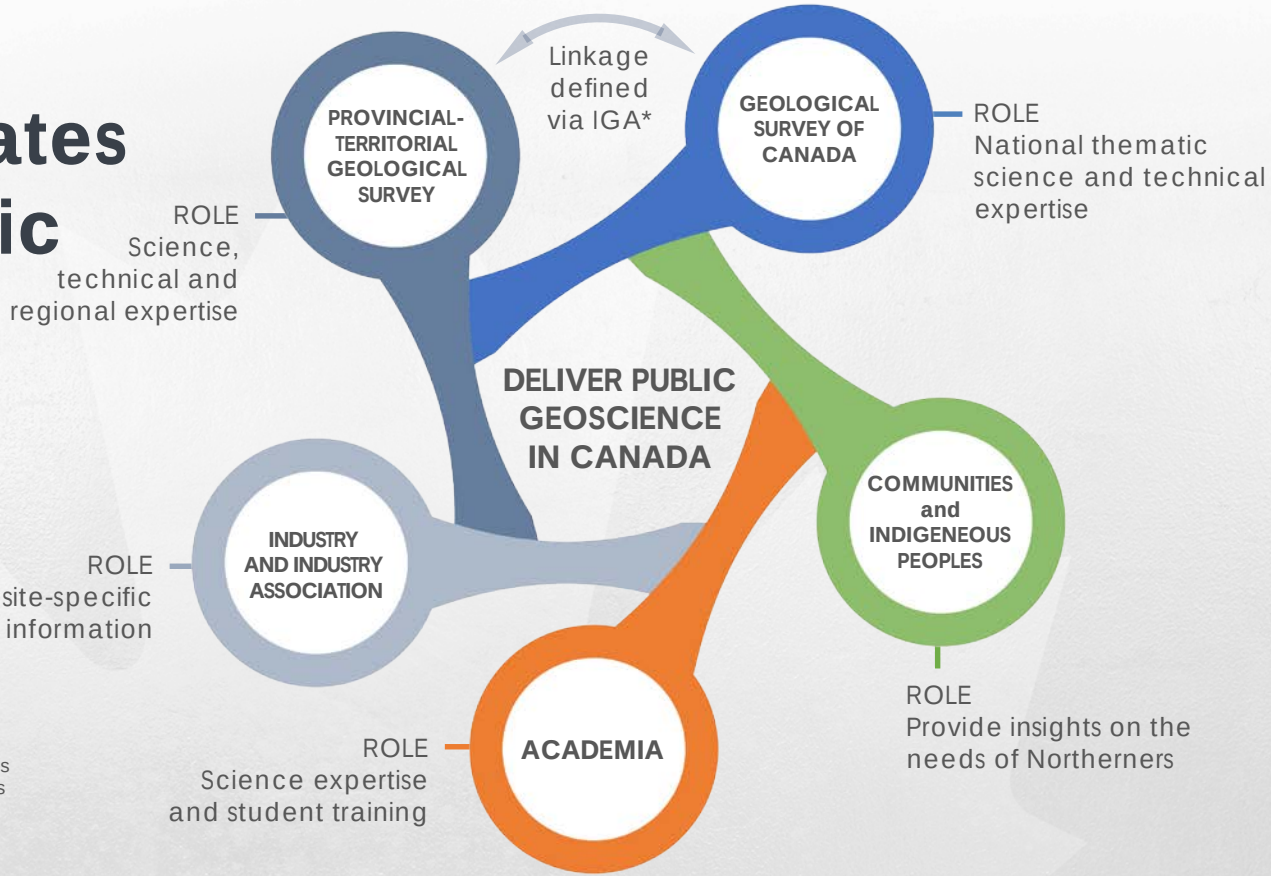
Government of Canada | Gouvernement du Canada

Geological Survey of Canada and Public Geoscience Programs

Presentation to the Council of Chairs of Canadian Earth Science Departments, October 2018

