Natural Resources Canada | Ressources naturelles Canada

Geological Survey of Canada

STRATEGIC PLAN

2023–2028

Canada

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The Geological Survey of Canada acknowledges that the vast lands on which we work, live and study span the traditional and unceded territories of many Indigenous Peoples. We encourage our staff, collaborators, all Canadians and visitors to these lands to learn about and regularly acknowledge the historic and current relationship that exists between the lands on which we live and work and the First Nations, Inuit and Métis. The Geological Survey of Canada respectfully seeks ways to work in partnership with Indigenous Peoples to advance their rights.

Photo of the landscape in McQuesten, Yukon, photographed during GSC fieldwork.

Geoscience for a vast country

As a large and geologically diverse country, Canada depends on public geoscience to inform policy, manage the country's landmass, and develop natural resources responsibly. This is truer today than ever as we work to meet global challenges such as climate change and the biodiversity crisis, while continuing to support the national economy.

Through this Strategic Plan, the Geological Survey of Canada (GSC) recognizes the strong historical and new mandates received from the Government of Canada, and the important role that geoscience will play in advancing these for the public good. We will expand our geoscience work in support of sound mineral supply and Northern development, and in particular, help the global energy transition and a net-zero carbon future through advice on new supplies of critical minerals and renewable energy. We will contribute crucial science information and knowledge for onshore and offshore land management decisions—including but not limited to leading geoscientific advice on Canada's submissions to the United Nations Commission on the Limits of the Continental Shelf, on environmental impact assessments for major development projects, and on how best to meet Canada's terrestrial and marine conservation targets. We will also further advance geoscience for climate and disaster resilience, particularly supporting adaptation to geo-hazards and climate change, development of low-carbon energy sources, and carbon sequestration and energy storage solutions.

This Strategic Plan also recognizes that science does not exist in a vacuum. The GSC will work to improve how we disseminate our science, to ensure that science consistently reaches the Canadians who need it. We will strategically enhance our collaborations and partnerships both domestically and internationally, to maximize synergies and develop innovative and relevant research. We will also strategically examine how we operate internally, to ensure that we provide an inclusive workplace and world-class research infrastructure, and are managing both effectively.

A few other important goals crosscut these priorities. First, across all our activities, the GSC aims to maintain and improve relationships with Indigenous Peoples in Canada. Second, aligned with longstanding Indigenous principles and global priorities, we will increasingly incorporate environmental, social and governance (ESG) considerations in our geoscience research. We will also coordinate our geoscience work with provinces and territories where possible, to increase efficiencies as we all work to serve the public good of Canadians. Finally, we will continue to embrace new technological developments and methodological innovations, to continuously improve the precision, accuracy, and relevance of our science.

GSC Strategic Science Priorities

Geoscience for mineral and Northern development

Geoscience for land management

Geoscience for climate and disaster resilience

GSC Strategic Operational Priorities

Connecting geoscience to users

Enhancing domestic and international partnerships

Organizational stewardship for continued success

Canadian commitments and priorities that influence work at the GSC

Federal legislation

e.g., Department of Natural Resources Act; Impact Assessment Act; United Nations Declaration on the Rights of Indigenous Peoples Act

Federal directives and policies

e.g., Directive on Open Government

Direction from Prime Minister

e.g., Minister of Natural Resources Mandate Letter

Parliamentary and Cabinet decisions

e.g., Federal budget

National strategies*

e.g., Canadian Critical Minerals Strategy; Pan-Canadian Geoscience Strategy; National Adaptation Strategy

International treaties

e.g., United Nations Convention on the Law of the Sea

International agreements

e.g., Paris Agreement; Sendai Framework for Disaster and Risk Reduction

*Strategies are typically developed in response to other commitments (e.g. ministerial mandate letters or international agreements).

Geological Survey of Canada: a world-class research institution

The GSC is Canada's federal organization for geoscientific information and research, recognized worldwide for our focus on geoscience for the public good.

$47 million **annual budget (2023-24)** in stable funding for mandate responsibilities, core science activities, internal services, and infrastructure.

over 45 specialized science laboratories, operating across Canada, including Isotopic Geochemistry and Geochronology, Inorganic Geochemistry, Paleontology, Mineralogy and Physical Properties, and Organic Geochemistry and Petrology labs

$50 million **additional budget (2023-24)** allocated by Cabinet for specific initiatives on evolving governmental priorities.

a modern workforce comprising 440 full-time staff, as well as part time staff, Emeritus scientists, post-doctoral research scientists, students and volunteers

Each year, we publish hundreds of maps, open files, peer-reviewed papers and other reports. Our scientists are recognized worldwide and sought after for their expert advice to support mineral and Northern development, land management, and climate and disaster resilience—including development of alternative energy sources.

Geoscientist Catherine Mottram analyzing a fault surface to better understand the tectonic evolution of the Yukon landscape.

Our principles

The GSC is committed to upholding the principles of the Government of Canada's Values and Ethics Code for the Public Sector, as well as Indigenous reconciliation and scientific excellence.

Respect for Democracy
The GSC recognizes that elected officials are accountable to Parliament, and ultimately to the Canadian people, and that a non-partisan public sector is essential to our democratic system. The GSC is committed to providing decision makers with all the information, analysis, and advice they need, always striving to be transparent, candid, and impartial.

Respect for People
The GSC values diversity and the benefit of combining the unique qualities and strengths inherent in a diverse workforce. The GSC is committed to working together in a spirit of openness, honesty and transparency that encourages engagement, collaboration and respectful communication free from harassment and discrimination.

Indigenous Reconciliation
Indigenous Peoples have inherent rights and important relationships with the lands and waters in what is now Canada. The GSC is committed to continuing its work to build and maintain respectful, cooperative, and mutually beneficial relationships with Indigenous communities through its geoscience initiatives. The GSC will seek out opportunities to work alongside Indigenous communities to chart a path that explores ways to weave together knowledges that will contribute to thoughtful stewardship of Canada's lands.

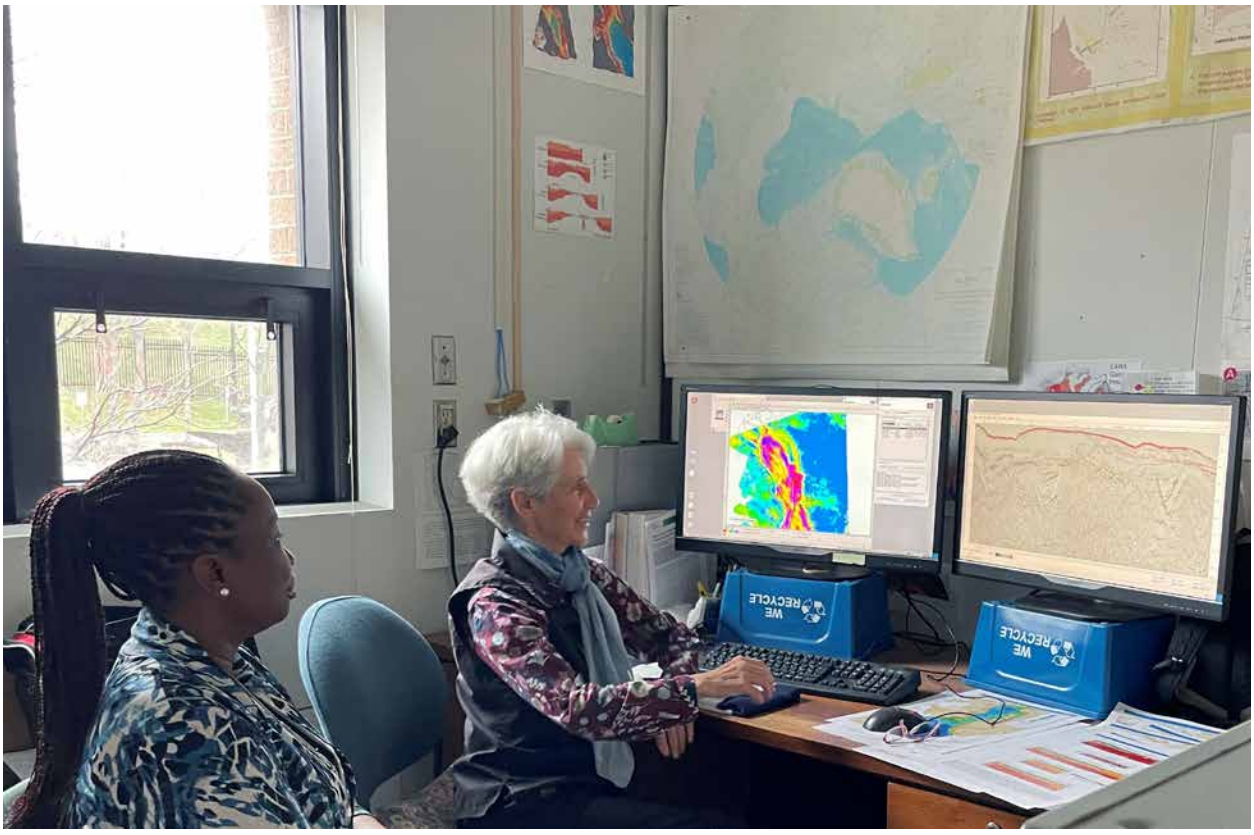
Environmental, Social and Governance Principles
Environmental, social and governance (ESG) are three principles that are used to measure the responsibility and sustainability of an organization or investment. The GSC is committed to supporting ESG principles, both through the conduct of its staff and by conducting research and other activities that advance global ESG-relevant goals such as net-zero emissions, biodiversity protection, and inclusion, diversity, equity and accessibility.

