Report of Activities 2025

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Geological Survey Division

Ed. C. J. Renaud

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Department of Natural Resources

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Cover Photo

Geologist Anna Ryan surveying Carter's Beach, in Port Mouton, Queens County in summer 2025.

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Nova Scotia Critical and Strategic Minerals Atlas.

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Industry Liaison and Public Outreach Activities at the Geoscience and Mines Branch, Nova Scotia Department of Natural Resources, 2025-2026

C. J. Renaud, M. J. O'Neill, and K-D. MacRae

During the 2025–2026 fiscal year, the Industry Liaison Geologist and Outreach Lead delivered the Geoscience and Mines Branch's (GMB) mineral industry liaison and public outreach programs. These activities supported investment attraction, sector growth, public awareness, and education related to Nova Scotia's mineral resources and mining sector.

Mineral Industry Liason

Mineral industry liaison activities focused on encouraging investment and supporting growth in the province's mineral sector. The Industry Liaison Geologist promoted Nova Scotia's mineral potential through intergovernmental business channels and engagement with industry stakeholders. Activities included supporting partnerships and funding agreements, and promoting the province's mineral tenure system and exploration framework at local and national trade shows.

The Geoscience and Mines Branch's third annual Mineral Resource Forum was held at Pier 21 in Halifax, consisting of two full days of presentations, panel discussions, and networking. Nearly 200 industry and government registrants attended the event, which was generously fully sponsored by the Nova Scotian industry. The event included speakers and panels highlighting the revitalization and resilience of the mining industry in Nova Scotia. Topics included critical mineral initiatives, industry project updates, and an update on the new Mining Engineering program at Saint Mary's University.

Two staff members, joined by five prospectors from the Nova Scotia Prospectors Association (NSPA), attended AME Roundup in Vancouver and showcased Nova Scotia's geology and its potential to investors. The contingent fielded a steady stream of enquiries about Nova Scotia and the opportunities available in the province. This event was attended by over 6,500 delegates from around the world, attracting considerable interest from companies working in western Canada and their associated mineral deposits.

Nova Scotia had a large presence at the annual Prospectors and Developers Association of Canada (PDAC) convention in Toronto enabling staff to engage with inquiries about potential new exploration opportunities. The Premier of Nova Scotia attended the event meeting with industry representatives and staff. The annual Nova Scotia Mining Breakfast hosted 150 people with many of the attendees proceeding to Canada's Atlantic Edge next door, where Nova Scotia, New Brunswick and Newfoundland held a full day of insight and discussion showcasing the mining exploration and investment opportunities in Atlantic Canada. There were over 32,000 participants at PDAC, marking a record attendance.

Two staff attended the Parrsboro Gem and Mineral show, where Nova Scotia's rocks and minerals were showcased and the programs at the Department of Natural Resources were promoted. The show hosted more than 1,000 people at 30 different booths over three days.

In 2025, the annual $1.5 million Mineral Resources Development Fund (MRDF) expanded to eight streams. By helping move projects through key stages of exploration and development, the fund encourages investment, supports job creation, and contributes to the growth and sustainability of the province's mineral sector. In addition, the MRDF helps build industry capacity by supporting education and mentorship, innovation projects, outreach activities, and community-based initiatives.

The eight streams for the MRDF include:

- Advanced Project Grants
- Prospecting Grants
- Shared Funding Exploration Grants
- Marketing Grants
- Research Grants
- Education, Outreach, and Engagement Grants
- Innovation Grants
- Communities' Grants

Public Outreach and Education

Public outreach initiatives were undertaken to improve understanding of the mining sector, including its economic significance, contribution to sustainability, role in everyday life, and available career pathways. The GMB staff participated in a range of events that strengthened provincial and pan-Atlantic industry connections, supported public health and safety initiatives, and highlighted the alignment between responsible mining practices and the United Nations Sustainable Development Goals (UNSDGs).

Staff participated in home shows in Halifax, Sydney, Truro, and Pictou to promote radon awareness, encourage residential testing, and discuss mitigation options, engaging with more than 1,500 families during the 2025–2026 period. Staff responded to questions and concerns about radon by providing information on home testing options and practical steps to reduce associated health risks. To support professional development and stay informed on current practices and research related to radon awareness and mitigation, staff attended the Canadian National Radon Proficiency Program (CNRPP) conference in Quebec City in April 2025.

In addition, staff co-hosted a community radon test kit giveaway in March 2026 at the Antigonish Town and County Library in partnership with LungNSPEI. The initiative aimed to increase testing in an area identified as having low testing rates and limited data. A total of 100 test kits were distributed, and staff delivered a presentation outlining general radon risks and the importance of testing.

The Outreach Lead participated in a Sustainable Development Goals event at the Nova Scotia Community College (NSCC) Tech Campus, engaging students and members of the public on safe mining practices and the role of minerals in renewable energy and green technology.

Outreach staff, in partnership with the Department of Energy, participated in the Skills Canada Career Event at NSCC Ivany Campus, attended by approximately 1,200 students in grades 9 to 12 from across Nova Scotia. This event provided an opportunity to engage students on the range of career opportunities within the mining sector, including roles requiring varying levels of education and training to highlight employment opportunities available within the province (Figure 1).

Figure 1. Outreach Lead Chelsea Renaud hosting a booth at the Skills Canada Career Event at the NSCC Ivany Campus in partnership with the Department of Energy.

Planned Activities (2026-2027)

In the upcoming fiscal year, outreach activities will continue to focus on expanding engagement with students, industry stakeholders, and communities across Nova Scotia. Planned initiatives include further updates to outreach materials and the GMB website, increased participation in public events, and expanded community engagement activities related to geology and mining.

Coastal Geoscience Research Program

M. Maracle and A. Ryan

Introduction

Nova Scotia's coasts are dictated by its complex bedrock framework, which provides the structural control for modern headlands and basins. This inherited topography was modified during the Quaternary by successive glacial and interglacial cycles, most notably the most recent Wisconsinan glaciation (75 -11ka). As ice sheets retreated approximately 11,500 years ago, they left behind a paraglacial landscape dominated by glaciofluvial deposits, tills, and drumlin fields in Nova Scotia (Piper & Pe-Piper, 2022). These landforms serve as the primary sediment reservoirs for the province's modern littoral systems.

The transition from a glaciated to drowned coastline is the result of complex post-glacial relative sea-level (RSL) dynamics. While global eustatic levels rose due to melting ice, Atlantic Canada experienced the collapse of the peripheral glacial bulge, leading to ongoing crustal subsidence and isostatic rebound (Koohzare et al., 2005; Shaw et al., 2002). As a result of this post-glacial transgression coupled with anthropogenic climate change, regional sea levels continue to rise by roughly 32 cm per century, forcing shorelines landward and accelerating the erosion of vulnerable bedrock and Quaternary bluffs (Forbes et al., 2009).

Managing these evolving risks requires a process-driven geomorphology perspective that views the coast as a series of semi-contained littoral cells. Within these cells, the erosion of glacial landforms, such as the glaciofluvial bluffs at Framboise or the till-capped cliffs at Five Islands, acts as a critical source of sediment. This material is then transported and deposited to form sediment sinks like beaches and dunes, which provide natural protection for the inland environment.

The Mi'kmaq have witnessed climatic and landscape transformations over generations in Atlantic Canada, providing invaluable long-term records of landscape transformation. For example, Mi'kmaw oral histories describing the catastrophic saltwater inundation of the historically freshwater Minas Basin have been corroborated by modern geoscience (Bleakney and Davis, 1983; Piper and Pi-Piper, 2022; Shaw et al., 2002). This knowledge supports a comprehensive approach to coastal research which integrates oceanographic and atmospheric factors, sediment transport and deposition, and seasonality and ephemeral events such as storms to understand controls over erosion. In many ways, understanding our past is the key to securing the present and future of our coasts.

Coastal Monitoring Program

Initiated in 2019, the Coastal Monitoring Program (CMP) is now in its sixth year of monitoring. The core objective is to improve our understanding of Nova Scotia's coastal dynamics and the geohazards associated with changing coastal environments.

The program has 124 active monitoring sites across the province, selected based on their geological setting, geomorphology, cultural significance, and alignment with community priorities (Figure 2). By building upon existing expertise and fostering collaborative research, the CMP is designed to inform climate adaptation strategies for the public, communities, government, NGOs, and industry.

Key outputs of the coastal monitoring program include:

- **Hazard Mapping:** Identifying risks related to erosion, slope stability, and geological vulnerabilities.
- **Public Transparency:** An interactive, publicly accessible map is currently being built to present updated coastal data to stakeholders and decision-makers.
- **Targeted Reporting:** Developing case studies and reports on zones of particular interest with interpretations from the DNR geoscience team.

Ultimately, the insights and data generated by the coastal monitoring program will provide the foundational data to support future provincial coastal policies, technical guidelines, and best management practices for protecting infrastructure.

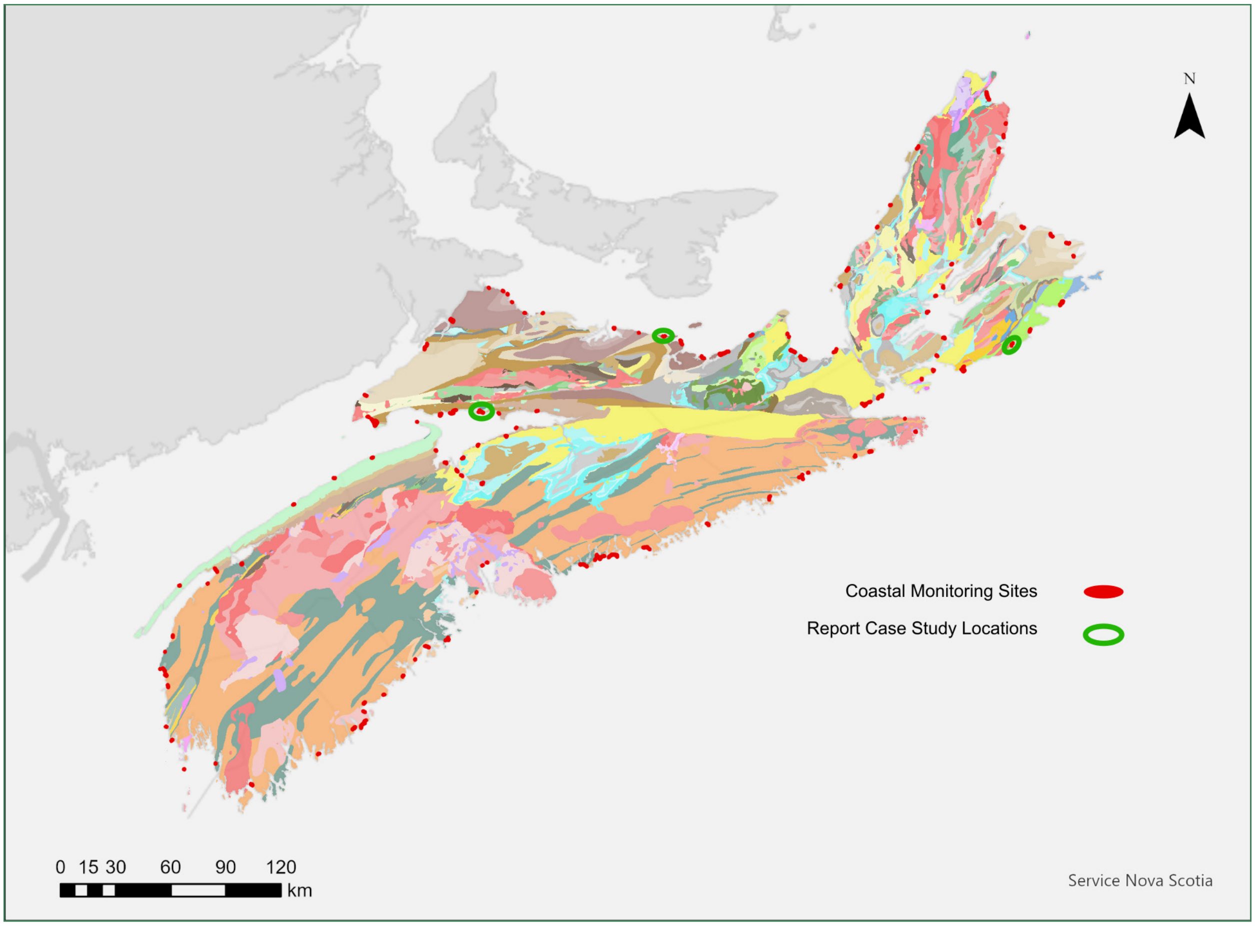

Figure 2. The location of all provincial coastal monitoring sites and case studies discussed in this report including, Framboise - Morrisons Beach, Five Islands Provincial Park, and Waterside Provincial Park with a bedrock basemap.

Methods

Coastal monitoring combines survey-grade Real-time Kinematic (RTK) receivers with RTK-equipped RPAS commonly known as a drone. RPAS missions utilize a grid pattern with a 75% nadir (bird's eye view) overlap and supplemental oblique imagery. To ensure georeferencing accuracy, ground control points (GCPs) are surveyed via a GNSS RTK receiver before each flight. Since 2024, the program has integrated RPAS-mounted LiDAR to penetrate dense vegetation and map the underlying geomorphology, a critical addition for defining landforms in heavily vegetated areas, providing greater insight into coastal bluff evolution and higher quality datasets.

Aerial imagery and GPS data are processed using Pix4D and DJI Terra photogrammetry software. Key outputs include: Orthomosaics, 3D Point Clouds, Digital Surface Models (DSMs), and Digital Elevation Models (DEMs). The resulting data maintains a high precision Ground Sampling Distance (GSD) of 1–3 cm/pixel, depending on flight altitude and equipment.

By comparing multi-year datasets (e.g., 2019 vs. 2025) in ArcGIS Pro or Global Mapper, cut/fill and surface difference analyses are conducted. This allows DNR geoscientists to quantify volumetric changes and interpret the sediment transport dynamics within each specific site and littoral cell.

Current Research Highlights

In 2025, a total of 65 coastal monitoring sites were surveyed, with LiDAR surveys successfully completed at 26 locations and photogrammetry at the other 39 sites. Combined, these sites cover approximately 66 km^2 of coastal land, an area roughly equivalent to 3.5 times the size of the Halifax Peninsula. Within this dataset, three notable sites were selected as case studies for this report from our 2025 analysis: Framboise – Morrison's Beach in Cape Breton, Five Islands Provincial Park, and Waterside Beach Provincial Park, with future longform reports coming for additional sites.

Framboise – Morrison's Beach, Cape Breton

A peninsula located at Morrison's Beach in Framboise, Cape Breton, constrains the beach and its littoral cell. The promontory consists of a fine- to medium-grained sand with glaciofluvial origin. The material is very susceptible to both wave action and aeolian erosion. The bluff crown has shown a landward recession of up to 9 m since the first DNR CMP survey was conducted in 2020. A mass failure occurred between the 2024 and 2025 surveys, leading to approximately 1,575 m^3 of material lost within one year. The high volume of sediment produced from the erosion of this bluff feeds into the local littoral cell, forming the sandy Morrison's Beach we see today. As storms increase, and the sediment source is reduced, the depositional and erosional environment of the whole cell will change, thus impacting longshore drift both locally and further afield.

Five Islands Provincial Park

On the shores of the Minas Basin in the Bay of Fundy, Five Islands is a popular hiking and camping destination known for its dramatic landscapes and macrotidal environment. Bluffs formed from glaciofluvial sediment and till make up the western border of the park, while the southern coast is characterized by 90 m cliffs of Blomidon Formation overlain by North Mountain Basalt, reaching a head at the basalt promontory known as "the Old Wife". Erosion is relatively consistent along the south side of the park with an average rate of 0.4 m/year, calculated using georeferenced air photos dating back to 1964. The rate of erosion along the loose sediment glaciofluvial and till side of the park varies greatly, dominated by mass failure events. The most significant area of erosion is located directly north of the Old Wife, where consistent mass failures has resulted in a 23.5 m setback at the bluff crown and approximately 16,000 m^3 of sediment lost between 2019 and 2025 (Figure 3).

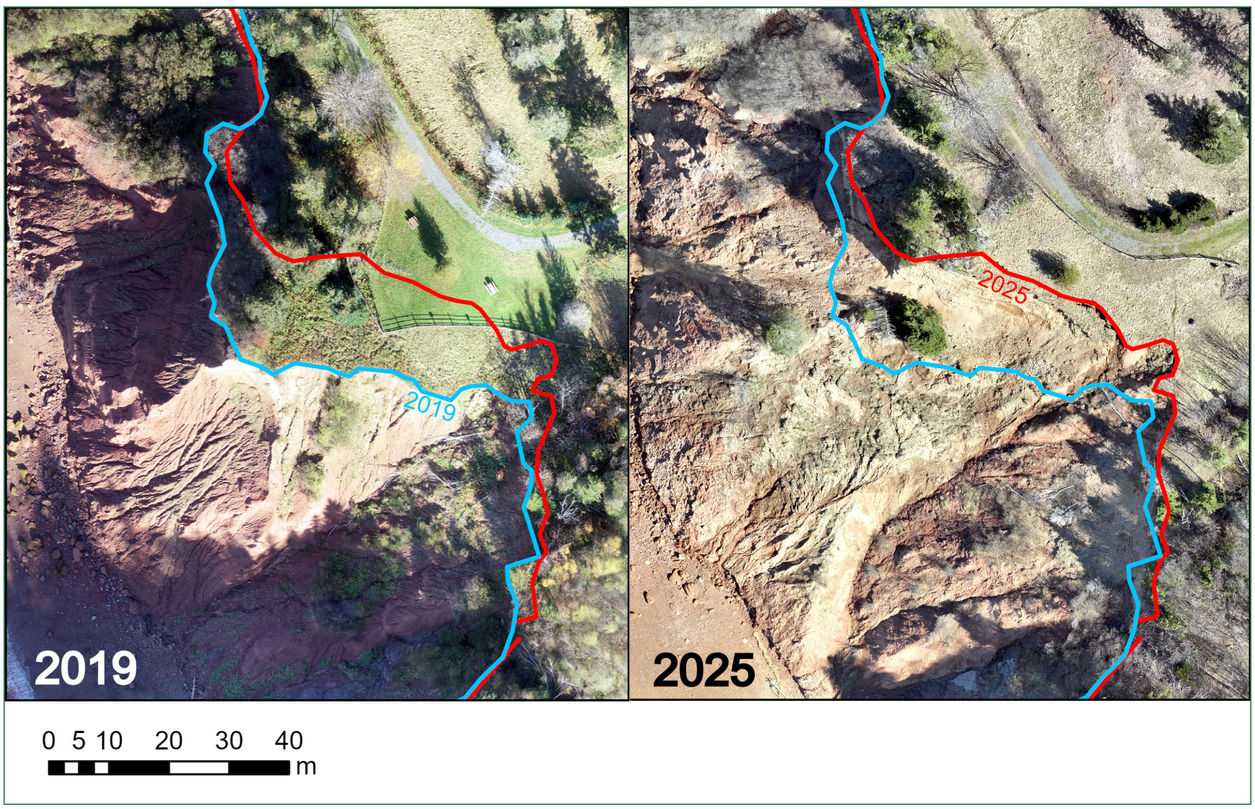

Figure 3. Nadir images of mass failure at Five Islands Provincial Park in 2019 (left) and 2025 (right) with bluff edge indicated for each year. Frequent landslides has resulted in over 20 m of setback in 6 years.

These failures are driven by a combination of factors. The base of the cliff, made up of siltstones and sandstones of the McCoy Brook Formation, is undercut by wave action at high tide. Meanwhile, the overlying Quaternary sediment is easily eroded, evident by rills formed from runoff and groundwater seepage, plus a fault in the bedrock creates a plane of weakness. Given these conditions, this section will continue to experience rapid erosion through rockfalls and rotational landslides.

Waterside Beach Provincial Park

Waterside Beach is constrained by headlands, divided in the middle by a bedrock outcrop overlain by a bluff of poorly sorted sandy to gravelly unconsolidated sediment. For this case study, only the littoral cell consisting of the eastern side of the beach was analyzed. Between 2019 and 2025, the shoreline of the beach advanced as much as 16 m with an elevation gain of up to 3 m in the foreshore (Figure 4). Additionally, 3D models created from the photogrammetry surveys show seaward dune migration averaging 1.3 m/year. The beach is primarily fed by sediment eroded from the bluffs at the headland and in the centre of the beach. Bathymetric maps show an anticline in the exposed bedrock of the seafloor offshore Waterside, while provincial bedrock geology maps provide further evidence this site sits at the hinge of a fold axis. This structure creates a trap for sediment transported shoreward, further feeding the beach and allowing sediment to accumulate.of 0.4 m/year, calculated using georeferenced air photos dating back to 1964. The rate of erosion along the loose sediment glaciofluvial and till side of the park varies greatly, dominated by mass failure events. The most significant area of erosion is located directly north of the Old Wife, where consistent mass failures has resulted in a 23.5 m setback at the bluff crown and approximately 16,000 m^3 of sediment lost between 2019 and 2025.

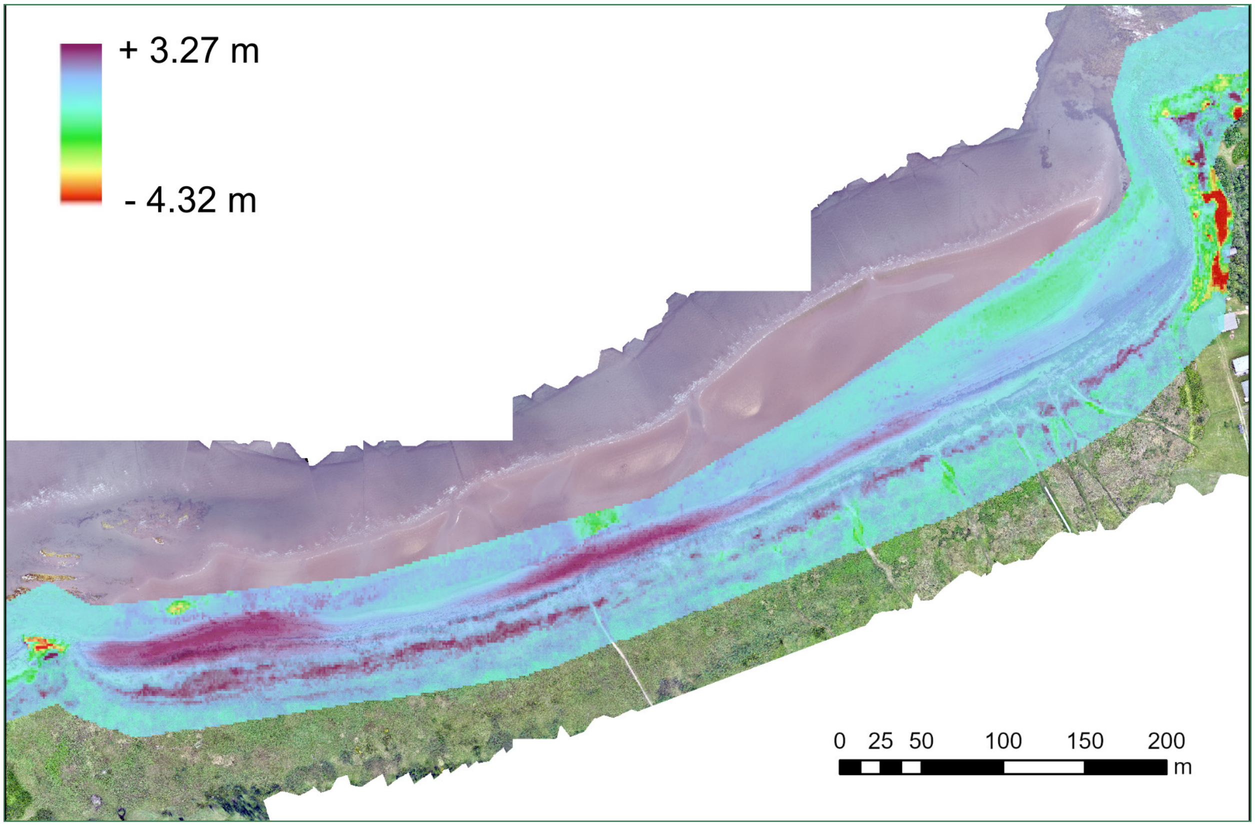

Figure 4. Nadir image of Waterside Beach Provincial Park with surface difference layer. The surface difference shown is between 2019 and 2025, with red representing erosion (sediment loss) and purple representing accretion (sediment gain).

