, thin stone veneer, ashlar and landscaping stone may be enough of a driver to warrant further investigations into the CLP's joint spacing via drilling as they do not require large quarry blocks for production.

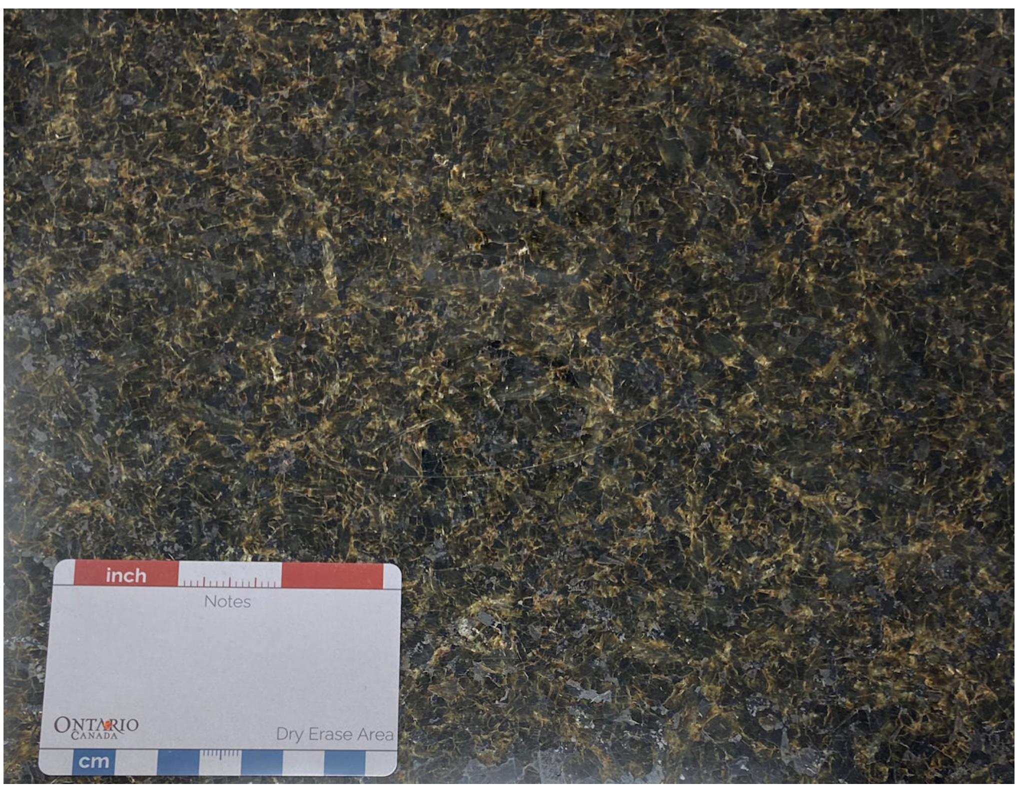

Photo 2. Polished tile of the Marathon Black Granite iron-rich augite syenite. Photo by G. Paju, 2025

Photo 3. Photo of outcrop showing the condition of the top 3 m of CLP gabbro; red outline is the area in closeup observed in Photo 4C. Photo by G. Paju, 2025

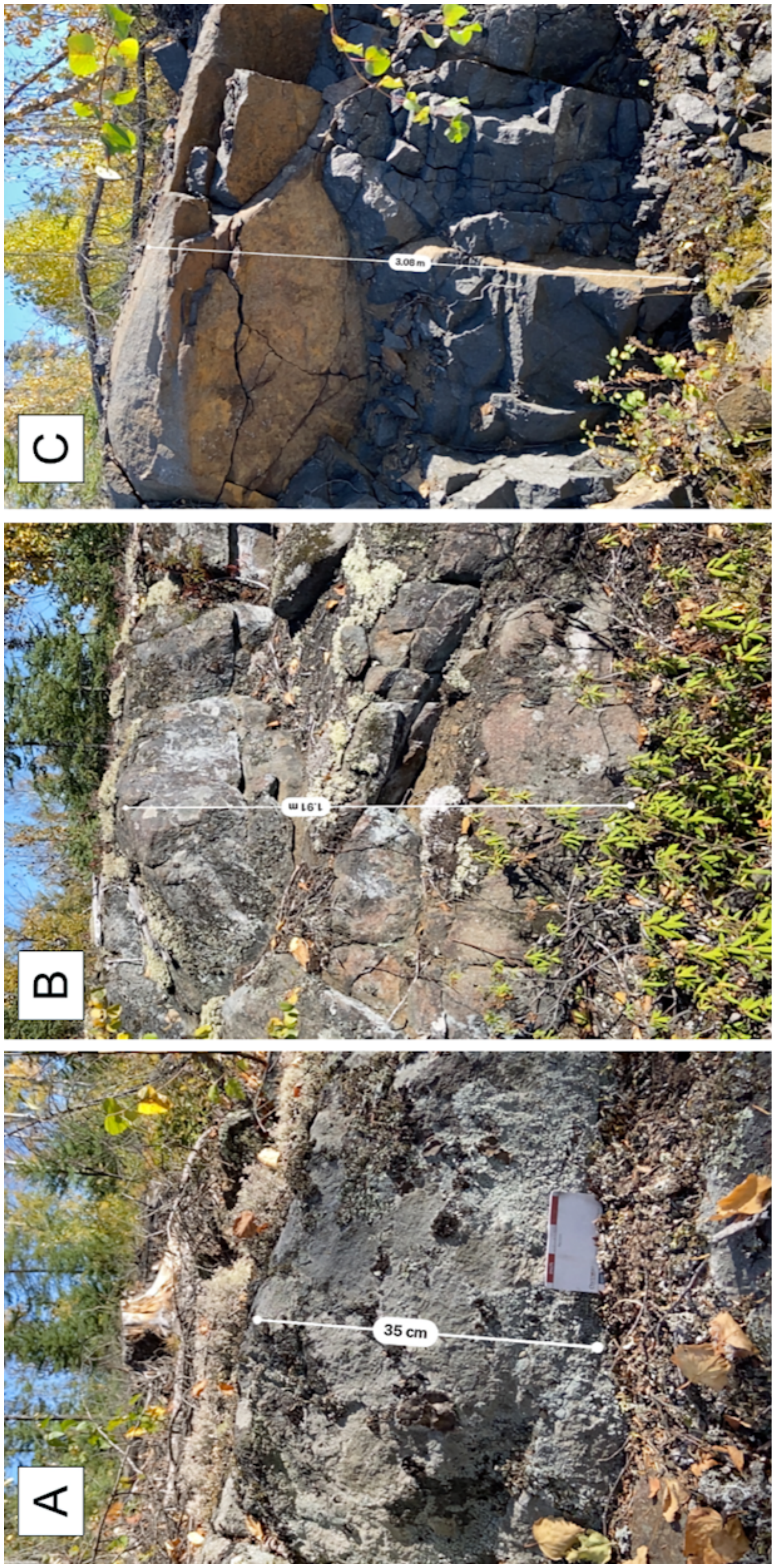

Photo 4. Photos of the Caribou Lake pluton showing the observed sheeting spacing of the outcrop **A)** 0.35 m; **B)** 1.19 m and **C)** the condition of the upper 3 m of the of the outcrop. Photos by G. Paju, 2025

Thin stone veneer (TSV) is natural, split-face stone cut to a thickness of 2 to 4 cm that gives the appearance of rough-cut stone at a much lower cost and weight than standard 10 to 15 cm thick ashlar. It can be applied to an existing wall by using a standard mortar mix over a metal mesh backing, and does not require extra footings and wall ties that are required by conventional, full-thickness veneer products. The ideal stone for TSV fabrication is 4 to 8 cm thick with 2 split faces. The slab is fed into a veneer saw and sliced into 2 pieces, each 2 to 4 cm thick with a sawn back and split face. The upper 3 m of the Caribou Lake pluton is well suited to the production of TSV or ashlar as well as decorative landscaping stone.

Further investigation is required to determine the suitability of the Caribou Lake pluton as a source of dimension stone. A series of vertical diamond-drill holes is recommended to determine if the jointing pattern is suitable for quarry blocks at depth (below 3 m) or closer to surface. Preliminary testing to *American Society for the Testing of Materials* (ASTM) standards can be completed prior to drilling, as this may be a cost-effective way to determine if drilling is warranted.

Dimension stone quarries are licensed and regulated under the *Aggregate Resources Act* (ARA), administered by the Ministry of Natural Resources. Private land must be acquired by purchase or by agreement with a landowner for extraction under the ARA. On crown land, a mining cell claim must be registered and brought to mining lease under the *Mining Act* prior to issuance of an aggregate licence (https://www.ontario.ca/page/aggregate-resources).

References

Churchley, S.V. 2025. Nickel potential in the Whiddon Lake and Caribou Lake townships; *in* Recommendations for Exploration 2024–2025, Ontario Geological Survey, Resident Geologist Program, p.30-32.

Hinz, P., Landry, R.M. and Gerow, M.C. 1994. Dimension stone occurrences and deposits in northwestern Ontario; Ontario Geological Survey, Open File Report 5890, 191p.

LeBaron, P.S., Verschuren, C.P., Papertzian, V.C. and Kingston, P.W. 1990. Building stone potential in eastern Ontario; Ontario Geological Survey, Mineral Deposits Circular 30, 368p.

Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release—Data 126 – Revision 1.

——— 2025. Ontario Mineral Inventory; Ontario Geological Survey, online database, October 2025 update. www.hub.geologyontario.mines.gov.on.ca

Sage, R.P., Breaks F.W., Scott, G., MacWilliams, G.H. and Bowen, R.P. 1974. Operation Ignace–Armstrong, Pashkokogan–Caribou lakes sheet, District of Thunder Bay; Ontario Division of Mines, Preliminary Map P.962, scale 1:126 720.

Sutcliffe, R.H., Bivi, A. and Kavanagh, G.W.L. 1981. Precambrian geology of the Fletcher Lake area, west sheet, Thunder Bay District; Ontario Geological Survey, Preliminary Map P.2409, scale 1:15 840.

Walker, E.C., Sutcliffe, R.H., Shaw, C.S.J., Shore, G.T. and Penczak, R.S. 1993. Precambrian geology, Port Coldwell complex, east half; Ontario Geological Survey, Preliminary Map P.3233, scale 1:20 000.

HIGHLIGHTS

- **Working exploration model for gold mineralization based on the coincidence of geological features**
- **Road accessible, regional-scale area available for claim acquisition**

The Coincidence of Gold Occurrences, Geophysical Trends and Porphyries in the Northwestern Sturgeon Lake Volcanic Rocks: A Working Exploration Model

The Sturgeon Lake greenstone belt (SLGB) has seen renewed interest in precious metal exploration, notably by Barrick Gold Corp., which has moved from land consolidation to testing of several large-scale geochemical anomalies (Barrick Gold Corp., news release, May 7, 2025). Historically, much of the exploration in the SLGB has focussed on the South Sturgeon assemblage (approximately 2736–2734 Ma), host to the Sturgeon Lake caldera and mining camp, which produced volcanogenic massive sulphide ore from 1970 to 1991, yielding 19.8 million tons at an average of 8.50% Zn, 1.06% Cu, 0.91% Pb and 119.7 g/t Ag (Franklin 1995).