Integrity
Integrity is the cornerstone of good governance and democracy. The GSC is committed to conserving and enhancing public confidence in the honesty, fairness and impartiality of public sector geoscience by holding all staff to the highest ethical standards, in accordance with the Natural Resources Canada Scientific Integrity Policy.

Stewardship
All federal public servants must use and care for public resources responsibly, for both the short term and long term. The GSC is committed to considering the present and long-term effects that our actions have on people and the environment, and acquiring, preserving and sharing knowledge and information.

Excellence
Excellence in the design and delivery of public sector science, policy, programs and services is beneficial to every aspect of Canadian public life. The GSC's modern and innovative geoscience is based on engagement, collaboration, effective teamwork and professional development. In addition to scientific excellence, the GSC is committed to providing fair, timely, efficient and effective services in both official languages, continually improving the quality of policies, programs and science advice, and fostering a work environment that promotes teamwork, learning and innovation.

The Government of Canada's Policy on Results sets out the fundamental requirements for Canadian federal departmental accountability, enabling open and transparent public reporting. The GSC publishes an annual report which allows readers to see, at a glance, how the GSC is performing against its departmental responsibilities.



GSC scientists reviewing the seismic stratigraphic framework of western Baffin Bay.

Strategic science priorities

All science produced by the GSC ultimately advances Natural Resources Canada's core responsibility to "lead foundational science and share expertise for managing Canada's natural resources, reducing the impacts of climate change and mitigating risks from natural disasters…" (Departmental Plan, 2022-23).

Within this responsibility, and aligned with a variety of other mandates and plans (described in detail in the GSC Annual Report), the GSC responds to the following pressing—and equally important—needs in Canada:

- Sound mineral supply chains
- Evidence-based onshore and offshore land management
- Climate and disaster resilience

Enabled by world-class science infrastructure such as laboratories, earth materials collections, and high-performance computing capacity, the GSC advances these science priorities through a combination of science and research activities, specially funded initiatives, and client-based services. This Plan describes the targeted areas that will be our focus for 2023-28.

Science: multi-purpose and interconnected

While it is necessary to put our science into categories to effectively explain what we do and why it matters, all of our science priorities, and the geoscience work that we do under them, are interconnected. For example, the geoscience necessary to increase climate and disaster resilience (e.g. understanding permafrost thaw) also supports the development of safe infrastructure—critical to mineral supply chains, particularly in the North. The GSC also conducts foundational 'framework' geoscience and develops analytical methods that support our more targeted fields of study.

Nch'kay (Mount Garibaldi) photographed during GSC fieldwork.

Geoscience for mineral and Northern development

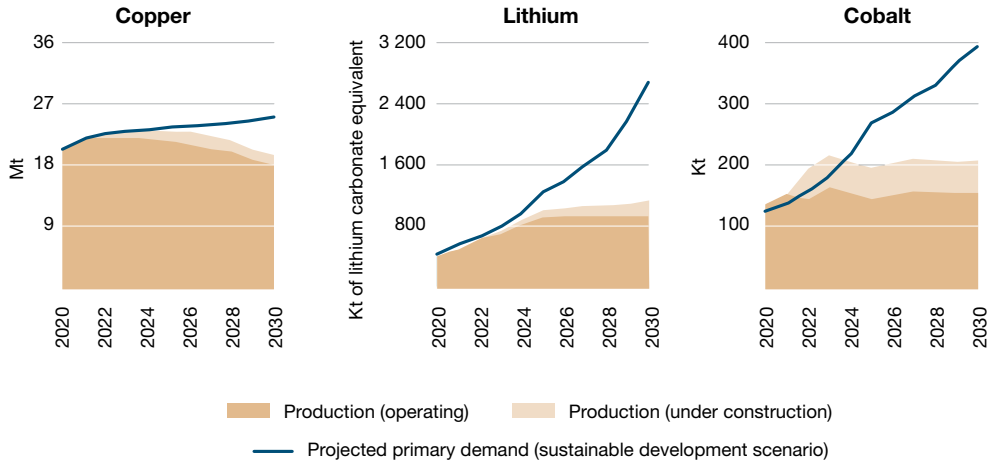
Canada's mineral sector is currently undergoing a dramatic and exciting transition. Demand is quickly growing for critical minerals as such as nickel, copper, cobalt, lithium, graphite and rare earth elements to support the renewable energy and information technology sectors. Canada is well positioned internationally to become a trusted supplier of these minerals, which presents unprecedented opportunities to create new jobs, develop infrastructure, seize new natural resource international markets, and retain sound mineral and energy supply at home for rising needs.

However, some challenges remain. Demand for many critical minerals is projected to outpace supply within the next 10 years (International Energy Agency 2021: The Role of Critical Minerals in Clean Energy Transitions), and continued production of other economically important minerals also remains a necessity. As deposits are mined, it becomes increasingly difficult to find new deposits—and the time lag from initial mineral exploration to development of a producing mine can be over a decade. Successful continued exploration for these important minerals will require increased efforts to look deeper beneath the surface or in Canada's North, which will in turn rely on significant and ongoing leading-edge geoscience research. Mineral development in the North is also tied to several other important considerations, such as the need for climate-resilient infrastructure and land use planning.

Strategic Outcome

Canada has the geoscience required to attract mineral investment across Canada, to inform sustainable development of the North, and to work with allied countries to become a leading supplier of responsibly developed minerals.

Global demand for many minerals may exceed global supply in the coming years.



Adapted from the International Energy Agency's 2021 analysis: The Role of Critical Minerals in Clean Energy Transitions.

Geoscientist heading back to the helicopter after a long day of field work to support mineral development in Yukon.

Mineral geoscience

The GSC works to improve mineral exploration effectiveness by developing predictive models of mineral potential and improving associated analytical techniques.

Critical Minerals Geoscience and Data (CMGD) Initiative

$80 million for **2022-27**

- Approved in Budget 2022 as a means of advancing Canada's Critical Minerals Strategy, this initiative focuses on lowering the development time for a key subset of the minerals on Canada's Critical Minerals List.
- Over 2022-27, the CMGD will:
    - Establish a comprehensive knowledge base for critical minerals deemed particularly important for the national economy and their use in batteries and magnets for the green economy.
    - Conduct critical minerals systems studies to inform exploration and development of critical minerals from both conventional and unconventional sources (e.g. emerging sources from mine waste that have the potential to quickly go into production).
    - Introduce advanced analytics for robust green critical minerals exploration, production and marketing decision making (inclusive of environmental, social and governance (ESG), economic and infrastructure considerations).
    - Conduct consumer and supplier critical mineral criticality assessments for Canada.
    - In the spirit of the Intergovernmental Geoscience Accord, provide contribution funding opportunities to the provinces and territories for critical minerals projects that are aligned with the CMGD mandate.
- These efforts could also become groundwork for future geoscience related to critical minerals, depending on the future needs of Canadians.