Outreach

In 2025, the Coastal Program geoscientists supported science communication by delivering 15 outreach presentations to a broad spectrum of stakeholders across Nova Scotia. These engagements facilitated an exchange of geoscience data and interpretations between DNR and government, academic, and community partners. A notable takeaway from these outreach events included DNR geoscientists providing technical expertise to researchers and coastal stakeholders to develop accessible geoscience projects and frameworks, including the implementation of 'CoastReach', community-based monitoring stations, across Nova Scotia. The team participated in high-profile public forums, including the Museum of Industry Climate Conversation Series and Parks Canada and Waterfront Baddeck community sessions. Presentations were delivered to the Climate Change Task Force, Parks Canada staff, and local community members in a Demystifying Climate Adaptation event, focusing on translating complex geomorphological data into actionable adaptation strategies.

Outreach efforts in 2025 also extended into multi-disciplinary and global geoscience leadership. Solidifying Nova Scotia's position as a global leader in coastal geoscience, the historic Thinkers Lodge in Pugwash convened its second international summit, where DNR geoscientists joined a leading cohort of researchers from across Canada and as far afield as Australia to advance collaborative discourse on coastal dynamics and erosion mitigation.

Future Work

To ensure the 2025 field data is accessible and transparent, the program is developing an ESRI Experience Builder platform. This interactive interface will host site-specific StoryMaps, allowing the public, policymakers, and stakeholders to visualize coastal changes and interpretations with geospatial data across all monitoring sites in Nova Scotia.

Monitoring will resume in Spring 2026, with a dual focus on closing data gaps by prioritizing sites not surveyed during the 2025 season and prioritizing stakeholders by addressing specific areas of concern identified by communities and government partners. Coastal geoscience outreach will also continue to be a core priority for our team in 2026.

Furthermore, the coastal monitoring program is building toward a comprehensive land-to-sea monitoring framework. Future efforts will move beyond surface geomorphology to include sub-surface and underwater mapping that will integrate bathymetry and stratigraphic interpretations to provide a more thorough holistic understanding of the littoral system. By linking onshore erosion with offshore sediment transport, the CMP aims to create high-resolution models for shoreline migration and long-term geohazard potential. Ultimately, this multidisciplinary approach will provide the technical foundation for evidence-based provincial coastal policies and infrastructure protection guidelines.

Acknowledgements

We are grateful to our dedicated summer student, Émilie Snow (Acadia University), for her hard work and contributions to the coastal program and research during the 2025 field season.

Finally, we would like to acknowledge the support and collaboration of our colleagues and partners, whose efforts have been instrumental in advancing coastal research and fostering collaborations.

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Geographic Information System Administration Activities for the Geological Survey Division (2025 – 2026)

A. C. MacKay Bryan

The Geographic Information System Administrator is responsible for developing and maintaining the Geoscience and Mines Branch (GMB) Geographic Information System environment, as well communicating data to the public through interactive web applications.

Infrastructure Modernization

The existing GMB ArcGIS Enterprise infrastructure is currently running version 10.4. A new 12-server, multi-tier, modernized ArcGIS Enterprise system was built alongside the legacy environment and completed in March 2025. As part of this upgrade, two SQL database servers were also implemented.

These new servers support the transition from file geodatabases to a centralized enterprise database system. Data migration is currently underway, with the Drillhole, Mineral Occurrences (MOD), and Abandoned Mines Openings (AMO) datasets successfully migrated to date. In parallel with migration efforts, new data schemas are being developed to ensure the system is intuitive, efficient, and scalable for future use. The new Fisher system will operate alongside the legacy environment until its planned retirement in 2026.

Web Applications

ArcGIS Dashboard

An ArcGIS Dashboard was developed to support drill core results from the Geochemical Characterization of Historical Drill Core Throughout Nova Scotia project, which was conducted with funding from the Critical Minerals Geoscience and Data (CMGD) initiative (Figure 5). It was first launched at the Prospectors and Developers Association of Canada (PDAC) convention in 2025 to showcase new geochemical analysis results. Phase two drill results have now been received and will be incorporated into the dashboard, with a full release planned for 2026. It provides an interactive display of Nova Scotia’s critical and strategic minerals alongside their associated geochemical data, overlaid on the province’s bedrock geology. This tool enables users to explore and interpret complex datasets in a clear, spatially integrated format.

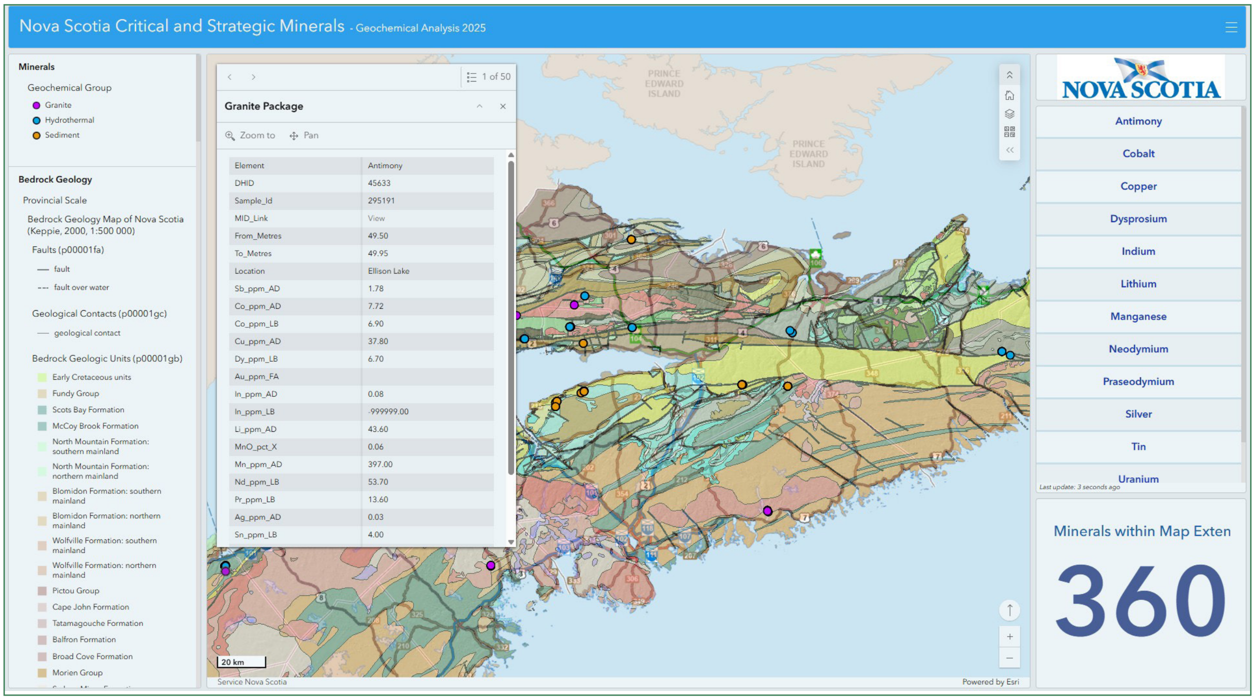

Figure 5. Nova Scotia Critical and Strategic Minerals Dashboard.

ArcGIS Experience Builder

Work has begun to migrate our existing web applications, to ERSI's ArcGIS Experience Builder. With this new application, we can transform how geoscience information is delivered to the public by moving beyond static maps to fully interactive, user-centered web applications. By seamlessly integrating maps, data, and storytelling into a single, intuitive interface, Experience Builder makes complex geological information more accessible and engaging for everyone, from industry professionals to students and the public. Its flexibility and responsive design allow us to tailor applications for a wide range of uses, from showcasing mineral resources to communicating environmental insights in real time, ultimately enhancing transparency, supporting better decision-making, and strengthening public understanding of our geoscience work

The Nova Scotia Critical and Strategic Minerals Atlas is out first application to be built within Experience Builder (Figure 6). It is an interactive, user-friendly web application designed to inform and engage the public. It enables users to explore which minerals have been identified as critical or strategic in Nova Scotia, along with the historical and industrial contexts that define their importance. The Atlas integrates the Province's Mineral Occurrences Database (MOD), providing access to over 3,200 metallic and non-metallic mineral records across Nova Scotia ranging from small occurrences to defined deposits with records being added and updated continually. Occurrences are filtered by status, from deposits through to past producers. Secondary commodity locations are also highlighted. When a user clicks on a location, detailed site information appears, including geological attributes and associated data and users can directly access the MOD report for that occurrence.

Each commodity includes a brief synopsis of their respective mineralogical properties, geological environment, and notable occurrences within Nova Scotia. The application also highlights how each mineral contributes to both Nova Scotia's economy and broader global industries.

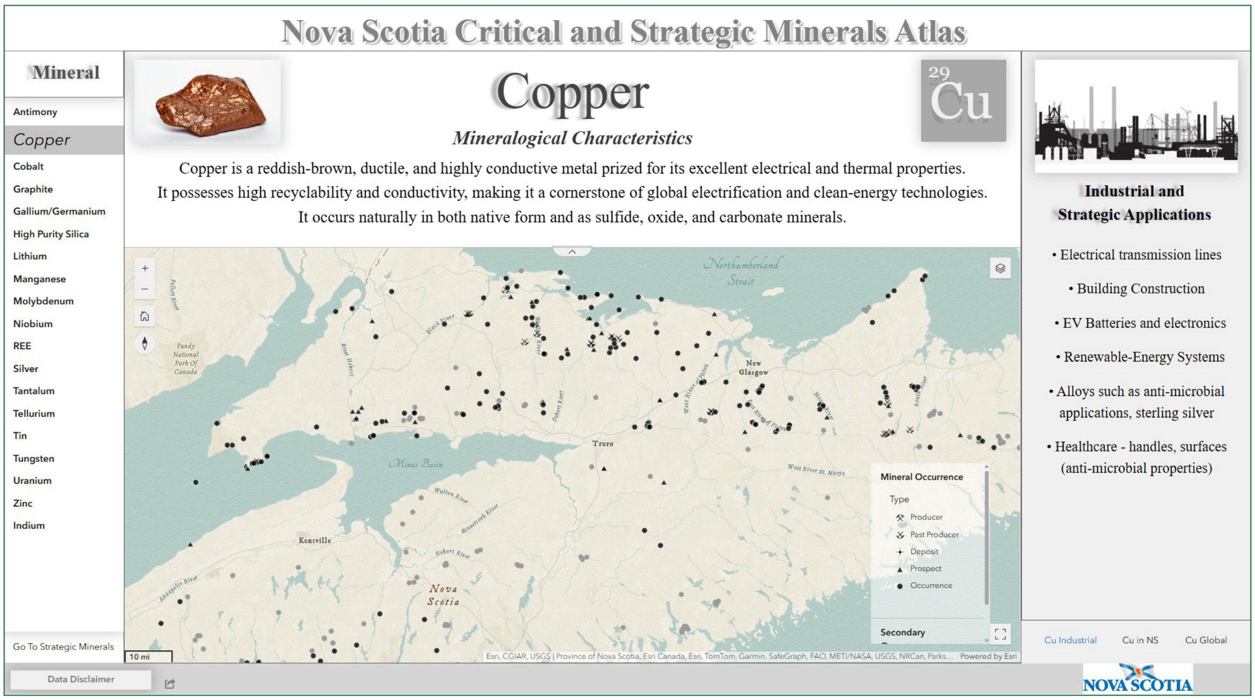

Figure 6. Nova Scotia Critical and Strategic Minerals Atlas.

Progress and Activities Report for the Nova Scotia Mineral Occurrence Database, 2025–2026

K-D. MacRae

The Geological Survey Division (GSD) of Nova Scotia's Department of Natural Resources maintains the Nova Scotia Mineral Occurrence Database (MOD), a digital inventory of metallic and industrial mineral occurrences within the province. The MOD provides a standardized compilation of geological information used to support mineral exploration, research, land-use planning, and government programs.

For GSD purposes, a mineral occurrence is defined as a location where naturally occurring concentrations of minerals, rock, or surficial material exceed typical background levels and are considered to be of geological or economic interest. Each record includes occurrence location, primary commodities, identified minerals and alteration types, geological descriptions, summaries of previous work, available geochemical analyses, and references to assessment reports and maps. The database is maintained as an evolving inventory through compilation of historical data, incorporation of new information, and field verification.

During the 2025–2026 fiscal period, work focused on modernization of the MOD through migration to a centralized server environment. Data transfer and restructuring of the database architecture are currently underway to improve end user accessibility, internal management, editing workflows, and long-term data stability. Release of the updated database platform is anticipated later in 2026.

Approximately 90 new mineral occurrences were added to the MOD during the reporting period. Existing records were reviewed and revised to improve positional accuracy, commodity attribution, and geological descriptions. At present, the MOD contains more than 3,300 mineral occurrences and over 2,000 geochemical sample locations. These totals do not represent all known occurrences in the province, and compilation work is ongoing. The database continues to be updated as new information becomes available.

Work during the reporting period also included development of standardized classification methods for mineral occurrences. New database fields for deposit group and deposit type were introduced and incorporates elements of the mineral deposit classification system outlined in Hofstra et al. (2021). Initial efforts carried out by the GSD focused on major past-producing deposits and historically significant occurrences and will be expanded to additional records in future updates. As updates continue, many mineral occurrences are expected to remain unclassified due to insufficient geological data or contextual information required to confidently assign a deposit model.

The bibliographic component of the MOD was substantially improved during the reporting period. References previously recorded as text citations were linked to available digital assessment reports and publications. Hyperlinks were added for more than 2,000 occurrences, providing direct access to supporting documentation through the database interface. These updates will be included in the next public release. The author gratefully acknowledges Carson Bowering for their assistance with this work.

Field visits were conducted to verify selected mineral occurrences, with priority given to sites associated with recent exploration activity or limited historical documentation. Photolog documentation was initiated to provide visual records of occurrence sites. Photologs consist of site photographs accompanied by brief descriptive summaries and are being prepared for integration into future database releases.

Upcoming work will focus on further standardization of mineral occurrence data. Planned initiatives include development of consistent inclusion criteria based on geological and geochemical thresholds, with evaluation of methodologies used by the Ontario, Manitoba and Québec geological surveys. Formal definitions distinguishing mineral occurrences, prospects, and mineral deposits will also be established to improve classification consistency and interoperability with provincial and federal geoscience datasets.

Ongoing development of the MOD improves access to standardized geological information and supports mineral exploration and resource assessment activities in Nova Scotia. Enhancements completed during the reporting period improve data consistency, accessibility, and spatial interpretation for industry, government, and research users.

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Drill Core Library Report of Activities, January to December 2025

A. MacKay and I. Aikens

Overview

2025 was another busy and productive year at the Nova Scotia Drill Core Library, marked by strong client engagement, facility improvements, and continued progress on new initiatives. Activities throughout the year focused on maintaining safe and effective access to core materials, supporting research and exploration, and improving long-term infrastructure and services.

Staffing and Client Services

In July, the Department hired a dedicated Client Services Coordinator. Core access requests are now handled through the Drill Core Library Access Request email: drillcore@novascotia.ca

Clients are encouraged to include as much information as possible when submitting requests, ideally including drill core ID, drill hole name, year drilled, and the company responsible for drilling. Providing clear and complete requests helps staff streamline client visits and improves overall service efficiency.

Client Use

Client engagement remained strong throughout the year. Staff supported client access to approximately 54,311 m of drill core and drill cuttings, representing an estimated $8.1 million in replacement value. This represents the largest amount since records began in 2022. A summary of client activity, including total client days, samples collected, and replacement value of accessed materials, is presented in Figure 7.

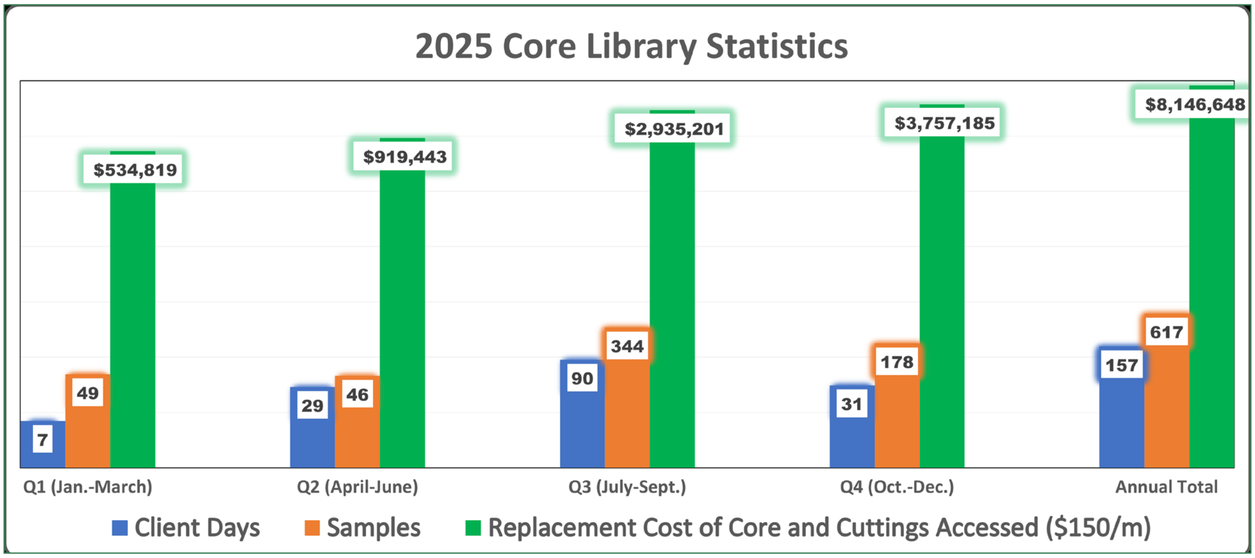

Figure 7. Drill Core Library client activity summary for 2025, including total client days, samples collected, and estimated replacement value of materials accessed.

User Groups and Research Activities

Clients accessing the Drill Core Library represented a mix of exploration, government, and academic users. Academic highlights included a PhD thesis investigating the carbon capture potential of several sedimentary units in Nova Scotia. The library also provided coal samples to Dalhousie University battery researchers and supported Geological Survey of Canada staff conducting palynological studies to improve age constraints across the Maritimes Basin.

User group activity, categorized by the primary objective of each visiting group, is summarized in Figure 8.

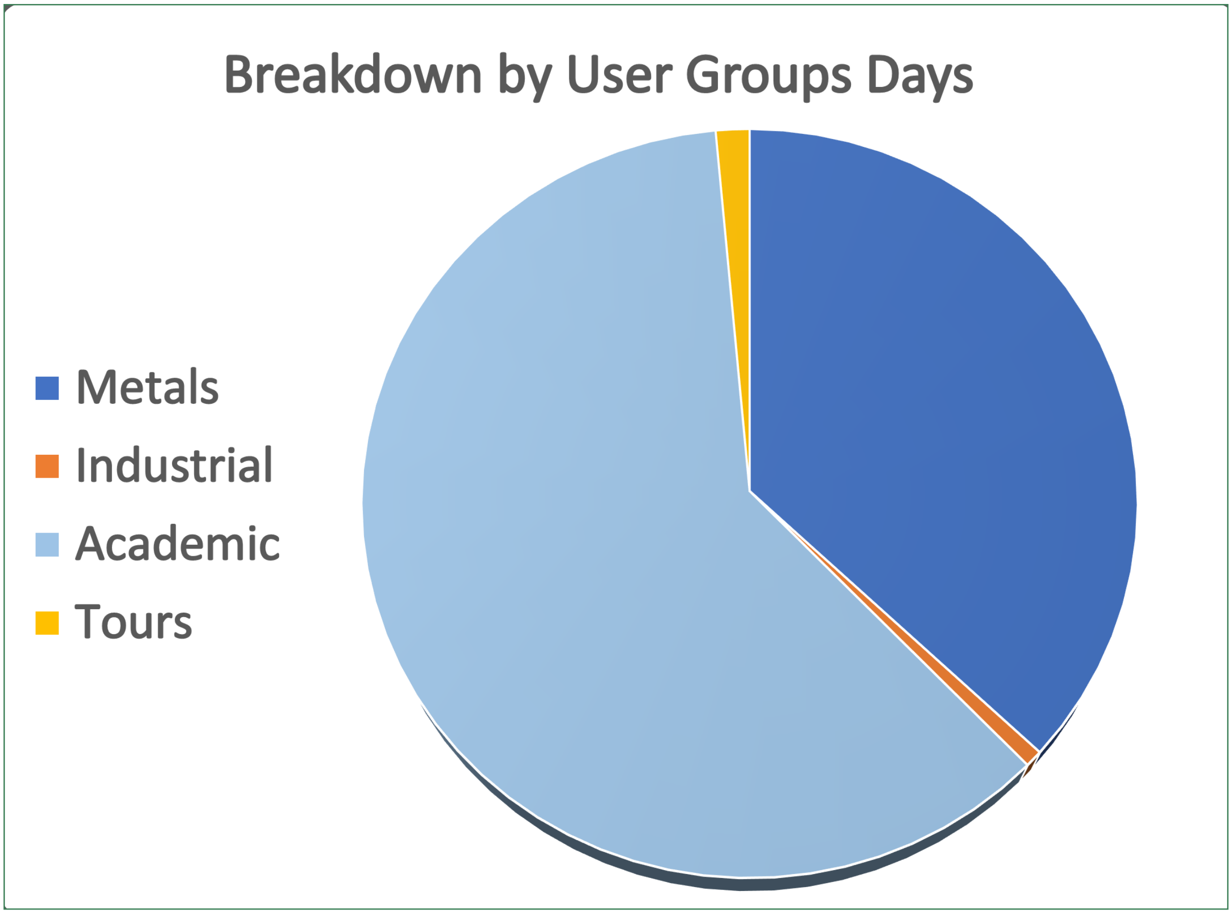

Figure 8. User group days categorized by the primary objective of each client group's visit to the Drill Core Library.

Mineral Interest Trends

Base metals, copper (Cu), lead (Pb), and zinc (Zn), continued to represent the largest proportion of mineral-related activity at the Drill Core Library during the reporting year. A detailed breakdown of metal interests by drillhole viewed is presented in Figure 9. Other non-mineral-related interests are grouped under "OP" (Other Purposes).