This article recommends exploration in the northwestern portion of the Fourbay Lake and Handy Lake assemblages, part of the older SLGB volcanic rocks (approximately 2775–2746 Ma, Figure 1). These areas, apart from some work at historical occurrences such as St. Anthony, Kings Bay and Barrick's Sturgeon Lake project, have not been explored using modern methods. The recommendation is based on the observation of northwesterly geophysical trends associated with gold-bearing porphyries and orogenic structures in the footwall rocks of the Sturgeon Lake caldera (Hudak 1996; Lessard and Ratthe 2020).

Porphyritic intrusions are a common feature in many Archean gold systems, with numerous economically viable examples found in Canada's Abitibi belt (Kirkham 1972) and Australia's Yilgarn block. In the Bardoc-Kalgoorlie area, minor porphyritic intrusions are present in approximately 30% of gold mines (Witt 1992). Although the timing of these intrusions relative to ore emplacement varies with some occurring less than 10 to 15 million years before or after mineralization, the consistent association between porphyries and gold systems highlights the importance of structural controls. These intrusions often exploit the same zones of crustal weakness as gold-bearing fluids, suggesting that structural architecture plays a critical role in localizing both magmatism and mineralization (Perring et al. 1991).

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Amyotte, E.G. and Biswas, S. 2026. The coincidence of gold occurrences, geophysical trends and porphyries in the northwestern Sturgeon Lake volcanic rocks: a working exploration model; *in* Recommendations for Exploration 2025–2026, Ontario Geological Survey, Resident Geologist Program, p.43-50.

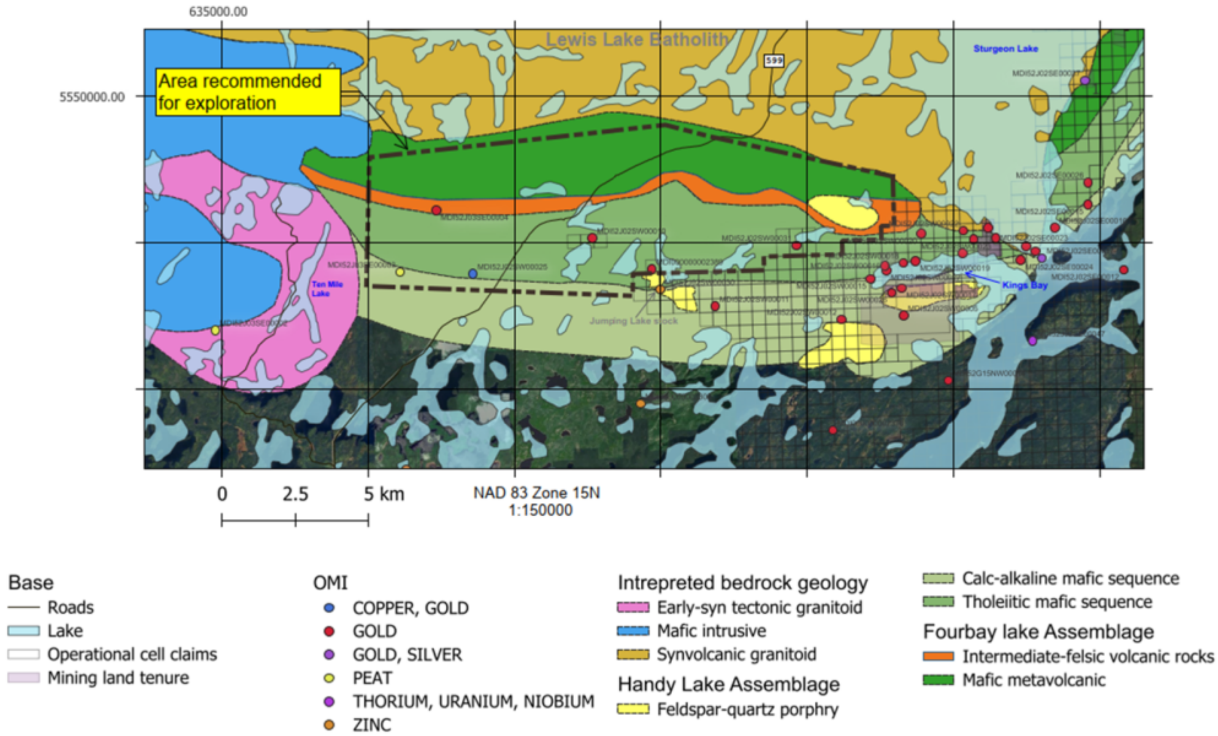

Figure 1. Interpreted bedrock geology of the northwestern Fourbay Lake and Handy Lake assemblages of the SLGB, *modified after* mapping by Sanborne-Barrie and Skulski (2005), overlain by location of mineral occurrences as documented in the Ontario Mineral Inventory database (OMI, Ontario Geological Survey 2025) and an area recommended for exploration (bolded dash-dot-dot line, Ontario Geological Survey 2011).

Geophysical Trends and Gold Occurrences

The horizontal gradient (HG) image of the reduced-to-pole (RTP) residual magnetic field of the Sturgeon Lake–Savant Lake area (Ontario Geological Survey 2003) is used in Figure 2 to highlight the edges of the magnetic sources in the study area. Geological interpretation of the HG image reveals 5 northwesterly geophysical trends which appear to be associated with gold-bearing porphyries and proximal orogenic structures (*see* Figure 2).

1. Rome Lake and Hoyle-Regis Occurrences

At Rome Lake (MDI52J03SE00004, Ontario Geological Survey 2025), Chataway (1984) documented an approximately 150 m long by 30 m wide northwest-trending porphyry unit that returned values of 5 to 1509 ppb Au, averaging 402 ppb Au across 7 samples. A 1.5 m chip sample returned 1009 ppb Au. Near the Fourbay Lake and Handy Lake assemblages contact, the Hoyle-Regis occurrence (MDI52J02SW00025, Ontario Geological Survey 2025) is underlain by mafic volcanic rocks and intercalated quartz-feldspar porphyry sills. It returned 1.21% Cu, 4.80 g/t Ag and 0.69 g/t Au over 0.2 m along a north-trending shear zone within pillow basalts (Scammell 1985).

2. Jessie Lake and McKinnon Lake Occurrences

At the Jessie Lake pit (MDI52J02SW00010, Ontario Geological Survey 2025), a 1.9 m, four-sample channel returned a composite average of 2.86 g/t Au across a shear trending approximately north-northwest in mafic volcanic rocks (Wellstead 2014). Near the porphyry units of the Jumping Lake stock, the McKinnon Lake occurrence (MDI52J02SW00011, Ontario Geological Survey 2025) returned values ranging from 0.33 to 8.26 g/t Au along a north-northeast-trending quartz vein associated with a shear zone (Bulatovich 2009). A structural study identified

3 probable fault sets oriented north-northeast, northwest and east-northeast forming the basis for 2 preliminary models: (1) a syntectonic brittle-ductile model and (2) a syn- to late-tectonic brittle model (Figure 3, MIR Télédétection 2009). A subsequent soil gas hydrocarbon (SGH) survey over the McKinnon Lake area revealed an approximate northwest-trending SGH anomaly (Figure 4, Newton 2016).

3. Speculative Northwest Fault Trend

Trend 3 is speculative, with no reported gold occurrences. However, a northwest-trending geophysical structure is visible and interpreted to represent a probable fault (*see* Figure 3; MIR Télédétection 2009). An inflection in the intermediate-felsic volcanic rocks of the Fourbay Lake assemblage and magnetic discontinuities are visible at the intersection of this trend (*see* Figure 2).

4. Armstrong-Johnson Fault-Shear Zone

Kuryliw (1995) describes a northwest-trending fault-shear zone at the Armstrong-Johnson occurrence (MDI000000002389, Ontario Geological Survey 2025) that cuts across pillow basalts diagonally. The partly sheared fine quartz-feldspar porphyry and shear band overprint on the quartz vein indicate a contemporaneous relationship among porphyry, quartz vein, and gold mineralization. Pillowed lavas to the northeast of the shear zone are more fractured and deformed than those to the southwest. Notable drill intercepts include 17.53 g/t Au over 0.30 m in hole A-3 and 10.35 g/t Au over 0.21 m in hole A-6 (Kuryliw 1995).

5. Pat Lake Occurrence

The Pat Lake occurrence (MDI52J02SW00020, Ontario Geological Survey 2025) returned up to 5.91 g/t Au from a grab sample of blue quartz vein from waste material near a historical trench where mafic volcanic rock is cut by a southeast-trending porphyry (Bragg 1984).

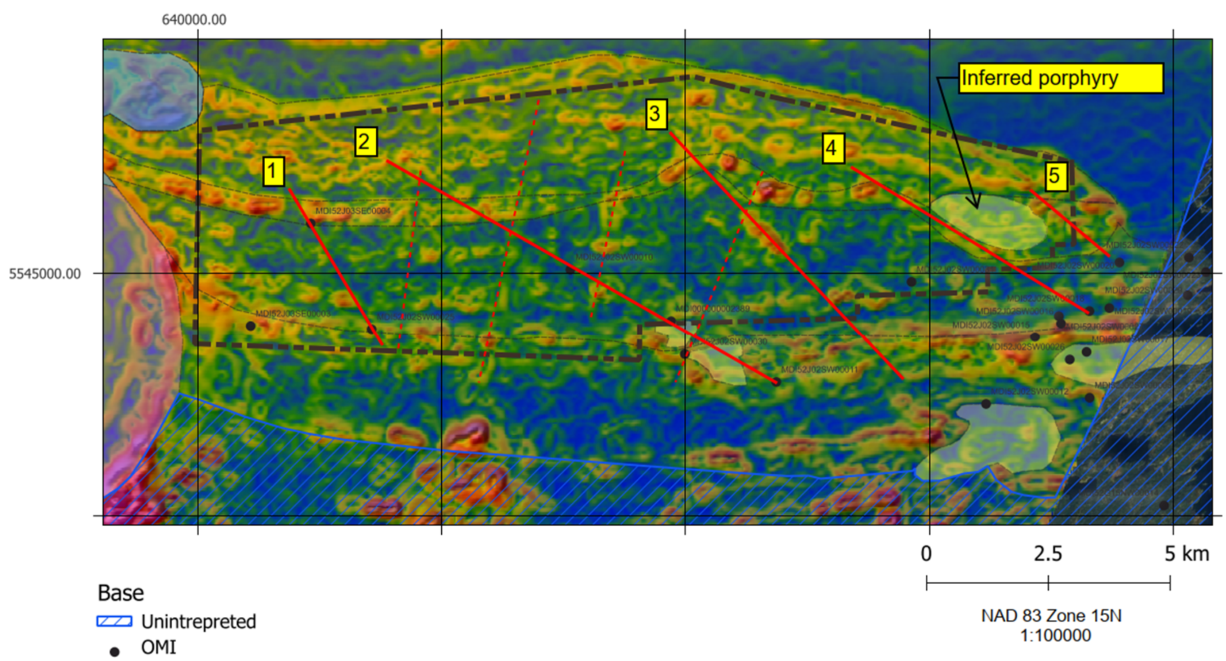

Figure 2. Horizontal gradient geophysical imagery of the area recommended for exploration (bolded dash-dotted line) illustrating east-west trends related to changes in volcanic stratigraphy (thin dashed line, geology lines *modified after* Sanborne-Barrie 2005), 5 northwest trends discussed in text (keyed in text) and thought to be associated with gold-bearing porphyry and orogenic structures (bold red line), and 4 northeast trends (red dashed line) potentially related to late posttectonic activity (geophysical imagery *modified after* Ontario Geological Survey 2003).