Canada

GSC Collaborates to Deliver Public Geoscience in Canada



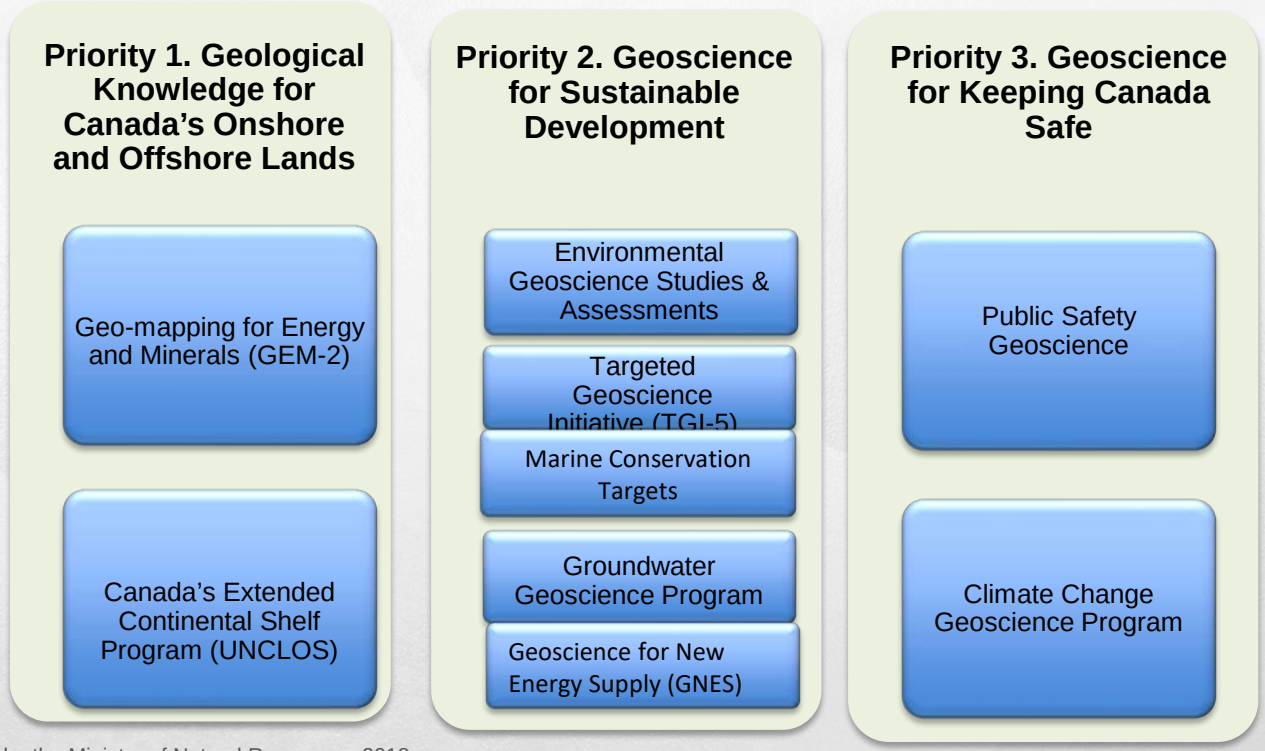
*The **Intergovernmental Geoscience Accord** (IGA) defines the complementary roles of Canada's geological surveys, as well as mechanisms for cooperation and collaboration

Highlights of the Geological Survey of Canada (GSC) Geoscience Programs

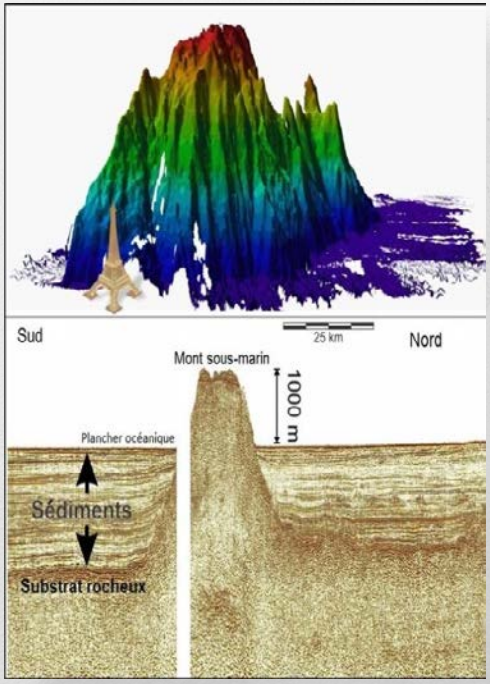
2018 to 2023: GSC Priorities

Mission*:*

- Provide authoritative geoscience knowledge to inform the stewardship of Canada's onshore and offshore lands,
- Responsible resource development for future generations
- Keep Canadians safe from natural hazards and related risks

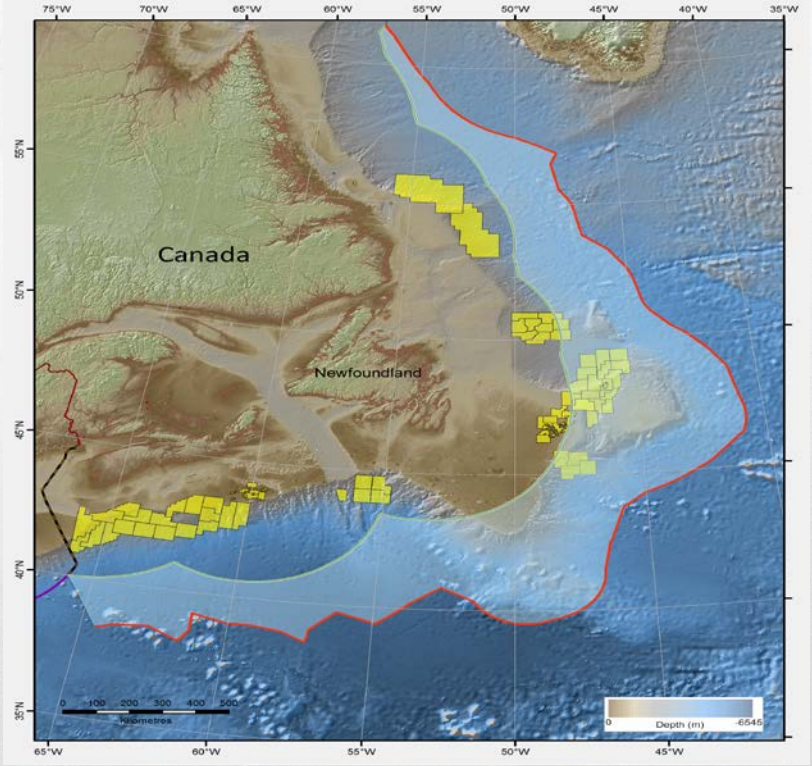


United Nations Convention on the Law of the Sea (UNCLOS)