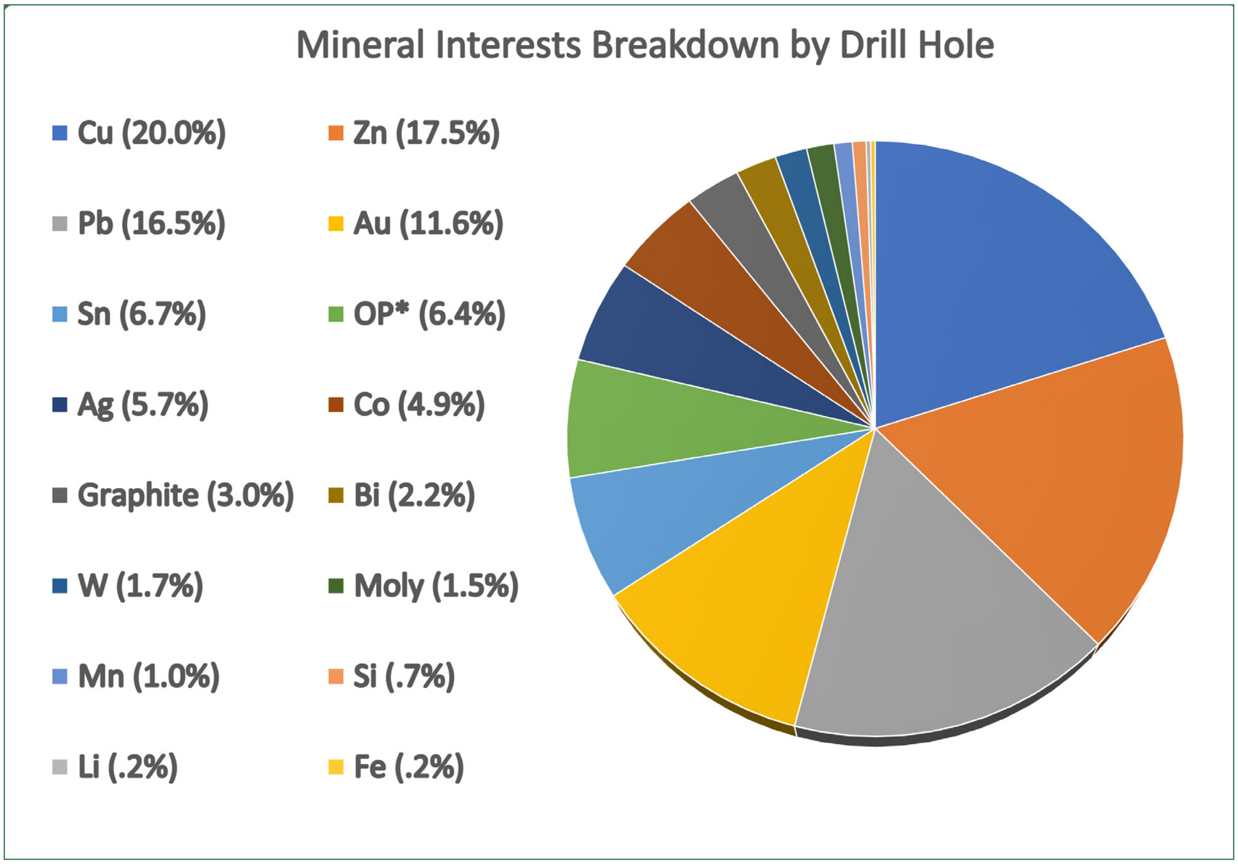

Figure 9. Mineral interests' breakdown by drill hole viewed at the Drill Core Library (*OP = other, non-mineral-related interests).

Facility Safety and Infrastructure Improvements

Scheduled energy-efficiency upgrades were completed in late spring with the replacement of several end-of-life systems. This work included the installation of new windows in the main office building, upgrades to heat pump systems, and the replacement of more than 400 light fixtures with LED lighting across the warehouse spaces. These upgrades have improved both energy efficiency and working conditions within the facility.

Presentations and Professional Engagement

The year began with a successful speaker series held in partnership with the Museum of Industry as part of their Climate Conversations Series. We would like to thank the museum for putting on the series as well as speakers John Waldron, Maureen Matthews, and Mitch Maracle for their excellent presentations. Respectively, the topics were Nova Scotia Tectonics and Climate thru Geologic Time, Geohazards in a Changing Climate and the Keeping Pace with the Sea: Monitoring Coastal Erosion in a Changing Climate. These talks were well attended and provided valuable opportunities to connect geological research with broader public conversations on climate change.

Staff presented at the Mineral Resources Forum in November, highlighting the role of the Drill Core Library in supporting exploration, research, and data preservation in Nova Scotia.

A Progress Report on the Geochemical Characterization of Historical Drill Core Throughout Nova Scotia (2025-2026 update)

K-D. MacRae

Introduction

Nova Scotia has a long history of critical mineral production and continues to demonstrate potential to contribute to Canada's critical mineral supply. Through the Critical Minerals Geoscience and Data Initiative (CMGD), supported by Natural Resources Canada and the Geological Survey of Canada, the Geological Survey Division of the Nova Scotia Department of Natural Resources continued geochemical characterization of historical drill core during the 2025–2026 fiscal year to improve assessment of critical mineral potential across the province and expand publicly available geochemical datasets.

Summary of 2024-2025 Program

As previously reported, the 2024–2025 program included analysis of 601 samples from 99 drillholes, with results released in February 2025 as a digital data product (DP ME 550), interactive map application, and online dashboard presented at the PDAC Convention in March 2025 (OFR ME 2025-1).

Samples were selected to enhance historical drilling records associated with known mineral occurrences in Nova Scotia, modernize legacy geochemical datasets, and identify critical minerals not routinely analyzed in earlier exploration programs. Samples represented a range of geological environments and mineral deposit types throughout the province.

2025-2026 Program

Building on the work completed in the previous year, 465 additional samples were collected from 31 drillholes and shipped to AGAT Laboratories in Calgary, Alberta for sample preparation and analysis (Figure 10). All samples were analyzed by lithium borate fusion (whole rock analysis) with X-ray fluorescence (XRF) to determine their major element oxide composition (AGAT package 11-320). A four-acid digest followed by

ICP-OES/ICP-MS for metal and trace element compositions (AGAT package 201-071), and lithium borate fusion with an ICP-MS finish for metals and full rare earth element compositions (AGAT package 201-078) was also completed. Select samples were analyzed by ICP-OES via fire assay for Au (AGAT package 202052).

Deposit specific certified reference materials (OREAS) from The AnalytiChem Canada (formerly SCP Science) of Baie D'Urfé, Québec, as well as internal, non-certified, standards from the East Kemptville and Walton deposits were included for quality control. In addition, silica sand (SiO_2) from Shaw Resources was used as blank material. Control samples were inserted at a rate of approximately 10%. Samples were cut using the onsite core saw at the Stellarton Core Library when required and were then secured in a plastic bag with a zip-tie and sample tag clearly identified. Sample bags were then placed into larger, labeled rice bags in preparation for shipment to the lab.

Analytical results were received between February and March 2026 and are scheduled to be released for publication in early fiscal year 2026–2027. In addition, refinements to the interactive map application are currently being undertaken. This follow-up phase continued to improve historical datasets surrounding known mineral occurrences.

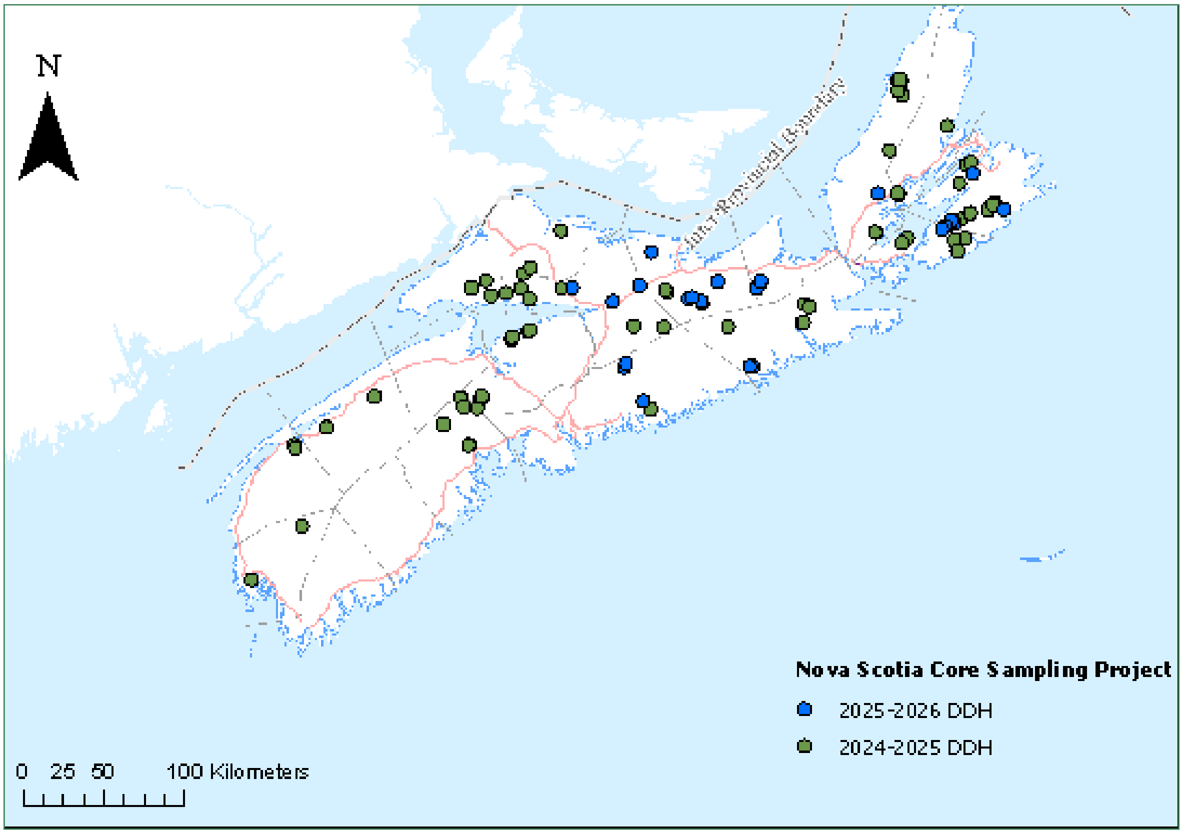

Figure 10. Map of sampled drillhole (DDH) locations across Nova Scotia for the geochemical characterization project. Drillholes sampled during the 2024-2025 campaign are shown in green while those sampled in 2025-2026 are shown in blue.

Acknowledgments

The author would like to acknowledge funding from the Geological Survey of Canada through the Critical Minerals Geoscience and Data Initiative for the opportunity to analyze these materials. In addition, the author would like to thank staff geologist Anna Ryan and contract geologist Neil Beaton for their technical assistance with drill core sampling, which contributed to the successful completion of this project as well as critical minerals specialist Andrew Russell for reviewing incoming results. We also acknowledge the summer students who assisted with core sampling and supported the program throughout the 2025 field season. Special thanks are extended to Stellarton Core Library staff Alex Mackay and Ivan Aikens for facilitating logistics and providing essential support during core library operations.

Surficial Geology Activities

E. Oicle

Surface to Bedrock Thickness Mapping

In 2023, Sediment thickness and bedrock topography maps of southwest Nova Scotia were published (Brushett et al., 2023) advancing our understanding of the bedrock topography, surficial sediment distribution, and sediment thickness of the southwest region of Nova Scotia. Bedrock elevation and surficial sediment thickness data are valuable tools in mineral exploration, aggregate resource assessments, groundwater studies, geotechnical work, and other land-use applications. The continuation of this mapping project will provide stakeholders with valuable information when it comes to planning future work across the province.

Methodologies follow those documented by Brushett et al. (2023) to ensure consistency across maps and digital products. Bedrock-to-topography mapping procedures are outlined by the Ontario Geological Survey and are utilized as a process guide (Gao et al., 2006). Primary data sources include the Drillhole Database (O'Neill et al., 2023), Well Logs Database (Kennedy and Fisher, 2022) and provincial digital elevation models (DEM).

Currently this project is in the quality assurance and quality control (QA/QC) of data phase, focusing on verification of spatial coordinates, true vertical depth corrections of angled drill holes and confirmation of reported bedrock lithologies in water well records. QA/QC is being conducted on a county-by-county basis. Upon completion, data interpolation will be carried out using methods consistent with those applied in the southwest Nova Scotia mapping. The final deliverable will be a provincially integrated surface-to-bedrock thickness map and bedrock elevation map.

Surficial Geology Features Digitization

LiDAR imagery available across Nova Scotia provides a high-resolution framework for identifying and delineating surficial geologic features, supporting the work of DNR geoscientists in mapping geohazards, coastal erosion, and karst terrain. Enhanced characterization of surficial landforms also benefits glacial reconstructions, drift prospecting, geotechnical engineering, and aggregate resource assessments.

LiDAR-based mapping conducted in the Cobequid Highlands by Brushett (2020) demonstrates the effectiveness of this approach in refining previously mapped landforms derived from legacy datasets and field observations. In many areas, LiDAR revealed additional details related to former ice dynamics, enabling improved identification of subglacial landforms (e.g. drumlins, fluted terrain, ribbed moraines) and meltwater features (e.g. meltwater channels, lateral channels). While remote sensing significantly enhances landform interpretation, field validation remains essential to confirm geologic interpretations.

Systematic classification of surficial landforms has direct economic implications, particularly for aggregate resource elevations. The Ministère des Forêts, de la Faune et des Parcs du Québec has demonstrated the link between surficial material types and aggregate potential. They identified kames, kame terraces, eskers, and glaciofluvial deltas as high-potential features due to favourable grain size distributions and minimal processing requirements (Dupuis et al., 2018). Given the diversity and wide range of surficial landforms in Nova Scotia, a comparable classification framework can be developed to identify, characterize, and rank features according to their aggregate resource potential.

The objectives of this project, utilizing remote sensing technology, are to:

- Refine and verify the facies boundaries in the provincial Surficial Geology Map (Stea et al., 1992), with particular emphasis on bedrock exposure delineation;
- Identify prospective surficial aggregate sources through the characterization of surficial landforms;
- Produce and disseminate digital landform datasets for stakeholder and client use.

Provincial-scale characterization of surficial landforms represents a substantial undertaking. Current work is focused on developing and validating mapping methodologies within selected study areas. Expansion to additional areas will commence once characteristics and interpretive criteria are established. Selection of future study areas will be guided by economic relevance, availability of historical data, and social considerations.

Upcoming 2026 Field Season - Expanding Till Geochemistry Coverage in Nova Scotia

Introduction

Glacially derived till accounts for 69% of the total material at surface in Nova Scotia, while exposed bedrock accounts for 10%; the remainder comprises a variety of unconsolidated sediments (Stea et al., 1992). The majority of Nova Scotia has low density coverage of till geochemistry data with notable gaps in data. An understanding of till geochemistry plays a key role in the reconstruction of ice flow history and tracing geochemical anomalies back to their bedrock source.

Across Canada, provincial, territorial, and federal geological surveys have implemented till sampling surveys to evaluate mineral potential in regions covered by glacial sediments (Plouffe et al., 2012). Integrated regional programs also include surficial mapping, sediment thickness modeling, stratigraphic studies, and indicator mineral analysis. This multi-disciplinary approach enhances the accuracy of exploration models and improves regional geological interpretations. Resulting datasets support mineral exploration activities, academic research, regulatory decision-making, and resource management.

Previous Work

The majority of Nova Scotia's till geochemistry datasets originated from programs in the late 1970s and 1980s.The three major till sampling programs that continue to be utilized include:

- 1977-1985: Till Geochemical Survey by the Nova Scotia Department of Natural Resources over mainland Nova Scotia with 1,890 samples (Nova Scotia Department of Natural Resources, 2006a).
- 1984-1989: Regional Till and Rock Geochemical Surveys of the South Mountain Batholith by the Nova Scotia Department of Natural Resources over western Nova Scotia with 2,071 samples (Nova Scotia Department of Natural Resources, 2006b).
- 1986-1989: Seabright Resources Inc. Till and Soil Geochemical Data by the Nova Scotia Department of Natural Resources over the Meguma Terrane Nova Scotia with 4,369 samples (Nova Scotia Department of Natural Resources, 2006c).

The minerals analyzed include precious, base, and critical minerals including Au, Ag, As, Ba, Ca, Cd, Co, Cs, Cu, Cr, Fe, Ir, Mg, Mn, Mo, Ni, Pb, Rb, Sb, Sc, Se, Sn, Ta, Th, U, W and Zn. Despite the utility of these datasets, significant spatial gaps remain across the province. Given the province's emphasis on critical mineral exploration, updating and expanding these datasets is both timely and necessary.

2026 Field Season

The primary objective of the proposed till sampling program for the 2026 field season is to build on these historical datasets. By targeting areas with limited data, sampling will increase our understanding of geochemistry and sediment characteristics within glacial till. The Geological Survey of Canada (GSC) has developed and refined their till survey methods to ensure high quality and consistency of till data which can be compared to other national and provincial datasets. Their till sampling methodology classifies a sample spacing of 4 - 10 km as a low to moderate sample density at a regional survey scale (McClenaghan et al., 2020). Given the spatial distribution of existing samples, a moderate sample spacing is appropriate for identifying underrepresented regions. Delineation of areas lacking adequate spatial coverage were identified by creating a 5km radius around samples from the three major sample programs (Figure 11). The GSC methodologies will be followed to achieve an unbiased and consistent sampling distribution. Subglacial till will be targeted as it has a high suitability for sampling due to its more local provenance and therefore a better representation of bedrock emplaced mineral resources. Standardized procedures will be implemented for, not limited to, sample site selection, sample collection methods, field descriptions, sample preparation, laboratory analysis, and metadata reporting.

Understanding the range and spatial variability of naturally occurring elements within surficial sediments, along with their concentrations, is essential for characterizing surface and near-surface geochemical conditions. Establishing baseline geochemical datasets provides critical context when assessing groundwater chemistry and interpreting environmental conditions. This information supports land-use planning, contaminant evaluation, and future development decisions by grounding them in the inherent characteristics of the local geological environment.

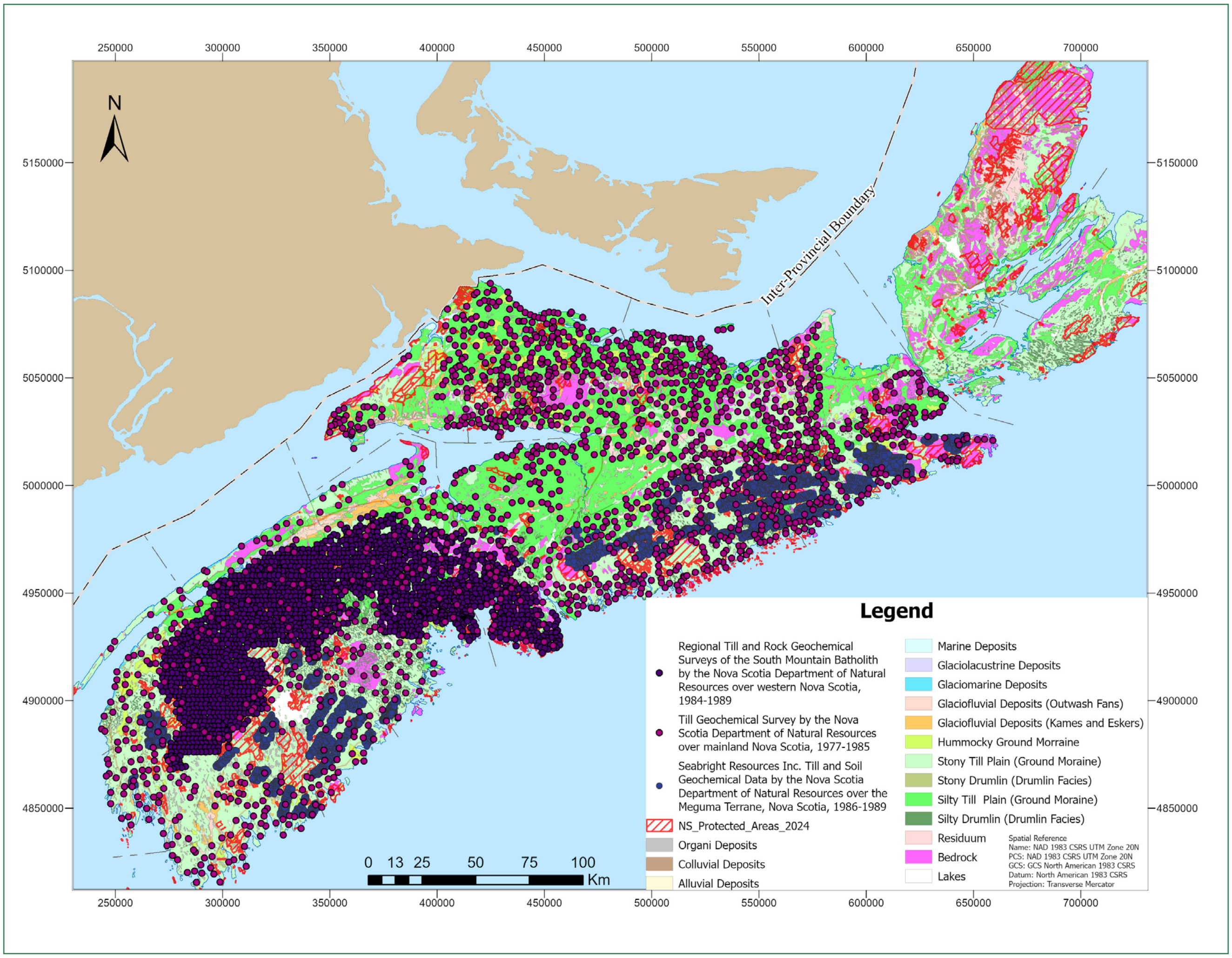

Figure 11. Map of Surficial Geology of Nova Scotia with Regional Till geochemistry sample locations.

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Corporate Geochemical Sample Database Project – Till Geochemistry

J. S. McKinnon

Introduction

Despite the amount of geochemical data available to the public, there is no source for geochemical analysis results organized into a single dataset. This pilot project was initiated with the aim of determining the work needed to integrate till geochemical data into a single data model, with the future goal to expand it to include geochemical analysis of other media types such as rock, sediment, soil, and biological geochemistry. Organizing all geochemical data into a single dataset will provide the Geological Survey Division (GSD) staff, industry, academia, and the public, better access to data to improve their research, decision-making, and understanding of the geology in the province.

The objectives of this project are to (1) merge a subset of till geochemistry sample locations into a single database table; (2) develop a data model that will integrate all associated information for each sample including geochemical analysis results, lithological information about the sample and the environment the sample was taken, and other analysis performed on the sample (e.g. rock or sediment composition, sieve analysis, etc.); (3) create a framework for an application that will serve as a geochemistry portal, in which the public and internal staff can access and query the data so they can find the specific information needed.

This report shows the findings from this pilot project, which includes noting the challenges that arose when dealing with complex data, identifying inefficiencies to streamline the process, and mapping future work that will be done next year to expand the project.

Till Geochemistry Sample Locations

To complete this pilot project efficiently, a subset of the till geochemistry for the province was chosen. The datasets chosen to be included consisted of; (1) three large provincial scale geochemical surveys undertaken in the 1970s and 1980s; (2) a recent regional scale till survey; (3) a subset of geochemical data extracted from assessment reports indexed in NovaScan. The large scale (small area) surveys were chosen because of the large volume of samples taken, the regional scale survey was chosen because of the complexity of the data and the broad range of elements that were tested, and the assessment reports were chosen to provide data from industrial geochemical logs.