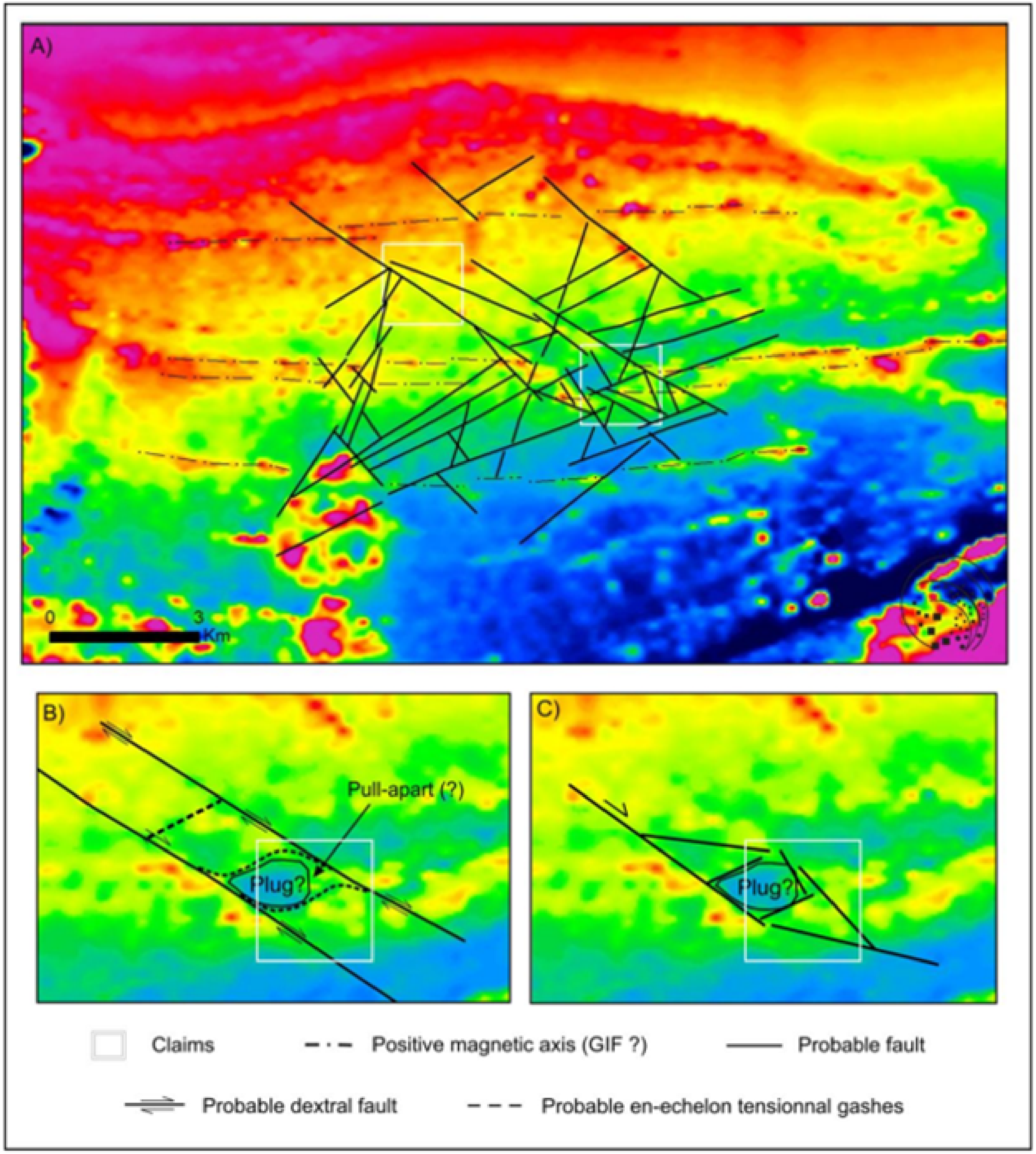

Figure 3. A) Lineament-based structural map of the Jessie Lake and Jumping Lake properties overlain by the magnetic total field illustrating 2 possible scenarios: **B)** A syntectonic brittle-ductile scenario where pull apart favors the intrusion of the inferred plug; and **C)** fault deflection scenario around the core of an early, resistant plug (*from* MIR Télédéction 2009).

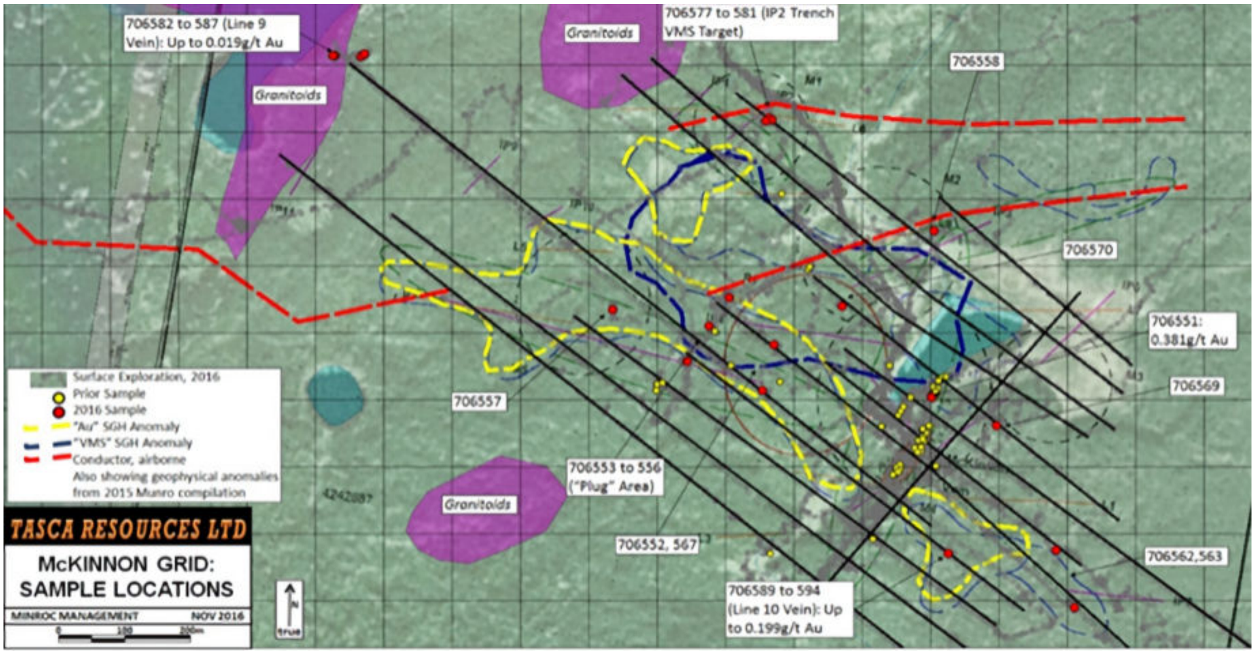

Figure 4. Satellite imagery and interpreted bedrock geology overlain by sample locations, soil in gas hydrocarbon (SGH) anomalies and geophysical conductors for the McKinnon Lake area. Note the presence of an approximate northwesterly trend of the SGH gold anomaly (*from* Newton 2016).

Discussion

The historical literature demonstrates extensive gold mineralization and supports the working model linking northwesterly geophysical trends with gold-bearing porphyries and orogenic structures in the area recommended for exploration. These northwesterly trends are associated with probable synvolcanic brittle-ductile faults and, at the McKinnon occurrence, exhibit kinematics indicative of a dextral strike-slip fault system that induced pull-apart shearing and facilitated the intrusion of an inferred felsic plug which appears as a magnetic discontinuity (Figure 3B).

It is possible that these kinematics are also responsible for the intrusion of the inferred porphyry near northwesterly geophysical trend 4 (*see* Figure 2). A potential analog for this style of porphyry-associated gold occurrence could be the Goldlund deposit (MDI52F16NW00004, Ontario Geological Survey 2025) approximately 110 km west-southwest with a Mineral Reserve of 621 Koz Au Probable and a Mineral Resource of 940 Koz Au Indicated and 704 Koz Au Inferred (Raponi et al. 2023). At Goldlund, the mineralization is controlled by northeast-trending shears and is adjacent to an approximately 1 km long lenticular porphyry (Figure 5; Armstrong and Webb 1950). Two other styles of porphyry are also observed in the vicinity of mineralization at deposit scale, foliation parallel sills and partially dismembered dikes (Chorlton, 1991; McCracken 2017).

Additionally, at the Jessie Lake and McKinnon Lake occurrences (Trend 2, *see* Figure 2), northeast-trending structures are recognized to be associated with gold mineralization. A possible mechanism for the formation of the northeast-trending structures is the late posttectonic event responsible for granitoid plutonism and the intrusion of the Ten Mile and Saunders Lake plutons. The northeast-trending structures occur relatively perpendicular to the Ten Mile Lake pluton, and along trend A in Figure 2, appear to be truncated by the Saunders Lake pluton.

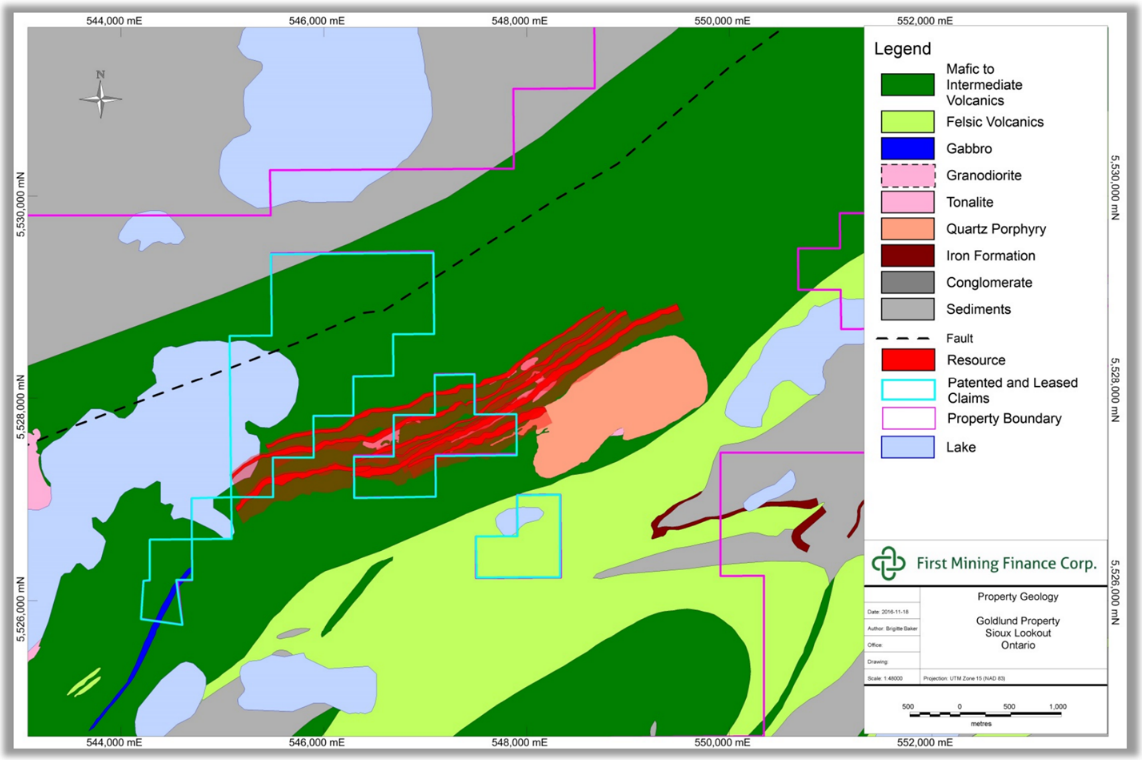

Figure 5. Goldlund property geology map with resource panels in red (*from* McCracken 2017).