UNCLOS – Atlantic Ocean Submission

- **2013:** Submission filed with the United Nations
- **2018:** Detailed legal and technical presentation to the UN Commission on the Limits of the Continental Shelf
- Adds **1.2 million square kilometers** to Canada's offshore landmass on the Scotian Shelf, Grand Banks and Labrador Sea
- The **Tail of the Grand Banks**, **Flemish Cap** and **Orphan Knoll** outside of Canada's Exclusive Economic Zone (green line) are now inside the outer limits (red line). Oil/gas lease blocks (yellow).



UNCLOS – Arctic Ocean Submission

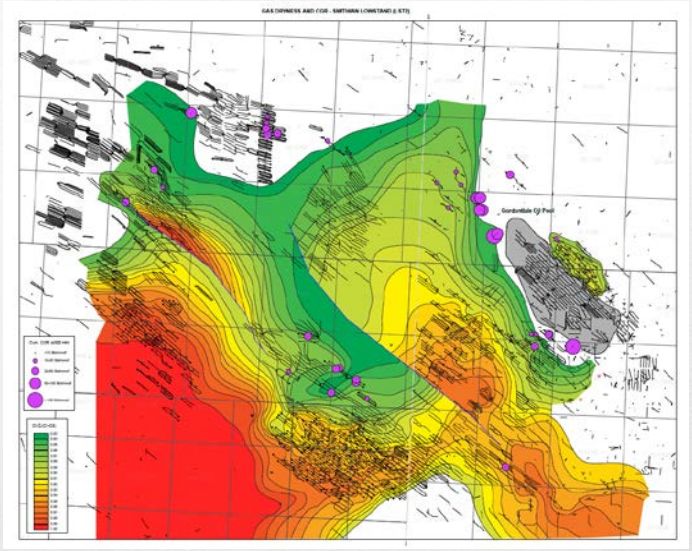
- Data acquisition with **icebreakers, ice camps and Autonomous Underwater Vehicles (AUVs)**
- **Surveys** with icebreakers conducted from **2007-2011** and **2014-2016**
- **International scientific collaboration.** Ten of 15 expeditions with **Denmark, Sweden or the United States**
- The program is on track to file Canada's submission with the UN **no later than 2019, defining Canada's last international boundary**
- Canada's extended continental shelf is expected to **exceed 1 million square kilometers of seafloor**

Public Safety Geoscience

- Strengthen the resilience of Canadian communities to natural disasters (landslides and marine), extreme weather events, and to
- reduce the costs of such events.
- Expanded seismic and GNSS station networks
- The Public Safety Geoscience Program newly supported work on **Earthquake Risk Assessments.**

Geoscience for New Energy Supply

- Development of new methods for resource assessments (e.g., shale reservoir assessments)
- increase awareness for renewable energy options and engage stakeholders
- Increased knowledge of Arctic energy resources; improved assessments



Mapping of liquids occurrence in discrete Montney intervals reveals reservoir connectivity and flow barriers

Environmental Geoscience Program

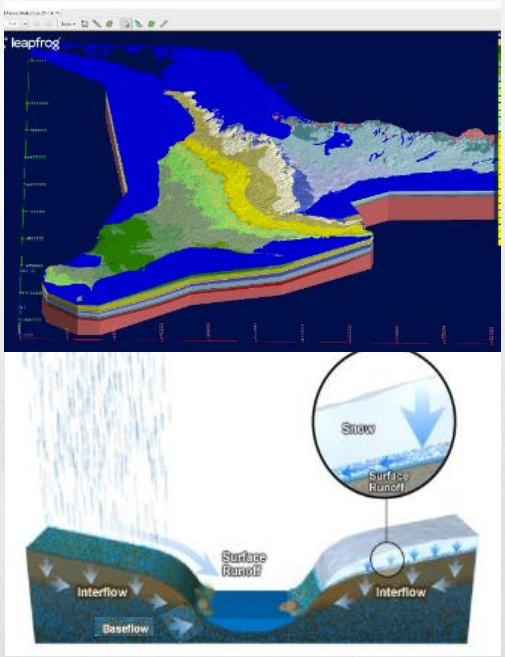
- Unconventional resource development (e.g., Assessing groundwater aquifer vulnerability to shale gas activities, induced seismicity)
- Mercury in the Environment
- Oil Sands (e.g., identification of source water and air-borne contaminants)
- Critical Metals and the Environment
- Geological Carbon Capture Storage

Groundwater Geoscience Program

Enhance our information delivery to users: Develop tools and products more accessible to users and enhance our technological transfer (e.g., GIN project).

Move to basin wide synthesis (Hydro regions + 3D models) and move towards water availability and water accounting.

