NATURAL RESOURCES CANADA - INVENTIVE BY NATURE
RESSOURCES NATURELLES CANADA - DE NATURE INVENTIVE

Geological Survey of Canada

2016 Update

Celebrating 175 yrs
Célébrons 175 ans

Presentation to:

Committee of Chairs of Canadian Earth Science Departments

October 18, 2016

Presentation Outline

GSC Strategic priorities

How we Collaborate

GSC Grant Update

How we Communicate with Academia

GSC Program Update

GSC's Mission and Vision

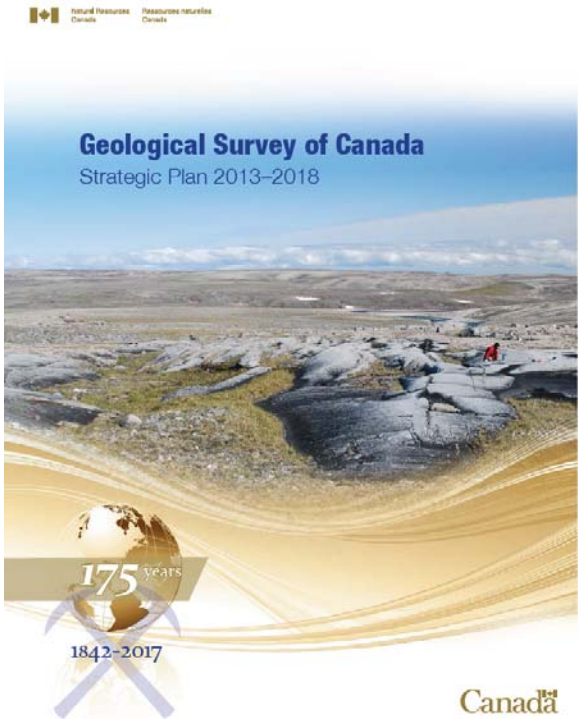
Mission: *Why the GSC Exists*

The Geological Survey of Canada provides geoscience knowledge to inform decision-making for internationally competitive mineral and energy sectors, for effective environmental stewardship and wise land use, and for the safety and security of Canadians.

Vision: *The difference GSC intends to make*

To sustain and extend Canadian prosperity and well-being through internationally authoritative and accessible public geoscience, anchored in a continuously improved understanding of earth dynamics and natural resources.

To achieve this, the GSC identified five priorities for 2013-2018



What the GSC will do…..

Priority 1. Unlock Canada's resource potential through geoscience

Priority 2. Environmental geoscience for responsible resource development

Priority 3. Geoscience for public safety and risk reduction

How the GSC will do it….

Priority 4. Open geoscience

Priority 5. Excellence in our people and science

Priority 1. Unlock Canada's Resource Potential Through Geoscience

Geo-mapping for Energy and Minerals (GEM-2)

- Complete onshore geological framework mapping in areas of the North with the highest resource potential

Targeted Geoscience Initiative (TGI-5)

- Improve understanding of major mineral deposit types through targeted & thematic studies for deep/remote exploration

Geoscience for New Energy Supply (GNES)

- Improve quantitative assessment methods for shale-based hydrocarbon
- Conduct energy resource assessments of key offshore basins in northern Canada

Canada's Extended Continental Shelf Program (UNCLOS)

- Complete and defend Canada's UNCLOS submission

Priority 2. Environmental Geoscience for Responsible Resource Development

Environmental Geoscience Studies & Assessments

- Understand baselines, and the cycling and transport of contaminants for oilsands and mineral development to the environment
- Understand induced seismicity hazards & risks to groundwater from hydraulic fracking
- Timely & authoritative execution of Environmental Assessment reviews, and resource assessments for marine protected areas

Climate Change Geoscience Program

- Model the responses of permafrost, coastal areas & groundwater to a changing climate in priority areas for northern infrastructure to inform development, maintenance, and operation

Groundwater Geoscience Program

- Assess the extent & dynamics of archetypical Canadian aquifers, and develop standard assessment methods that others can use

Priority 3. Geoscience for Public Safety and Risk Reduction

Public Safety Geoscience

- **Implement & validate tools for assessing earthquake risk at regional and national scales**
- **Improve understanding of submarine geohazard processes and develop robust methods to establish their probability of occurrence**

Canadian Hazard Information Service (CHIS)

- **Advance national and regional-scale seismic monitoring and Global Navigation Satellite Systems (GNSS) to improve real-time earthquake and tsunami alerting**
- **Timely and authoritative execution of mandated responsibilities for emergency management (earthquakes, space weather, Comprehensive Test Ban Treaty)**

Priority 4. Open Geoscience

Commitment

- Within the federal **Open Government Initiative**, develop and implement an Open Geoscience Information Management and Technology (IMT) plan.
  - **Expectation going forward that, as with NSERC requirements, that all science generated through GSC Grants to academia will be made publically available**
- Acquire, manage and disseminate all geoscience data by using internationally accepted, web-enabled methods for quality, authority, timeliness and accessibility
- Modernize and web-enable all key ESS geoscience datasets and publications, including metadata of rock collections and archive material.