Exploration should prioritize northwesterly trends where magnetic discontinuities may represent felsic intrusions, such as at the Rome Lake occurrence. A secondary priority is the intersection of northwesterly and east-west trends, which may indicate changes in volcanic stratigraphy and zones of dilatancy favorable for gold mineralization, such as near the inferred porphyry at Trend 4 (*see* Figure 2).

Finally, the northeasterly trends should be evaluated for remobilized gold mineralization, considering the intersection of all 3 trends (i.e., northwesterly, east-west and northeasterly) and the intersection of the northwesterly and northeasterly trends.

Conclusion

The area recommended for exploration in Figure 1 is an approximate 8000 hectare polygon of gold-endowed Archean greenstone which is road accessible and largely available for claim acquisition at the time of the writing. A recommended approach to exploration could be the following.

1. Acquire and interpret a regional high-resolution geophysical survey to better delineate gold-related structures
2. Conduct a prospectivity analysis utilizing geological mapping (Sanborne-Barrie and Skulski 2005), acquired geophysical survey, historical exploration, etc.
3. Design and implement a surficial sampling survey targeting prospective areas. The SLGB is known to underlie relatively thick layer of glacial till and vegetation cover that has challenged traditional prospecting efforts. A recent till sampling survey on Barrick's Sturgeon Lake property revealed that gold grain counts in till are an effective way to vector towards gold mineralization (Hua 2024).
4. Perform targeted prospecting, stripping and geological mapping

References

Armstrong, H.S. and Webb, J.K. 1950. Township of Echo, District of Kenora, Ontario; Department of Mines, Map 1950-1, scale 1:12 000.

Bragg, J.G. 1984. Report on Steep Rock's King Bay property, Sturgeon Lake, Ontario, Hudson Bay Exploration and Development Company Ltd.; Kenora Resident Geologist's office, Fourbay Lake area, assessment file 52J02SW0016, 78p.

Bulatowich, M.B. 2009. Prospecting activities in the Jessie Lake and Jumping Lake areas – Fourbay Lake, northwestern Ontario, *prepared for* Aur Lake Exploration Inc.; Kenora Resident Geologist's office, Fourbay Lake area, assessment file 20000004419, 23p.

Chataway, R.T. 1984. Geological and prospecting report on the Sturgeon Lake area properties, Patricia Mining Division, *prepared for* Copconda York Resources, Inc.; Kenora Resident Geologist's office, Handcuff Lake Area, assessment file 52G15NE0003, 27p.

Chorlton, L.B. 1991. Geological history of the Sandybeach Lake area, Sioux Lookout Dinorwic Belt, Wabigoon Subprovince, and its implications for gold exploration; Ontario Geological Survey, Open File Report 5752, 199p.

Franklin, J.M. 1995. Volcanic-associated massive sulphide base metals; *in* Geology of Canada Series no.8, Geological Survey of Canada, p.158-183.

Hua, B. 2024. Report of till sampling and bedrock mapping on the Sturgeon Lake property, *for* Barrick Gold Corp.; Kenora Resident Geologist's office, Squash Lake area, assessment file 20000021919, 547p.

Hudak G.J. 1996. The physical volcanology and hydrothermal alteration associated with late caldera volcanic and volcaniclastic rocks and volcanogenic massive sulphide deposits in the Sturgeon Lake region of northwestern Ontario; unpublished PhD thesis, University of Minnesota, Minneapolis, Minnesota, 463p.

Kirkham, R.V. 1972. Geology of copper and molybdenum deposits; Geological Survey Canada Paper 72-1, p.82-87. doi.org/10.4095/105334

Kuryliw, C.J. 1995. Report on Armstrong-Johnson gold prospect, diamond drilling program, Sturgeon Lake area, Ontario; Kenora Resident Geologist's office, Fourbay Lake area, assessment file 52J02SW0007, 43p.

Lessard P. and Ratthe, G. 2020. 2019 diamond drilling campaign report, Sturgeon Lake property, Ontario, Canada; Kenora Resident Geologist's office, GTP Block 7, assessment file 20000018459, 38p.

McCracken, T. 2017. Technical report and resources estimation update on the Goldlund project, Patricia and Kenora Mining Division, Ontario; *prepared for* First Mining Finance Corp. by WSP Canada Inc.; NI 43-101 Technical Report, filed February 10, 2017 with SEDAR+®, *see* www.sedarplus.ca/home/, 165p. [accessed October 10, 2025].

MIR Télédétection Inc. 2009. Structural analysis of IKONOS satellite data, Jumping Lake, Ontario; *prepared for* AUR Lake Exploration Inc.; Kenora Resident Geologist's office, Fourbay Lake area, assessment file 20000005959, 7p.

Newton, F. 2016. Report on the September 2016 prospecting program on the Fourbay property; *prepared for* for Tasca Resources, Minroc Management Ltd., Kenora Resident Geologist's office, Fourbay Lake area, assessment file 20000013517, 48p.

Ontario Geological Survey 2003. Ontario airborne geophysical surveys, magnetic and electromagnetic data, grid and profile data, Geosoft® format, Sturgeon Lake–Savant Lake Area; Ontario Geological Survey, Geophysical Data Set 1033B.

——— 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release—Data 126 – Revision 1.

——— 2025. Ontario Mineral Inventory; Ontario Geological Survey, online database, October 2025 update. www.hub.geologyontario.mines.gov.on.ca

Perring, C.S., Groves, D.I., Shellabear, J.N. and Hallberg, J.A. 1991. The "porphyry–gold" association in the Norseman–Wiluna belt of Western Australia: implications for models of Archean gold metallogeny; Precambrian Research, v.51, p.85-113.

Raponi, T.R., Gilles, A., Kautzman, S., MacDougall, C., Ritchie, D., Vasquez, L., Dyck, D., Kalenchuk, K. and Gault, K. 2023. NI 43-101 technical report and prefeasibility study of the Goliath Gold complex, *prepared for* Treasury Metals Inc. by Ausenco Engineering Canada Inc.; NI 43-101 Technical Report, filed March 27, 2023 with SEDAR+®, *see* www.sedarplus.ca/home/, 531p. [accessed October 10, 2025]

Sanborn-Barrie, M. and Skulski, T. 2005. Geology, Sturgeon Lake greenstone belt, western Superior Province, Ontario; Geological Survey of Canada, Open File 1763, scale 1:100 000. doi.org/10.4095/221213

Scammell, D.R. 1985. Diamond drilling report 34, Fourbay Lake area, Sturgeon Lake property due diligence program, Hoyle Resources Inc. and Regis Development Corp.; Kenora Resident Geologist's office, Fourbay Lake area, assessment file 52J01NW0018, 58p.

Wellstead, M. 2014. Report on the July 2014 prospecting program on the Fourbay property, *prepared for* Tasca Resources, Minroc Management Ltd.; Kenora Resident Geologist's office, Fourbay Lake area, assessment file 20000014549, 36p.

Witt, W.K. 1992. Porphyry intrusions and albitites in the Bardoc-Kalgoorlie area, Western Australia, and their role in Archean epigenetic gold mineralization; Canadian Journal of Earth Science, v.29(8), p.1609-1622.

HIGHLIGHTS

- **LCT-pegmatite exploration along large-scale structures within the Berens River Subprovince**
- **New geochemical data from the McInnes Lake greenstone belt**

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The Berens River Subprovince is not so Barren Anymore: Lithium Potential West of the Frame Lake Pluton

Lithium remains a commodity of interest as it is a critical mineral of interest to the provincial and federal governments. Its uses in rechargeable batteries, electricity storage and electric vehicles makes it critical for the energy transition and net-zero emissions goal. The area of recommendation is west of the Frame Lake pluton in the Berens River Subprovince (Figure 1), which hosts the PAK lithium project along its northern boundary defined by the southeast-trending Bear Head fault. Previous mapping by the Ontario Geological Survey, aeromagnetic surveys and field work completed by the Red Lake Resident Geologist Program (RGP) office in 2024 suggest further exploration work should be done west of the Frame Lake pluton.

The Frame Lake pluton is located 140 km north of the town of Red Lake, within the Berens River Subprovince that is bounded in the north by the Sachigo Subprovince and in the south by the Uchi Subprovince. The Berens River Subprovince is dominated by Neoarchean felsic to intermediate intrusive rocks that generally trend to the southeast and volumetrically small greenstone belts that trend north (Buse and Préfontaine 2007). The greenstone belts in the Berens River Subprovince include the Hornby Lake, McInnes Lake and Cherrington Lake, along with a series of slivers that extend between the McInnes Lake and Red Lake greenstone belts. The McInnes Lake greenstone belt records an eastward younging with ages that range from 2974 Ma to 2928 Ma (Corfu et al. 1998), the Hornby Lake greenstone belt has a recorded age of 2901 Ma (Stone 1998), consistent with an eastward younging direction. This provides supporting evidence that the 2 greenstone belts were previously connected (Stott, Buse and Préfontaine 2006). Within the granitoid units of the Berens River Subprovince, ages span 2750 Ma to 2690 Ma (Corfu and Stone 1998). The plutonism commenced as tonalitic to granodioritic that was followed by the emplacement of granite to granodiorite units. The youngest phase of plutonism was the emplacement of the sanukitoid intrusions—the Frame Lake pluton— that has an age of 2696 Ma (Corfu and Ayres 1984).

A principal exploration technique for pegmatites is identifying fertile parental granites, as the genetic relationship between S-type granites (i.e., fertile parental granites) and lithium-cesium-tantalum (LCT)–group pegmatites has been well established (e.g., Černý 1989a; Wise, Müller and Simmons 2022, and references therein). Mapping by S. Préfontaine and S. Buse in 2006 (Buse and Préfontaine 2007), followed up on mapping by Stone et al. (1993), focussed on the greenstone belts and supracrustal remnants within the Berens River Subprovince. Stone et al. (1993) mapped two-mica granites west of the Frame Lake pluton and

Price, R.L. 2026. The Berens River Subprovince is not so barren anymore: lithium potential west of the Frame Lake pluton; *in* Recommendations for Exploration 2025–2026, Ontario Geological Survey, Resident Geologist Program, p.51-55.