The till geochemistry survey data that was included in this pilot project consisted of 9,079 samples, which are listed below, and illustrated in Figure 12 with the Surficial Geology Map of Nova Scotia:

Historical Till Geochemistry Surveys

- DP ME 134, Version 2, 2006, Compilation of Seabright Resources Inc. Till and Soil Geochemical Data by the Nova Scotia Department of Natural Resources over the Meguma Terrane, Nova Scotia, 1986-1989
- DP ME 137, Version 2, 2006, Regional Till and Rock Geochemical Surveys of the South Mountain Batholith by the Nova Scotia Department of Natural Resources over western Nova Scotia, 1984-1989
- DP ME 138, Version 2, 2006, Till Geochemical Survey by the Nova Scotia Department of Natural Resources over mainland Nova Scotia, 1977-1985

Regional Till Geochemistry Survey

- DP ME 502, Version 1, 2018. Till Geochemical Data from the Warwick Mountain Area, Eastern Cobequid Highlands, Nova Scotia, by D.M. Brushett and C.C. MacMullen

Assessment Reports*

AR ME 2010-045	AR ME 2011-101	AR ME 2012-075
AR ME 2010-062	AR ME 2011-105	AR ME 2012-099
AR ME 2010-066	AR ME 2011-119	AR ME 2012-125
AR ME 2010-094	AR ME 2011-120	AR ME 2012-164
AR ME 2011-062	AR ME 2011-122	AR ME 2012-168
AR ME 2011-069	AR ME 2011-123	AR ME 2012-191
AR ME 2011-095	AR ME 2011-135	AR ME 2012-192

*Full listing of assessment reports in References

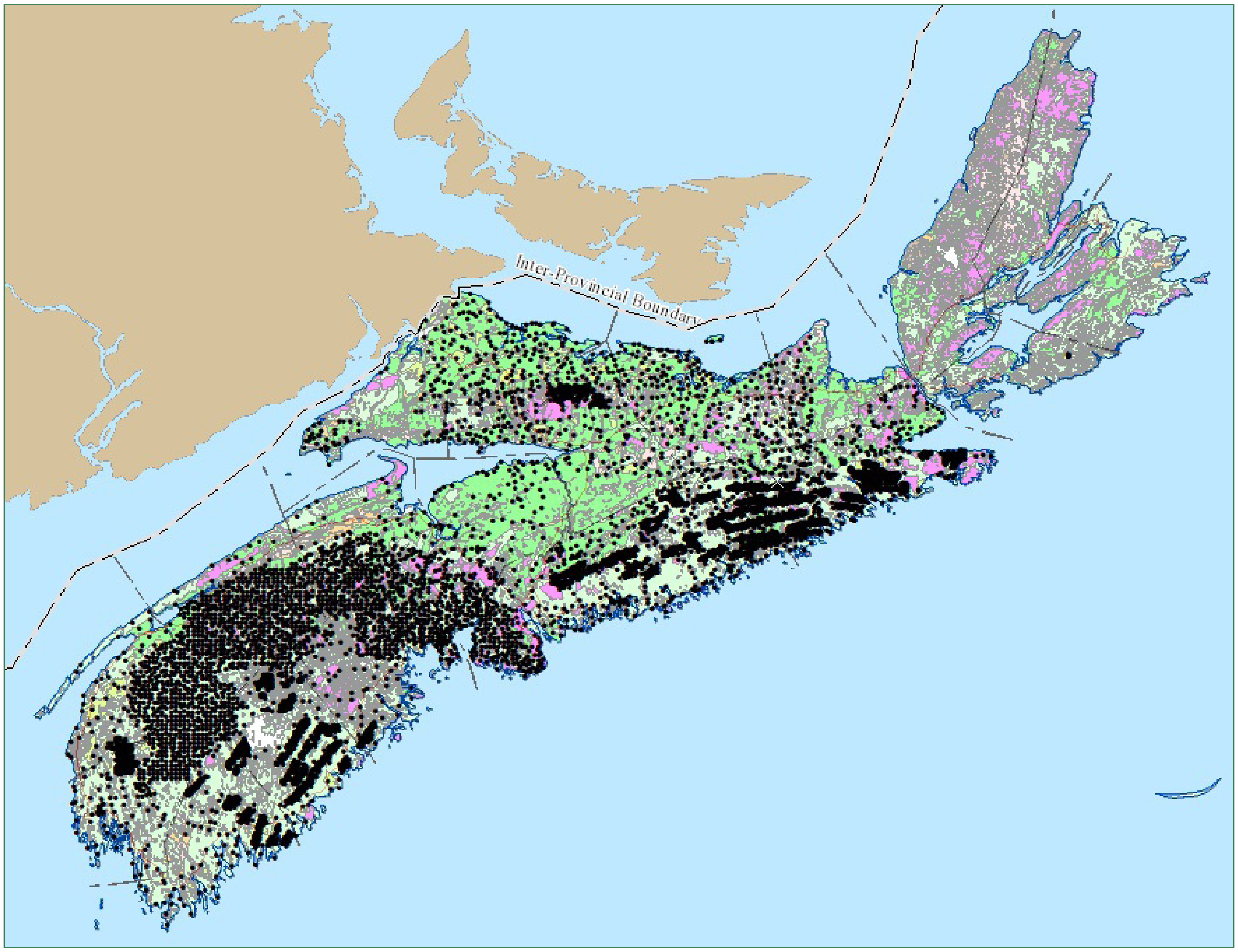

Figure 12. Till sample locations included in the pilot project (n = 9,079), overlain on the DP ME 36 Version 2 (2006) basemap, derived from the Nova Scotia Department of Natural Resources surficial geology mapping (Stea et al., 1992; scale 1:500,000).

Challenges

During this pilot project, a few difficulties arose with combining the data into one source. The biggest issue was dealing with geochemical analysis that involved testing a sample for the same element using differing methods (e.g. Intstrumental Neutron Activation Analysis (INAA) and Total Digestion). This problem was fixed with individual surveys by creating fields in the database table for each method (e.g. Ce_ppm_NA and Ce_ppm_TD). Combining analysis results from multiple surveys into a single table is unsustainable due to the use of multiple analysis methods. As a result, the data model was adjusted to store results in separate, related tables based on testing method.

The data model also had to be adjusted to accommodate till samples that were tested from drill core versus surface sampling to include depth values. Sample analysis results were subdivided by media (surface and drill core) for till analysis and in the future for rock analysis to reconcile downhole rock testing at differing depths. Also adding to the complexity of the data model were other analysis results such as gravel composition and sieve analysis that were performed depending on the media that is being tested, as well as sample preparation information before the analysis. These results, as well as a description of the sample and sampling environment, were subdivided into related tables.

Additional challenges included the need to conduct quality assessments to verify legacy data sourced from outdated formats. Till sampling of the Meguma Terrane especially needs to be cross-checked by evaluating the initial assessment reports and geochemical lab reports to authenticate the results as errors were identified. Lastly, transferring till geochemistry data from the large volume of assessment reports was extremely time consuming, and moving forward should be targeted more towards specific surveys or prospects. Another component is implementing a new data entry template to be used when assessment reports are initially indexed, to streamline the addition of new data.

Future Work

Now that the till geochemistry pilot project has been expanded to incorporate the geochemical analysis of other media (e.g. biological, rock, sediment, and soil), the primary goal for the coming year is to integrate previously released geochemical data from other sampled media into the new data model. Another major objective for the project is to begin creating a Geochemistry Portal dashboard which will provide clients with the ability to search for sample data spatially, query geochemical analysis results by mineral/metal indicators (critical minerals, REE, base metals, precious metals), and also have an option to filter out negative (below threshold) values, as well as standards, blanks, and duplicates used for quality control. These are just some of the features that can potentially be added. Another objective for the year is potentially performing a quality assessment for the Meguma Terrane till survey data.

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LiDAR Project

J. C. Poole

Introduction

The Geological Survey Division (GSD) has recognized the importance of Digital Elevation Models (DEMs) as a tool for bedrock, surficial, and geohazard mapping for over 20 years. DEMs traditionally have been used to identify topographic features and drainage systems, but they can also help identify geological structures, lithological units, and surficial features. Stereo photogrammetry was the principal tool to create DEMs but has been replaced by Light Detection and Ranging (LiDAR) technology. LiDAR has advanced significantly over the past 15 years to create high resolution DEMs (1 m or less) with exceptionally clean bare-earth models. Table 1 summarizes some of the DEMs and geoscience products created by the GSD from DEMs over the past 20 years.

The Province of Nova Scotia now has full 1 m resolution LiDAR coverage, achieved by integrating individual surveys acquired over the past 15 years. (NS Data Locator - Elevation Explorer). The detail of the geological features that can be resolved between a 1 m LiDAR DEM and a 20 m DEM is quite remarkable (Figure 13). This positively impacts geological mapping and the next generation of bedrock and surficial maps.

Table 1. DEM and Shaded Relief Image products produced by the GSD over the years.

Product ID	Title	Resolution	Description
DP ME 55 2000 (v1)	Enhanced Digital Elevation Model of Nova Scotia	20 m, stereo photogrammetry plus other data	A 20 m hydrologically correct Digital Elevation Model for Nova Scotia.
DP ME 56 2003 (v1)	Shaded Relief Images of Nova Scotia	25 m from DP ME 55	Images generated with 8 Azimuths (000, 045, 090, 135, 180, 225, 270, 315) at 3 Altitudes (30°, 45°, 60°) and two Z-Factors (5 and 10).
DP ME 455 2010	Shaded Relief Image of the North Mountain Area, Nova Scotia	5 m LiDAR	Azimuth = 315 and Altitude = 45°
DP ME 447 2011	Surficial Geological Data of the Halifax Metropolitan Area	2 m LiDAR	Azimuth = 315°, Altitude = 45° and Z-Factor = 5
DP ME 479 2012	Shaded Relief Images of the Cobequid Highlands Area, Nova Scotia	1 m LiDAR	144 shaded relief images using 8 Azimuths (000, 045, 090, 135, 180, 225, 270, 315) and 3 Altitudes (30°, 45°, 60°) and two Z-Factors (5 and 10).

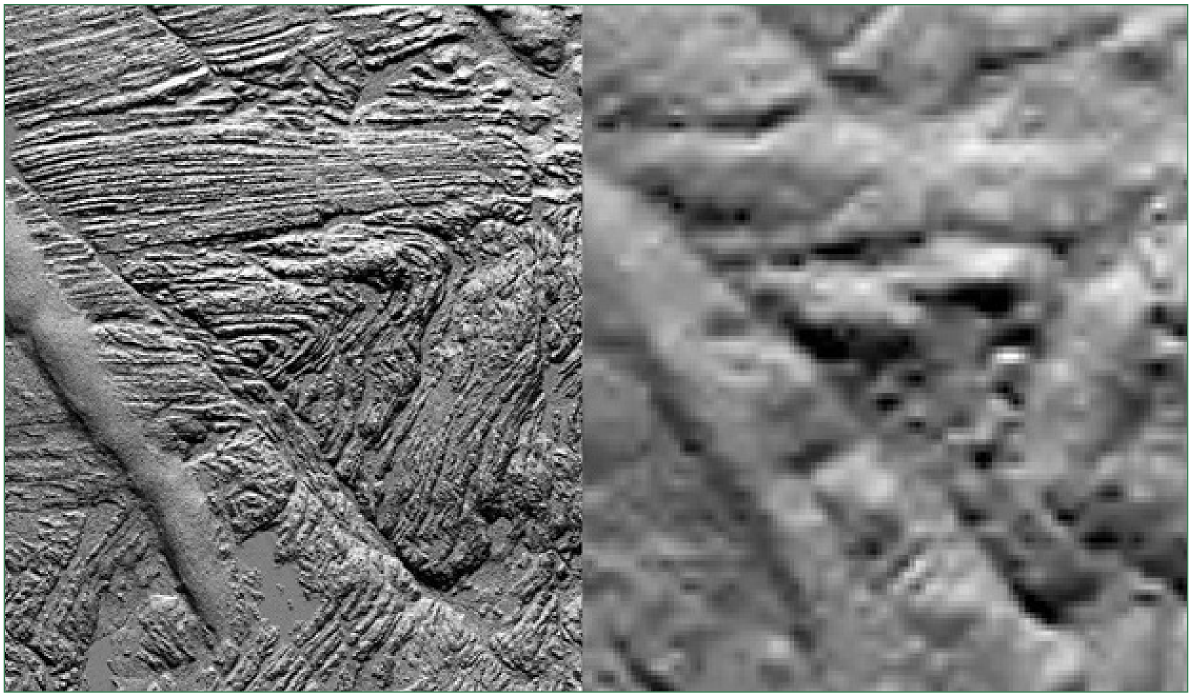

Figure 13. A comparison of a hillshade image derived from a 1 m resolution LiDAR dataset (left) and a 20 m DEM (right). The details of fold structures and faults are far easier to resolve in the left hillshade image derived from the 1 m DEM.

Purpose

The purpose of this project is to make LiDAR DEMs and/or products generated from the DEMs available to staff and clients. This will involve:

1. Reviewing and compiling all LiDAR data for the province, and determining a practical level of detail for regional or project area mapping – current resolutions: 1 m, 2 m, and 5 m.

2. Creating ArcGIS Pro hillshade projects from clipped LiDAR datasets to meet the project needs of staff. This will develop workflows that can be standardized in the future.

3. Applying other raster processing and machine learning tools to extract features from the LiDAR DEMs and create vector features (polygons). Examples include karst and other surficial geology features provincewide.

4. Updating or creating new hillshade image atlases using classic and multidirectional models for the province, and determining the best way to deliver this information, e.g. static downloadable products or web services.

Strategic Relevance

Bedrock and surficial geology maps are fundamental to what the GSD does. Improved maps help us make more informed decisions. For new projects, LiDAR provides staff with advance knowledge of field conditions, enabling more efficient use of time. Many of our legacy geologic maps were created using paper topographic maps. Using high resolution LiDAR, we can more precisely show the size, shape, and location of geological features, and define new features that were not recognized previously (Figure 14).

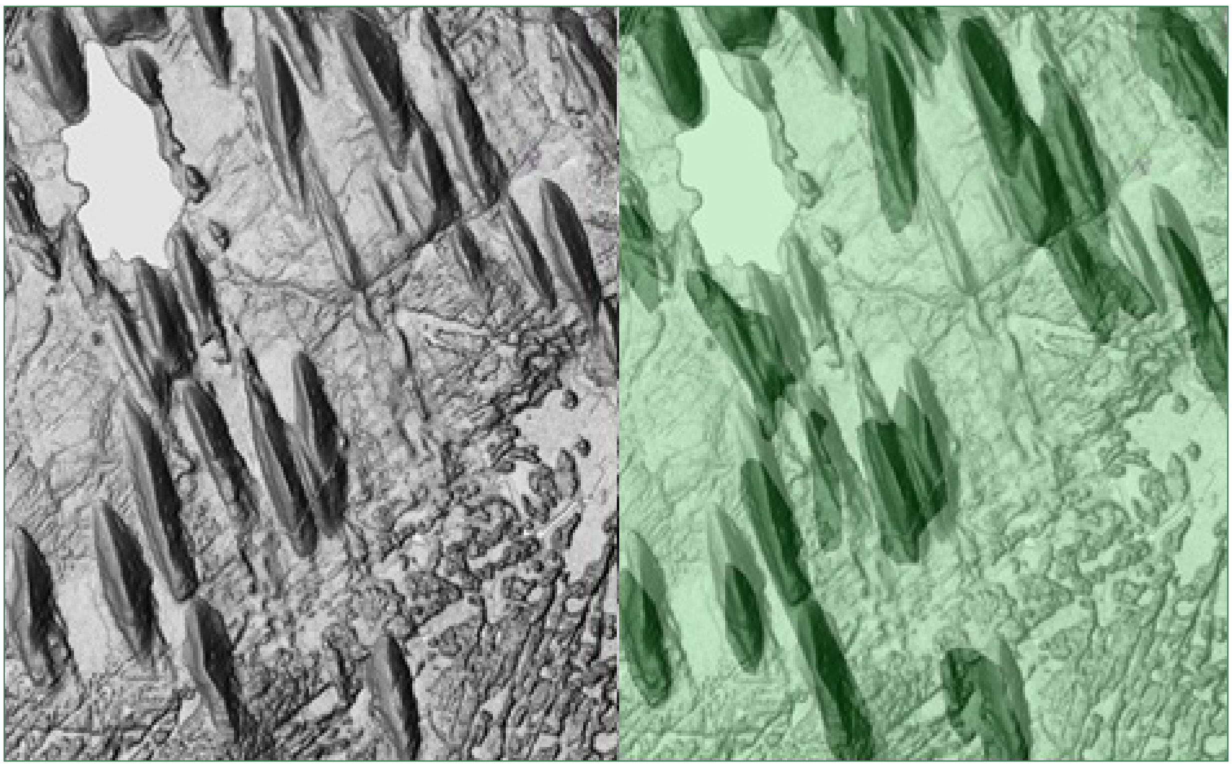

Figure 14. The left image shows a hillshade image of drumlins in southwest Nova Scotia. The right image shows the same area with an overlay of legacy mapped drumlin polygons created from old topographic maps. There is clearly an offset, size discrepancies and missing features. LiDAR can help “fine tune” the shape, size and location of these features.

Methodology and Preliminary Results

Practical case studies using staff geologists’ project areas have been conducted by selecting LiDAR surveys and clipping the data to the designated project area. LiDAR survey data can be large and clipping it to smaller project areas can make processing and analysis more efficient. An initial assessment and application of hillshade parameters by GIS staff and one or two revisions in consultation with staff, can create useful results. The parameters that go into this modelling are demonstrated in OFM 2004-001.

Preliminary results indicate that there is a place for products derived from multidirectional hillshade models as well as one directional classical hillshade models depending on the topography and the geology in a study area. Multidirectional hillshade models provide a general unbiased overview of an area. Symmetrical depressed features (e.g. sinkholes) standout using a multidirectional hillshade model (Figure 15). When directional geologic features (e.g. bedding, folds, faults) are known, classical hillshade models oriented orthogonal or at high angles to these features are useful. If folds are suspected, hillshades aligned with fold axes can help highlight hinge zones. Depending on the topography in an area, varying the vertical exaggeration (Z-Factor) can also be useful and using Z-Factors up to 5 or 10 can be valuable. (Figure 16).

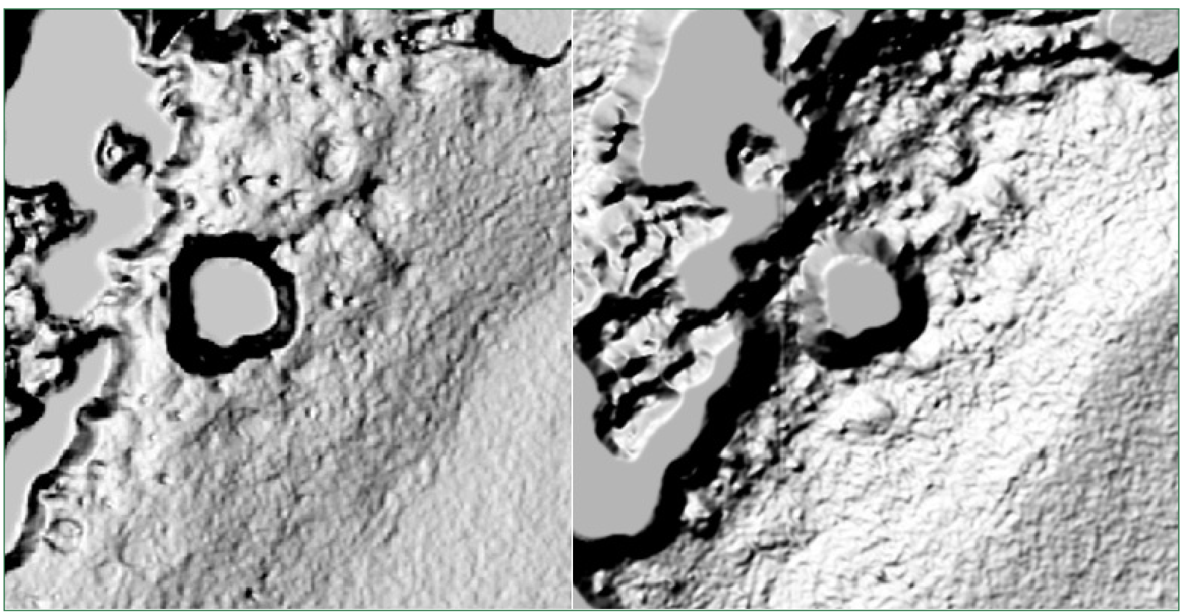

Figure 15. The left image shows a multidirectional hillshade image of sinkholes east of Black Lake in the Oxford area of Nova Scotia. The right image shows the same area with a classical single direction hillshade image (Az 135, Angle 45, Z-Factor 10). The left multidirectional hillshade image results in shadows that follow the inner slope of the sinkhole depression and make it stand out more than the right single directional hillshade image where a shadow is only partially visible in the sinkholes.

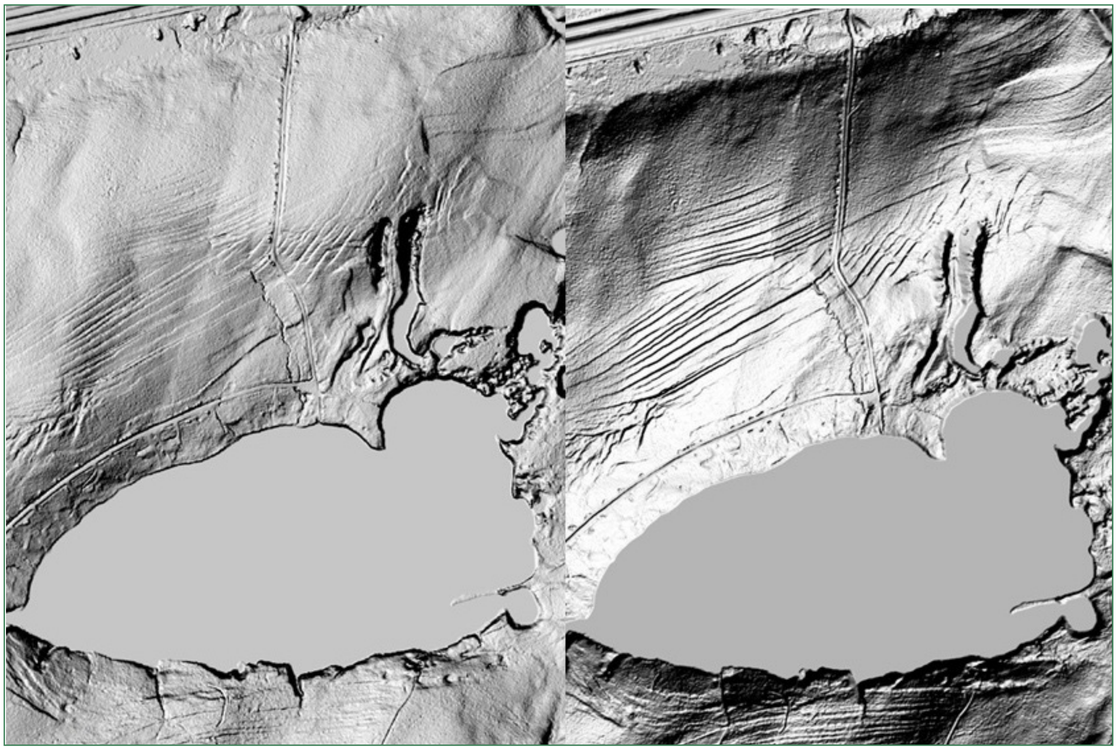

Figure 16. The left image shows a multidirectional hillshade image of the geology north of Black Lake in the Oxford area of Nova Scotia. The right image shows the same area with a single direction classical hillshade image (Az 135, Angle45, Z -Factor 10). The NE- SW trending stratigraphy stands out in the right image with an unconformity clearly visible north of the lake. The stepped nature of the beds is only ~1 m.

Next Steps

The next steps in this project will be to investigate raster processing and machine learning tools to extract features from the LiDAR DEMs and create vector features (polygons). An example would be creating filters and models to automate finding karst topography and sinkholes.

Opportunities will also be explored to make general products from this work available to staff and clients. This includes updating or creating new hillshade image atlases for the province using both classical and multidirectional algorithms. The optimal delivery method (e.g. static downloadable products or web services) will need to be determined, as the large file sizes of high resolution 1 m LiDAR products, compared to older 25 m products, present a significant challenge.

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Geophysical Data Processing, Compilation and Interpretation – Provincial Compilation Project

K-D. MacRae

Overview

Between January and March 2026, the Geological Survey Division (GSD) of the Department of Natural Resources carried out a provincial-scale geophysical data processing, compilation, and interpretation program to modernize and integrate legacy airborne geophysical datasets across Nova Scotia. The project was undertaken to enhance regional geological understanding and improve exploration targeting for critical minerals through the development of standardized, interpretation-ready geophysical products.