Targeted Geoscience Initiative (TGI)

$35 million for **2020-27**, followed by **$5 million per year** thereafter

- First launched in 2000, TGI was converted in 2020 by Natural Resources Canada from a temporary initiative to an ongoing one, in recognition of its crucial and continuing role in supporting the mineral exploration industry. TGI aims to provide innovative public geoscience that can inform mineral exploration at depth.

- TGI will:
    - Develop predictive, next-generation geological models for economically important minerals (ensuring complementarity with work under CMGD).
    - Develop leading edge tools and innovative techniques, particularly related to analytical, laboratory and field methods for mineral geoscience.
    - Issue grants to organizations outside the federal government, for scientific projects aligned with TGI priorities.

TGI fieldwork at the Malartic mine, northern Quebec.

Geoscience for Northern development

The GSC provides geoscience focused on mineral potential and sustainable development in Canada's North in the context of a changing climate. This work informs decisions related to mineral development, climate-resilient infrastructure, and land use. While all of our science priorities have a Northern component, this particular Northern-specific research is necessary due to the unique scientific knowledge gaps and infrastructure challenges in the region.

GEM-GeoNorth Initiative

$100 million for **2020-27**

- As the third phase of Geo-Mapping for Energy and Minerals, GEM-GeoNorth aims to provide new geoscience to increase the attractiveness of Canada's North for economic development in the context of Northerners' priorities and a changing climate.
- GEM-GeoNorth will:
    - Produce new public geoscientific data, knowledge and maps of northern Canada (north of the 57th parallel), focusing on areas with high potential for strategic minerals and other mined commodities, and where economic and/or infrastructure development is likely to benefit Northern communities.
    - Convene expertise from provinces and territories, e.g., through collaborative planning of federal-provincial-territorial geophysical and geochemical surveys.
    - Continue to convene an Advisory Group of Northerners and hold collaborative dialogues with territories, provinces, Indigenous governments and organizations, and other Northerners, to maintain alignment of GEM-GeoNorth research with Northern priorities.
    - Provide Indigenous landholders with accessible and plain-language geological information that can be incorporated into their land use decision making processes.
    - Disburse grants to academia, territorial/provincial geological survey organizations, or Indigenous organizations, for geoscience and multidisciplinary activities aligned with GEM-GeoNorth priorities.

GSC scientist Dawn Kellett conducting structural analysis of faults in central Yukon, under the GEM-GeoNorth Initiative.

Geoscience for land management

Appropriate land management decisions are critical for Indigenous rights, national economic prosperity, and environmental, social and governance (ESG) performance. These decisions also enable Canada to deliver on international commitments such as the UN Sustainable Development Goals, UN Convention on Biological Diversity (under which the federal government has set the goal of conserving 30 percent of Canada's land and water by 2030), and the UN Convention on the Law of the Sea.

Geoscience is one of many knowledge types that supports land management and conservation decisions. For example, the precise delineation of Canada's international boundaries is informed by geoscientific understanding of our submerged landmass. Geoscience helps provide a clear picture of mineral, energy and groundwater resources, informing what lands might be best suited for responsible development. Geoscience also provides foundational information that enables understanding of potential environmental impacts of development.

It is paramount to address land management through a respectful collaboration with Indigenous Peoples, who have rights, knowledge, and priorities for how land is used. The GSC will collaborate with Indigenous communities across all areas of research, and all science priorities, to address concerns and develop appropriate work plans.

Strategic Outcome

Canada has the geoscience required to inform responsible resource development and environmental stewardship in both terrestrial and marine environments, and to support its extended continental shelf submissions to the United Nations.

Sound land management depends on a good understanding of landscapes' underlying geology. Artwork by GSC scientist David Huntley (*Painted Mountains*; reproduced with permission).

Geoscience to delineate Canada's continental shelf

As a party to the United Nations Convention on the Law of the Sea (UNCLOS) treaty, Canada must define its continental shelf beyond 200 nautical miles (the Exclusive Economic Zone). The GSC is the sole source of the high-resolution geoscience to make this possible. Our work is critical for obtaining international recognition of Canada's entitlement to the living and non-living resources on and below the seafloor.

This work includes:

- Conducting geological and geophysical mapping of Canada's extended continental shelf in the Atlantic and Arctic Oceans to understand the history and structure of the ocean floor.
- Developing and submitting appropriate documentation to the United Nations (UN) Commission on the Limits of the Continental Shelf (see UN website for summaries of Atlantic and Arctic documentation submitted prior to 2023).
- Engaging and collaborating with other nations to improve understanding of Arctic marine geology.
- Providing expert advice within the Government of Canada on scientific issues related to Canada's extended continental shelf.

$121.2 million for 2023-2030 has been proposed for Natural Resources Canada (via the GSC) to prepare a revised submission to secure Canada's rights over its extended continental shelf in the Arctic Ocean, and to protect Canadian sovereignty in this increasingly contested area. The first five years of this funding ($113 million) was announced in Budget 2023. A Treasury Board Submission is required to unlock this funding, and is under development at the time of Strategic Plan writing.

GSC scientists Patrick Meslin and Kai Boggild deploying a sonobuoy in the central Arctic Ocean, in the vicinity of the North Pole.

Environmental geoscience

The GSC's environmental geoscience (including hydrogeology) supports responsible terrestrial land management. Under this umbrella, we also convene expertise from across the GSC on a variety of topics to support Canada's impact assessment process—a critical core function of government under the Impact Assessment Act—and contributes to ESG principles.

Over 2023-28, the GSC will continue longstanding important activities:

- Fill knowledge gaps related to Canadian water resources, thus supporting sustainable water management and decision making aligned with ESG principles. This includes developing innovative methods, such as models of groundwater dynamics that also include other components of the water cycle and are coupled with climate data.
- Conduct environmental geoscience research during multiple phases of the natural resource development cycle, from pre-development to post-closure. This research aims to distinguish the environmental effects of natural resource development from those produced by natural processes. This work will also help us better understand cumulative effects of natural resource development.
- Convene GSC expertise for impact assessments, through the Environmental Impact Assessment Service.

Furthermore, over the same period, participation in the multi-departmental Impact Assessment and Regulatory Processes (IARP) initiative will enable the GSC to undertake additional activities, to support current federal land management priorities more comprehensively.

GSC scientist Michael Parsons sampling sediments for cumulative effects research in the Cobalt mining camp, northern Ontario.

Environmental Impact Assessment Service (EIAS)

- First established in 1992, this client-based service ensures that federal impact assessments, and the quasi-judicial Joint Review Panels that follow, incorporate necessary geoscience expertise.
- EIAS functions are available on-request to the Impact Assessment Agency of Canada and other boards or departments, and include:
    - Convening thorough, impartial, timely and coordinated expertise and advice from the GSC (e.g. on hydrogeology, geochemistry, natural hazards) to federal impact assessment reviews.
    - Providing advice and technical support to Joint Review Panels.
- Over the 2023-28 period, EIAS will particularly support federal commitments under the cross-departmental Impact Assessment and Regulatory Processes (IARP) initiative. Funding for this additional work is captured in the IARP initiative box (see next page).

GSC lab technologist Lori Campbell sampling a flooded open pit mine to analyze geoenvironmental characteristics of Canadian critical mineral deposits.

Impact Assessment and Regulatory Processes (IARP) Initiative

Approximately $17 million for **2023-28**

- First approved in Budget 2018 as part of a then-new impact assessment regime, this multi-departmental initiative aims to increase the scientific capacity in federal departments and agencies necessary for effective impact assessments; implement changes required to protect water, fish and navigation; enhance capacity to conduct cumulative effects research and provide open science; and increase Indigenous and public participation.

- Now renewed with further funding for 2023-28, the current IARP initiative has the same overarching goals as the original initiative, with additional emphasis on sustainable development, Indigenous participation, and review of proposed development projects that aim to support net-zero targets.

- Over the 2023-28 period, GSC responsibilities under IARP will include:
    - Providing scientific expertise and advice to support the Impact Assessment Agency of Canada's multi-phase impact assessment activities.
    - Helping to deliver regional terrestrial assessments, including information on cumulative effects, for areas that have been prioritized for potential development.
    - Developing new marine geoscience knowledge products to inform onshore and offshore planning in prioritized areas.