Support to provinces on their aquifer mapping program providing thematic based research (S-Ontario and S-Québec projects).



Climate Change Geoscience Program

Supporting Adaptation in Permafrost Regions

Collaborative efforts in the North are leading to improved regional permafrost and terrain sensitivity mapping including new ground ice potential maps.

Initiated pilot project for **Permafrost Information Network** that will increase availability of permafrost-related information for use by decision makers to facilitate informed implementation of climate change adaptation strategies to increase resilience of northern infrastructure.

Government Geoscience to support mineral exploration

Geomapping for Energy and Minerals (GEM)	Targeted Geoscience Initiative (TGI)
In the **"North"**	National, but concentration in **"South"**
Opportunity for **new** economic development	Need economic **sustainability** for mining-dependent communities
Foundational geoscience knowledge base to minimum level needed for industry exploration	Mineral system models and tools for use by industry to focus their deep exploration strategies
Identified areas with highest potential for discovery of large, easily reachable deposits	Near-surface deposits likely exploited
Primary interest of **"Juniors"**	Primary interest to **"Miners"**
Near Northern communities	Exiting and emerging mining camps
In areas of **inadequate geoscience knowledge**	In **data-rich, well studied** mining camps
Remote and expansive	**Active mineral regions**

…. programs are sunsetting March 2020

Geo-mapping for Energy and Minerals Program (GEM)

2008

FIRST LAUNCHED

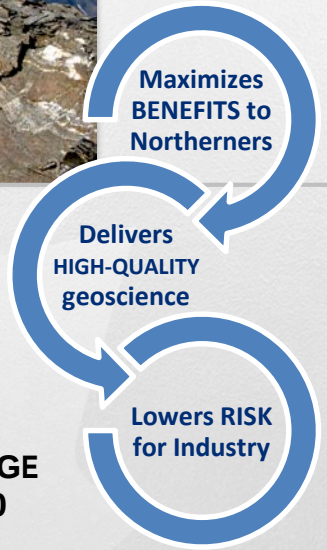
to advance and modernize geological knowledge of the North

2013

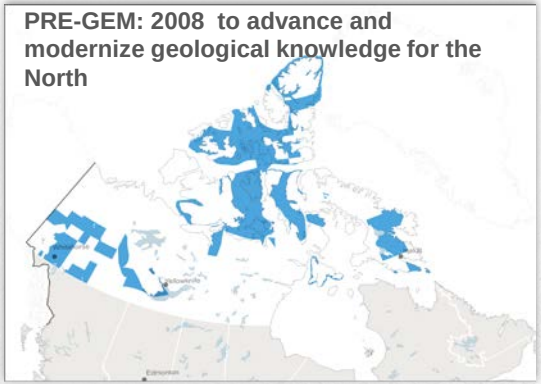
SECOND PHASE

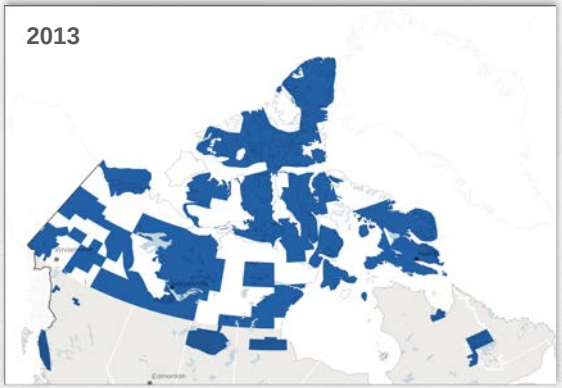
2020

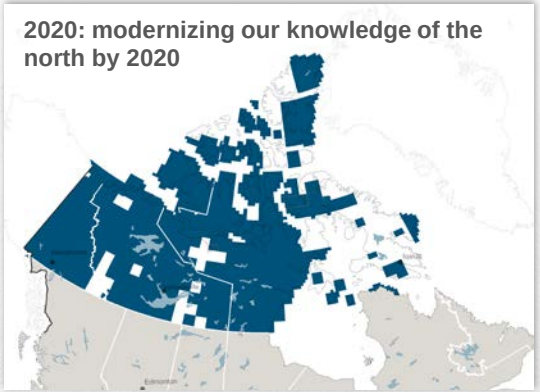
MODERNIZING OUR GEOSCIENCE KNOWLEDGE OF THE NORTH BY 2020



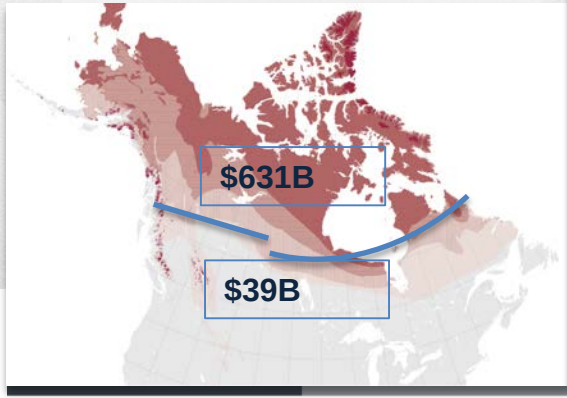
Geomapping for Energy and Minerals (GEM)







Canada Geology in the North pre-2008
...old data + old models = outdated conclusions



A significant driver for Territories and Canada's economy

- Mining is currently the primary private-sector driver for the territorial economies, accounting directly for 18 to 25% of their GDP.
- Mining accounts for approximately 15% of overall employment in the Territories, making a difference in the lives of Northerners.