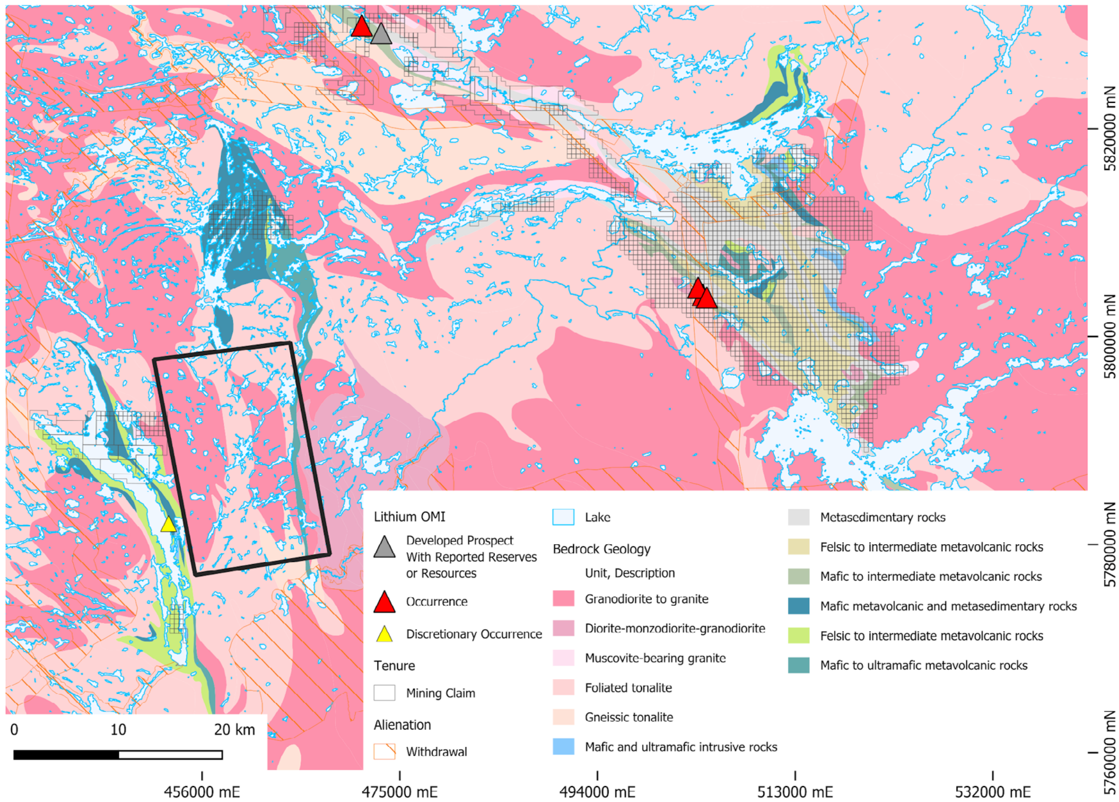

Figure 1. Geology map (*modified from* Ontario Geological Survey 2011) with the recommended area for exploration (black box) relative to the occurrences documented in the Ontario Mineral Inventory (OMI) database that contain lithium as a primary commodity (Ontario Geological Survey 2025). Universal Transverse Mercator (UTM) co-ordinates are North American Datum (NAD) 1983, Zone 15N.

noted they could contain biotite, muscovite, garnet, tourmaline, apatite and cordierite (*see* Figure 1). Similarly, Buse and Préfontaine (2007) noted the two-mica granite that exists west of the Frame Lake pluton contains garnet and sillimanite, an aluminosilicate (Figure 2). Generally, S-type granites contain minor biotite and/or magmatic silver muscovite, with more evolved S-type granites containing green lithium-bearing muscovite, garnet, tourmaline, apatite, cordierite, andalusite (aluminosilicate) and/or topaz (Breaks, Selway and Tindle 2003).

In 2024, the Red Lake RGP office completed fieldwork within the McInnes Lake greenstone belt and collected samples from the previously mapped two-mica granites. The two-mica granites contain accessory biotite, muscovite, garnet and/or tourmaline (Table 1). Rare-element content is also an indicator for fertility as they tend to be enriched in granites that have undergone a higher degree of fractionation (Breaks, Selway and Tindle 2003). Table 1 shows select elemental compositions from the whole-rock lithogeochemistry that shows that the two-mica granites are enriched in the rare-elements compared to the average upper continental crust values. This suggests a higher degree of fractionation produced the granites and a residual melt could have produced LCT-group pegmatites.

The S-type granite-pegmatite systems are largely confined to large-scale faults, pre-existing batholithic contacts or lithologic boundaries (Černý 1989b). Although the Bear Head fault has been the focus of exploration, there are several southeast-trending structures within the Berens River Subprovince that were interpreted through aeromagnetic data (Stott, Buse and Préfontaine 2006) and have had limited exploration (Figure 3). One such structure has been interpreted to exist west of the Frame Lake pluton and appears to displace the McInnes Lake greenstone belt from the Hornby Lake greenstone belt in a dextral motion (*see* Figure 1). The felsic plutonic bodies between the McInnes Lake and Hornby Lake greenstone belts appear to have been emplaced as irregular, steeply dipping sheets, consistent with syn-emplacement deformation (Stott, Buse and Préfontaine 2006). The later dextral shearing is seen at all scales and trends to the south to southeast and is observable in the McInnes Lake and Hornby Lake greenstone belts (Stott, Buse and Préfontaine 2006) (*see* Figure 3). Stott, Buse and Préfontaine (2006) interpret long, curviplanar mega-shear zones on a regional scale within the Berens River Subprovince that have a similar orientation to the Bear Head fault.

Table 1. A list of the accessory minerals and rare-element chemistry of samples collected from the two-mica granites in the McInnes Lake greenstone belt in 2024. The average upper continental crust values are from Rudnick and Gao (2002).

Sample	Easting	Northing	Accessory Minerals	Cs (ppm)	Li (ppm)	Nb (ppm)	Rb (ppm)	Ta (ppm)
Average upper continental crust:				4.9	24	12	84	0.9
2024RP019	446025	5790685	Ms, Bt, Grt	8.580	36.04	6.86	527.60	1.191
2024RP020	446017	5790683	Ms, Bt, Grt	5.316	37.18	9.77	481.79	2.758
2024RP021	445875	5790564	Ms, Bt	7.832	39.78	9.04	512.93	0.892
2024RP022	445796	5790484	Bt, Ms, Grt	3.761	56.13	12.26	217.22	1.571
2024RP023	445759	5790139	Ms, Bt	6.138	77.32	17.81	166.46	1.94
2024RP024	454657	5773348	Ms, Bt, Grt	18.638	40.93	4.55	296.40	1.382
2024RP025	454645	5773369	Ms, Tr, Grt	7.314	36.02	10.42	137.87	6.621
2024RP026	454632	5773389	Tr, Grt, Ms	17.785	64.85	11.10	478.89	2.537

Abbreviations: Cs, cesium; Li, lithium; Nb, niobium; Rb, rubidium; Ta, tantalum; Ms, muscovite; Bt, biotite; Grt, garnet; Tr, tourmaline.

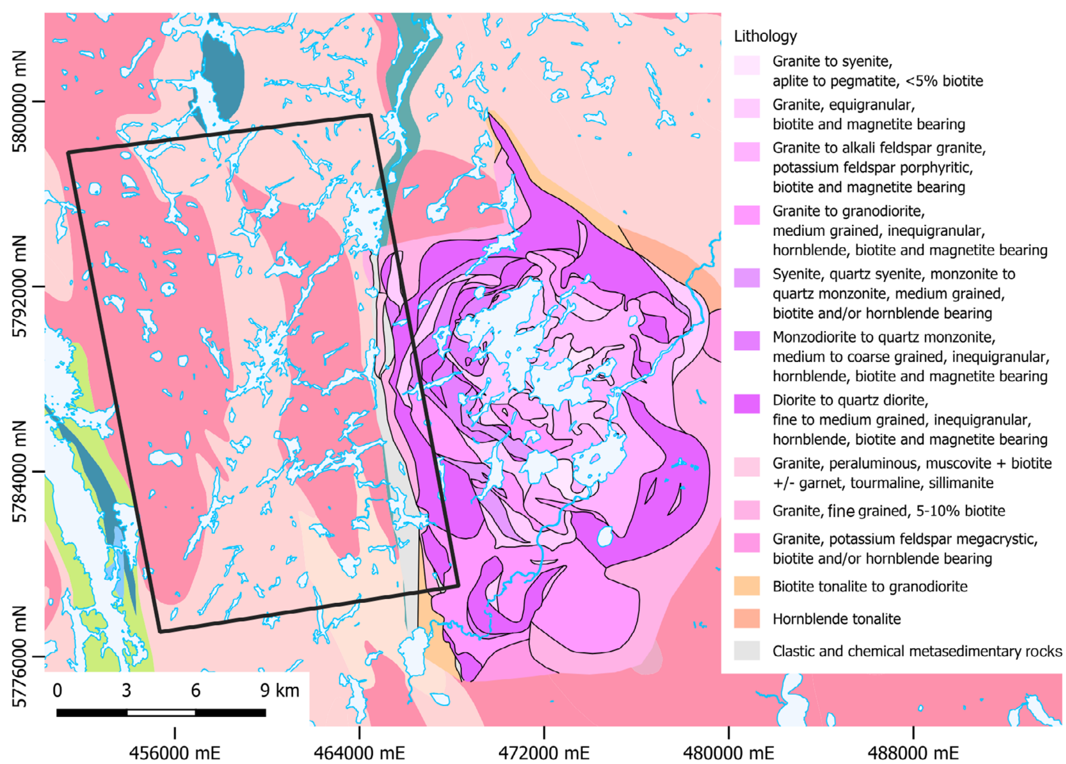

Figure 2. Geology map of the Frame Lake pluton with the mapping by S. Buse (P3591, *see* Buse 2007) showing the peraluminous granite along the western margin of the Frame Lake pluton (*modified from* Ontario Geological Survey 2011). UTM co-ordinates are in NAD83 Zone 15N.