Compilation and interpretation work was contracted to DIP Geosciences of Cocagne, New Brunswick. The program evaluated aeromagnetic, radiometric, very low frequency (VLF), electromagnetic, and gravity datasets sourced from Natural Resources Canada (NRCan), the Nova Scotia Geoscience Maps and Publications Database (NovaScan), and previously released provincial surveys. Datasets were reviewed for coverage, acquisition parameters, and data quality prior to inclusion in compilation workflows.

Data Processing and Compilation

Aeromagnetic data represented the primary component of the project. A provincial regional compilation based on NRCan's Total Magnetic Intensity (TMI) grid was standardized and delivered at 200 m cell size, while higher-resolution surveys were reprocessed and integrated into a 50 m grid compilation (Figure 17). A consistent suite of interpretation products, including reduction-to-pole, first vertical derivative, horizontal gradient, tilt derivative, and analytic signal amplitude, was generated to support geological interpretation.

Radiometric surveys were reprocessed and mosaicked to produce potassium, thorium, uranium, and total-count grids, along with element ratio and ternary products useful for lithological discrimination and alteration analysis.

VLF datasets were processed individually due to acquisition inconsistencies between surveys, while existing NRCan gravity datasets were retained and supplemented with derivative products to enhance interpretive value.

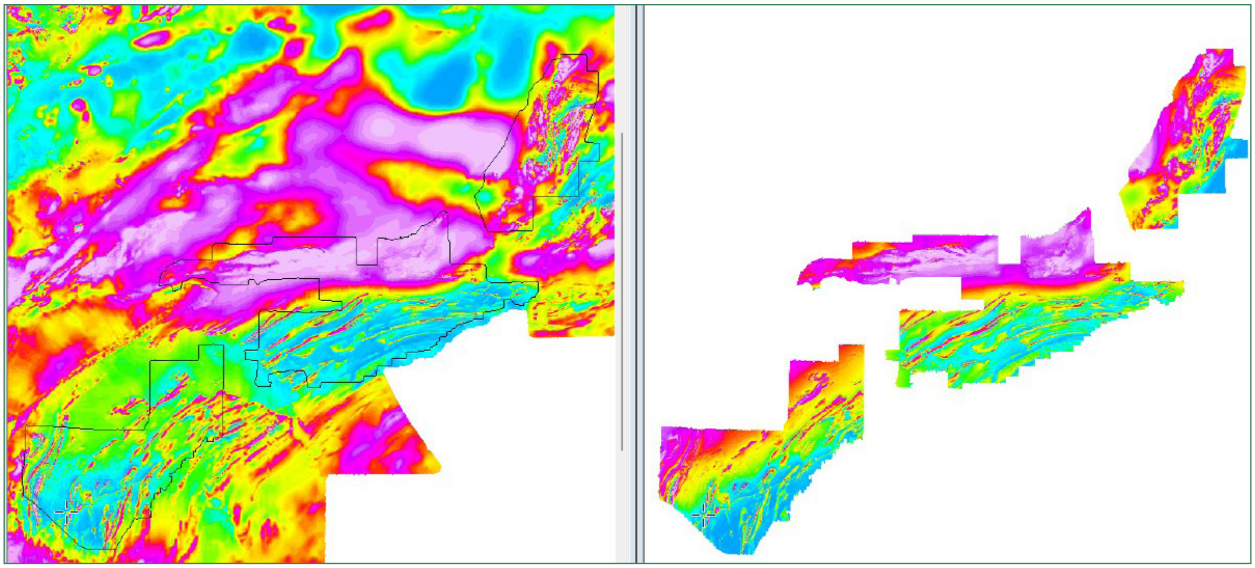

Figure 17. Compilation of high-resolution aeromagnetic Total Magnetic Intensity (TMI) data for Nova Scotia. The image shows merged 50 m–resolution aeromagnetic surveys, highlighting detailed magnetic fabric and structural trends across the province. The high-resolution compilation (right) is compared with the Geological Survey of Canada's 200 m grid (left), demonstrating the improved definition of lithological boundaries and folded geological structures resolved in the newer dataset. (Ugalde, 2026).

Structural Interpretation

Integrated interpretation of aeromagnetic derivatives enabled province-wide structural analysis and development of a litho-structural framework (Figure 18). Continuous geophysical coverage allowed structural trends to be traced across areas of limited outcrop, extending mapped geological structures beneath sedimentary and surficial cover.

A deformation model was established for the major tectonic terranes based on cross-cutting and offset relationships observed in magnetic lineaments. Three generations of structural features were recognized within each tectonic zone, reflecting successive deformation events. Interpretation identified regional faults, splays, fold axes, and ductile deformation patterns, including multiple folding phases (F1 and F2) and later fault-related deformation, particularly within Meguma metasediments.

Structural interpretation significantly expanded the known fault and contact framework across the province, including recognition of faults beneath Carboniferous cover and improved definition of structural corridors associated with mineral occurrences.

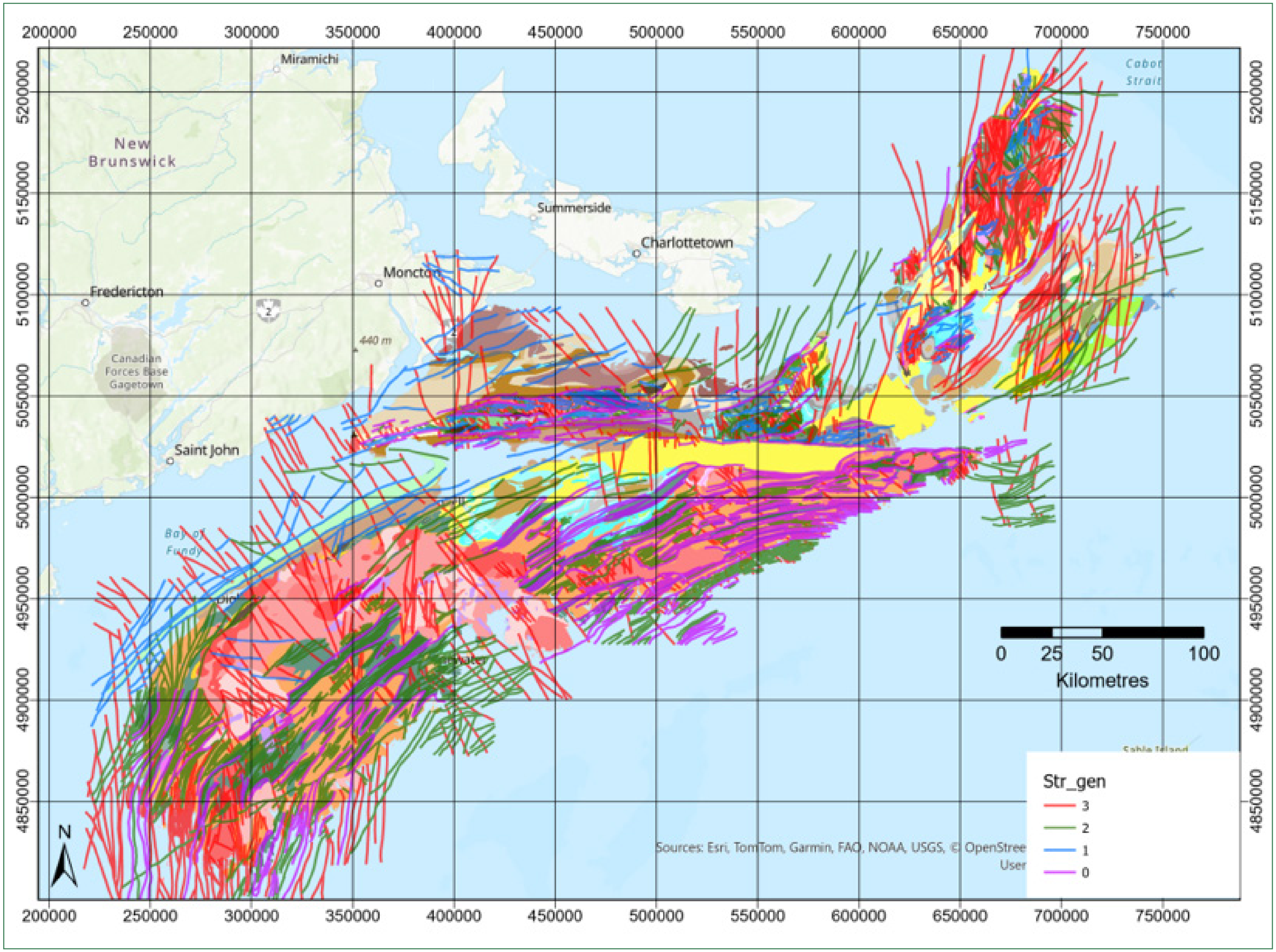

Figure 18. Province-scale structural interpretation of Nova Scotia based on integrated aeromagnetic derivatives (Ugalde, 2026).

Lithological Interpretation

Lithological interpretation was derived primarily from analytic signal amplitude responses of aeromagnetic data, which highlight contrasts in magnetic susceptibility between rock units (Figure 19). Magnetic domains were classified according to magnetic character (high, moderate, and non-magnetic) and spatial association with mapped geology to refine lithological boundaries and identify previously unrecognized extensions of intrusive and stratigraphic units. In some regions, particularly Cape Breton, highly magnetic units could not be uniquely separated into metavolcanic, basaltic, or intrusive lithologies at regional scale. This work highlights the potential future need for supporting petrophysical data, including density, chargeability and magnetic susceptibility, to better integrate geological and geophysical datasets and to facilitate more robust calibration of geophysical interpretations.

Litho-Structural Integration and Exploration Implications

Integration of structural and lithological interpretations produced a province-wide litho-structural model combining interpreted magnetic lithologies, structural lineaments, and deformation history (Figure 20). The results emphasize that mineral occurrences are commonly associated with intrusive contacts, regional faults, and structurally controlled zones such as fold hinges and fault splays. The interpretation also extended several intrusive bodies beneath sedimentary cover and identified structural pathways potentially favourable for fluid flow and mineralization, improving the regional framework for critical mineral exploration.

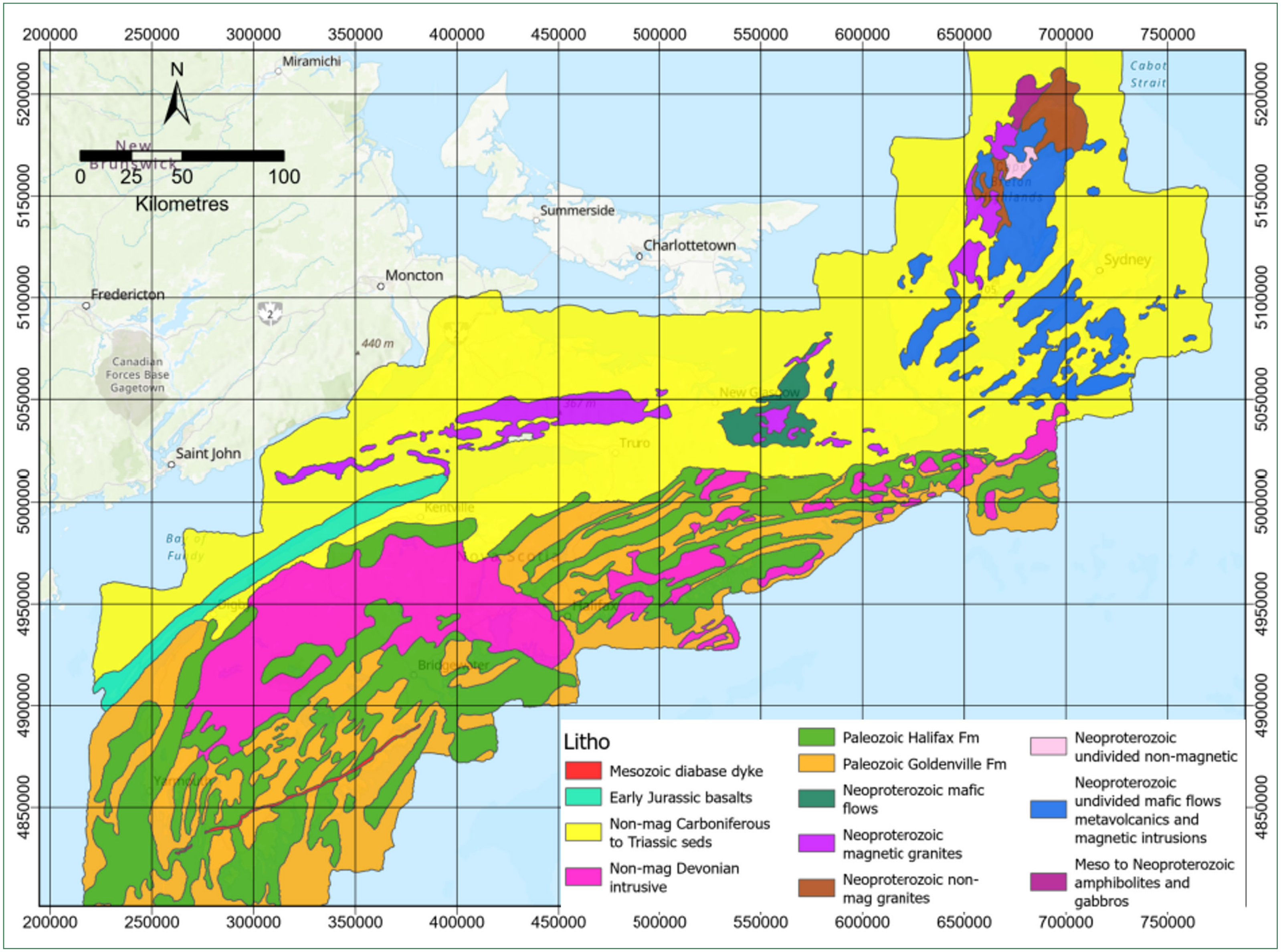

Figure 19. Lithological interpretation of Nova Scotia derived from aeromagnetic data. Where lithological attribution was uncertain, undivided units were assigned to represent mixed or ambiguous magnetic responses (Ugalde, 2026).

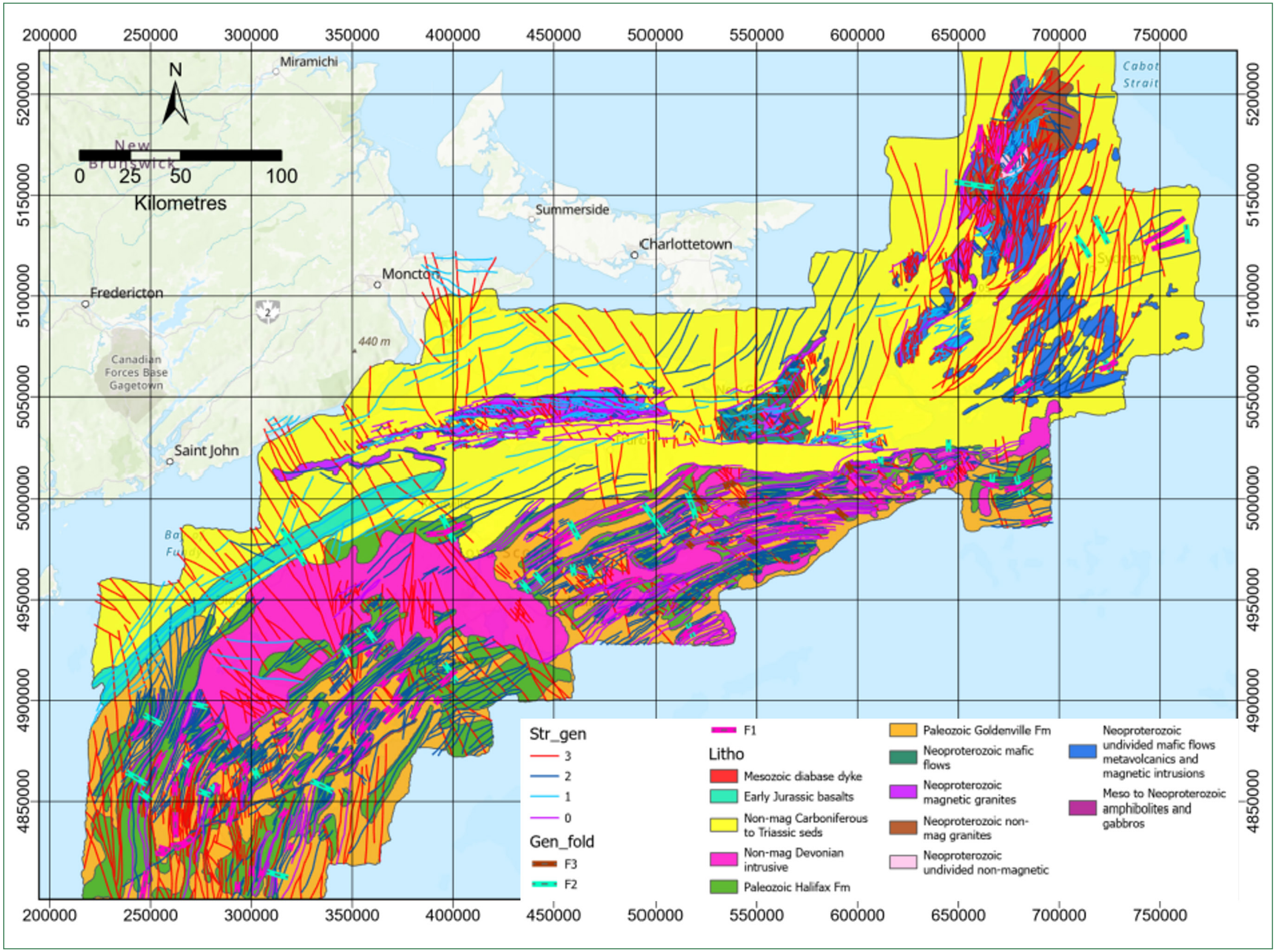

Figure 20. Integrated structural–lithological model of Nova Scotia combining aeromagnetic interpretations with geological constraints (Ugalde, 2026).

Conclusion

The program successfully merged and interpreted legacy geophysical datasets into a modern provincial geoscience framework. The resulting litho-structural interpretation enhances understanding of Nova Scotia's tectonic evolution and provides a robust foundation for future critical mineral exploration, detailed follow-up interpretation, and geophysical survey planning. The project delivered a modern, internally consistent suite of provincial geophysical datasets and interpretation products. These results substantially improve geological continuity mapping, refine lithological and structural frameworks, and strengthen exploration targeting capability across Nova Scotia.

Work is currently underway to prepare the datasets and interpretation products for release on the Branch's website.

Acknowledgments

The author would like to extend a special thank you to Hernan Ugalde, of DIP Geosciences, whose work forms the basis of this project. Despite a compressed timeline, their diligence and collaboration enabled the successful completion of the project.

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High-Resolution UAV Magnetic Survey of the Eastern Musquodoboit Batholith, Nova Scotia

K-D. MacRae

Between February 27th and March 10th, 2026, the Geological Survey Division (GSD) of the Department of Natural Resources completed a high-resolution unmanned aerial vehicle (UAV) magnetic survey over the eastern portion of the Musquodoboit Batholith, Nova Scotia for a total of 1,230 line-kilometres (Figure 21). The survey was carried out to acquire modern geophysical data to support exploration targeting for critical minerals and mineralization associated with granitic batholith systems and adjacent metasediments.

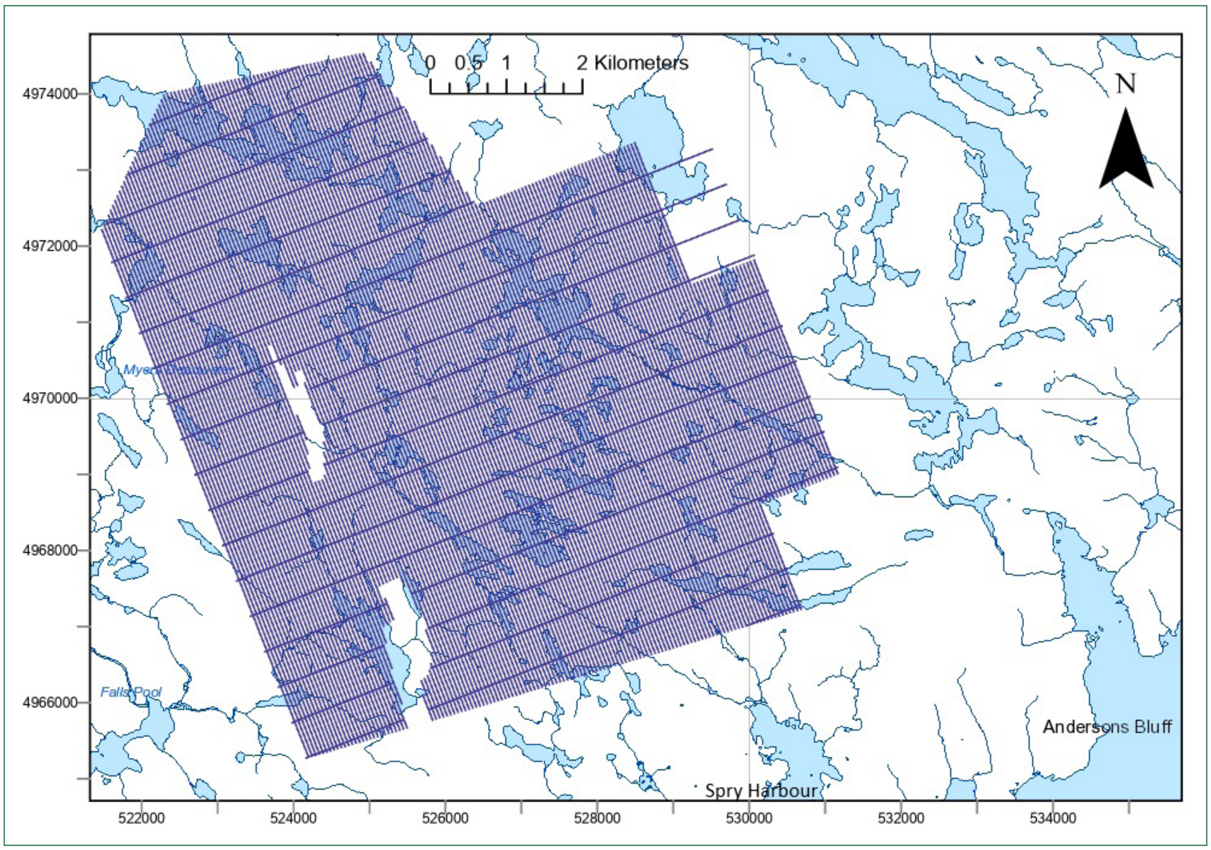

Figure 21. UAV flight-line trajectories collected during the 2026 airborne geophysical survey for a total of 1,230 line-kilometres near Tangier, Nova Scotia.

The survey targeted the eastern extent of the Musquodoboit Batholith, an area known to host tungsten mineralization identified through mapping, diamond drilling and trenching (e.g. East Lake and Tangier tungsten mineral occurrences; MacRae et al., 2024; Corey, 1994; Neyedley, 2024). At the time of the survey, the area was unstaked, presenting an opportunity for regional-scale evaluation. Survey parameters were developed to ensure detailed coverage of distinct magnetic domains, enabling effective geological and structural interpretation.

Survey acquisition was contracted to Terrascope Inc. of Québec City, Québec, who conducted both field operations and initial data handling. Two field crews were mobilized using truck and snowmobile access to support winter operating conditions. Data acquisition was completed using a Skylle 1550 MMC drone. This drone is a multi-rotor (six motors) UAV equipped with a Scintrex CS-VL cesium vapour magnetometer (2–1200 Hz range) suspended beneath the aircraft on a 5 m sling to minimize magnetic interference (Figure 22). The magnetic survey was flown at 50 m spaced lines oriented 339˚ with 500 m spaced tie-lines oriented 069˚ to align perpendicular to the strike of regional structures. The survey was flown to a mean altitude of 30 m above the ground.