Priority 5. Excellence in our People and Science

Commitment

- **People**: Define, cultivate and reward excellence, innovation and focus, and ensure recognition of work contributing to our goals
- **Partnership**: Seek out, maintain and enhance internal and external collaborations for mutually beneficial access to the best resources
- **Programming**: Ensure the continuing alignment of our geoscience with current government priorities and responsiveness to emerging needs.
- **Organization**: Through efficient internal partnerships, ensure that staff has free and timely access to the data, information and knowledge that are necessary to deliver our objectives and that is necessary for professional development

Strategic planning currently underway for 2018-2023

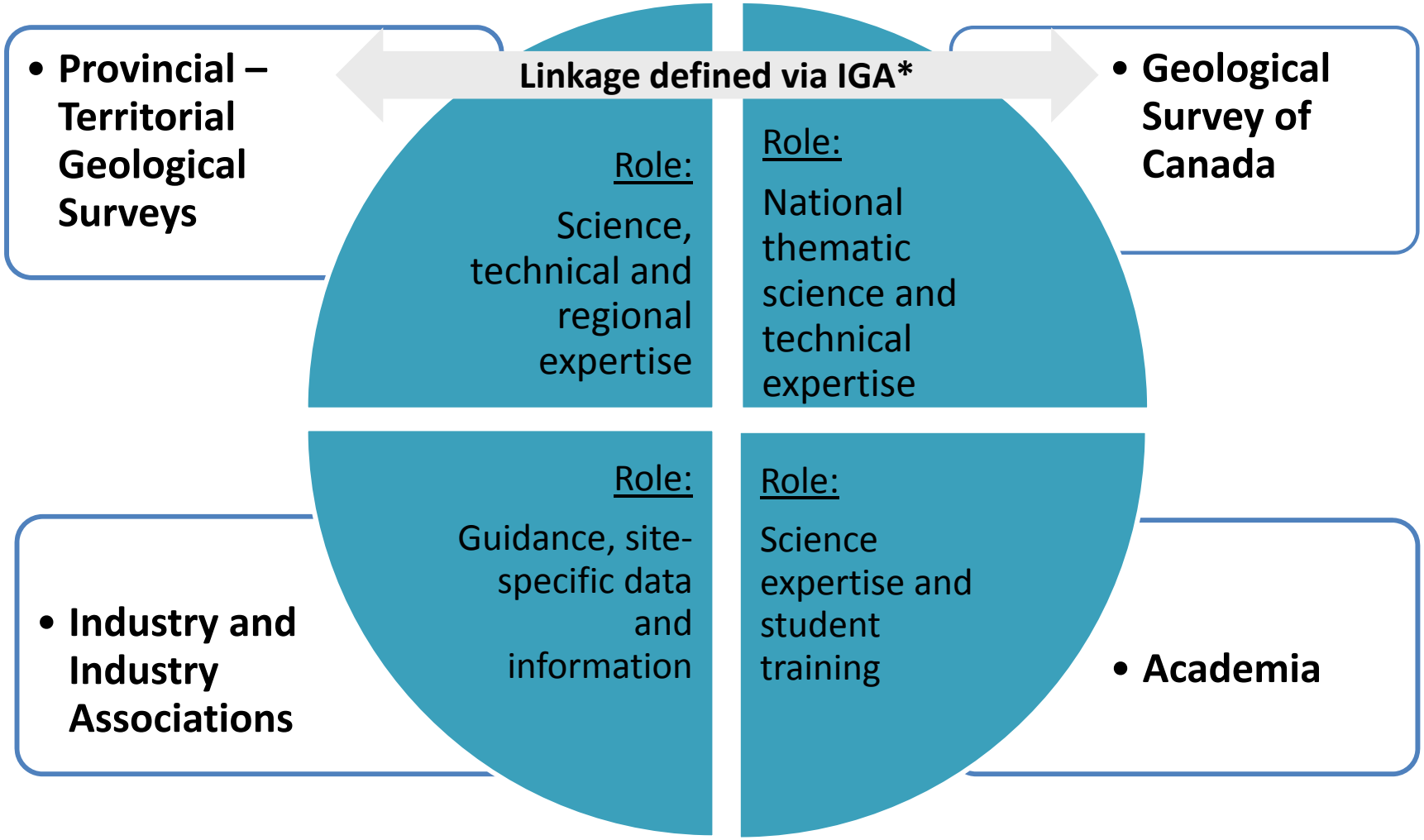
Four scientific themes proposed to frame our new Strategic Plan;

1. Climate change adaption and mitigation
2. Environmental sustainability
3. Competitiveness of the natural resource sectors
4. Public safety and national security