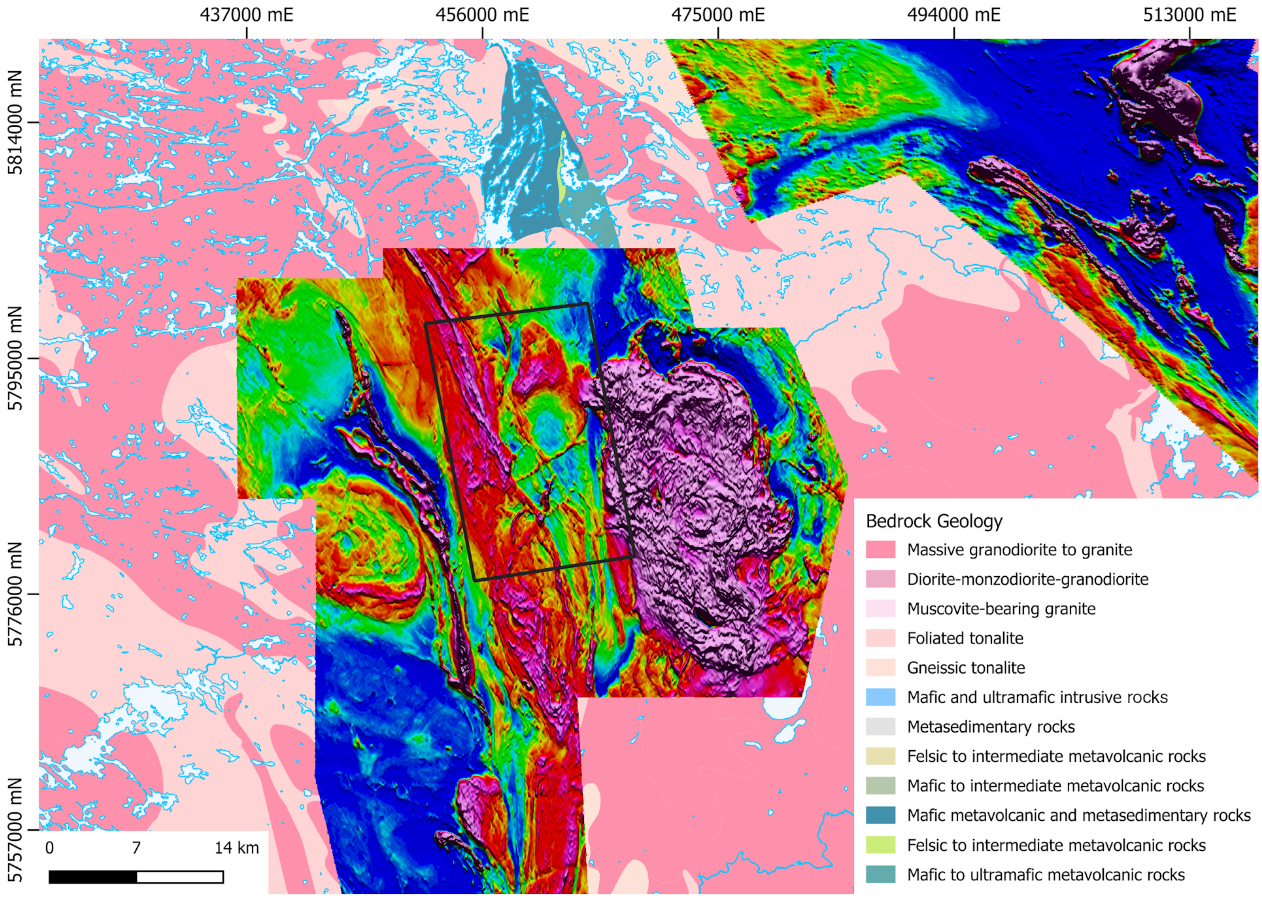

Figure 3. Geology map overlain by the residual magnetic intensity image shows elongated aeromagnetic trend lines west of the Frame Lake pluton that represent a large-scale dextral shear zone as suggested by Stott, Buse and Préfontaine (2006) (*modified from* Ontario Geological Survey 2011, 2017). UTM co-ordinates are NAD83 Zone 15N.

At the time of writing, the area west of the Frame Lake pluton, the southern extension of the Hornby Lake greenstone belt and the central region of the McInnes Lake greenstone belt is open for claim acquisition (*see* Figure 1). The observation of two-mica granites that contain accessory minerals and anomalous values for rare-elements suggest there are granites in the region that are fertile and could be parental to LCT-group pegmatites. The interpreted dextral structure west of the Frame Lake pluton could be an excellent location for the residual melt to have exploited. The proximity of the structure to the greenstone belts and the limited exploration and mapping within the granitoid units of the Berens River Subprovince leave a large opportunity for discovery in the area.

References

Breaks, F.W., Selway, J.B. and Tindle, A.G. 2003. Fertile peraluminous granites and related rare-element mineralization in pegmatites, Superior Province, northwest and northeast Ontario: Operation Treasure Hunt; Ontario Geological Survey, Open File Report 6099, 179p.

Buse, S. 2007. Precambrian geology of the Frame Lake pluton, northwestern Ontario; Ontario Geological Survey, Preliminary Map P.3591, scale 1:20 000.

Buse, S. and Préfontaine, S. 2007. Precambrian geology of the McInnes Lake greenstone belt, the supracrustal remnants study area and the Frame Lake pluton, Berens River Subprovince, Ontario; Ontario Geological Survey, Open File Report 6210, 128p.

Černý, P. 1989a. Exploration strategy and methods for pegmatite deposits of tantalum; *in* Lanthanides, Tantalum and Niobium, Springer-Verlag, New York, p.274-302.

——— 1989b. Characteristics of pegmatite deposits of tantalum; *in* Lanthanides, Tantalum and Niobium, Springer-Verlag, New York, p.195-239.

Corfu, F. and Ayres, L.D. 1984. U-Pb age and genetic significance of heterogeneous zircon populations in rocks from the Favourable Lake area, northwestern Ontario; Contributions to Mineralogy and Petrology, v.88, p.86-101.

Corfu, F., Davis, D.W., Stone, D. and Moore, M.L. 1998. Chrono-stratigraphic constraints in the genesis of Archean greenstone belts, northwestern Superior Province, Ontario, Canada; Precambrian Research, v.92, p.277-295.

Corfu, F. and Stone, D. 1998. Age structure and orogenic significance of the Berens River composite batholiths, western Superior Province; Canadian Journal of Earth Sciences, v.35, p.27-42.

Rudnick, R.L. and Gao, S. 2002. Composition of the continental crust; Treatise on Geochemistry, v.3, Elsevier, P.1064.

Stone, D. 1998. Precambrian geology of the Berens River area, northwest Ontario; Ontario Geological Survey, Open File Report 5963, 116p.

Stone, D., Atkinson, B., Crawford, J. and Halstead, J. 1993. Precambrian geology, Critchell Lake area; Ontario Geological Survey, Preliminary Map p.3219, scale 1:50 000.

Stott, G.M., Buse, S. and Préfontaine, S. 2006. Regional structures and their implications in the Berens River region, northwestern Ontario; *in* Summary of Field Work and Other Activities 2006, Ontario Geological Survey, Open File Report 6192, p. 12-1 to 12-10.

Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release—Data 126 – Revision 1.

——— 2017. Ontario airborne geophysical surveys, magnetic data, grid data (ASCII and Geosoft® formats), magnetic supergrids; Ontario Geological Survey, Geophysical Data Set 1037—Revised.

——— 2025. Ontario Mineral Inventory; Ontario Geological Survey, online database (October 2025 update). www.hub.geologyontario.mines.gov.on.ca

Wise, M.A., Müller, A. and Simmons, W.B. 2022. A proposed new mineralogical classification system for granitic pegmatites; The Canadian Mineralogist, v.60, p.229-248. doi.org/10.3749/canmin.1800006

HIGHLIGHTS

- **New spodumene occurrence in the Far North**
- **Pierce Lake assemblage open for claim acquisition**
- **~22 km strike length with potential for LCT pegmatites**

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Lithium Occurrence in the Pierce Lake Area

Introduction

Ontario and Canada have listed lithium on their respective critical mineral lists, and there are many known occurrences throughout the province (Ontario 2025 and Natural Resources Canada 2025). At present, the main use for lithium involves the production of ceramics and glass.

Lithium is poised to play a vital role in Ontario's economy, particularly in supporting the transition from internal combustion engine vehicles to electrical motor vehicles (Bradley et al. 2017).

During the summer of 2024, staff of the Red Lake District office of the Resident Geologist Program (RGP) visited the Pierce-Ponask-Sachigo greenstone belt, working in tandem with George Gao, Quaternary Geoscientist of the GeoScience Mapping - Sedimentary and Environmental Geoscience Section of the Ontario Geological Survey (OGS). Work was completed by helicopter while based out of Sandy Lake First Nation.

During this visit, work was primarily limited to areas accessible by helicopter. The Pierce-Ponask-Sachigo greenstone belt strikes northwest-southeast, overlain by Pierce, Ponask and Sachigo lakes (Figure 1). The Pierce assemblage is separated from the rest of the greenstone belt by the Ponask Lake shear zone and is analogous to the Island Lake area across the border in Manitoba (Thurston, Osmani and Stone 1991).

Thurston, Osmani and Stone (1991) describe the Pierce assemblage as comprising a metasedimentary unit, with mafic to intermediate flows, felsic volcaniclastic and ultramafic intrusions. Mapping by Stone, Hallé and Lange (1998) provided more detailed geological maps where two-mica granites were noted at the Ontario–Manitoba border and along the strike length of the Pierce assemblage.

Why Explore Pierce Lake?

There are several reasons for examining the Pierce Lake area for lithium potential, many of which can guide exploration for lithium-cesium-tantalum (LCT) pegmatites. The first reason to explore the Pierce Lake area is that there has been previous exploration nearby, but not work focussed on the Pierce Lake area. The closest assessment reports recorded in the area cover the Ponask Lake portion of the Pierce-Ponask-Sachigo greenstone belt. Exploration focussed on copper and asbestos, with no mention of pegmatites. Examining underexplored areas could reveal previously unrecognized occurrences and increase the potential of successful exploration.

Malegus, P.M. 2026. Lithium occurrence in the Pierce Lake area; *in* Recommendations for Exploration 2025–2026, Ontario Geological Survey, Resident Geologist Program, p.56-61.