Figure 22. Field photograph of UAV-based geophysical survey operations during the survey period, illustrating the drone platform and suspended sensor payload used for magnetic data collection.

Operational support included snow clearing and maintenance of access routes and designated drone launch and landing zones (LZs), which were provided by Triple B Excavating Ltd., of Sheet Harbour, Nova Scotia. Survey activities were carried out in accordance with Transport Canada UAV regulations and visual line-of-sight operational requirements (Transport Canada, 2026).

Field operations progressed efficiently until deteriorating weather and ground conditions necessitated demobilization on March 10, 2026.

Following acquisition, preliminary data processing was carried out by Devbrio Geophysics of Gatineau, Québec, while final data processing and interpretation was completed by geophysical consultant Marc Boivin, P. Geo (APGNS).

Results confirmed the presence of distinct magnetic domains corresponding to the Musquodoboit Batholith and adjacent Goldenville Group metasediments. Enhanced magnetic derivatives highlighted structural trends and geological contacts, refining the interpreted boundary between lithological units. Interpretation indicates the southern Goldenville–batholith contact is positioned approximately 1 km north of its location in previous geological mapping (Keppie, 2000). The survey identified interpreted northwest–southeast trending structural features prospective for mineralization, particularly within the southwestern extent of the survey area. These features broadly coincide with known tungsten occurrences and identify additional structural controls considered favourable for mineralization, providing high-quality targets for follow-up exploration work (Figure 23).

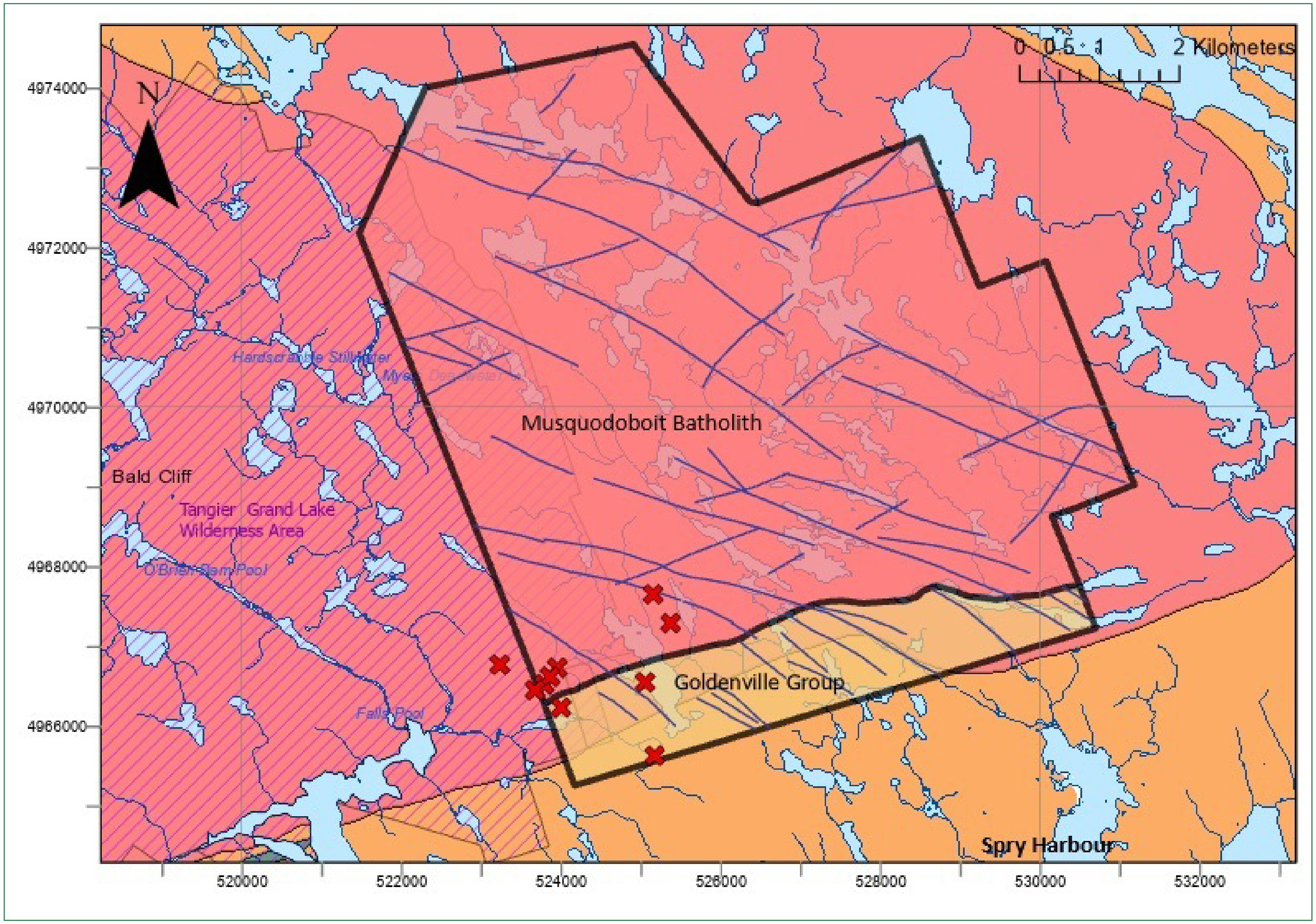

Figure 23. Geological map modified from Boivin (2026) in bold and overlain on the provincial geological map of Keppie (2000), displaying structural interpretations and the refined geological contact between the Musquodoboit Batholith and Goldenville Group metasediments constrained by magnetic survey results, west of Sheet Harbour, Nova Scotia. Existing known Tungsten mineral occurrences are indicated by red “X” symbols.

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Tailings Geochemical and Mineralogical Analysis Program

A. Russell

Introduction

The Critical Minerals Geoscience Data (CMGD) initiative is a federal program led by the Geological Survey of Canada (GSC) and Natural Resources Canada (NRCan) with the purpose of strengthening Canadian critical mineral supply chains. The Province of Nova Scotia, through the Department of Natural Resources, actively participants in this program by advancing projects that expand geoscience knowledge, assess economic potential, and identify pathways for development.

One ongoing project focuses on upstream inventories for downstream applications and thus aims for a better understanding of the potential for critical minerals from secondary sources, such as tailings. To support this, a preliminary assessment of historical tailings material was undertaken.

Tailings Sampling Program

Between August and December 2025, several sites were selected for tailings sampling in conjunction with previously planned phased environmental site assessments by external consultants (Figure 24). The collection of tailings samples was carried out at legacy mine and mine tailings sites on Crown land, presently under environmental site assessments (ESAs).

Generally, tailings material was collected as sample sets (a shallow, weathered tailings sample and a deeper, unweathered tailings sample) using a hand auger. In addition, grab samples were collected from waste rock piles and submitted for Rare Earth Element (REE) Analysis.

All samples were analyzed for metals by way of multi-acid digestion followed by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and/or Inductively Coupled Plasma Mass Spectrometry Optical Emission Spectroscopy (ICP-OES) and X-Ray Diffraction (XRD). A combination of digestion and analytical methods were used. A brief report was prepared by the consultants collecting the samples, and summarizing the findings.

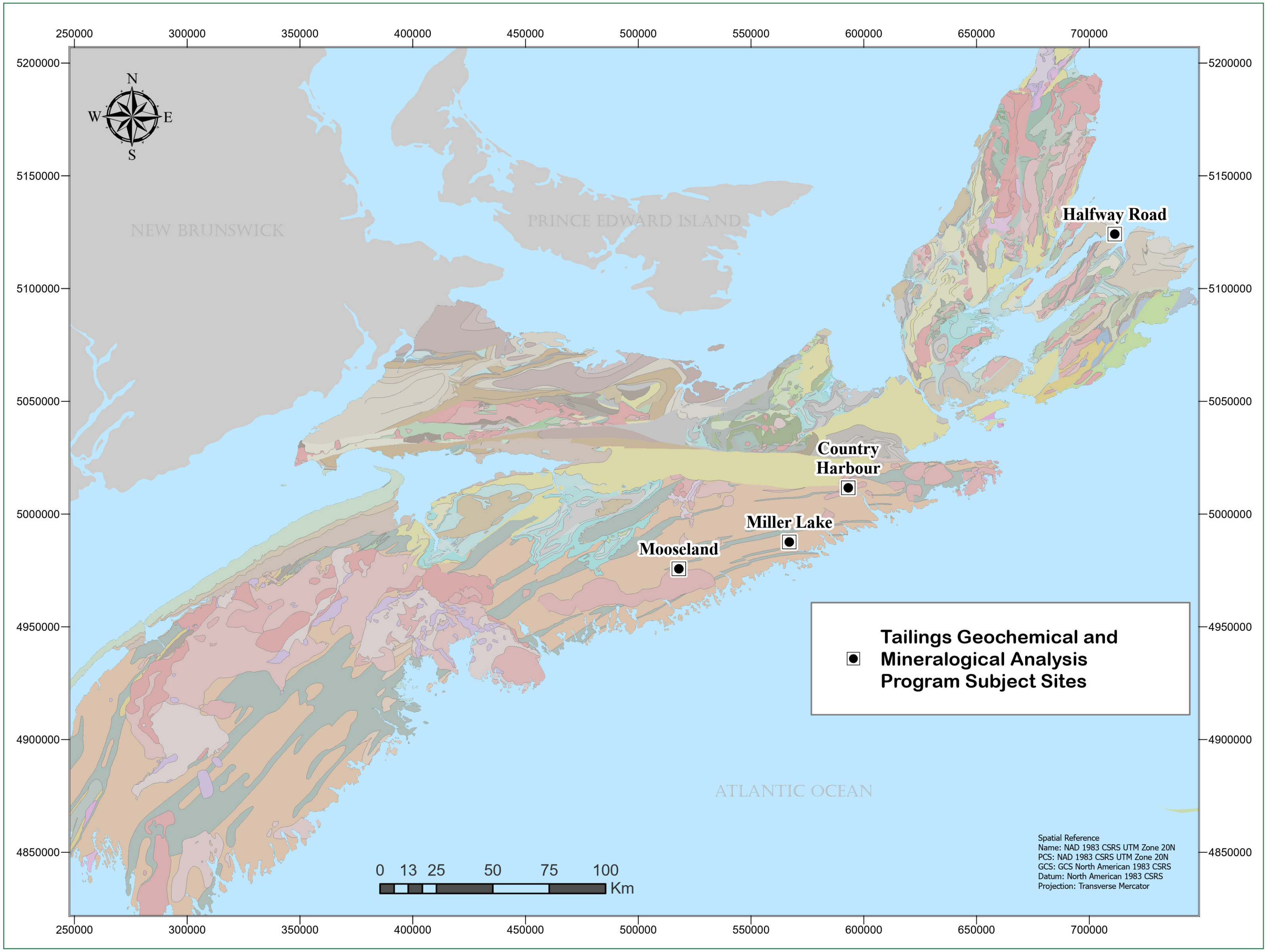

Figure 24. Tailings Geochemical and Mineralogical Analysis Program Sample Locations.

Site Geology

Mineralization on the Country Harbour property is typical of Meguma-style gold occurrences, consisting of gold-bearing quartz veins hosted in metre-scale slate units within the dominantly metagreywacke rocks of the Goldenville Group. The Country Harbour Mine was mined in the late 1800s and returned to in the 1930s. During historical mining activities, approximately 5,500 tonnes of gold tailings were produced.

The Halfway-Tobin Road area is primarily underlain by the Sydney Mines Formation and consists of fluvial and lacustrine mudstone, shale, siltstone, sandstone, limestone, and coal.

The Miller Lake area is underlain by metawackes and metasiltstones of the Goldenville Group. Gold bearing quartz veins are stratabound and vary from a few centimetres to 30 centimetres thick. The Miller Lake area was mined in the early and mid 1900's, with approximately 1,200 tonnes of gold tailings being produced.

The Mooseland area is underlain by metawacke, quartzite and slate units of the Goldenville Group. Mining in the Mooseland area was conducted in the late 1800s and into the early 1900s, with approximately 1,200 tonnes of gold tailings being produced.

Preliminary Results

Tailings at the former Country Harbour site consisted predominantly of quartz, muscovite, and biotite, with residual gold concentration ranging from 0.421 ppm to 0.887 ppm.

Waste rock material at the former Halfway-Tobin Road site consisted of a mix of fluvial and lacustrine mudstone, shale, siltstone, sandstone, limestone, and coal. A total of five waste rock samples were collected and submitted for analysis. The results indicated negligible concentrations of economically significant metals.

Tailings at the former Miller Lake site consisted predominantly of quartz, and muscovite, with residual gold concentration ranging from 0.165 ppm to 6.32 ppm.

Tailings at the former Mooseland site consisted predominantly of quartz, and muscovite, with residual gold concentration ranging from 0.454 ppm to 1.78 ppm.

Future Work

Tailings and waste rock material collected from historical gold and coal mine sites are planned to continue, including five sample sets at the former Harrigan Cove gold mine. These samples are planned to be collected for analysis of metals via ICP-MS with multi-acid digestion, and XRD. At the former coal mines located in Joggins and River Hebert, four samples are planned to be collected, and at the former coal mine located in Point Aconi, eight samples are planned to be collected for analysis of REE’s. Fieldwork has been completed at the former Port Hood site; however, analytical results have not yet been received.

Acknowledgements

The author would like to thank Build Nova Scotia, AECOM Canada, and Dillon Consulting for their work on this project. The author would like to acknowledge funding from the Geological Survey of Canada through the Critical Minerals Geoscience and Data Initiative for the opportunity to analyze these materials.

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An Update on Flake Analyses of Graphitic Rocks within Appalachian Terranes in Nova Scotia, Canada

T. J. Moss

Introduction

One of many roles within the Geological Survey Division (GSD) of the Nova Scotia Department of Natural Resources (DNR) is leadership in the management and responsible development of the province's mineral resource assets. Launched in March 2024, Nova Scotia's Critical Minerals Strategy aims to accelerate the clean energy transition by advancing research on 20 key minerals and materials essential for technologies like batteries, wind turbines, and solar panels. Within the GSD includes a team of geoscientists and experts who are responsible for delivering high-quality geological data and supporting a wide range of rightsholders and stakeholders, including all levels of government, industry, academia, and the public.

Batteries are essential to Nova Scotia's energy transition. The demand for graphite, a key anode material in battery technology is projected to increase globally (~220%) in a net-zero 2050 scenario (IEA, 2025). Key battery minerals like graphite have been the subject of recent funding from Natural Resources Canada (NRCan)'s Critical Mineral Geoscience Data Initiative (CMGD; NRCan, 2025). In April 2025, the Graphite in Support of Battery Value Chains project[1] activities were initiated as part of a two-year (2025-2027) contribution agreement between NRCan and DNR.

As Nova Scotians adopt clean energy technologies, like electric vehicles (EVs) and grid battery storage (Figure 25), they become increasingly reliant on minerals mined and processed outside Canada[2]. Graphite is a soft, slippery, opaque carbon mineral historically used in steel production, refractories, lubricants, and electrical components. Graphite has a high thermal stability (melting point 3927°C), and strong electrical and thermal conductivity make it highly sought after for lithium-ion battery technology (USGS, 2020). Graphite flake size[3] is particularly important, as it affects conductivity, durability, and the economics of energy storage in a battery (Sun et al. 2014).

[1]The Graphite in Support of Battery Value Chains project is referred to as "project" or "cmdg-3" within this update.

[2] In 2024, China was the world's leading producer of graphite, accounting for 79.4% of total production. Global graphite consumption reached 5.7 million tonnes, up from 5.2 million tonnes in 2023 (NRCan, 2026).

[3] Lo w electric resistivity of 2.45 μΩ-m (2.45e-6 Ω-m) and a high thermal (as opposed to electrical) conductivity of 498 W/m·K when mean size of graphite flakes in raw material are 425 μm (Sun et al. 2014). This project will consider ideal exploration performance to be greater than 40 μm.

Understanding Nova Scotia's geological setting, graphite deposit types, and flake characteristics is both economically strategic and essential to supporting the province's energy transition. The project objectives in Year 1 (April 1, 2025–March 31, 2026) focused on refining Nova Scotia's flake graphite geological model through a compilation of historic data and addressing key knowledge gaps, particularly flake size distribution and graphite liberation.

In winter 2025-2026, a total of eighty-five whole rock and reference samples (n=85; 71 core; 7 outcrop; 7 reference materials) and thirty-three (33) thin section rock slabs were submitted to AGAT Laboratories Ltd. in Calgary, Alberta for sample preparation, geochemical and mineral processing analyses (i.e. graphitic carbon content (n=80); flake size and flake liberation (n=28), stable isotope analysis (Carbon, Nitrogen, and Sulfur (C–N–S isotopes); n=6), and major element (n=13) and trace element geochemistry (n=6)). Additionally, thirty-three (33) polished thin sections were prepared by AGAT.

The results will guide the characterization of graphite quality (i.e. resource evaluation) and support the delineation of exploration targets and preliminary baseline conditions in Year 2 (April 1, 2026–March 31, 2027). A final report will be published in early 2027 by Nova Scotia DNR.

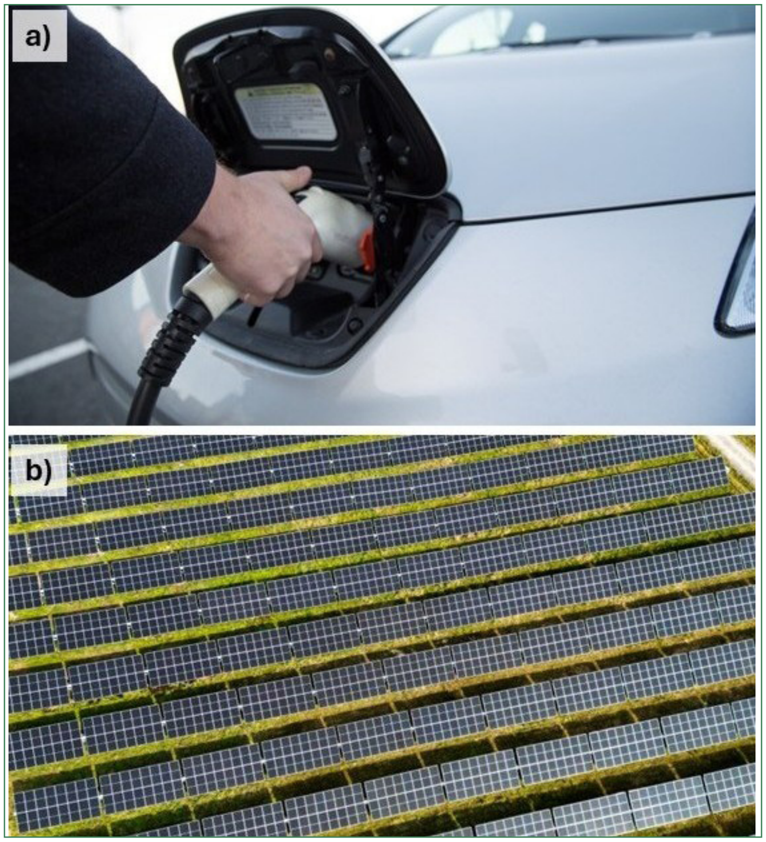

Figure 25. Graphite is projected to increase by ~220% in a 2050 net-zero scenario as Nova Scotians adopt clean energy technologies like this a) EV at a charging station in Halifax County; and grid battery storage to support clean energy solutions like this b) solar panel installation at the Berwick community solar garden in Kings County.

Activities

In 2025, plans were made to address information gaps regarding total graphitic content, and flake size and liberation analyses of graphitic rocks. Geological activities conducted between April and December 2025 included: 1) three-dimensional (3D) drill hole data compilation and preliminary geological modelling; 2) core and field sampling; and 3) whole rock laboratory analyses.

Downhole attributes from drill logs (i.e. drill holes (n=61; Figure 26; Appendix I); core intervals (n=944) representing ~4000 m total) were digitized using ArcGIS® Survey123 (Survey123) and integrated into a 3D geological workspace using Geoscience ANALYST, a product by ©Mira Geoscience Limited (ANALYST), to improve the useability of the historic data and serve as a visual representation throughout the project. Downhole lithological and structural attributes contributed to the decision-tree analysis based on key performance indicators (KPI[4]) that identified priority drill holes (i.e. the Frenchvale–Boisdale Hills area; notably Rear Boisdale, west of Campbell Lakes FV-10-05 and FV-10-04; Figure 28e). Geological characterization of the Frenchvale area confirmed dolomitic marble-hosted disseminated graphite (locally up to ~5%; Wightman, 2011; Black, 2010), calc-silicate skarn mineralization, tremolite–serpentine–phlogopite assemblages, and formed in a contact-metasomatic domain associated with pegmatitic, quartz-feldspathic intrusions (Figure 28c).

Applied geophysics (i.e. electric conductivity[5], and electromagnetism [EM]) can refine our understanding of highly prospective areas in Nova Scotia by making it easier to distinguish between electrically resistivity anomalies caused by graphite mineralization and other known conducting geological formations (e.g. porous rock filled with saline water, marine clay deposits, sulphides; Rønning et al., 2017; USGS, 2025; Mantos et al., 2025). Time domain EM surveys can delineate diamagnetic[6] graphite as weak magnetic low responses (Legault et al., 2015), and when coinciding with low resistivity may be an indicator of good quality graphite (Rønning et al., 2017). Where data was available, priority areas for the project developed with these combinations of geophysical insight and geological, geochemical, and mineral processing insight. Figure 29 illustrates a polygon sketch of structurally controlled, geophysical targets for the project, interpreted from low resistivity (i.e. < 48 ohm-metre (Ω-m); FV-08-03, FV-10-08), and weakly magnetic anomalies (i.e. < 0 nT/m) in relation to project activities in the Rear Boisdale area west of Campbell Lakes, Cape Breton County (modified after Wightman, 2017; Dube, 2020; Wightman, 2023; Halle, 2023).

Field Work

[4] Carbon-rich Proterozoic high-grade metamorphic rocks including dolomitic marble, skarn, schist, gneiss (i.e. paragneiss), and metamorphic “complex” units. Project is using 2% or greater cut-off for total graphitic carbon values or non differentiated carbon values.

[5] Graphite is an electronically conducting mineral, and the resistivity in massive graphite ore bodies is commonly less than 2 Ω-m (the electronic conductivity of pure graphite is reported to be ca. 10-3 Ω-m; Telford et al. 1976; and 1 Ωm when exhibited with other minerals; Rønning et al., 2017), with conductivity higher than 500 mS/m, (0.5 S/m; Dalsegg 1994, Rønning et al., 2012, Rønning et al., 2014).

[6] Graphite is a diamagnetic mineral and may reduce the magnetic field (Reynolds, 2011; Rønning et al., 2017) of magnetic minerals like pyrrhotite that are also present in the rock.