- GSC will address these needs by expanding existing activities and capacity in environmental geoscience and marine geoscience.

Marine geoscience

The GSC's marine geoscience supports the safe, effective and sustainable use of resources on and below the seafloor of Canada's three oceans. It contributes to Fisheries and Oceans Canada's national marine spatial planning process, federal impact assessment and regulatory processes, and national marine conservation targets.

Marine Geoscience for the IARP Initiative

(**funds administered through IARP** for **2023-28** - see previous page)

- Under the multi-departmental IARP initiative, GSC has committed to support offshore planning in prioritized areas, by developing new marine geoscience products and providing technical expertise and advice. This work will support marine spatial planning, geological hazard risk-management, and decisions related to renewable energy in the offshore.
- Specific marine geoscience contributions will include:
    - Expanding on previously-developed marine spatial plans and atlases for offshore areas identified as priority bioregions. All new maps of offshore seabed geology will be accessible through the Marine Spatial Data Infrastructure.
    - Providing stakeholders with scientific and technical expertise and advice, including rigorous scientific reviews.

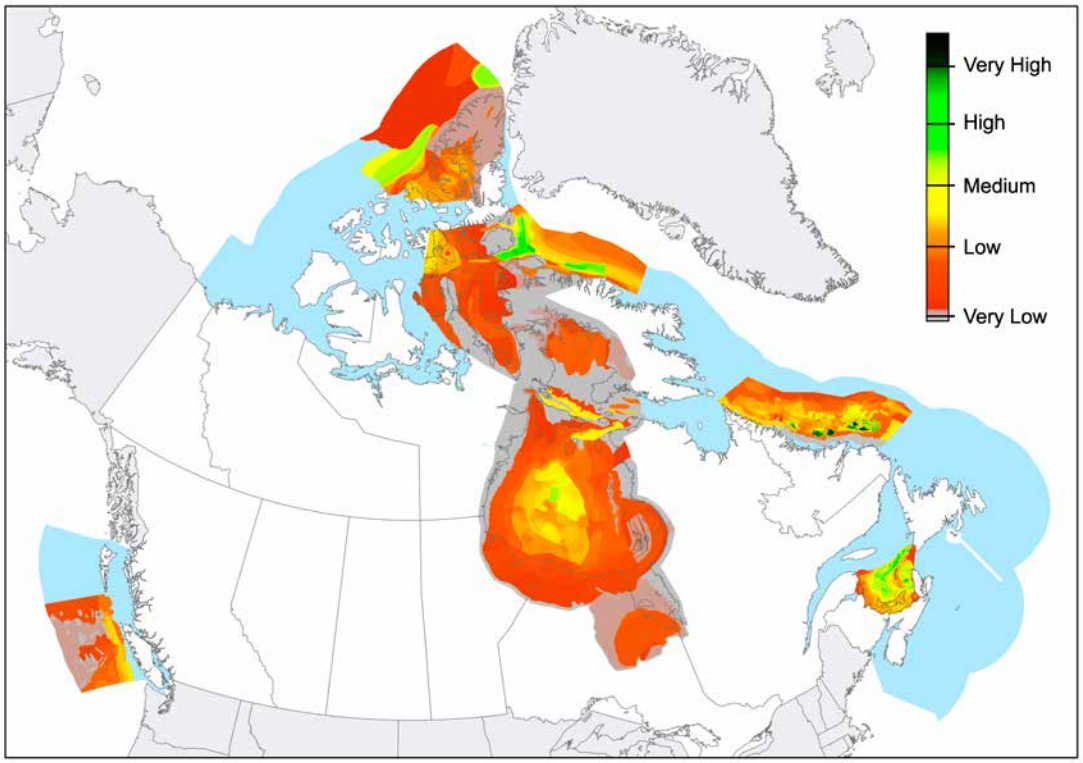
Expedition in Southwind Fjord, Baffin Island, lead by GSC scientist Alex Normandeau, to investigate submarine landslides.

Marine Conservation Targets (MCT) Initiative

$9.5 million for **2021-27**

- First launched in Budget 2016, this initiative was renewed in 2021 to contribute to Canada's Marine Conservation Strategy. It provides assessments of energy and mineral potential for offshore and coastal areas that are being considered for conservation by Fisheries and Oceans Canada, Parks Canada, and Environment and Climate Change Canada. This work has become increasingly important over time, as Canada now aims to conserve 25% of offshore and coastal regions by 2025 and 30% by 2030.

- Over the current renewal period, the MCT Initiative will:
    - Analyze data, samples and previous studies to evaluate the geologic conditions that may have led to the formation and emplacement of petroleum or other natural resources beneath the seabed.
    - Continue developing resource assessments in collaboration with others from across Natural Resources Canada.



Map showing areas where qualitative hydrocarbon resource assessments have been completed to date for the Canadian offshore, as part of the MCT Initiative. Colour coded gradation bar ranges from no potential (grey), to the highest potential (dark green, globally competitive for exploration) as per Lister et al. (2018).

Geoscience for climate and disaster resilience

Bordered by three oceans, and spanning diverse climatic and geological settings, Canada is exposed to a range of natural hazards such as earthquakes, flooding, landslides, coastal erosion and wildfires, and environmental changes such as permafrost thaw, glacier melt, and sea-level changes. Many of these phenomena are exacerbated by climate change. The Intergovernmental Panel on Climate Change's Sixth Assessment Report unequivocally shows that climate change is causing widespread and increasingly complex losses and damages to the natural environment, human health, infrastructure and the economy. For example, global warming trends are decreasing permafrost stability in the Canadian Arctic and elsewhere, which can cause buildings, roads, and railways to sink or collapse, as well as releasing previously locked solutes, suspended and organic matter, with implications for hydrology and greenhouse gas emissions. It is also clear that climate change is in large part caused by emissions of greenhouse gases, which are closely tied to the use of fossil fuels—a carbon-based resource—as a common energy source. Resilience to environmental changes and natural disasters requires understanding natural hazards, climate change, and the interactions between the two. Ensuring future resilience to climate change also requires bringing greenhouse gas emissions down to net-zero, both by sequestering carbon from the atmosphere and by pursuing low-carbon energy solutions.

Geoscience is essential for preparing for, adapting to, and mitigating, natural hazards and climate change. Geoscience research to understand natural hazards, climate change, and related risks helps minimize the impact of future events in Canada and globally, thereby avoiding losses in communities, the environment, and the economy. This is true across the country but is particularly important in Arctic regions, where climate change impacts are accelerated. Geoscience can also contribute to reducing net greenhouse gas emissions by locating sources of low-carbon energy, such as geothermal reservoirs, and determining optimal geological parameters to capture, use and store carbon.

Strategic Outcome

Decision makers and communities have access to the geoscience that they need to make Canada more resilient to natural hazards and climate change, and to achieve a net-zero future.

View from a helicopter flight over a glacier in the spectacular Coast Range, captured during GSC fieldwork in Yukon.

Natural hazards and climate change geoscience

The GSC provides an extensive evidence base for decision makers to ensure that Canada's built and natural environment is resilient to natural hazards in a changing climate. This work contributes to national codes, standards, and commitments, including the National Building Code of Canada, Emergency Management Strategy for Canada, Canada's National Adaptation Strategy and the Climate Science 2050 synthesis. It also supports land use planning decisions, as well as Canada's commitments under the United Nations Sendai Framework (Priority 1 – Understanding Risk) and action on Sustainable Development Goals (Sustainable Cities and Communities; Climate Action).

Over 2023-28, the GSC will:

- Refine knowledge and map where, when, and how geohazards (including earthquakes, submarine and terrestrial landslides, tsunamis, volcanoes, and coastal hazards) occur across Canada.
- Develop techniques to effectively monitor and better understand risk from landslides and volcanoes.
- Monitor, map and predictively model changes in permafrost, glaciers, coastal erosion and sea-level, to support climate adaptation decisions and a systems-based approach to climate change.
- Explore a whole-of-system understanding of the dynamic environment from mountain top to seafloor to support resilience decision making in a changing climate.
- Provide advice on the potential impacts of natural hazards in Canada through open and easily accessible data.