Important to our planning is stakeholder engagement

- Academic partners
- Industry associations
- Prov/Terr Geological Surveys
- Regulators
- Indigenous people

The Need to Collaborate in Delivery of 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*

Collaboration with Academia

GSC Collaborates with Academia via:

Direct Collaborations (e.g. Task-Shared Agreements)

Grant Programs (e.g. GEM-2, TGI -5)

- Specific application, proposal assessment and timeline requirements, tied to GSC Program outcomes

Student Bursary Programs (RAP)

- Set amount ($17,500/yr for MSc, $21,000/yr for PhD) for students working on multi-year research project co-supervised by GSC staff

Adjunct Professorships

- GSC staff cannot gain compensation additional to their salary; Estimated time required and duties must be approved by their manager

Other Avenues

- Student hiring programs (FSWEP and CO-OP), visiting fellowship program, co-organization of events, contracts for services, revenue agreements, public servant-in-residence program etc

Collaboration with Academia – GSC Grants

Example: **Targeted Geoscience Initiative (TGI) Grant Agreements**

Development of strategic collaborations with the Canadian academic community (professors and students) will:

- help complement existing TGI scientific and/or technical expertise to address TGI research objectives to generate improved mineral system models and new methods and technologies
- Contribute to long-term Canadian research capacity
- Provide opportunity for innovation in the development of ideas and methods that are applicable to industry needs.
- $multi-year agreements involving academic institutions, federal contributions will be limited to 95% of total project costs.

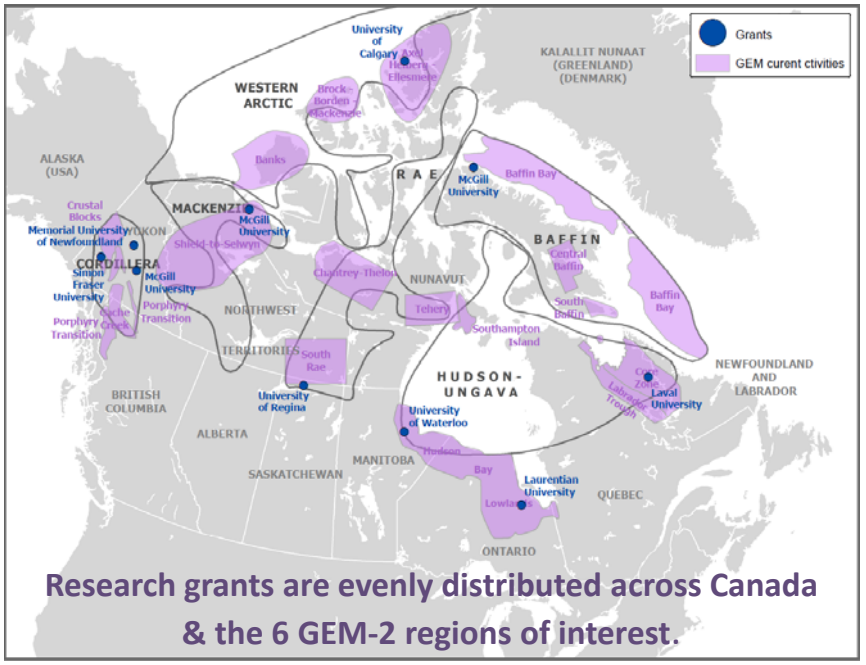
Targeted Geoscience Initiative (TGI)-5 Grant Update

- Priority areas focussed on gaps related to metal sources, magmatic metals, metal pathways, metal traps, metals through time and metals through space
- 69 grant proposals received, 13 recommended by TGI-5 Science Advisory Group, 9 implemented with academia to date for a total cost of $1.2M over 2 yrs
    - year 1 results to be delivered by 2017
- Next round of grants to be announced second half of 2017, with activities to start on April 1, 2018

Geo-Mapping for Energy and Minerals (GEM-2) Grants Update

Geoscience Grants:

- 24 Geoscience research projects have been funded to date
- 2-year geoscience grants 2015-17
  - $1.1M in total funds awarded to fund 10 projects at 9 Canadian universities in 8 provinces
- **Upcoming call** for next round of 2-year geoscience grants in late 2016/early 2017



Research grants are evenly distributed across Canada & the 6 GEM-2 regions of interest.