Analysis of data from Statistics Canada & Government of NWT

Natural Resources Canada | Ressources naturelles Canada

12 years of mapping the North

Canada

Ten years of GEM

2008 — 2017

~39,000 SAMPLES ANALYZED

30 DATA SETS

46 GRANTS

~700,000 GEOPHYSICAL line-km flown

~400 ARTICLES

~400 GEOLOGICAL MAPS

~500 OPEN FILES

CANADIAN SHIELD

CORDILLERA

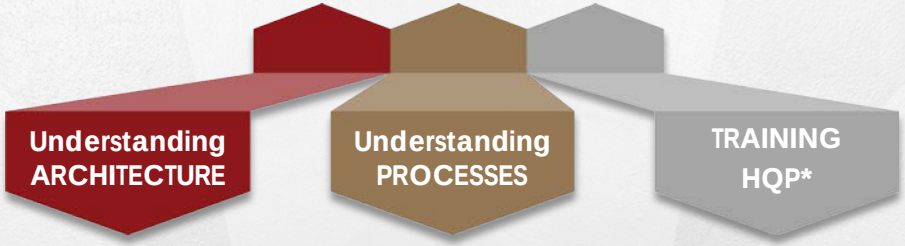
ARCTIC BASINS

SURFICIAL GEOLOGY

Targeted Geoscience Initiative (TGI)

Targeted Geoscience Initiative generates geoscience knowledge to enhance effectiveness of deep exploration for Canada's key economic minerals

KEY ELEMENTS OF THE TGI PROGRAM



Develop new knowledge, methodologies and models that will enhance the exploration industry's ability to detect buried ore deposits

Integrate multi-scale scientific knowledge of sources of metals and the pathways they take to become an ore deposit that can be used by industry to innovate their exploration approaches

Participate in the training and mentoring of students to increase the number of HQP available to the mineral industry

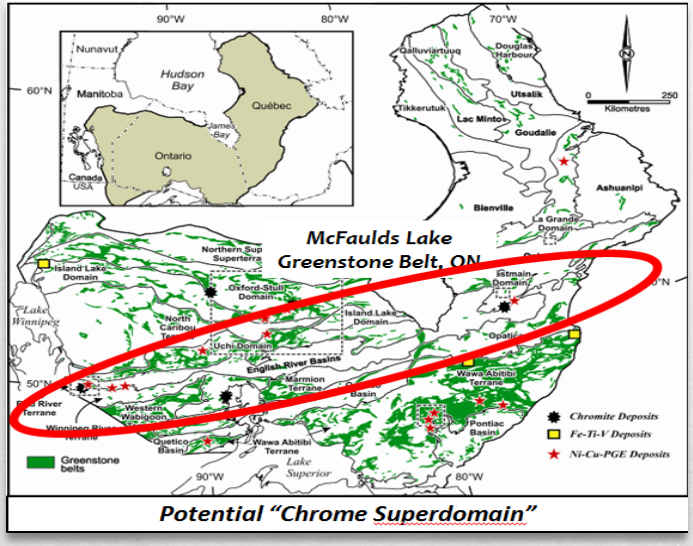
* HQP – Highly Qualified Personnel

Understanding ARCHITECTURE

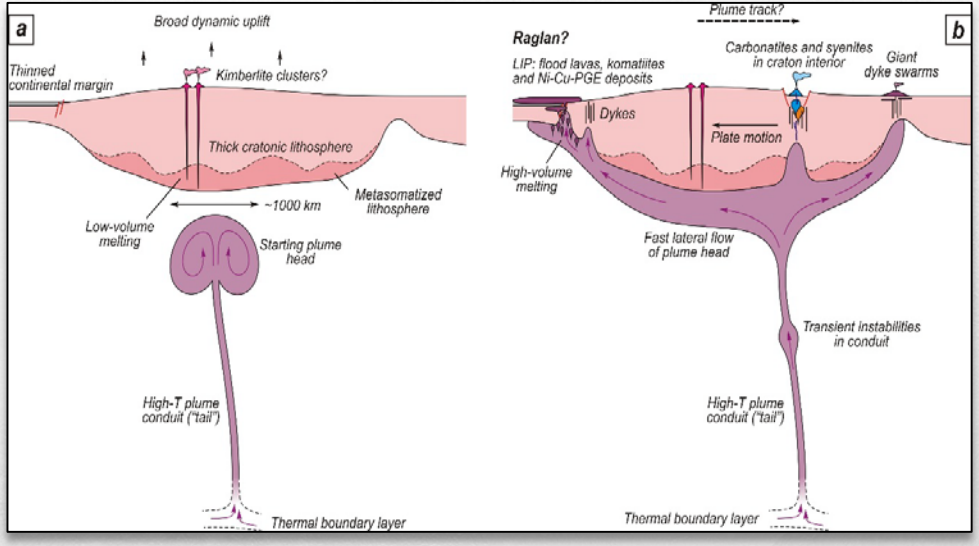
Understanding PROCESSES

“Chrome Superdomain”