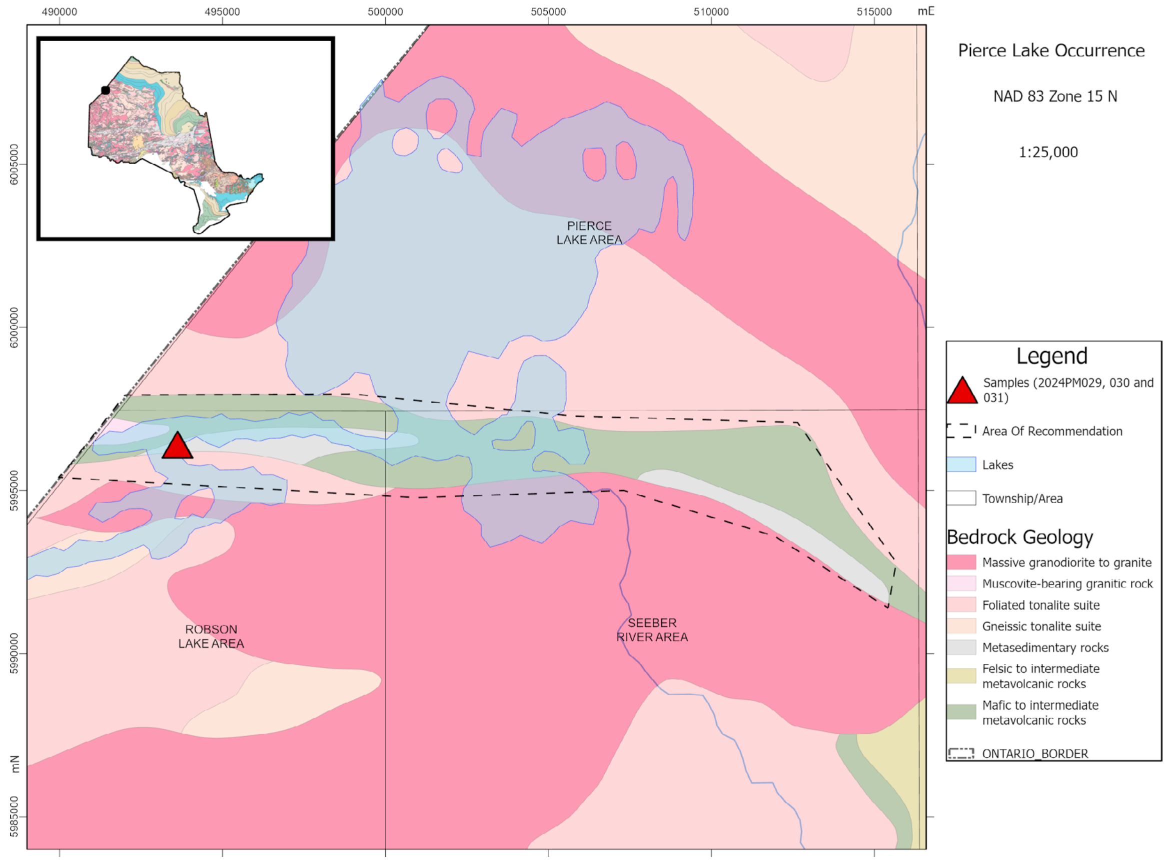

Figure 1. Bedrock geology map showing location of Pierce Lake with sample locations and area recommended for exploration (*modified from* Ontario Geological Survey 2011).

Secondly, mapping by Stone, Hallé and Lange (1998) noted multiple two-mica granites along strike throughout the greenstone belt with select garnet-bearing two-mica granites. The presence of two-mica granites with garnets is an indicator that a peraluminous fertile granite could be present, which are important characteristics in the development of an LCT pegmatite (Breaks, Selway and Tindle 2003).

Third, across the border into Manitoba there are a total of 19 pegmatite occurrences, 4 of which have recorded LCT pegmatite mineralization (TD, SQ, PK and BL). Mineralization noted in the pegmatites in Manitoba includes cassiterite, garnet, apatite, tourmaline in TD; spodumene, muscovite and tourmaline in SQ; tourmaline, potassium feldspar, plagioclase and microlite in PK; and beryl, biotite, muscovite and apatite in BL (Manitoba Geological Survey 2011a-d).

Pierce Lake Occurrence

A new occurrence was discovered on the shore of a small island south of the main Pierce Lake where the occurrence was discovered (Figure 1). Six samples were collected across the island, with 3 samples on the northeast shore returning particularly interesting results (Tables 1, 2 and 3).

While no spodumene was noted in the hand samples in the field, 3 samples returned anomalous- to occurrence-level grades for lithium, the highest value from sample 2024PM030 returning 16 612.62 ppm Li. Occurrence-level grades were returned for beryllium with 238.918 ppm Be in sample 2024PM029 and rubidium in all 3 samples, ranging from 679.78 to 2542.04 ppm Rb (*see* Table 3). With the very promising results from the grab samples, additional work was completed by SEM (scanning electron microscopy) to identify and confirm specific minerals.

Table 1. Samples, with field description, collected from the Pierce Lake occurrence in 2024 by staff of the Red Lake District RGP office. Universal Transverse Mercator (UTM) co-ordinates provided using North American Datum 1983 (NAD83) in Zone 15.

Sample No.	Sample Type	Township/Area	Easting (m)	Northing (m)	Field Description
2024PM029	Grab	Robson Lake Area	493624.59	5996461.44	Pegmatitic-leucogranite, appears to be two types of feldspar, smoky quartz, muscovite books (10%) and trace garnets. Coarse grained
2024PM030	Grab	Robson Lake Area	493613.7	5996466.46	Same granitic ridge as 2024PM029, but this spot appears primarily composed of feldspar. Trace green muscovite, and a significant amount of a silvery sulphide that scratches with the scratcher, could be löllingite.
2024PM031	Grab	Robson Lake Area	493611.1	5996460.8	White pegmatitic-leucogranite, coarse grained, composed of white feldspar, smoky quartz, and muscovite.

Table 2. Results of major element analyses for samples collected at the Pierce Lake occurrence.

Sample No.	Al_2O_3	BaO	CaO	Cr_2O_3	Fe_2O_3	K_2O	MgO	MnO
Units	wt %	wt %	wt %	wt %	wt %	wt %	wt %	wt %
Detection Limit:	***0.02***	***0.004***	***0.006***	***0.002***	***0.01***	***0.01***	***0.01***	***0.002***
2024PM029	15.45	0.004	0.177	0.003	0.47	2.86	0.04	0.089
2024PM030	-	<0.004	0.055	0.016	0.84	1.01	0.08	0.01
2024PM031	15.60	<0.004	0.176	<0.002	0.47	2.85	0.04	0.088

Sample No.	Na_2O	P_2O_5	SiO_2	TiO_2	Total	LOI
Units	wt %	wt %	wt %	wt %	wt %	wt %
Detection Limit:	***0.02***	***0.002***	***0.04***	***0.01***		
2024PM029	5.70	0.095	73.09	0.01	98.34	0.36
2024PM030	0.88	0.028	76.43	0.02	95.25	0.07
2024PM031	5.67	0.094	73.41	0.02	99.34	0.93

Analyses by Geoscience Laboratories, Ministry of Energy and Mines, Sudbury, Ontario. All by XRF (X-ray fluorescence).

Table 3. Results of trace element analyses for samples collected at the Pierce Lake occurrence.

Sample No.	Be	Cs	Li	Nb	Rb	Sn	Ta
Units	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Detection Limit:	***0.024***	***0.018***	***0.24***	***0.05***	***0.15***	***0.17***	***0.015***
2024PM029	238.918	100.913	231.98	157.48	2542.04	56.07	157.819
2024PM030	4.095	56.939	16612.62	19.56	679.78	15.20	20.711
2024PM031	42.000	78.137	528.37	218.96	2127.69	57.77	69.148

Analyses by Geoscience Laboratories, Ministry of Energy and Mines, Sudbury, Ontario. All by ICP–MS (inductively coupled plasma mass spectrometry).

Scanning electron microscopy analysis of 2024PM029 showed that the sample was primarily composed of microcline/orthoclase and quartz, with less than 5% plagioclase and muscovite. Accessory minerals noted in the sample include spessartine, apatite, arsenopyrite, xenotime and scorodite; with the xenotime found as inclusions within apatite (Gore 2025).

Scanning electron microscopy analysis of sample 2024PM030 showed that the sample was composed primarily of plagioclase, microcline/orthoclase, quartz and muscovite, with trace löllingite. The most important mineral identified in this sample is spodumene, constituting approximately 5% of the sample (Photo 1). Spodumene is typically anhedral to subhedral prismatic crystals, with cross-hatched texture noted in thin section, most likely the cleavage (Photo 2) (Gore 2025).

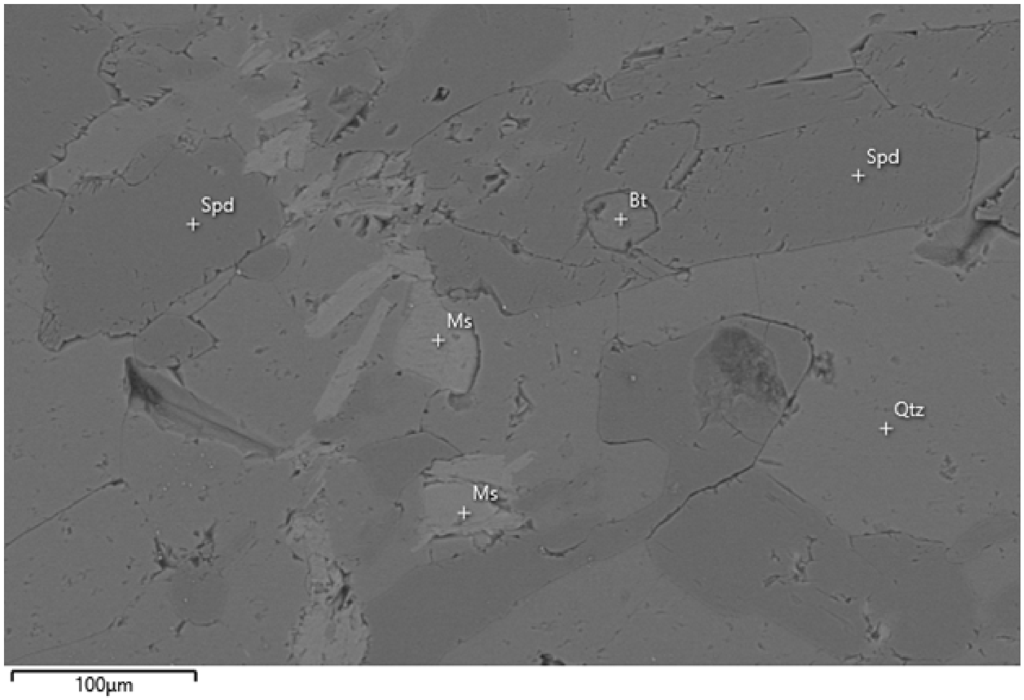

Photo 1. Backscattered electron image of sample 2024PM030 showing the intergrowth of spodumene (Spd), quartz (Qtz), muscovite (Ms) and biotite (Bt) (Gore 2025).

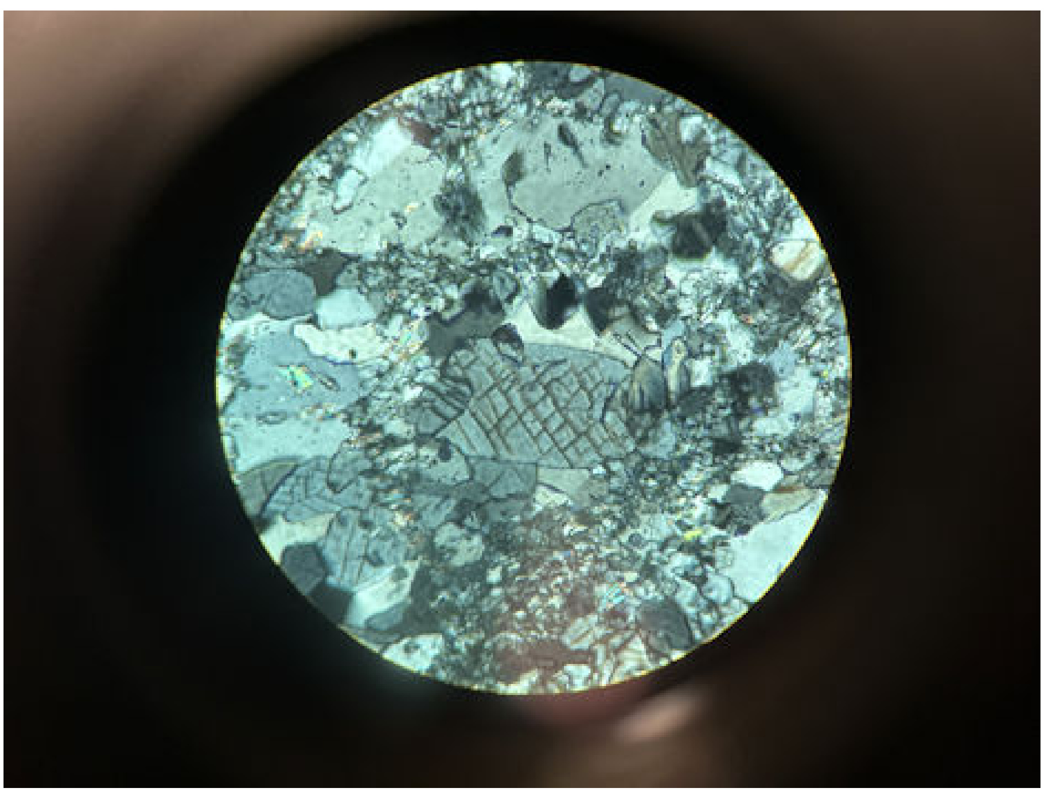

Photo 2. Cross-polarized thin section image of spodumene in sample 2024PM030, showing cleavage planes.