Multi-Disciplinary Grants:

- Fund innovative approaches and tools to facilitate uptake of GEM knowledge by Northerners
- 5 projects distributed across the North were completed in 2016 totalling $201K
- Options are being explored for larger projects and longer term collaboration with key northern stakeholders

Engagement and Communication with Academia

GSC has been re-evaluating it's approaches to stakeholder engagement in order to:

- ❑ Enhance effectiveness
- ❑ Account for today's information-overloaded environment

As a result, GSC is working to:

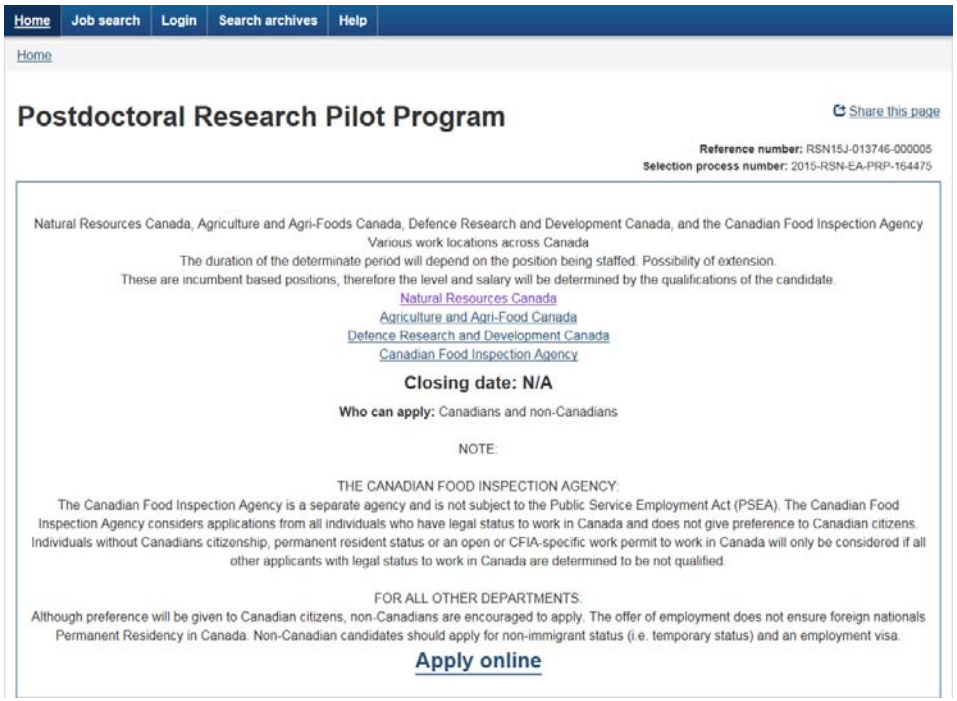
- ❑ Be more proactive in it's communication and engagement
- ❑ Better target those strategies to specific stakeholders
- ❑ Work with stakeholders to develop better dissemination and distribution channels

Postdoctoral Research Program (PRP)

- Developed to replace NSERC's Visiting Fellowship in Government Laboratories Program (VFP) and to provide scientists with the opportunity to work with research groups in Canadian government laboratories and research institutions

- Natural Resources Canada, Agriculture and Agri-Foods Canada, Defence Research and Development Canada, and the Canadian Food Inspection Agency are participating in this new pilot program. **Positions are available in various work locations across Canada**

- **Must be within 36 months of graduation from PhD**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Postdoctoral Research Pilot Program

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Reference number: RSN15J-013746-000005
Selection process number: 2015-RSN-EA-PRP-164475

Natural Resources Canada, Agriculture and Agri-Foods Canada, Defence Research and Development Canada, and the Canadian Food Inspection Agency
Various work locations across Canada
The duration of the determinate period will depend on the position being staffed. Possibility of extension.
These are incumbent based positions, therefore the level and salary will be determined by the qualifications of the candidate.
Natural Resources Canada
Agriculture and Agri-Food Canada
Defence Research and Development Canada
Canadian Food Inspection Agency

Closing date: N/A

Who can apply: Canadians and non-Canadians

NOTE:

THE CANADIAN FOOD INSPECTION AGENCY:
The Canadian Food Inspection Agency is a separate agency and is not subject to the Public Service Employment Act (PSEA). The Canadian Food Inspection Agency considers applications from all individuals who have legal status to work in Canada and does not give preference to Canadian citizens. Individuals without Canadians citizenship, permanent resident status or an open or CFIA-specific work permit to work in Canada will only be considered if all other applicants with legal status to work in Canada are determined to be not qualified.