Research in TGI4 helped define a new superdomain highly prospective for chrome deposits that extended from Thompson, Manitoba to Cape Smith, Québec



Research in TGI5 has delineated the **process** that results in these deposits

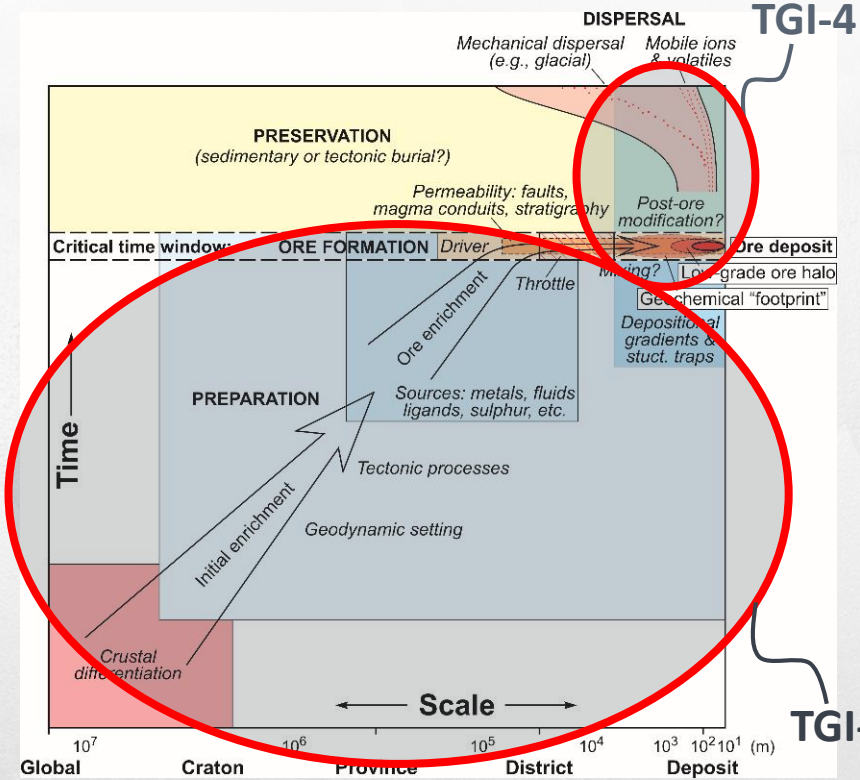


Bleeker & Kamo, 2017

Natural Resources Canada | Ressources naturelles Canada

Canada

TGI is integrating new knowledge about **source of metals** and the **pathways** to the **depositional environment**…



Modified from Huston et al 2012

…leading to innovation-based exploration approaches that can be **applied at all scales**

TGI by the numbers

2010 — 2017

+1000 public geoscience knowledge **PUBLICATIONS**

55 distinct **INNOVATIVE RESULTS** being used by industry

48 GRANTS

+500 public and stakeholder science **PRESENTATIONS**

+75 COLLABORATING COMPANIES

+150 STUDENTS TRAINED

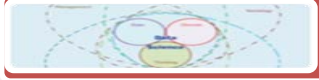
Projects focused on Canada's key economic minerals

SYSTEMS

- GOLD
- NICKEL-COPPER-PGE
- URANIUM
- VOLCANIC AND SEDIMENTARY
- PORPHYRY
- SPECIALTY METAL

Looking Forward: Developing New Geoscience Programming

Challenges and Opportunities for Geological Surveys



Transdisciplinary science
Chemical, mechanical, physical, biological, radiological & engineering

Earth System Science
Rock, soil, water, air, natural hazards, earth observation, climate adaptation

Zero Footprint Mining R&D
Zero tailings, Zero emission, Zero water contamination,

Low Carbon Future
Building and transportation efficiency, Efficient batteries, Renewable Energy

Big data and Artificial Intelligence
Environmental change, mineral exploration, natural hazard mitigation

Social Science and Indigenous Knowledge
Engaging society and communities

Human and Environmental Protection
Therapeutics, radiation standards, air quality, regulatory science

Human Capital

Developing a talent pipeline for competency, leadership and outreach

Government of Canada Science Objectives

New Vision for Science (Budget 2018):

- Strengthen science; Strengthen evidence-based decision making; and Strengthen the culture of curiosity in Canada

Informed by Minister of Science Kristy Duncan, recommendations from Canada's Fundamental Science Review (C. David Naylor & panel), interactions between Minister and researchers and students working in facilities across the country

Highlights:

- ca. $5.5B in new funding for basic science over the next five years to support academic research.
- $2.8B investment in new federal government science infrastructure to create a new approach to science that is horizontal, interdepartmental, partnered, excellent
- Investment in new, shared infrastructure and ITM capacity
- Open Government

Budget 2018 Science Infrastructure Commitments

- **Investing in Canadian scientists and researchers**
  Collaborations, S&T infrastructure for universities and colleges, connecting researchers coast to coast

- **Federal Science**
  Launching the first phase in an ambitious plan to rebuild
- federal laboratories