Scanning electron microscopy analysis on the fine sample 2024PM031 showed it was primarily composed of quartz and microcline/orthoclase, and lesser amounts of plagioclase, feldspar and muscovite. Accessory minerals identified include spodumene, spessartine and columbite (Photo 3) (Gore 2025).

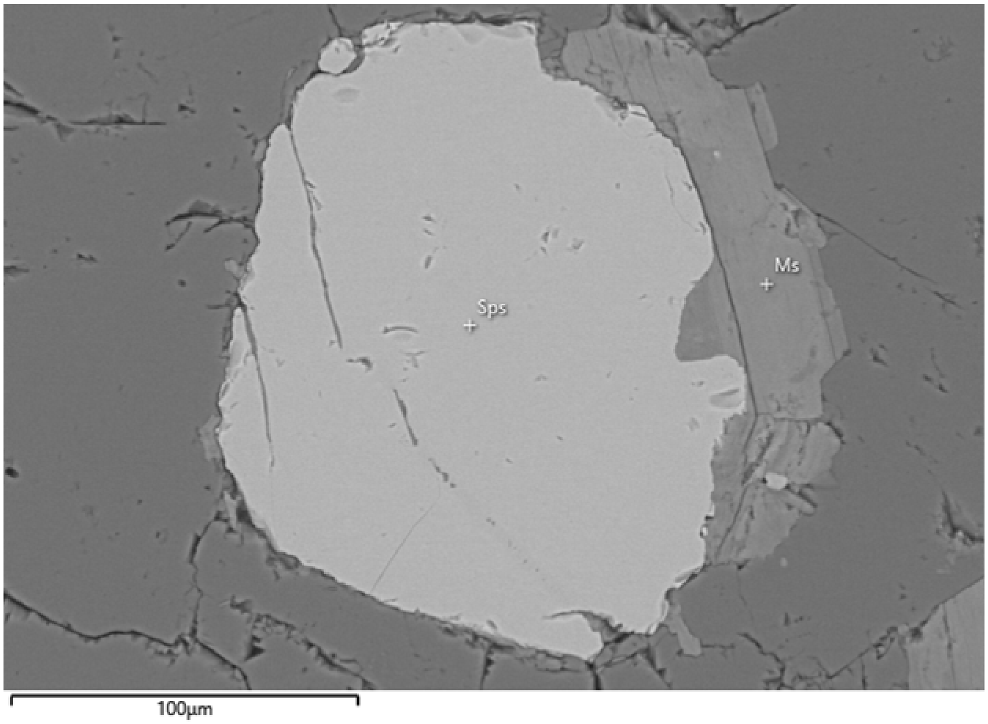

Photo 3. Backscattered electron image of sample 2024PM031 showing a grain of spessartine (Sps) garnet overgrown by muscovite (Ms) (Gore 2025).

Area Recommended for Exploration

Based on the initial work completed at the Pierce Lake occurrence, there is a 22 km strike length (approximate) from the Ontario–Manitoba border to the end of the Pierce assemblage that is prospective for LCT pegmatites (Figure 1). Prospecting and/or exploration work should be concentrated on the known two-mica granites mapped in map P.3376 (Stone, Hallé and Lange 1998) and where accessory minerals are present. As a first pass exploration program, these would be the most prospective areas to find potential LCT pegmatites. Additionally, mineralogical work to determine a direction of increasing fractionation could assist in targeting areas in the Pierce Lake assemblage. This recommendation for exploration is further proof of Ontario’s vast potential for critical minerals and how the RGP can play a vital role in driving exploration in the province.

References

Bradley, D.C., Stillings, L.L., Jaskula, B.W., Munk, L. and McCauley, A.D. 2017. Lithium; *in* Critical Mineral Resources of the United States—Economic and Environmental Geology and Prospects for Future Supply, United States Geological Survey Professional Paper 1802, p.K1-K21. https://pubs.usgs.gov/publication/pp1802K. [accessed November 21, 2025]

Breaks, F.W., Selway, J.B. and Tindle, A.G. 2003. Fertile peraluminous granites and related rare-element mineralization in pegmatites, Superior Province, northwest and northeast Ontario: Operation Treasure Hunt; Ontario Geological Survey, Open File Report 6099, 179p.

Gore, T.E. 2025. Mineralogy report: 25-0042, internal report; Ontario Geological Survey, Geoscience Laboratories, 7p.

Manitoba Geological Survey 2011a. TD; *in* Manitoba Mineral Deposits Database, Manitoba Geological Survey, Deposit Number M53K/04-001. https://www.manitoba.ca/iem/geo/index.html

——— 2011b. SQ; *in* Manitoba Mineral Deposits Database, Manitoba Geological Survey, Deposit Number M53K/04-002. https://www.manitoba.ca/iem/geo/index.html

——— 2011c. PK; *in* Manitoba Mineral Deposits Database, Manitoba Geological Survey, Deposit Number M53K/04-003. https://www.manitoba.ca/iem/geo/index.html

——— 2011d. BL; *in* Manitoba Mineral Deposits Database, Manitoba Geological Survey, Deposit Number M53K/04-004. https://www.manitoba.ca/iem/geo/index.html

Natural Resources Canada 2025. Canada's Critical Minerals; Government of Canada, May 5, 2025 update, https://www.canada.ca/en/campaign/critical-minerals-in-canada/critical-minerals-an-opportunity-for-canada.html [accessed October 2, 2025].

Ontario 2025. Critical Minerals; Ministry of Energy and Mines, September 12, 2025 update, https://www.ontario.ca/page/critical-minerals [accessed October 2, 2025].

Ontario Geological Survey 2011. 1:250 000 scale bedrock geology of Ontario; Ontario Geological Survey, Miscellaneous Release—Data 126 - Revision 1.

Stone, D., Hallé, J. and Lange, M. 1998. Precambrian geology, Pierce Lake area; Ontario Geological Survey, Preliminary Map P.3376, scale 1:50 000.

Thurston, P.C., Osmani, I.A. and Stone, D. 1991. Northwestern Superior Province: review and terrane analysis; *in* Geology of Ontario, Ontario Geological Survey, Special Volume 4, Part 1, p.81-142.

Notes

Back inside cover photos (from top to bottom):

Amy Brush (2024 Summer Student, Resident Geologist Program, Thunder Bay North District) poses next to a large spodumene crystal at Green Technology Metals' Ltd. Seymour Lake Property, northwest of Armstrong. Credit: Sophie Churchley, Resident Geologist Program.

Deformed metasedimentary rock in drill core stored at the RGP's Thunder Bay outdoor core storage facility. Credit: Mateo Dorado-Troughton, Resident Geologist Program.

International Lithium completed a drill program in July 2024 on their Firesteel Copper project, located approximately 10 km west of Upsala. The Firesteel Copper property was acquired by International Lithium from local prospector Byron Holbik. From left to right: Victor Lum, Jeremy Beales, Anthony Kovacs, Byron Holbik, and Daniel Gianotti.

Vittoria D'Angelo (2024 Acting Regional Resident Geologist, Resident Geologist Program, Timmins District) examines the Gowganda Formation during a field trip of the Huronian Supergroup in the Elliot Lake area. Credit: Véronique Gagnon-Coderre, Resident Geologist Program.

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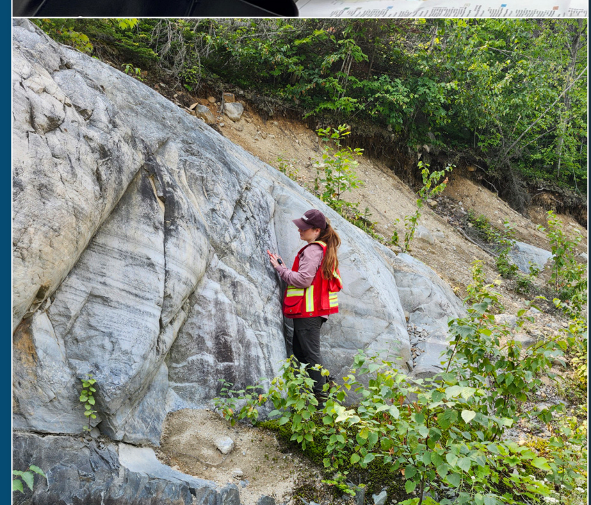

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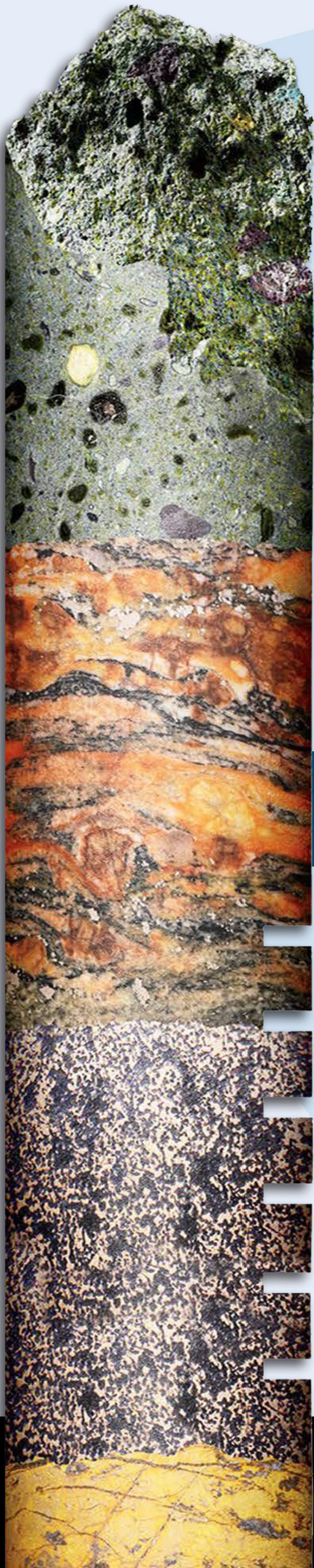

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