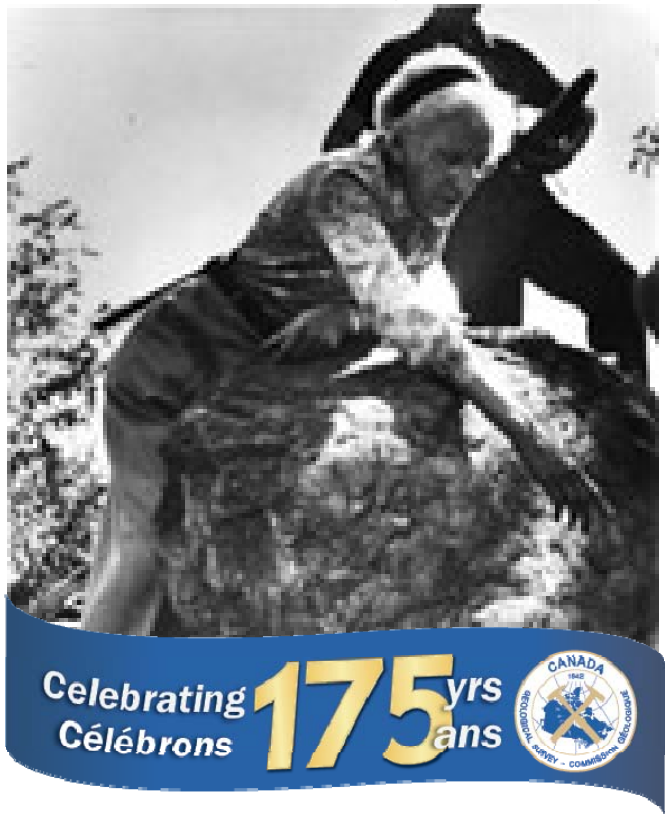
FOR ALL OTHER DEPARTMENTS:
Although preference will be given to Canadian citizens, non-Canadians are encouraged to apply. The offer of employment does not ensure foreign nationals Permanent Residency in Canada. Non-Canadian candidates should apply for non-immigrant status (i.e. temporary status) and an employment visa.

Apply online

- The PRP inventory is advertised on **jobs.gc.ca** with and applications are held for one year (renewable), can also contact **nrcan.PRP.rncan@canada.ca**

Geological Survey of Canada
Alice Wilson Fellowship

In celebration of the upcoming 175th anniversary of the GSC, the Survey has launched the **Alice Wilson Fellowship**, named after the GSC's first female geologist and first woman to be elected to the Royal Society of Canada



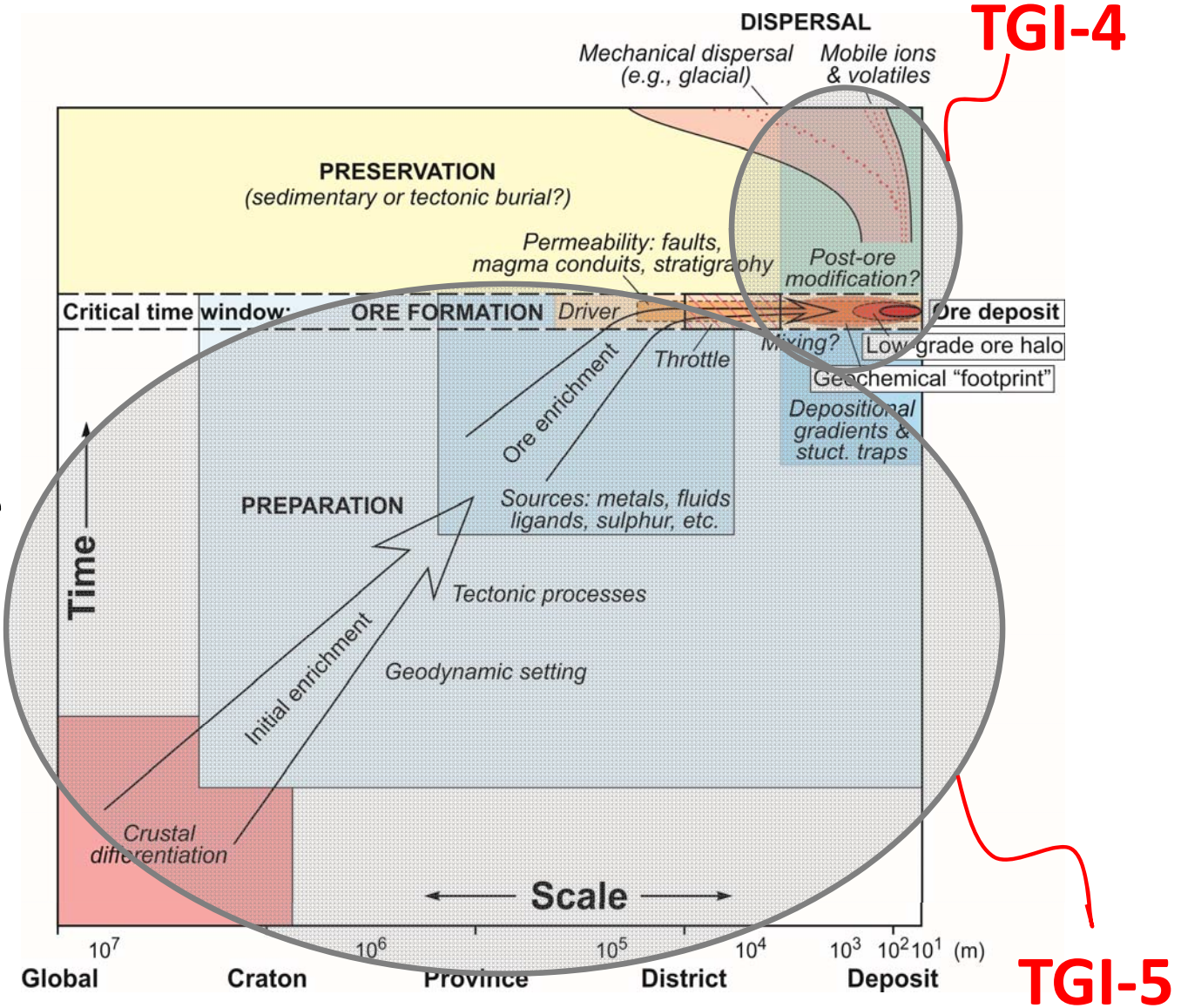
- In honour of her pioneering spirit the GSC has established a new fellowship targeted at **talented women scientists** who are interested in pursuing a post-doctoral research position in the field of earth sciences