GSC Master's student Ginny McLane conducting fieldwork on Nch'kay (Mount Garibaldi) volcanic field in British Columbia.

Geoscience for a net-zero future

The GSC supports the development of clean, renewable energy sources, as well as Carbon Capture, Utilization and Storage (CCUS) to help reduce national greenhouse gas emissions and mitigate climate change impacts. This work foundationally supports energy-related goals across government, and as such the work is funded not only by GSC but also by partners such as the Office of Energy Research and Development (OERD).

Over 2023-28, the GSC will:

- Expand its research on geothermal and emerging energy sources such as hydrogen, as well as underground storage options for gases. The latter informs both CCUS and storage of gases used as low-carbon energy solutions (e.g., hydrogen, high-pressure air).
- Work with partners such as OERD to further explore opportunities to deliver on Canadian clean energy objectives. At the time of writing, OERD recently provided additional funding for the GSC's low-carbon energy research, so that projected funding from OERD totals approximately $15 million over 2023-28.
- Identify priority energy themes for future research, in consultation with Indigenous communities and national and international scientific institutions.

GSC scientist Stephen Grasby examining Mount Cayley volcano as a potential source of geothermal energy, in support of Canada's clean energy transition.

Strategic operational priorities

Reaching new horizons for geoscience relies on strong operational foundations. This includes how we plan and manage our research, how we manage our data and information, how we disseminate our geoscience, how we support our people, and how we manage the operational systems themselves.

For the 2023-28 period, the GSC will particularly work to:

- Further enhance how we share our geoscience with stakeholders, Indigenous Peoples, and the public.
- Ensure that we are collaborating effectively both within and outside Canada, while considering changing geopolitical contexts.
- Assess and improve how we support our people (particularly in terms of inclusion, diversity, equity and accessibility), maintain and advance our research infrastructure, and manage our operational systems.

Each strategic operational priority in this plan is based on one of these goals and will be implemented through a combination of existing capacity and strategic investments.

GSC Collections curator Michelle Coyne and scientist Nikole Bingham-Koslowski examining a few geological samples out of the GSC's vast and historical earth materials collection.

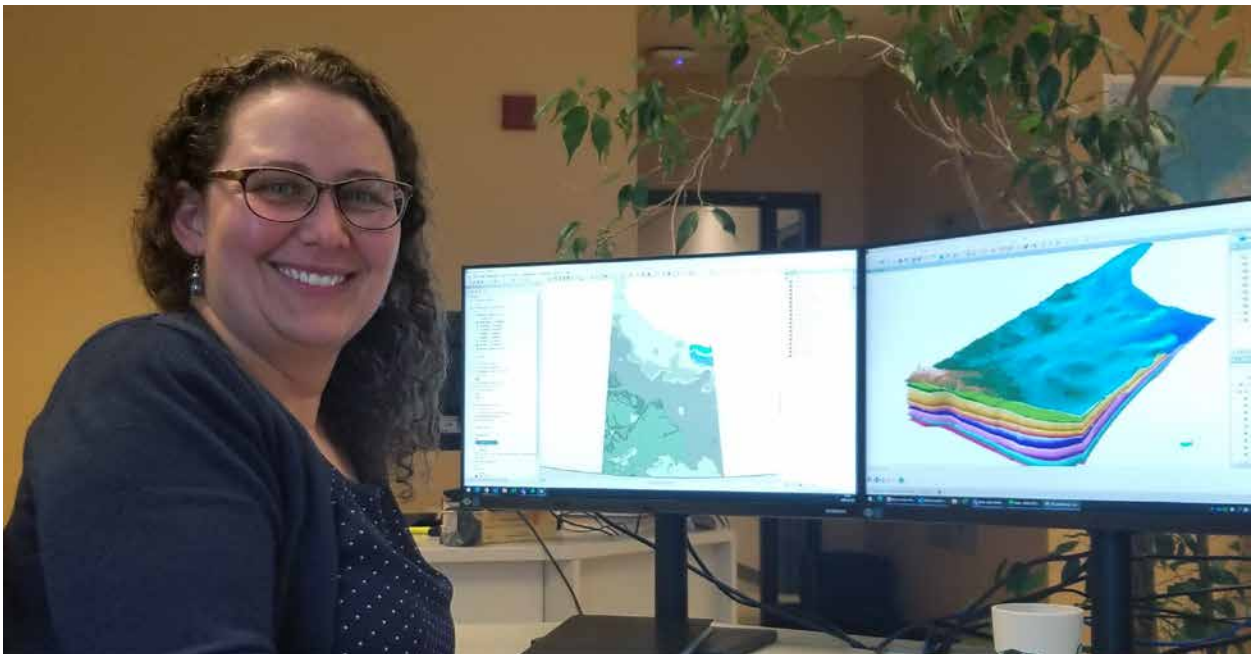
Connecting geoscience to users

As noted in previous sections, public geoscience provides an important evidence base for effective monitoring, protection, management, and restoration of natural resources.

These benefits are enhanced when geoscience is openly available, readily useable, and well communicated, so that everyone who needs the information—whether governments, communities, industry, non-profit organizations, or individuals—can find and use it. On a practical level, access increases the application of the science, and enables swifter economic, societal, and environmental advancements. For example, the GSC's Environmental Impact Assessment Service provides on-demand information and expertise to decision-makers in the Impact Assessment Agency of Canada, which directly informs land management decisions and responsible resource development projects. Less tangibly but also importantly, access to public geoscience information can inspire people, spark their curiosity and entice them into the rich world of geoscience – fieldwork, lab analyses, data analysis, working in scientific teams, informing policy discussions and contributing to ESG performance.

Strategic Outcome

Decision makers in Canada can access the geoscience they need, regardless of level of scientific expertise.



GSC scientist Karine Bédard creating publicly-available 3D geological models of Canada's subsurface.

Data and information management

The GSC develops many public geoscience products (e.g. maps, publications, tools and data) through our various core science activities and initiatives, most of which are already available in digital formats online. These are regularly used and cited outside the organization. The GSC's earth materials collections are also regularly consulted by Canadian researchers.

Over 2023-28, the GSC will continue to enhance the findability, accessibility, interoperability and reusability of our data and information by:

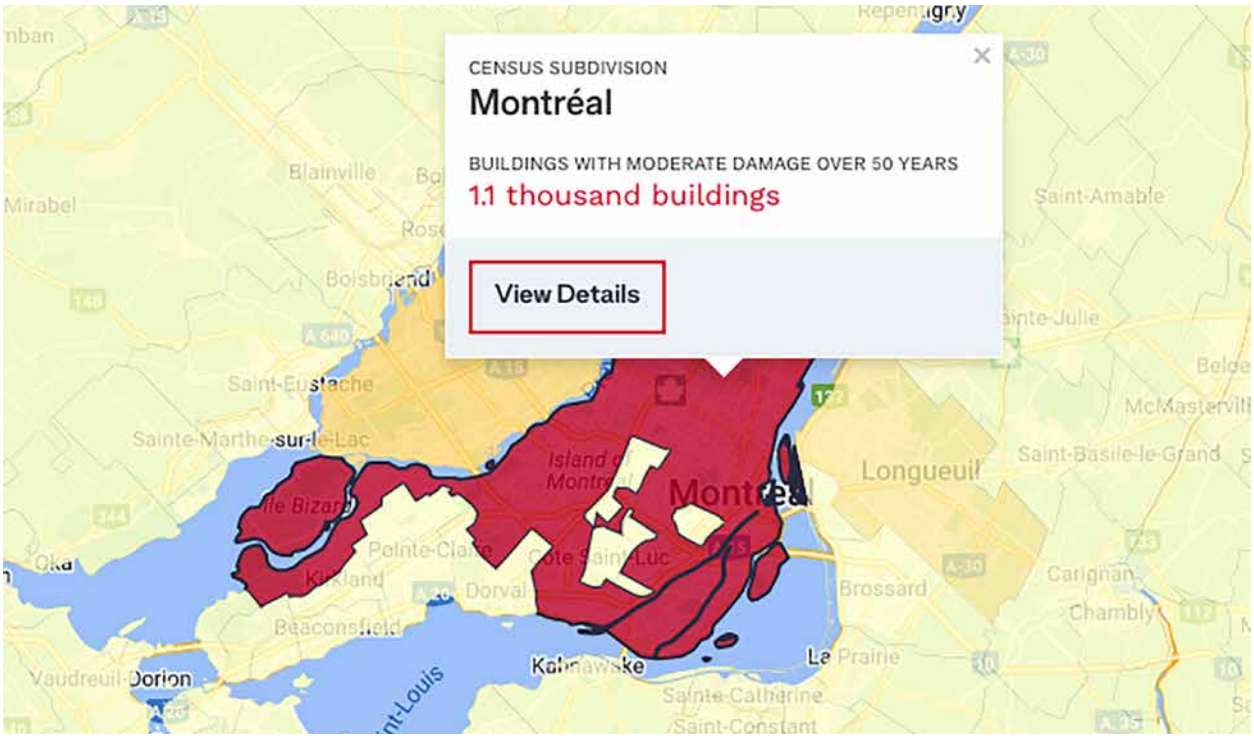
- Establishing and implementing clear, organization-wide processes for the acquisition, management, dissemination and preservation of geoscience data throughout its life cycle.
- Developing and implementing standards for data structure and format, to increase interoperability and reusability.
- Collaborating with provincial and territorial geological survey organizations to improve interoperability of our respective datasets.
- Enhancing findability and accessibility of GSC's earth materials collections, including rock samples and fossils.
- Improving the GSC internal publication process.
- Developing new methods and technologies to acquire geoscience data and derive new knowledge.
- Improving the organization's literacy in data science, digital tools, artificial intelligence, and other emerging technologies.