- $2.8 billion over five years, starting in 2018–19, with $4.5 million per year ongoing
- Bring together federal scientists
- Collaborations with post-secondary institutions and businesses
  - NRCan facility needs: GSC, Canmet Mining and Canadian Hazard Information Service (CHIS)
  - Locations to be determined

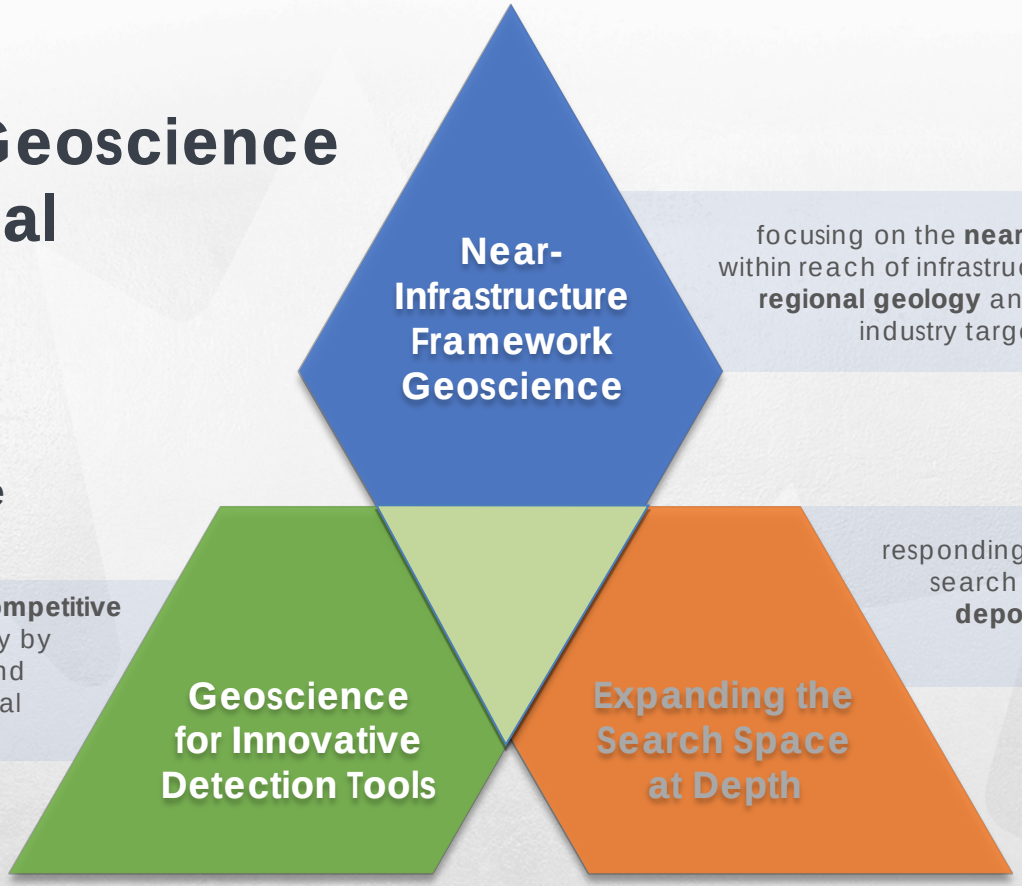
The Canadian Minerals and Metals Plan

A plan that helps position Canada as the leading mining nation and lay the foundation for lasting success at home and abroad.

Post TGI: Public Geoscience Supporting Mineral Exploration

The future for industry success leads through three intersecting themes

Promoting a more innovative and **competitive Canadian** exploration service industry by creating **novel, cutting-edge tools** and methods to better detect new mineral deposits