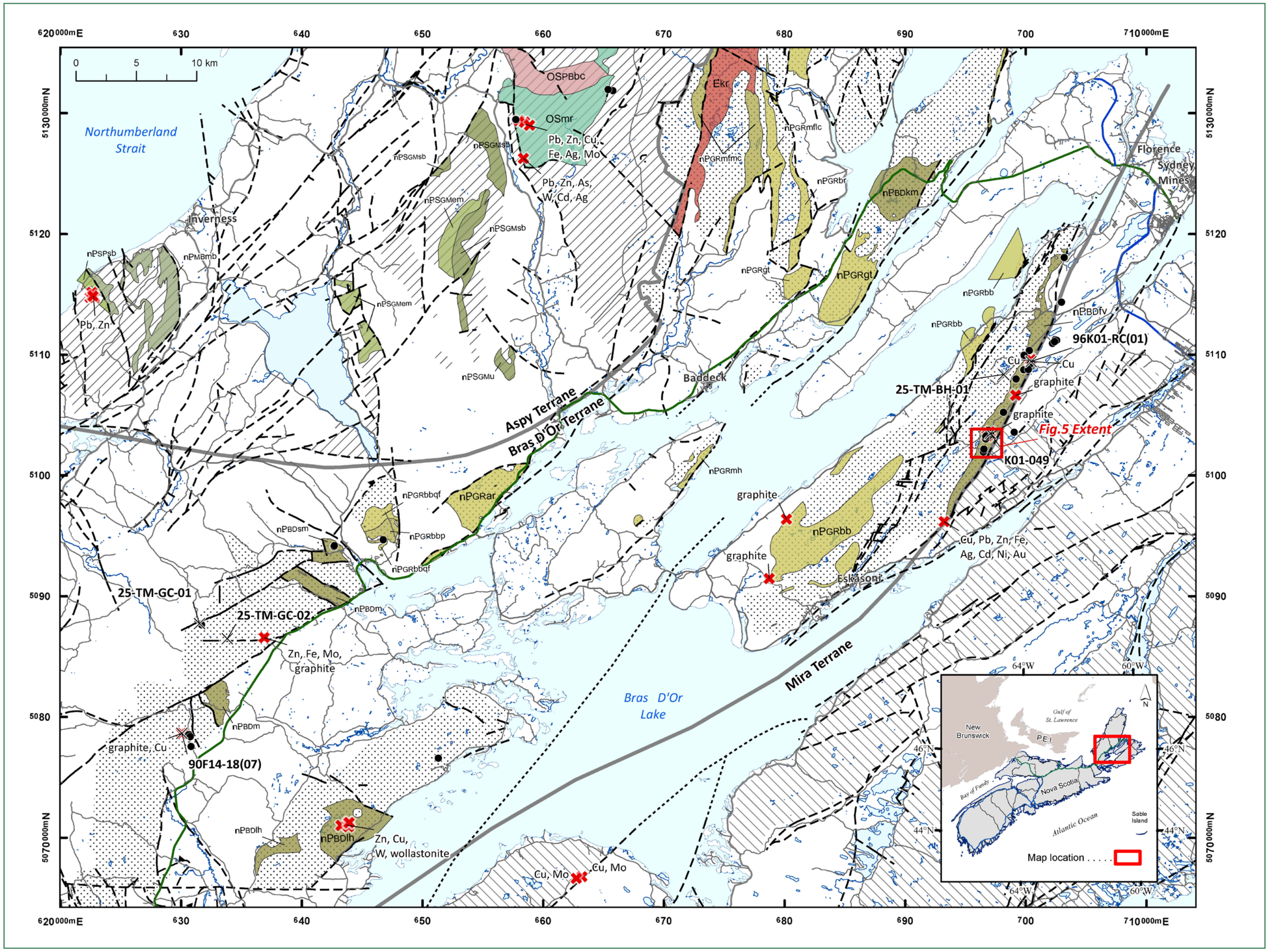

Figure 26. Overview map illustrating the location of sixty-one (61) drill holes digitized (many overlapping at this scale, see Appendix I for list of drill holes) as part of the 2025-2026 preliminary compilation of downhole attribute data in relation to historic mineral occurrences that list graphite as either a primary (labelled) or accessory mineral (not labelled) and a selection of geological rock unit target areas (KPI) with three (3) tectonic terranes in Cape Breton Island: Aspy, Bras d'Or, and Mira terranes (see Figure 27 for legend; modified after Barr and White, 2021; Barr et al., 2017; MacRae et al., 2024).

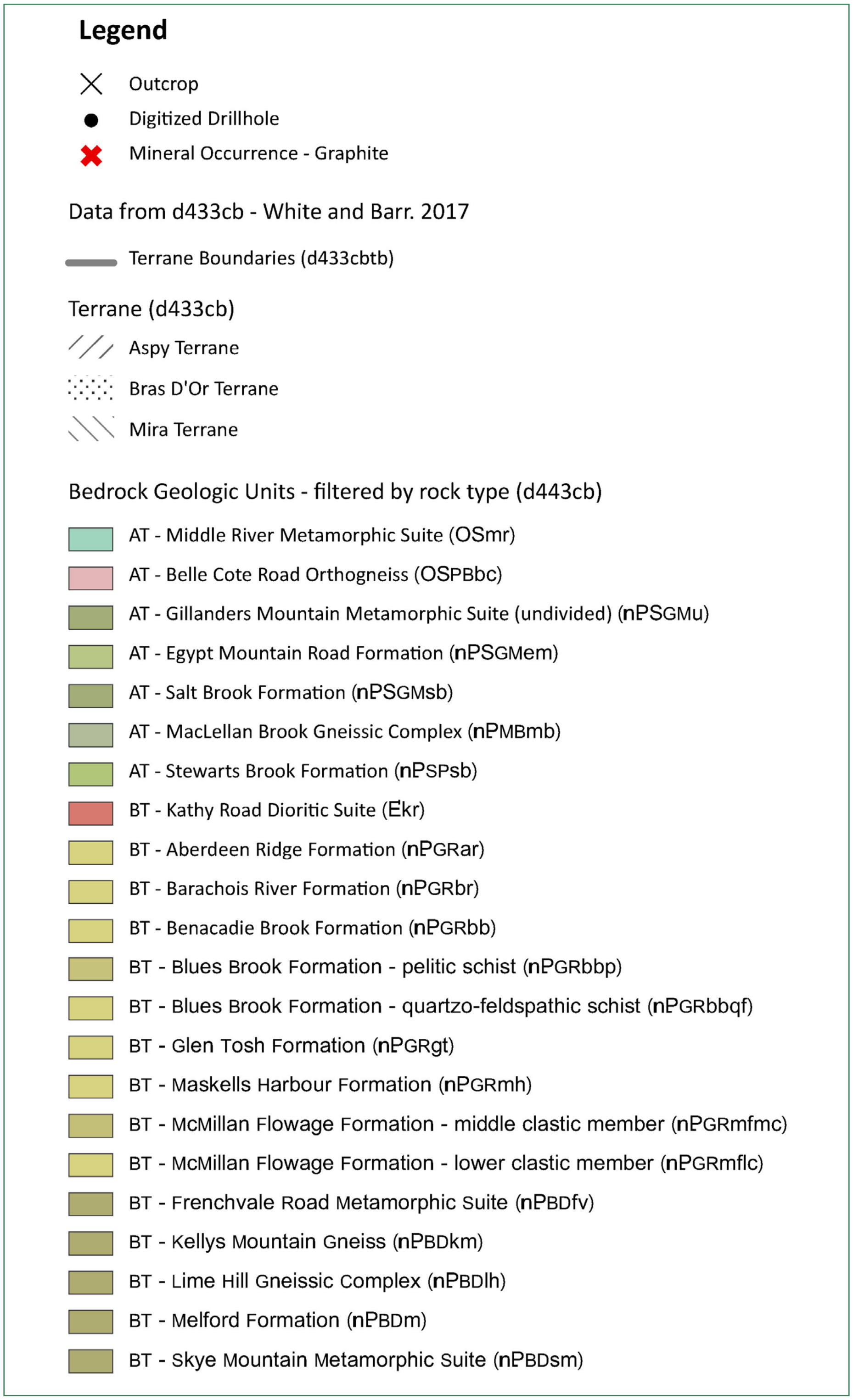

Figure 27. Legend for overview map (Figure 26).

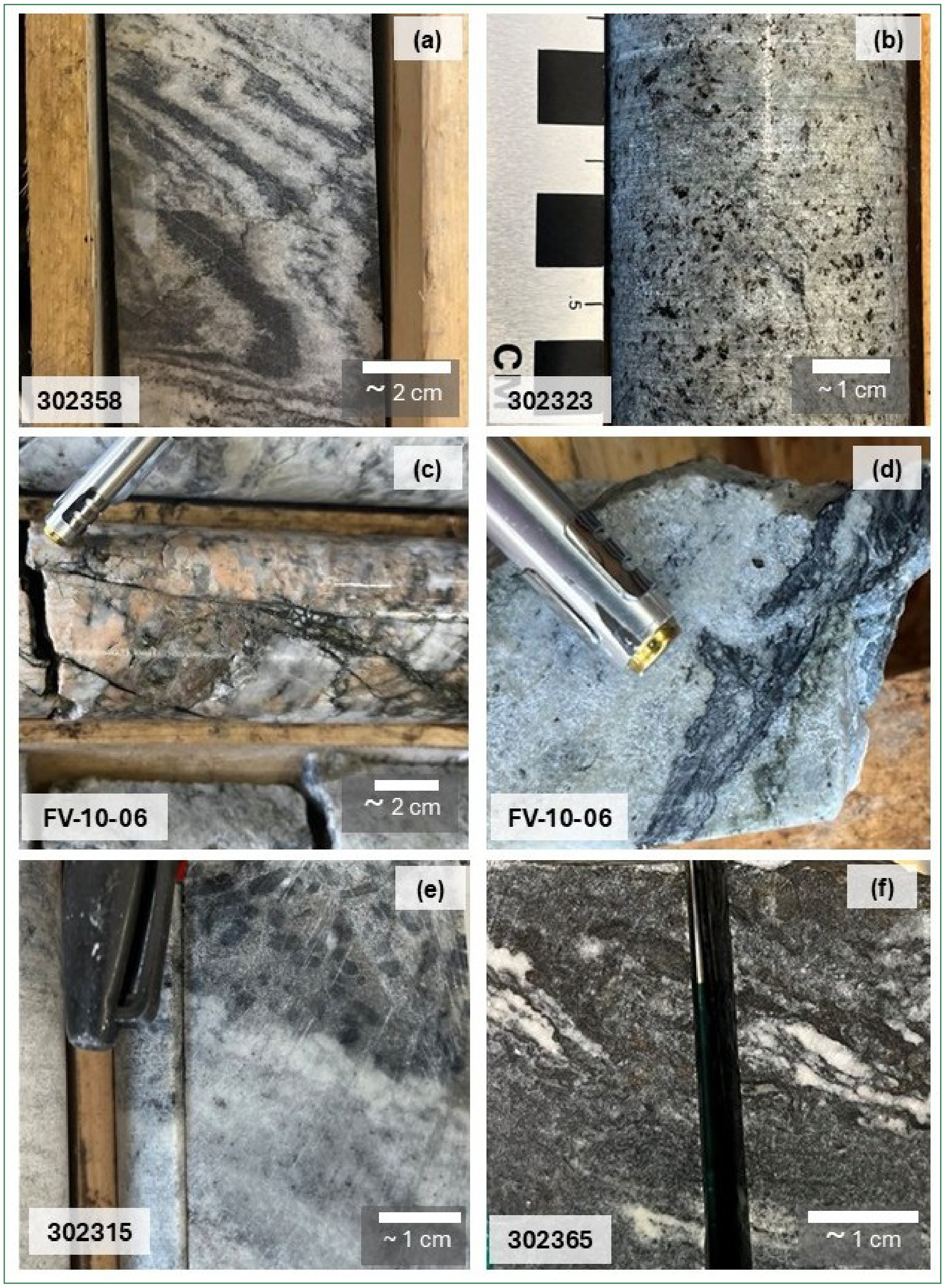

Figure 28. Highlights from 2025 drill core sampling: a) FV-08-04: compressive stress features (z-folds) in grey, banded, marble; b) FV-10-07: grey, marble, local serpentine; patchy graphite (suggested to be the siliceous marble unit "red zone" by Black 2005) in proximity to granitic pegmatite intrusions; c) FV-10-06: feldspar pegmatite (Boisdale Hills Pluton) with graphitic fractures; d) FV-10-06: graphite and calcite development near pegmatite contact (skarn) with marble; e) FV-10-04: light grey, weakly graphitic, tremolite banded marble; f) FV-10-04: black, sheared, pyritic biotite schist (locally graphitic; suggested to be the graphitic biotite gneiss unit "blue zone" by Black, 2005).

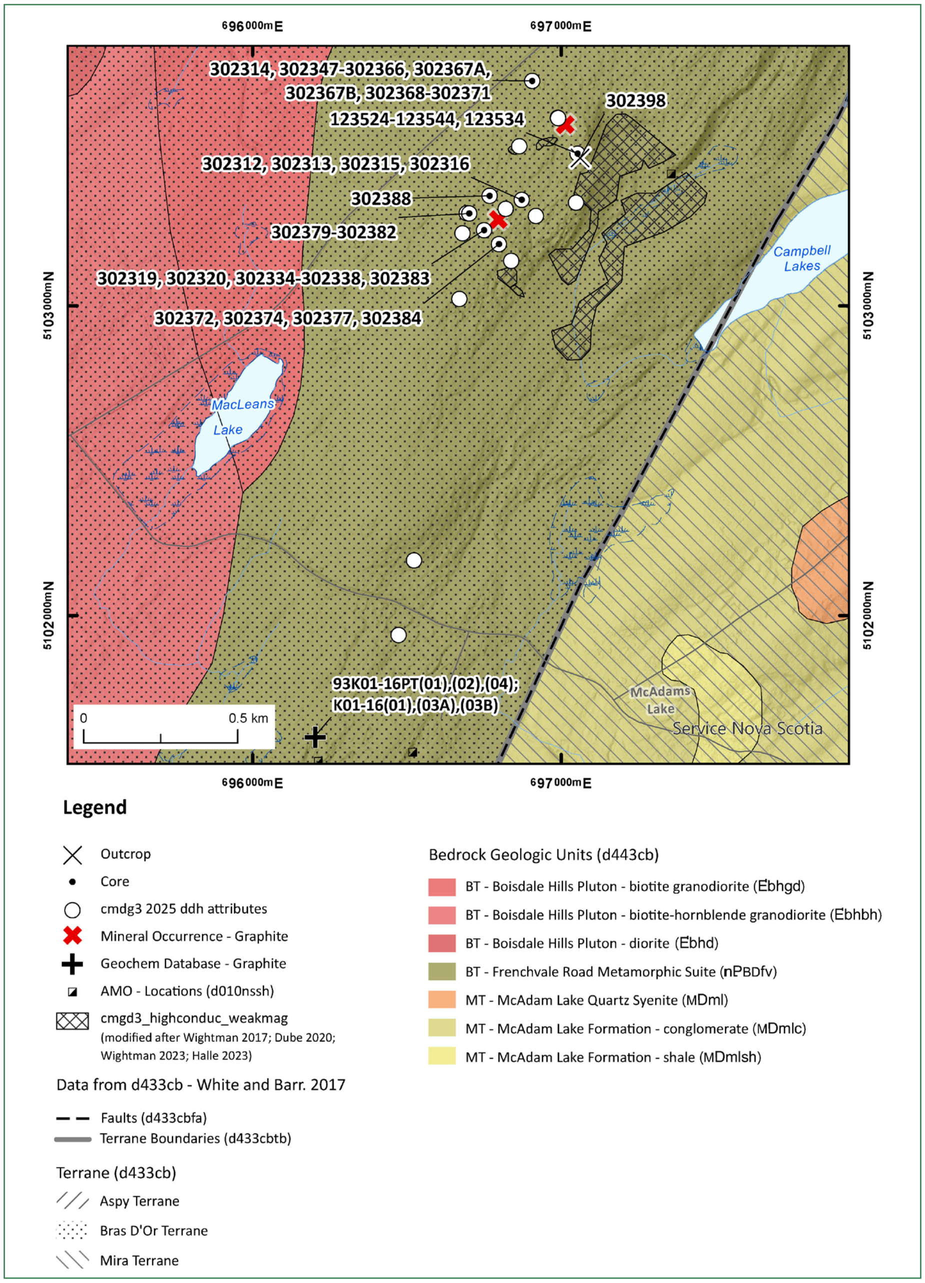

Figure 29. Geological map of Rear Boisdale, Cape Breton County and west of Campbells Lakes extending from the Frenchvale Road to McAdams Lake areas showing the location of drill holes (sampled, digitized), historic graphitic mineral occurrences and geochemical samples, in relation to a crosshatched polygon sketch representing high potential targets for the project, interpreted from low resistivity (i.e. < 48 Ω-m) and weakly magnetic anomalies (i.e. < 0 nT/m; modified after Milligan and Parsons, 1963; modified after Barr and White, 2021; Barr et al., 2017; MacRae et al., 2024; Fisher, 2006; modified after Wightman, 2017; Dube, 2020; Wightman, 2023; Halle, 2023).

In July 2025, four (4) outcrop samples were collected from Rear Boisdale, Cape Breton County and Glencoe, Inverness County (Table 2; Figure 26; Figure 29). Earlier drilling program practices did not always include measurements for the elevation (z-value) associated with the drill collar location, which is essential for a 3D geological model. A total of six (6; Table 3) ground elevation values (z) were collected for drill collar sites in Cape Breton County. Additional site visits are planned for Year 2 (2026-2027).

Table 2. Sample descriptions from 2025-2026 graphite sampling within the Bras d'Or Terrane.

Sample Location	Rock Type	Sample Description
Rear Boisdale, Cape Breton County	Graphitic marble	(302398; Frenchvale Road Metamorphic Suite) Dark gray, light green/blue, white; foliated, coarse-grained marble (calc-silicate calcitic dolomite); tremolite patches; graphite (TGC = 0.17%; Appendix II, III) & disseminated sulphides (fine, silvery), slight stockwork/boxwork veinlets of dark mineralization along slightly schistose plane.
Boisdale Hills, Cape Breton County	Biotite granodiorite	(302394; Boisdale Hills Pluton) Light pink, grey, medium-grained, biotite granodiorite (quartz-rich granitoid; Appendix III).
Upper Glencoe, Inverness County	Dolomitic marble	(302400; Blues Brook Formation, George River Metamorphic Suite) Dark grey, white; foliated, banded, medium- to fine-grained, high-purity calcitic limestone/marble. White calcite recrystallized veining. Dark grey surface weathering.
		(302399; Blues Brook Formation, George River Metamorphic Suite) Light grey, bright white, dark grey; foliated, banded, medium- to fine-grained, high-purity calcitic limestone/marble (TGC = 0.11%; Appendix II, III). Recrystallized calcite veinlets, dark grey sugary textured (crystal/grain). Dark grey, smooth, weathered surface.

Table 3. Ground elevations recorded with a handheld Garmin GPS from drill hole sites where the drill's collar eleveation was unknown within the Nova Scotia Drill Hole Database.

Location	Drill Hole Site	Ground Elevation (m)*
Frenchvale	FV-08-01/FV-24-01	225
	FV-08-02	226
	FV-08-03	215
	FV-08-04	213
McAdams Lake	453-4	150
	453-5	163

* Approximately ± 3-10 m error. Prefeasibility values should be measured with a Real-Time Kinematic (RTK) device to improve accuracy (i.e. ~ cm degree of error).

Sample Preparation

Forty-three (43) of the sixty-one (61; 70%) drill hole logs digitized have a portion of representative cored (HQ to BQ) whole rock material from several campaigns spanning from 1964 to 2010. It was decided that the Frenchvale area would be able to produce a higher amount and wider distribution of moderate to high grade graphitic metamorphic sedimentary core material compared to other locations[7] (Black et al. 2010, Wightman, 2011). This seemed particularly important in the FV-08-03 and FV-10-08 areas were both resistivity and magnetism are low (Wightman, 2017; Dube, 2020; Wightman, 2023; Halle, 2023).

In the summer of 2025, drill core was examined and sample intervals were planned at the Nova Scotia Core Library in Stellarton. In the fall of 2025, seventy-one (71) graphite-bearing drill core samples were cut using a diamond blade. A total of seventy-eight (n=78) rock samples collected between late 2024 and early 2026, and seven (n=7) reference materials were submitted to AGAT Laboratories in Calgary.

Between September and December 2025, thirty-three (33) thin section slabs from whole-rock samples were prepared for optical petrography. Prior to weighing all project samples,

[7] i.e. Core available from the Glendale and Glencoe area are suggested to be low grade metamorphic sedimentary rocks and was not a priority area for the project in 2025.

thin section slabs from select locations were cut into approximately 30 mm by 50 mm slabs at the Stellarton Core Library, using a diamond-blade saw. Slabs were labelled in an arrow using a permanent marker to indicate ideal polishing surface.

Analytical Methods

In fall 2025, the Nova Scotia Geological Survey Division obtained certified standard reference materials from CDN Resource Laboratories Ltd. in Langley, British Columbia to evaluate the laboratory performance of the carbon analysis (Appendix II; CDN Resources, 2014). Silica sand (SiO_2) from Shaw Resources in Shubenacadie, Nova Scotia, was used as blank material[8] to evaluate the laboratory cleanliness during graphitic carbon analysis. These standards and blank materials were inserted into the analytical workflow approximately every 10th sample, and some adjustments were made to position blanks after samples observed as being highly graphitic. Samples were secured in a plastic bag with a plastic zip-tie, stapled with an identification tag, and sealed in buckets (approximately 10 samples per bucket; average sample weight ~ 1.5 kg).

The procurement of analytical services for this project was through a standing offer with Canadian-owned AGAT Laboratories Ltd. (AGAT) in Calgary, Alberta. All eighty-five (85) samples arrived at the AGAT facility in three (3) separate shipments by late January 2026, and AGAT is managing the laboratory workflow and procedures for the following analytical packages (AGAT, 2026): Total Graphitic Carbon (TGC) Analysis by Combustion Infrared (IR) Detection (n=80; AGAT-284109); polished thin sections (n=33; AGAT-08109); Flake size distribution (%) by Scanning Electron Microscope (SEM; n=28; AGAT-08502; subdivided into individual fractions); Mineral Liberation Analysis (MLA) of graphite (i.e. Quantitative Evaluation of Minerals) by Scanning Electron Microscopy (QEMSCAN; n=28; AGAT-08714); Major Oxides (Lithium Borate Fusion, ICP-OES; n=13; AGAT-201076); Whole-Rock Lithogeochemistry (Lithium Borate Fusion, ICP-MS; n=6; AGAT-201078); Stable Isotope Analysis of by Elemental Analysis Isotope Ratio Mass Spectrometry (C–N–S isotopes; EA-IRMS; n=6; AGAT-20571[9]).

AGAT was provided rock descriptions of six (6) samples to aid with C–N–S isotopes and utilized the prepared thin section to determine if samples met requirements for testing by Scanning Electron Microscope (SEM) and Mineral Liberation Analysis (MLA/QEMSCAN) of graphite.

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[8] This project assumes this sand product to be relatively carbon-free, with little to no silt, clay, or diamictons (known to occur within Wisconsian aged glaciolacustrine deposits).

[9] Internationally recognized standards (e.g. Vienna Pee Dee Belemnite (VPDB)) will be tested and reported by AGAT and used as a baseline for global consistency of C–N–S isotope values.

A portion of analytical results were received in February 2026 and April 2026 (Appendix II-IV), and the remaining analytics (i.e. graphite flake size by SEM, MLA of graphite by QEMSCAN, and C-N-S isotopes). Remaining results are expected in late April 2026. Environmental safety will be followed during the disposal of rejects (AEP, 2025; AGAT Laboratories, 2025), and pulps will be returned to the Stellarton Core Library for storage.

Despite very few samples meeting the projects KPI for TGC, field work in 2026-2027 will follow up on ideal TCG results at FV-08-04 (i.e. Frenchvale Road Metamorphic Suite) in Rear Boisdale, Cape Breton County, and slightly ideal TCG results at 1227-1 (i.e. Middle River Metamorphic Complex) near Sarach Brook, Inverness County.

Remarks

The new analytical results from Year 1 will be compiled into the 3D workspace, enhancing access and useability of important data and generating insight about potential use of Nova Scotia graphite for battery technology applications, and other industrial applications. Geochemical and geotechnical analyses will fill information gaps needed to support decision-making in Year 2.