This work will build on existing efforts by the Open Geoscience Network (described in GSC Annual Report), and the National Geological Surveys Committee (described in annual NGSC Progress Report) and will be implemented across all of the GSC.

Databases and portals

The GSC makes most of its publications, maps, open files and data publicly available on GEOSCAN. Data and results can also be found through the following thematic databases and web portals (note that this is not an exhaustive list):

- Critical Minerals Mapping Initiative Portal (co-managed with Geoscience Australia and USGS)
- Canada-3D (collaborative project with provincial and territorial geological survey organizations; under development)
- Canadian Database of Geochemical Surveys
- Groundwater Information Network
- Permafrost Information Network
- CanCoast
- RiskProfiler
- Expedition Database
- BASIN Database
- Canadian National Marine Seismic Data Repository
- Seafloor photographs, offshore Canada
- Web Map Services for Marine Geoscience Data
- Canadian Geochronology Knowledgebase
- GeoCollections
- WEBLEX Canada



The GSC's earthquake risk assessment platform, Riskprofiler.ca, shows results of a probabilistic earthquake risk assessment that allows users to view and compare potential damage and losses across the country for a given return period. This figure predicts that Montreal would expect to see 1100 buildings damaged over a 50 year period as an average value, based on current exposure.

Geoscience engagement and outreach

To ensure that Canadians know about our public geoscience and where to look for it online, GSC also disseminates geoscience information to a variety of user groups and actively engages Indigenous communities.

Currently, the GSC works with Indigenous communities during the planning phases of fieldwork to ensure that lands are only accessed through free, prior and informed consent. Science programs and individual researchers often undertake additional activities with communities, such as presenting our findings to communities, developing plain-language reports, and learning from the teachings of others. During 2023-28, the GSC will work to strengthen existing relationships and build new relations with Indigenous Peoples to listen and learn about priorities that could be advanced together in future.

Regarding broader geoscience dissemination, the GSC aims to reach both specialized users (e.g., scientists from industry, academia, non-governmental organizations) and the general public. Reaching the latter is a particular commitment under the Pan-Canadian Geoscience Strategy. To engage key users of geoscience, the GSC actively shares research findings in scientific journals, conference presentations, annual reports, and also convenes advisory groups such as the Advisory Group of Northerners and the Industry Advisory Group. To reach the wider public, the GSC also communicates research through a variety of channels, including but not limited to social media, Natural Resource Canada's Simply Science platform, the GSC webpage, interviews, outreach to students and youth, community visits, and plain-language reports. This helps both to increase public awareness and interest in our work, as well as to counter misinformation and emphasize the benefits of geoscience.

Over the 2023-28 period, the GSC will work to expand its engagement and outreach efforts in both official languages, as well as harmonizing these efforts with those of other federal, provincial and territorial organizations.

GSC Scientist Vicki Tschirhart engaging local Indigenous community members during a GSC fieldwork event in northern Nunavut.

Enhancing domestic and international partnerships

Some of the most innovative and impactful science arises from bringing together multiple ways of thinking, or by combining data from multiple geographical regions and science domains. We can create important synergies by working both with local, regional, and international governments; other federal government organizations; Indigenous organizations and communities; academia, professional associations, and other non-governmental organizations; and the private sector. Collaboration and dialogue through various networks also enable us to fulfill important policy aspirations and obligations, which are described further in the following sections.

Strategic Outcome

The GSC works effectively with partners both within and outside Canada, to produce the best possible science and outcomes for Canada.

GSC collaboration with the Korea Polar Research Institute (KOPRI) on marine geoscience and permafrost thaw in the Beaufort Sea.

Collaborations and partnerships within Canada

The GSC has a long and successful history of working with partners within Canada on a variety of research topics. We have over 30 Memoranda of Understanding and other collaboration agreements with governmental and non-governmental institutions (including Indigenous communities), regularly seek input from stakeholders through advisory groups and multilateral dialogues (e.g. National Dialogue on Groundwater), and collaborate both formally and informally within the federal government. Over 60 GSC scientists are also adjunct professors at academic institutions, which also supports the development and training of next generation geoscientists.

The GSC is committed to strategically enhancing partnerships with federal, provincial, territorial, Indigenous, academic, and other organizations and institutions to meet the needs of Canadians. Priority areas for action over 2023-28 include:

- Further developing relationships with Indigenous Peoples to understand communities' priorities and support the co-development of research priorities and partnerships across GSC science programming.
- Continuing to break down siloes and advance multidisciplinary research between federal science organizations involved in Laboratories Canada, particularly the TerraCanada Hub.
- Working with provinces, territories, and national organizations such as the Canadian Federation of Earth Sciences to strengthen the public geoscience ecosystem in Canada. Areas of focus will include both the technical and human elements of this ecosystem, as laid out in the federal-provincial-territorial Pan-Canadian Geoscience Strategy and Intergovernmental Geoscience Accord.

Meeting of the National Geological Surveys Committee (executives from federal, provincial, and territorial geological survey organizations) to discuss regional and national geoscience priorities, and advance the Pan-Canadian Geoscience Strategy.

Indigenous relations: A priority for Canada, a priority for the GSC

Indigenous Peoples have inherent and important relationships with the lands and waters in Canada, and thus are in a strong position to both contribute to and benefit from geoscience. The GSC is committed to Indigenous reconciliation as a fundamental organizational principle, and furthermore aims to continually strengthen relations and partnerships with Indigenous Peoples.

To advance this priority, in 2020 the GSC established an Indigenous Relations Network as an internal community of practice focused on supporting the organization's capacity to build long-term relations and to conduct meaningful Indigenous engagement. This builds on the GSC's experience to enhance relationships with Indigenous communities and organizations while remaining grounded in the principles of mutual respect and cooperation and recognizing the value of Indigenous worldviews and knowledge. Delivering our science programming respectfully and with Indigenous partners is a cornerstone of this strategic plan.

Specific areas for action by the GSC's Indigenous relations from 2023-2028 will be to:

- Provide on-going and targeted training to staff as foundation to support reconciliation and conduct meaningful engagement.
- Introduce a consistent approach to engagement within the GSC that respects the rights of Indigenous Peoples and provide tools and training to enable this approach.
- Actively participate in Natural Resources Canada's Sistering Indigenous and Western Science (SINEWS) student mentorship initiative.
- Align research priorities of GSC science programs where possible with those of Indigenous governments, regional Indigenous representative organizations, and other Indigenous organizations and communities.
- Identify barriers that limit or restrict the use of agreements or procurement procedures between the Geological Survey of Canada and Indigenous communities and subsequently strive to improve and streamline these processes.
- Identify and monitor the development of protocols and action plans under the United Nations Declaration on the Rights of Indigenous Peoples Act, with the support of the Natural Resources Canada sector, Nòkwewashk*.
- Collaborate with Nòkwewashk* to address and resolve Departmental challenges and barriers to effective Indigenous relations and collaboration.