- It will be funded for a 2-year term and 2 positions are currently available;
  - 1 position within the program areas of **environmental geoscience**, **groundwater**, **geo-hazards**, **climate change** or **energy**,
  - In process of hiring a candidate in the **Targeted Geoscience Initiative (TGI-5) Program**

- Candidates must be currently enrolled in the PRP Program and will be selected through a transparent process, on the basis of excellence and impact of research area upon the program

Targeted Geoscience Initiative (TGI-5) Program

- Source-to-Ore (phase 5) complements Ore-to-Surface (phase 4)
- TGI-4 was mostly focused on **deposit-scale and its surface expression**
- TGI-5 will integrate new knowledge about **source of metals and the pathways depositional environment**
- This will lead to innovation-based exploration approaches that can be **applied at all scales**



Geo-Mapping for Energy and Minerals (GEM-2) 2013-2020

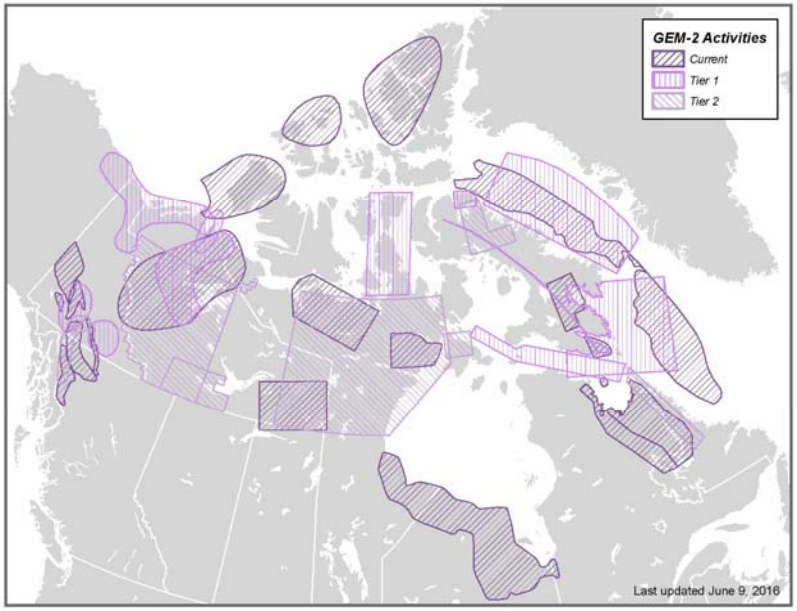
- Geo-Mapping for Energy and Minerals (GEM-2) program is a 7-year, $100-million initiative to **complete modern regional-scale geological maps and data sets** for Canada's North.
- GEM-2 will continue to provide geoscience knowledge that has **been instrumental to making informed resource investment and land-use decisions** in the North and can **help industry be effective in exploring for new resources**

Three key elements of the program

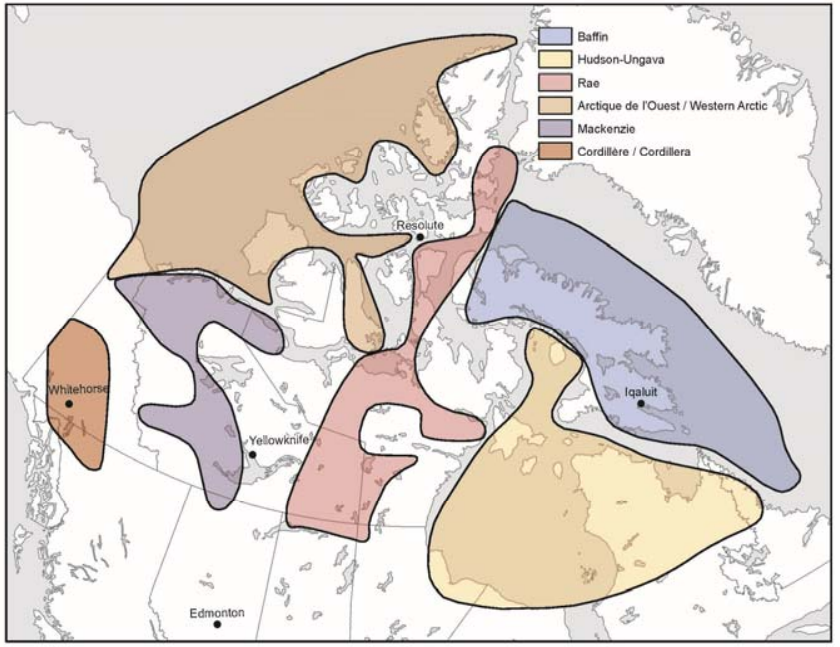
Collaboration to ensure research quality and accessibility	**Ensuring the delivery of high-quality integrated geoscience**	**Maximizing benefits for Northerners**