Acknowledgements

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Overview of Karst Program Activities 2025-2026

K-D. MacRae, A. Ryan, and J. Beckwith

Karst topography develops where groundwater and surface water interact with soluble bedrock, producing distinctive landforms such as sinkholes, caves, springs, disappearing streams, and solution-sculpted rock surfaces. Karst features in Nova Scotia are most associated with evaporite and carbonate rocks of the Mississippian Windsor Group, including gypsum, halite, anhydrite, and limestone, which are highly susceptible to physical and chemical dissolution processes (Tizzard, 2021). Karst investigations in Nova Scotia are critical for identifying sinkhole hazards, protecting groundwater resources, and informing safe land-use and infrastructure planning in karst-prone areas.

Field investigations during the 2025 season were conducted in Hants, Cumberland and Victoria Counties, integrating geological mapping, Remotely Piloted Aircraft (RPAS) surveys, LiDAR analysis, and field verification to document karst features and refine interpretations of structural controls influencing karst development.

Geological mapping revealed previously undocumented bedrock consisting of Windsor Group lithologies exposed along the River Philip and within sinkholes at Slade and Vickery lakes. Structural measurements indicate predominantly northeast-oriented bedding, folding, and fracture systems consistent with regional interpretations of an evaporite-cored anticline, suggesting strong structural influence on groundwater flow pathways and localized dissolution (Figure 30).

LiDAR analysis played a central role in identifying previously undocumented karst features concealed beneath vegetation and surficial deposits. Field verification confirmed numerous sinkholes ranging from shallow vegetated depressions to large collapse features associated with lake basins. This work allowed for the enhancement of the Nova Scotia karst inventory database, resulting in the addition of approximately 2,800 new sinkhole occurrences, primarily from karst-prone areas across the province, to the provincial database through LiDAR interpretation and preliminary field validation. These newly compiled datasets enabled the development of preliminary sinkhole susceptibility maps, integrating geological, structural, and terrain variables to identify areas of elevated karst potential and support early-stage hazard assessment and land-use planning (Figure 31). Standardized digital geospatial workflows were implemented to ensure consistent data collection and facilitate long-term monitoring. Future work will include field verification of the occurrences added to the database to confirm they are karst related features, as well as continued work towards developing and releasing susceptibility maps.

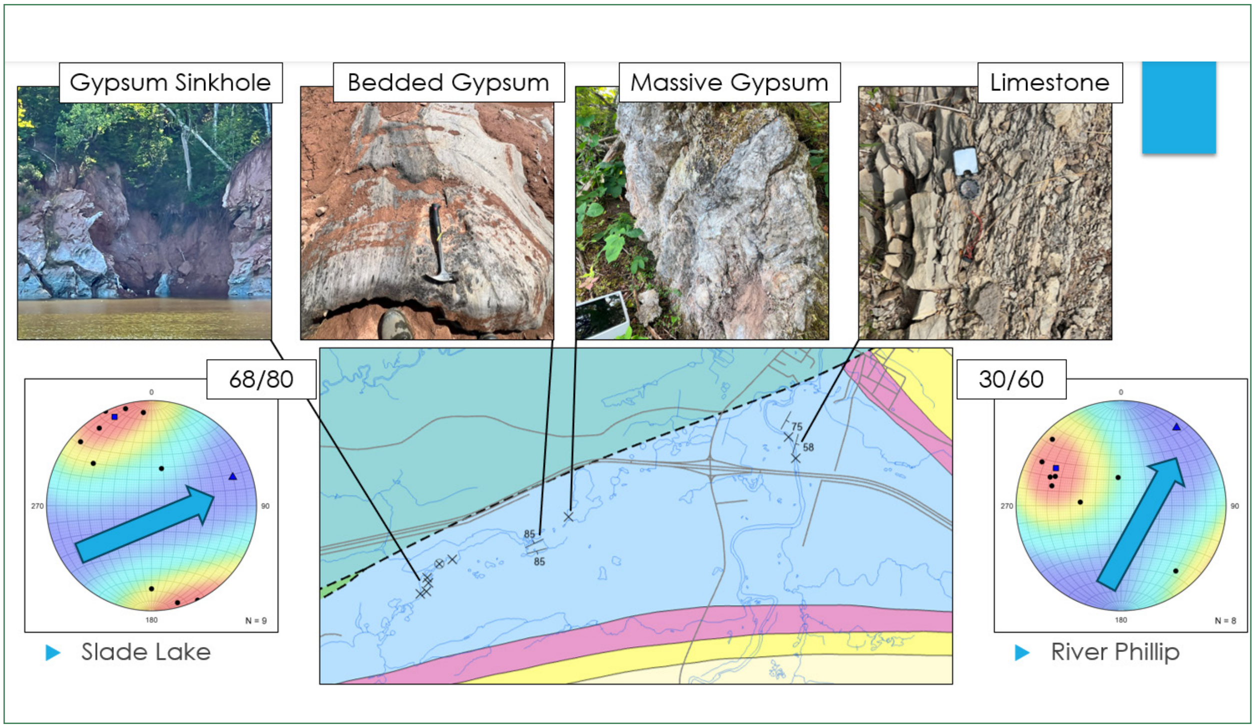

Figure 30. Newly documented bedrock outcrop, with corresponding structural measurements. Stereonets for Slade Lake (068/80) and River Phillip (030/60) indicate predominantly northeast-oriented bedding, folding, and fracture systems (J. Beckwith, unpub. rept., 2025).

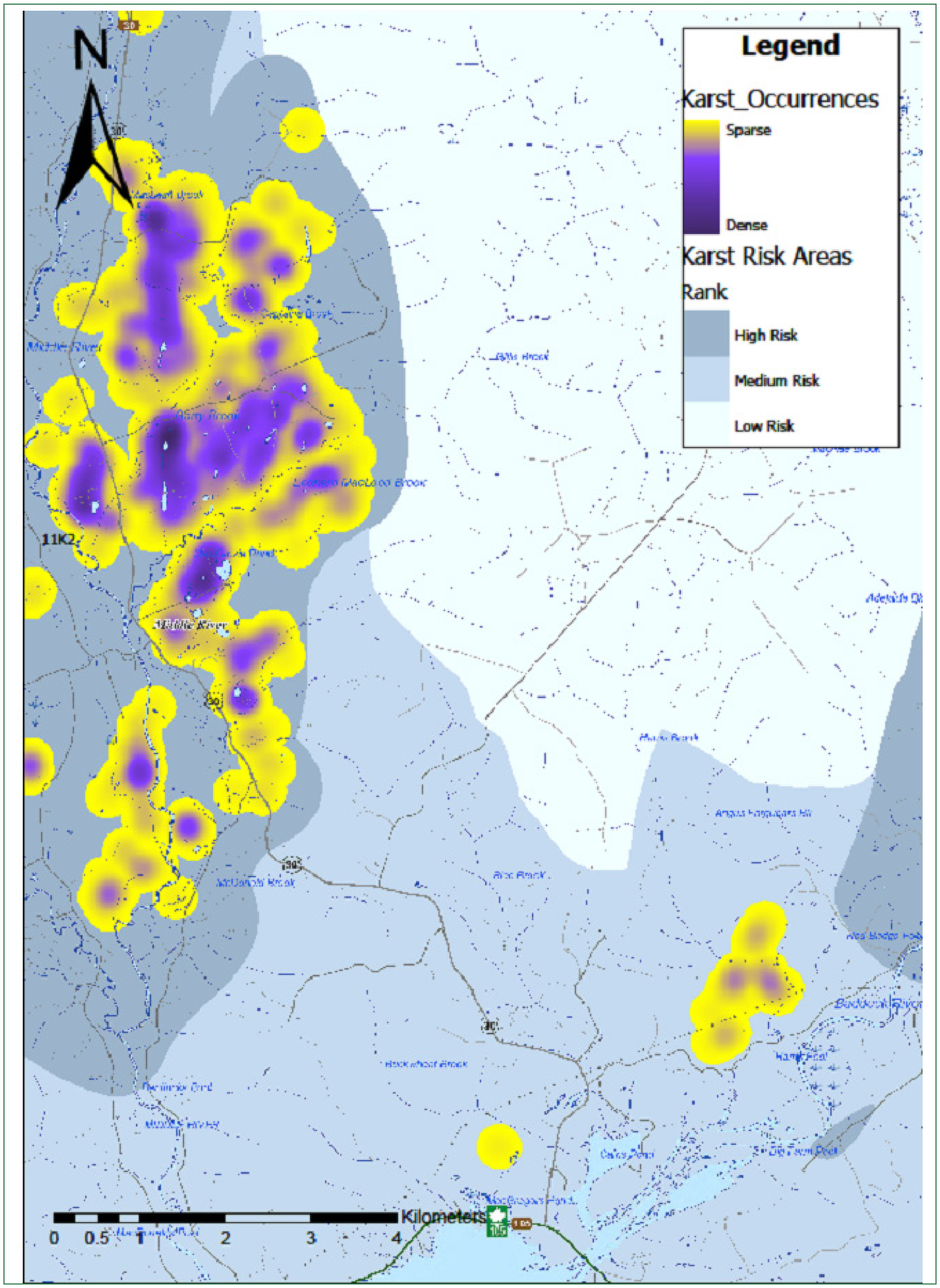

Figure 31. Preliminary sinkhole susceptibility map from Middle River, Victoria County showing the spatial distribution and density of LiDAR identified karst occurrences and associated risk ranking. Areas are classified into low, medium, and high susceptibility zones based on karst occurrence density and geological controls.

Water level monitoring at Slade Lake continued throughout 2025 to assess hydrological changes associated with active karst drainage. Follow-up LiDAR and photogrammetry surveys expanded earlier investigations from 2021 (Tizzard and Horne, 2021) and provided high-resolution elevation data for monitoring active karst features. These surveys consisted of Real-time Kinematic (RTK) equipped RPAS mounted with LiDAR. RPAS missions utilize a grid pattern with a 75% nadir overlap and supplemental oblique imagery. The surveys were flown to a mean altitude of 75 m above the ground. To ensure georeferencing accuracy, ground control points (GCPs) were surveyed via a GNSS RTK receiver before the flight.

RPAS LiDAR surveys were completed in early summer and early fall under controlled conditions, with each survey conducted following a minimum of three consecutive days without rainfall to minimize the influence of precipitation and surface runoff on measured water levels. Survey results indicate significant water-level decline across multiple areas of the lake. Along the eastern margin, where drainage activity is most pronounced and water levels are lowest, lake levels decreased by approximately 0.5 m between June and October 2025. Comparison with a previous survey conducted in 2021 (Tizzard and Horne, 2021) shows a cumulative water-level decline of 2.7 m in this area, corresponding to an estimated loss of approximately 12,700 m^3 of water (Figure 32).

A substantial decrease in water level was also observed in the southwestern portion of the lake, where levels declined by approximately 7 m between the 2021 and 2025 surveys. Complete spatial coverage of this area was not achieved during the June survey; however, volumetric estimates suggest approximately 93,400 m^3 of water loss. Other areas of the lake exhibited minor decreases in water level, likely influenced in part by the warm, dry conditions experienced during the summer months.

Future work will expand field verification, refine geological contacts, and advance hydrological investigations. Monitoring of Slade Lake will continue during summer 2026 alongside development of a regional lake sampling program targeting approximately 55 sinkhole and karst lakes in the Oxford area. Planned sampling of surface waters for temperature, salinity, pH, and conductivity will establish baseline hydrogeochemical conditions and improve understanding of hydraulic connectivity within karst systems. These investigations aim to better assess the likelihood and risks associated with inland saltwater contamination in karstic regions of Nova Scotia.

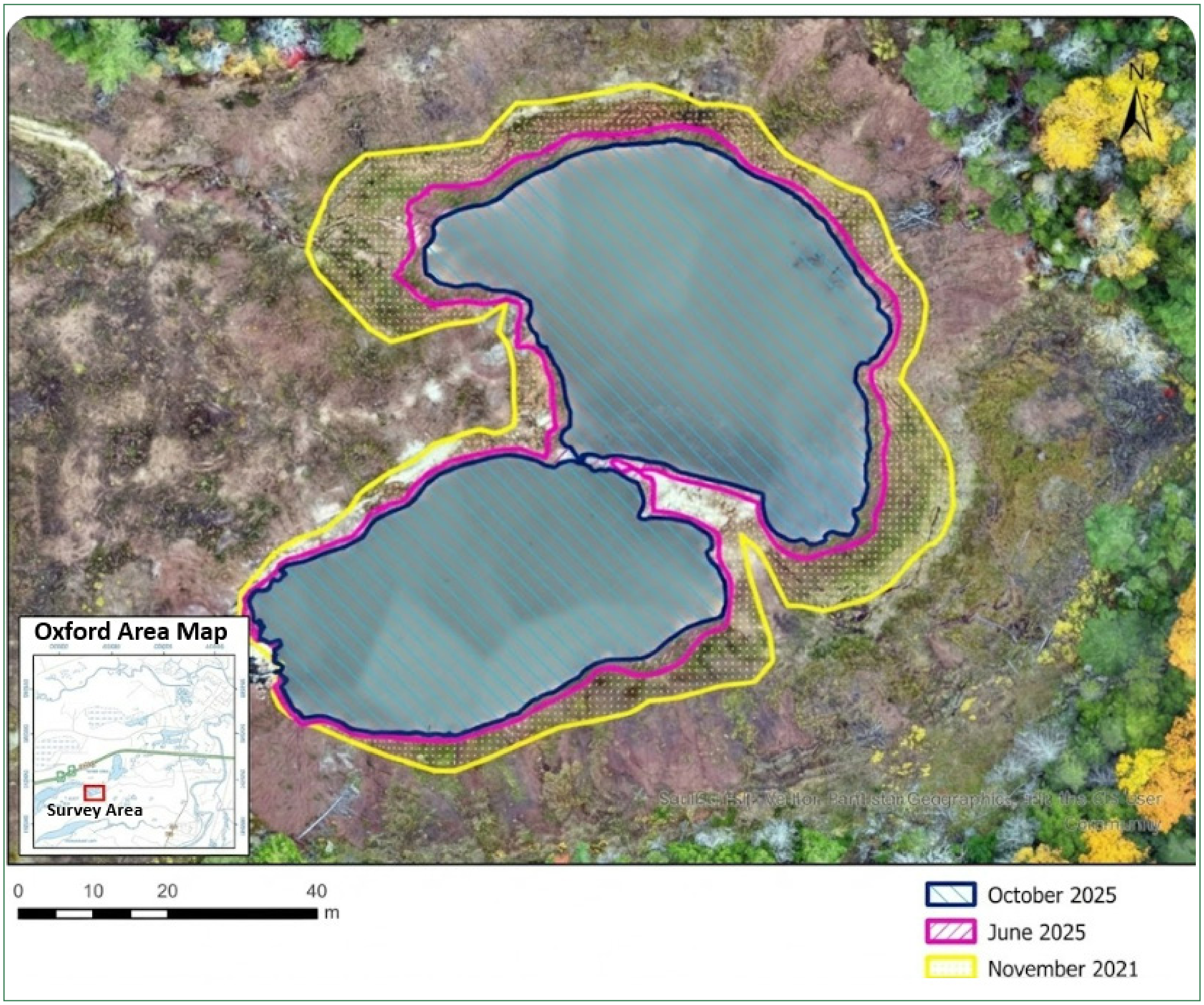

Figure 32. Nadir UAV image of Slade Lake near Oxford, Nova Scotia acquired in October 2025. Lake edge mapped from November 2021, June 2025, and October 2025 surveys are shown, illustrating progressive reduction in lake surface area associated with declining water levels.

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Tizzard, A., and Horne, P., 2021. A Preliminary Volumetric Analysis of Water Draw-Down in Active Karst Terrain, Slade Lake, Cumberland County, 2020; *in* Report of Activities 2020-2021. p. 65-71. <https://novascotia.ca/natr/meb/DATA/pubs/21re02/12ROA_2021_Tizzard&Horne.pdf>

NovaScan Update – Documents and Products Released in 2025

J. C. Poole and C. J. Renaud

Introduction

NovaScan is the geoscience publications and maps database on Nova Scotia and its offshore regions. As of December 31, 2025, the database contained 19,232 records, consisting of 9,962 mineral exploration assessment and property reports, 1,560 open file reports, 2,142 maps and illustrations, 872 theses, 291 contribution series, 224 digital products, 41 outside publications, and 4,140 other publications.

To provide better service to staff and clients, the Geoscience and Mines Branch maintains a public search application that allows the public to query records in the NovaScan database using an Internet browser. NovaScan can be searched by title, author/organization, subject, area, map sheet (NTS), map type, licence type, licence number, document type, document number, year, and map scale. NovaScan is updated monthly as new mineral exploration assessment reports, geoscience maps, publications, open files and theses become available. The search interface can be accessed at https://gesner.novascotia.ca/novascan/DocumentQuery.faces

If you would like to sign up to receive our monthly release notice of reports, products and assessment reports, please send a request to GMB@novascotia.ca.

Reports and products completed by Geoscience and Mines Branch staff during the 2025 year are outlined below.

Documents and Products Released in 2025

Information Circular

Information Circular ME 83:

Mineral Production in 2023 and Exploration in 2024, Mineral Management Division, Nova Scotia Department of Natural Resources, 2025, 18 page(s)

https://novascotia.ca/natr/meb/data/pubs/ic/ic_me_083.pdf

Digital Product

Digital Product ME 550:

Digital Data from the Geochemical Characterization of Historical Drill Core Throughout Nova Scotia, Canada, by MacRae, K-D, Burden, D, and Neyedley, K, Nova Scotia Department of Natural Resources, 2025. Available in SHP, GDB, CSV and XLS formats.

https://novascotia.ca/natr/meb/download/dp550.asp

Open File Reports

Open File Report ME 2025-1:

Geochemical Characterization of Historical Drill Core Throughout Nova Scotia, Canada, by MacRae, K-D, Burden, D, and Neyedley, K, Nova Scotia Department of Natural Resources, 2025, 3 page(s)

https://novascotia.ca/natr/meb/data/ofr/ofr_me_2025-001.pdf

Open File Report ME 2025-2:

Erratum: Geological Mapping of Southwestern Nova Scotia - Open File Maps ME 2012-077 to 079, 081 to 084, 086 and 087, by Geoscience and Mines Branch, Nova Scotia Department of Natural Resources, 2025, 2 page(s)

https://novascotia.ca/natr/meb/data/ofr/ofr_me_2025-002.pdf

Reports

Report ME 2025-001:

Geoscience and Mines Branch Report of Activities 2024, by Webber, D E, Nova Scotia Department of Natural Resources; MacDonald, D R, Nova Scotia Department of Natural Resources, 2025, 40 page(s)

https://novascotia.ca/natr/meb/DATA/pubs/25re01/25re01.pdf

Report of Activities Articles:

Drill Core Library Activities, by MacKay, A, Nova Scotia Department of Natural Resources, 2025, 1-4 page(s)

https://novascotia.ca/natr/meb/DATA/pubs/25re01/01ROA_2025_MacKay_DCLib.pdf

Nova Scotia Mineral Occurrence Database, by MacRae, K-D, Nova Scotia Department of Natural Resources, 2025, 5-11 page(s)

https://novascotia.ca/natr/meb/DATA/pubs/25re01/02ROA_2025_MacRae_MODB.pdf

Radon in Indoor Air in Nova Scotia, by MacRae, K-D, Nova Scotia Department of Natural Resources, 2025, 12-20 page(s)

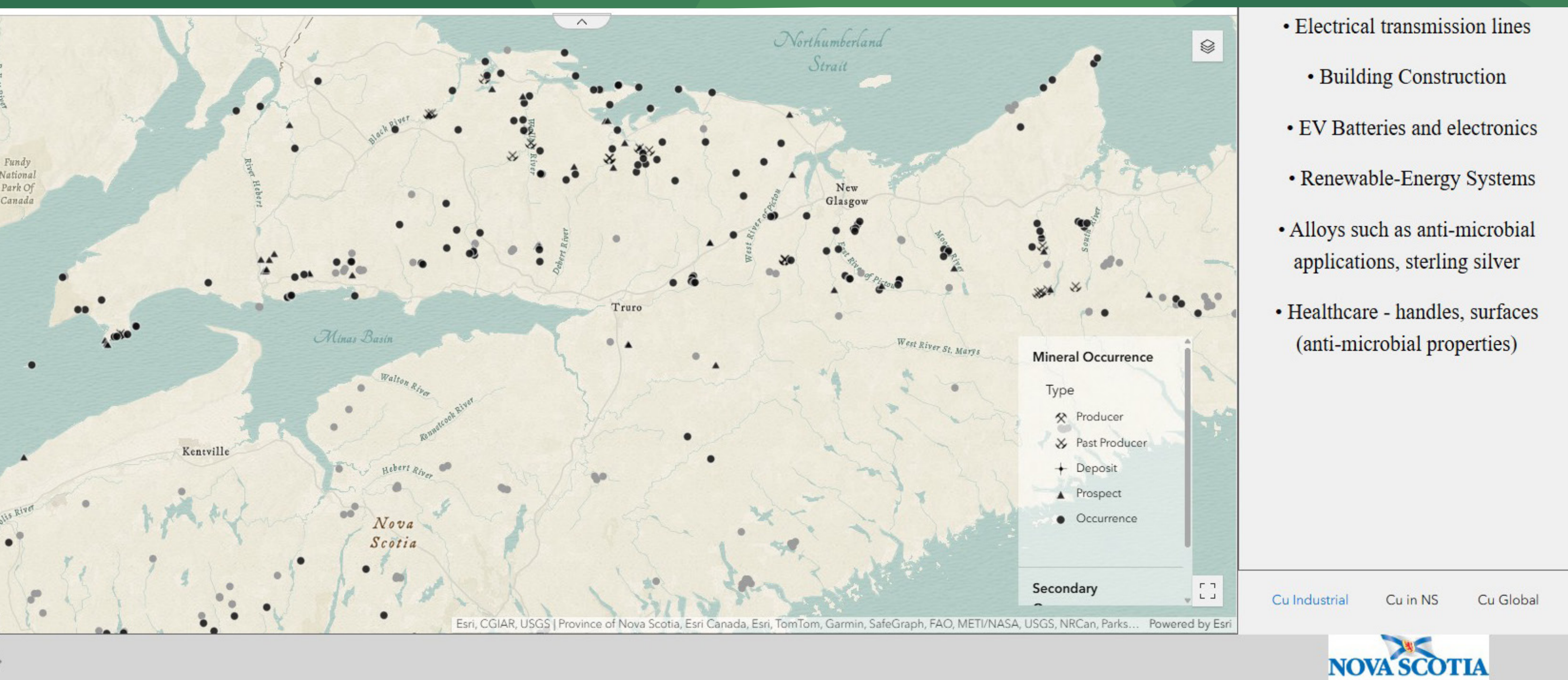
https://novascotia.ca/natr/meb/DATA/pubs/25re01/03ROA_2025_MacRae_Radon.pdf

Coastal Monitoring Program, by Maracle, M, Nova Scotia Department of Natural Resources, 2025, 21-30 page(s)

https://novascotia.ca/natr/meb/DATA/pubs/25re01/04ROA_2025_Maracle_CstlMon.pdf

Industrial Minerals, by Moss, T J, Nova Scotia Department of Natural Resources, 2025, 31-40 page(s)

https://novascotia.ca/natr/meb/DATA/pubs/25re01/05ROA_2025_Moss_IndMin.pdf


Northumberland Strait
Fundy National Park Of Canada
River Hebert
Black River
Debert River
New Glasgow
Truro
Minas Basin
Walton River
Kennetcook River
West River St. Marys
Kentville
Hebert River
Nova Scotia
Mineral Occurrence
Type
Producer
Past Producer
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Prospect
Occurrence
Secondary
Esri, CGIAR, USGS | Province of Nova Scotia, Esri Canada, Esri, TomTom, Garmin, SafeGraph, FAO, METI/NASA, USGS, NRCan, Parks… Powered by Esri
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