*Nòkwewashk is Natural Resources Canada's Centre of Expertise in meaningful Indigenous participation in natural resources projects and net-zero transition. It delivers Indigenous engagement, program support and policy leadership on economic reconciliation and regulatory coordination while bringing together Indigenous partners, provinces, territories and industry in project development. To deliver key Natural Resources Canada initiatives in partnership with Indigenous peoples, Nòkwewashk actively works to identify opportunities to strengthen Indigenous inclusion in the natural resource sectors while maintaining respectful relationships.

GSC scientist Jim Craven establishing a magnetotelluric station, used for visualizing sub-surface geothermal reservoirs in 3D, on the flank of Mount Cayley, with help from an Environmental Monitor from the Squamish Nation.

Collaboration with international partners

Geological features and processes are global phenomena that cut across many international borders. Canada is a world leader in geoscience, and our expertise can be used to benefit partner nations and the international community— includes delivering on Canada's commitments to the UN Convention on the Law of the Sea, the UN Sustainable Development Goals, and other international treaties and agreements. Other nations, in addition to doing their part to advance global goals, can also contribute to GSC's research work and offer insights into Canada's vast landmass and offshore.

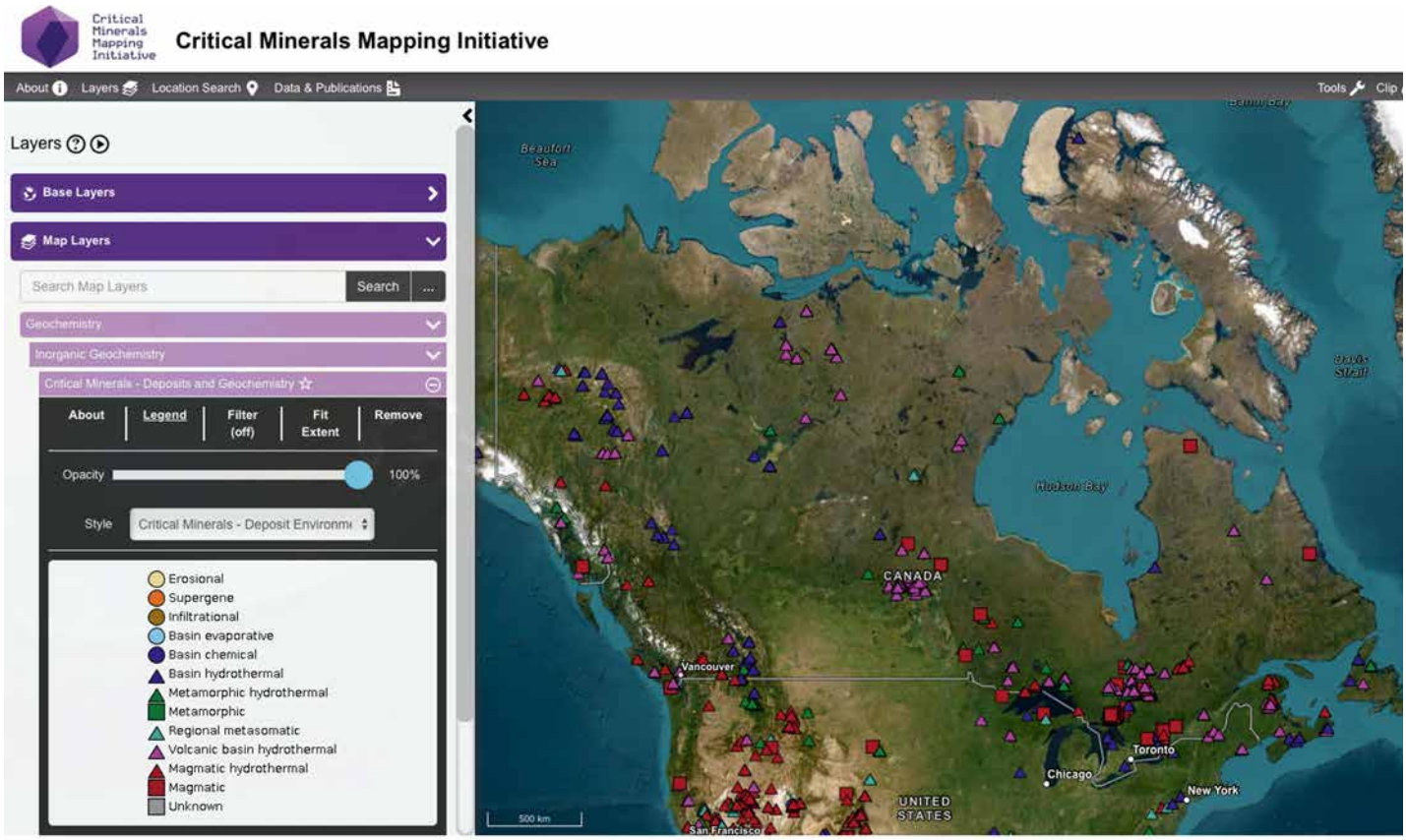
The GSC therefore collaborates internationally with a variety of partners, including both governmental and academic/industry science organizations. We have Memoranda of Understanding for cooperation in geoscience with over 6 international organizations, which cover a multitude of bilateral and multilateral collaborative scientific projects. In recent years, one of the most impactful of these projects is the Critical Minerals Mapping Initiative, to pool geological expertise and resources to map the occurrence of critical minerals globally, thereby addressing supply vulnerabilities and advancing commitments under the Canada-U.S. Joint Action Plan on Critical Minerals Collaboration. Similarly, knowledge gained from GSC's involvement in the Global Earthquake Model Foundation informed development of Canada's National Earthquake Risk Assessment project. The GSC also has a history of constructive partnerships with international agencies studying an array of geoscience issues in the marine environment, and will continue to actively develop collaborative projects in this area in the future.

In addition to collaboration with international partners on specific projects, the GSC participates in a variety of international dialogues and fora. Our scientists provide data and knowledge, whether directly or via other federal organizations, to international bodies such as the Intergovernmental Panel on Climate Change (e.g., sea level change) and the World Meteorological Organization (e.g., glacier monitoring data). We are also a founding member of World Community of Geological Surveys, a best practice community of national and regional geological survey organizations.

In an ever-changing geopolitical context, the GSC remains committed to producing the best possible science and best possible outcomes for Canadians and collaborating with like-minded international partners wherever appropriate to advance both domestic and global goals.

Over the 2023-28 period, the GSC will:

- Continue to participate actively in relevant international assessments, initiatives, dialogues, and fora.
- Pursue meaningful collaboration with allied nations and international organizations under the principles of science diplomacy. This can include expanding existing collaborative projects, or developing new ones.
- Employ engagement mechanisms, such as the Global Affairs Canada International Assistance Envelope, to assess opportunities related to international assistance.



Critical Minerals Mapping Initiative (CMMI) Portal. This free interactive mapping tool was developed through collaboration between the GSC and counterpart geological survey organizations in the USA and Australia, and aims to help build a diversified critical minerals industry in these countries.

Organizational stewardship for continued success

The demand for geoscience knowledge in Canada has increased steadily over the past decade. At the time of writing, rapid growth in the number of initiatives, funding, and scientific capacity are providing exciting new directions for the GSC. For example, the launch of the Critical Minerals Geoscience and Data Initiative and other high-dollar value initiatives provide an opportunity to bring in new and diverse talent and expertise to the GSC, and to update some of our corporate systems. Likewise, the GSC's participation in the Laboratories Canada 25-year strategy is a generational opportunity to renew our science infrastructure, starting with Ottawa and Quebec City, through the TerraCanada Hub network.

Strategic Outcome

GSC equitably attracts and retains talent and expertise, and ensures that the foundations are in place to support new research horizons.

GSC scientist Abeer Haji Egeh curating insect fossils from the GSC earth materials collections in ethanol at the Canadian Museum of Nature.