GEM-2 Program Update

- 17 on-going field and desktop studies
- 13 fieldcamps this summer
- 226 engagement letters sent to 69 identified communities, 13 communities visits took place



The GEM-2 program (2013-2020) undertook long-term planning for the remaining projects activities until 2020



- 39 students (RAP, FSWEP, casual) hired by GEM activities
- Hiring gap – attracting Northern students to work on GEM
- 26 task-shared agreements (completed/in-progress for 2016-17)
- 47 publications released through GEOSCAN

Developing Program: Geoscience for Enhancing Climate Resilience (GECR)

- 2016-17 a transitional year focussed on permafrost, groundwater, coastal geoscience and earth observation
- GECR program Logic model approved (2017-2021)
- GECR Internal call for 4 year proposals this fall – LOI followed by full proposals; expected completion by January 2017


Thank you

Annex

Collaboration

The GSC is committed to the broadest possible collaborations in order to provide public geoscience with a focus on;

- geoscience surveys
- sustainable development of Canada's resources
- environmental protection
- technology innovation
- safety and security of Canadians

How we foster awareness of our engagement:

Grants

- Email/engagement with Chair of CCCESD for redistribution to chairs who redistribute to department
- Email/engagement with Provincial-Territorial Geological Survey Directors
- Announcements and flyers at science conferences, on the web
- Scientist-to-scientist communication

Other opportunities

- Contracts: Post on government contracting website
- Contracts: Small dollar value (<$25k) Request For Proposals
- Informal collaboration, co-organization of events: Scientist-to-scientist communication
- MOU's: Discussion and negotiation between Faculty/department and NRCan/GSC
- Research outputs (e.g. joint papers, reports): Scientist-to-scientist engagement