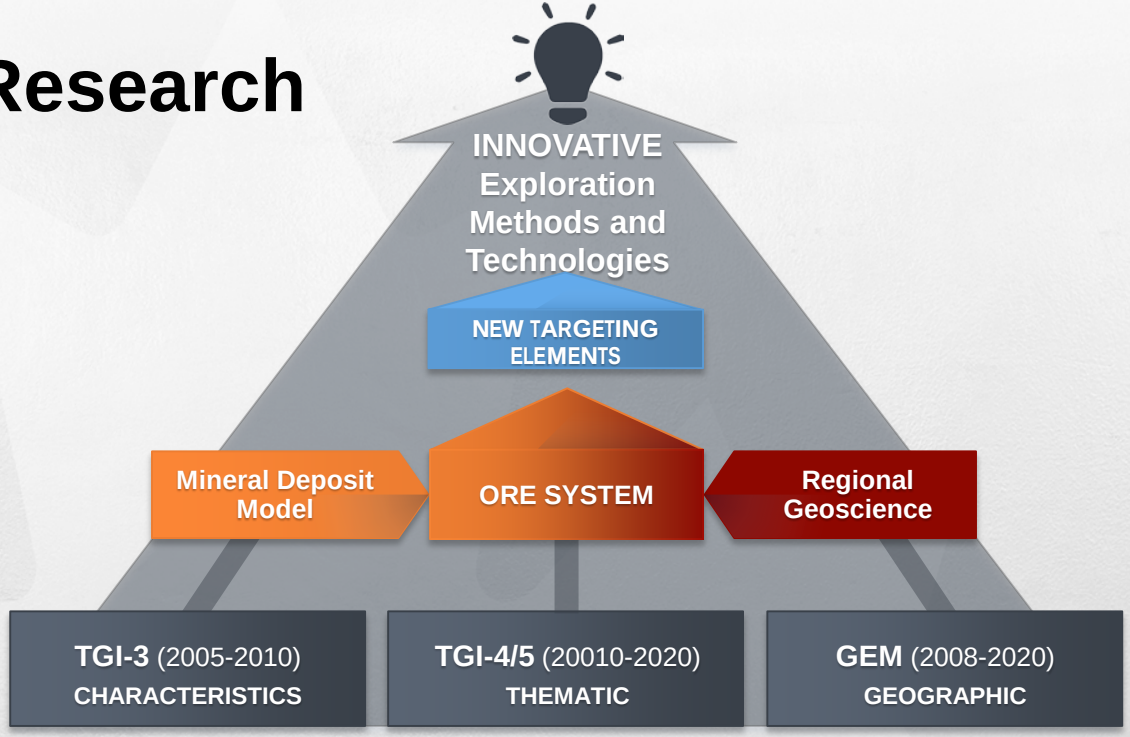


focusing on the **near-surface regions** within reach of infrastructure to **improve regional geology** and help the junior industry target high potential

responding to the need to search **deeper for new deposits** near known deposits

New Ore System Research

Leading to Better Defined Features in order to Target and Lower Risk Exploration



Post GEM: Looking Forward In Canada's North

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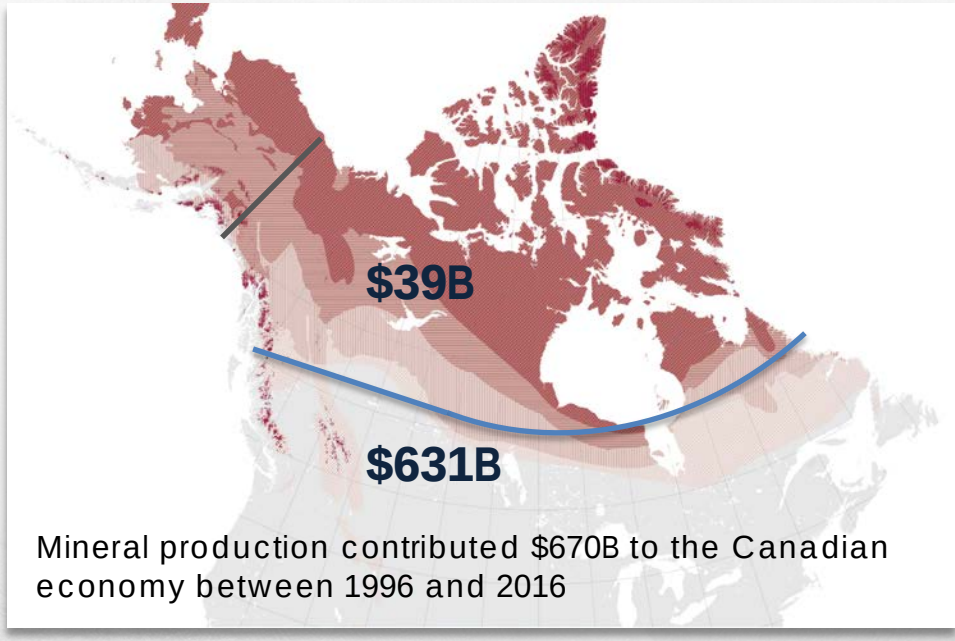

Mineral production contributed $670B to the Canadian economy between 1996 and 2016

Permafrost map of Canada (Data courtesy of National Snow and Ice Data)

Unique considerations for northern land-use decisions

Geoscience for northern discovery, infrastructure and the environment

“Climate change is accelerating threats to existing infrastructure: melting permafrost is directly impacting the integrity of building foundations, roads, runways, pipelines and coastal infrastructure.”

Recommendation: “Increase the level of geoscience spending in the Arctic to expand the availability of baseline mapping and geological research.” *Mary Simon, Final Report 2017*

“Geo-mapping can provide important information for land use planning purposes”

Conference Board of Canada, 2013

Cumulative Effects Initiative

- GSC scientists to conduct regional investigations near targeted natural resources developments to deepen approaches to establish natural baselines, determine cumulative effects and improve Canadian performance in terms of Environmental Impact Assessments.
- GSC science to be published and accessible using the Open Science/Open Data concepts via a discovery portal
- Contribute to DFO's mandated responsibility for marine spatial planning and analyses for 4 marine areas (Salish Sea, Pacific North Coast, Newfoundland and Labrador shelves, Bay of Fundy/Scotian Shelf)

Program Changes Affecting Academic Partnerships

GEM and TGI Programs end March, 2020

- Impacts grants
- Impacts students and bursary opportunities
- Impacts Post-doctoral opportunities

Cumulative Effects Initiative – new research area, will need new expertise

- Adds students and bursary opportunities
- Adds Post-doctoral fellowship opportunities

Questions?