Diverse workforce and inclusive workplace

Our people are at the heart of the GSC's ability to deliver our science. GSC staff are a dedicated and committed group of innovative thinkers, dedicated analysts and professional administrators who are driven to realize results. As the GSC turns its attention to delivering on a number of government priorities until 2028, we seek knowledgeable professionals keen to help us advance our priorities of identifying mineral resources, supporting evidence-based land management decisions, and maximizing resilience to climate change and natural disasters.

To encourage and support a results-driven, inclusive, and vibrant workforce, over 2023-28, the GSC will work actively towards:

- Recruiting new skilled staff through inclusive processes that attract people from Canada's North, designated employment equity and equity-seeking groups (e.g., Indigenous Peoples, visible minorities, 2SLGBTQI+, people with disabilities).
- Promoting staff recruitment and retention for all employees by fostering an accessible and inclusive workplace that identifies and addresses barriers (e.g., social, financial, bias-driven).
- Increasing support for career-long learning and development, talent management, and opportunities for advancement. This includes working to identify and address systemic biases in training and advancement processes.

GSC Delta-lab team in the stable isotope geochemistry laboratory.

Robust research infrastructure

The GSC's leading-edge science activities depend on access to robust research infrastructure and associated assets. This includes many unique science laboratories, earth materials collections, high-performance computing capacity, warehouses, specialized storage (chemicals; radioactive materials; field equipment), machine shops, and libraries.

Given that the GSC manages multiple research facilities across Canada, and that laboratory and digital technologies are constantly evolving, strategic management of infrastructure and assets is critical to the continued success of the organization.

Over 2023-28, the GSC will:

- Expand the role of its Science Laboratory Network as a federal innovation centre for geoscience research and development, while collaborating with provincial and territorial partners. This includes identifying areas for short and long-term strategic investments.
- Identify areas for strategic investment in earth materials collections warehouse facilities across the country for optimization of storage facilities, including triage of legacy material and modernization of physical environments.
- Work collaboratively with federal partners to ensure that a robust high performance computing infrastructure is in place to support research activities.
- Strategically invest in cloud space, programming/analytical software, and other digital technologies, for data management, compilation, analysis, and delivery.
- Work collaboratively with TerraCanada Partners, Laboratories Canada, and across Natural Resources Canada, to plan and prepare for future transitions to enhanced facilities.

GSC lab technician Leanne Komaromi, setting up heavy liquid separation for extraction of Paleozoic limestone conodont elements.

Effective governance and processes

The GSC is committed to sound management practices, and recent evaluations of GSC programs signal that these have been well managed and delivered. As our organizational directions change, we must strategically adjust how we plan, manage and report on our science. This includes both our overall governance and how we manage our people and infrastructure.

Over 2023-28, the GSC will:

- Establish and implement streamlined governance structures aligned with the Strategic Plan.
- Strategically assess and improve science planning, management and reporting processes, including filling capacity gaps where required.
- Continue to evaluate and improve how we manage our people and our research infrastructure, to ensure continued organizational success.

GSC employees participating in the Vancouver Pride Parade.

Moving forward

Some of the objectives and goals that the GSC has set are familiar for a geological survey organization, but many others will require us to expand our horizons. We will take up the challenge of delivering science to support evidence-based decision making in Canada at a time of great technological and social change.

However, we will not be able to do this alone as many challenges before society require integrated and considered approaches informed by diverse views. To deliver on our strategic directions, we will strengthen our ties to other federal organizations, provinces and territories, Indigenous organizations, non-governmental research institutions, the private sector and civil society as a whole.

We ask you to contact us, to challenge us and, most importantly, to join with us to assure the sustainable future of Canada through thoughtful, respectful dialogue about the land we live on, its resources and its future.

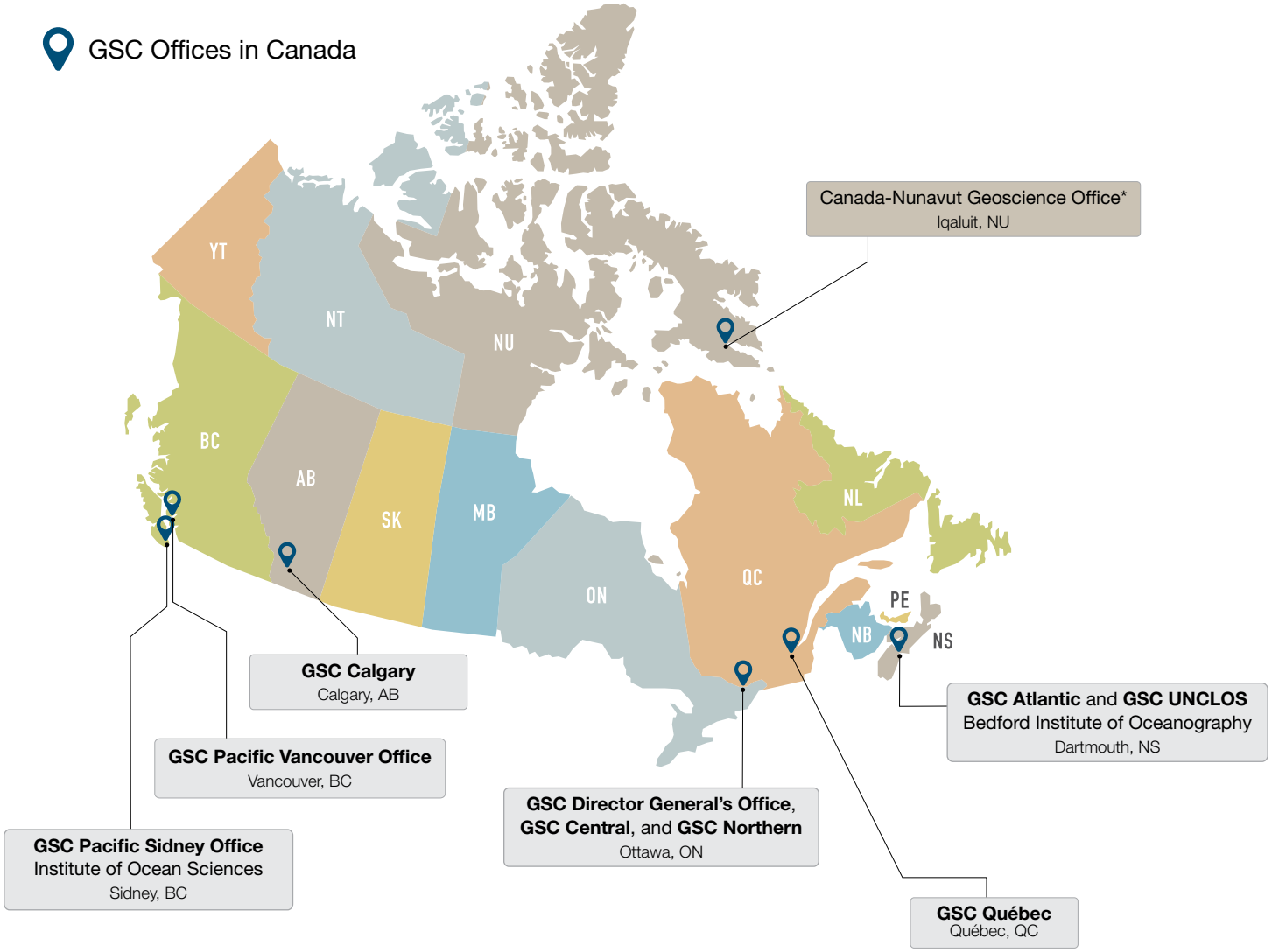
Late Paleozoic Horsefeed Formation limestone, near Turtle Lake and the British Columbia/Yukon border, photographed during GSC fieldwork.

Contact us

Have questions? Interested in collaborating with us? Send us an email and we'll make sure that your inquiry is directed to the right office or, contact one of our executive directors or program managers directly.

GSC.Info.CGC@nrcan-rncan.gc.ca

GSC Offices in Canada



*Co-managed until Nunavut devolution by the Department of Economic Development and Transportation of the Government of Nunavut, Natural Resources Canada, and Crown-Indigenous Relations and Northern Affairs Canada. Nunavut Tunngavik Incorporated is an ex-officio member of the Office's Management Board.

www.nrcan.gc.ca/geoscience