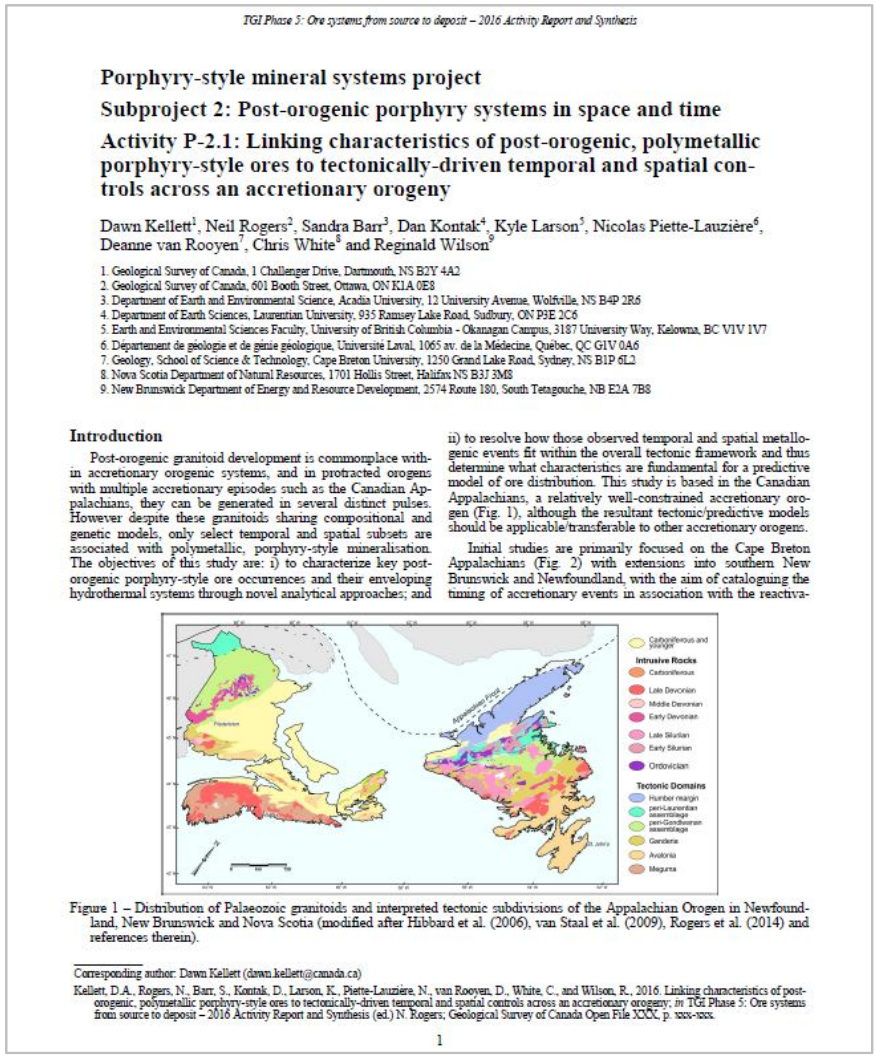
Student Hiring Programs

- Announcements and flyers at science conferences, on the web
- General student awareness

Student Bursary Programs

- Scientist-to-scientist communication
- Announcements and flyers at science conferences, on the web
- General student awareness

Disseminating Geoscience: TGI-5 Mid-year synthesis Open File



TGI Phase 5: Ore systems from source to deposit – 2016 Activity Report and Synthesis

Porphyry-style mineral systems project

Subproject 2: Post-orogenic porphyry systems in space and time

Activity P-2.1: Linking characteristics of post-orogenic, polymetallic porphyry-style ores to tectonically-driven temporal and spatial controls across an accretionary orogeny

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Introduction

Post-orogenic granitoid development is commonplace within accretionary orogenic systems, and in protracted orogens with multiple accretionary episodes such as the Canadian Appalachians, they can be generated in several distinct pulses. However despite these granitoids sharing compositional and genetic models, only select temporal and spatial subsets are associated with polymetallic, porphyry-style mineralisation. The objectives of this study are: i) to characterize key post-orogenic porphyry-style ore occurrences and their enveloping hydrothermal systems through novel analytical approaches; and ii) to resolve how those observed temporal and spatial metallogenic events fit within the overall tectonic framework and thus determine what characteristics are fundamental for a predictive model of ore distribution. This study is based in the Canadian Appalachians, a relatively well-constrained accretionary orogen (Fig. 1), although the resultant tectonic/predictive models should be applicable/transferable to other accretionary orogens.

Initial studies are primarily focused on the Cape Breton Appalachians (Fig. 2) with extensions into southern New Brunswick and Newfoundland, with the aim of cataloguing the timing of accretionary events in association with the reactiva-

Figure 1 – Distribution of Palaeozoic granitoids and interpreted tectonic subdivisions of the Appalachian Orogen in Newfoundland, New Brunswick and Nova Scotia (modified after Hibbard et al. (2006), van Staal et al. (2009), Rogers et al. (2014) and references therein).

Corresponding author: Dawn Kellett (dawn.kellett@canada.ca)

Kellett, D.A., Rogers, N., Barr, S., Kontak, D., Larson, K., Piette-Lauzière, N., van Rooyen, D., White, C., and Wilson, R., 2016. Linking characteristics of post-orogenic, polymetallic porphyry-style ores to tectonically-driven temporal and spatial controls across an accretionary orogeny; *in* TGI Phase 5: Ore systems from source to deposit – 2016 Activity Report and Synthesis (ed.) N. Rogers; Geological Survey of Canada Open File XXXX, p. xxx-xxx.

- 29 mid-year synthesis reports of key activity accomplishments over last 6 months
- Published as 1 single program level open file; geoscan@nrcan.gc.ca
- Serves as an easy “first-stop” for access to new science generated in the program

TGI Projects and Subprojects

Precious Metals (Y. Michaud)	Base and Other Metals (N. Rogers)
<u>Gold:</u> • Subproject 1: System controls on gold through space and time. (Source and Trap) • Subproject 2: Tectonic influences on gold (Tectonic drivers and Conduits)	<u>Volcano-Sedimentary Base Metal Deposits:</u> • Subproject 1: Seafloor ore deposition through space and time • Subproject 2: Base metal sources and mineralizing processes
<u>Nickel-Copper-PGE-Chrome:</u> • Subproject 1: System scale and deposit scale controls on Ni-Cu-PGE mineralization in cratonic areas and their margins • Subproject 2: Architecture of Cr-bearing ore systems • Gap: *Metal endowment of mafic-ultramafic magmatic systems in convergent margins*	<u>Porphyry:</u> • Subproject 1: Arc-related porphyry systems in an evolving orogen (“Arc-related Porphyry”) • Subproject 2: Mineral markers of porphyry processes (“Mineral Markers”) • Subproject 3: Temporal and tectonic controls of post-orogenic porphyry-style mineralization (“Post-orogenic Porphyry”)
	<u>Uranium:</u> • Subproject 1: Uranium Fluid Pathways • Subproject 2: Uranium-rich Deep Metasomatic Processes

Full project/Subproject proposals available on GCDOCS at this link