Canada-Nunavut Geoscience Office

Summary of Activities 2015-2016

By: Linda Ham, Chief Geologist

Canada-Nunavut Geoscience Office

Natural Resources Canada | Ressources naturelles Canada

Indigenous and Northern Affairs Canada | Affaires autochtones et du Nord Canada

Canada

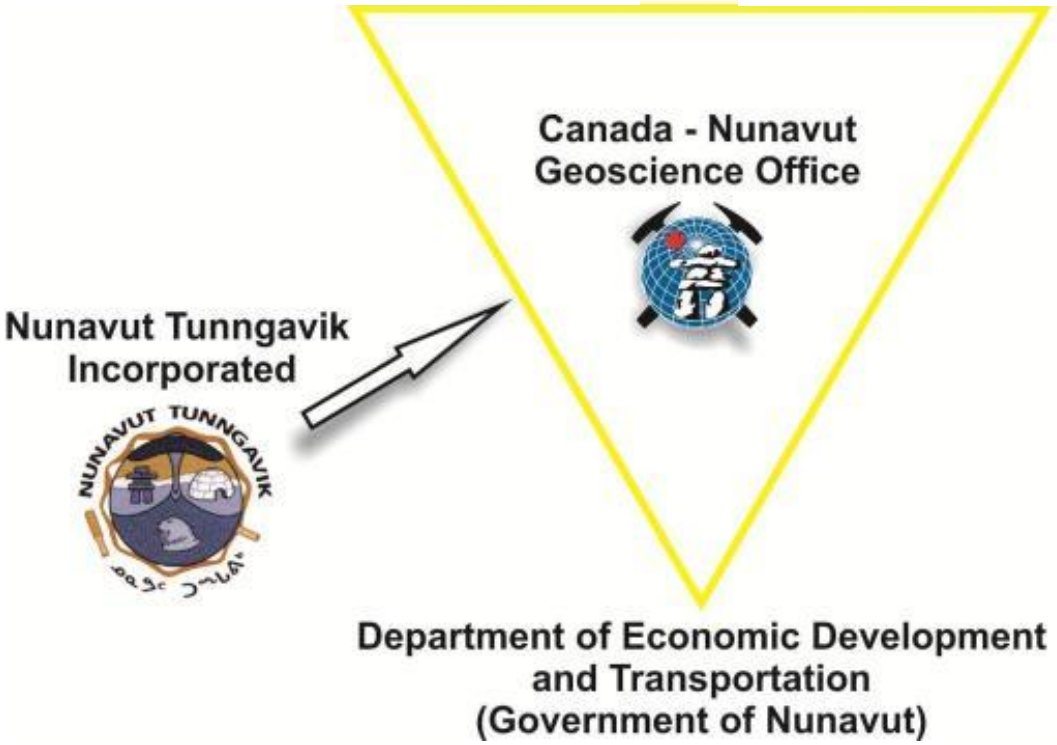
Nunavut

The Canada-Nunavut Geoscience Office (CNGO)

A unique government entity and office, partnered with and co-funded by NRCan (ESS-GSC), INAC and GN

Geological Survey of Canada (Natural Resources Canada, Earth Science Sector [ESS])

Indigenous and Northern Affairs Canada



Management Board – CNGO Chief Geologist, representatives from the three governments, and an ex-officio representative from NTI

CNGO was opened in 1999 by Nancy Karetak-Lindell (Liberal MP for Nunavut), Ralph Goodale (federal Minister of Natural Resources) and Peter Kilabuk (Nunavut Minister of then-Department of Sustainable Development)

The Canada-Nunavut Geoscience Office

Cooperation in support of sustainable development

Rationale for the office

- Geoscience will continue to play a key role in sustainable development in Nunavut by providing support for: sound decision making, education and training, mineral exploration, environmental studies, land use planning, and the discovery of materials for local artisans.
- The capacity to generate and utilize geoscience information is needed in Nunavut.
- The Canada-Nunavut Geoscience Office is a step towards developing this capacity.
- It was hoped that ‘the partnership arrangement to be embodied in the creation of the geoscience office (CNGO) will serve as a model for collaborative government program delivery and capacity building’.

Canada-Nunavut Geoscience Office

Mandate: Provide accessible geoscience information and expertise in Nunavut.

Six person office
Chief Geologist (1), Paleozoic geologist (1), Bedrock mapper (1), Surficial mapper (1), GIS specialist (1) and Data dissemination/ computer programmer (1).

Office move into new building (February 2013)

Funding to/for CNGO is provided in two ways:
1) Office agreement (five-year 2013-2018) between NRCan, INAC and GN is the over-arching agreement for running and managing the office – salaries, O&M.
2) Strategic Investments in Northern Economic Development (SINED) funding through CanNor is for geoscience research.

Mission Statement

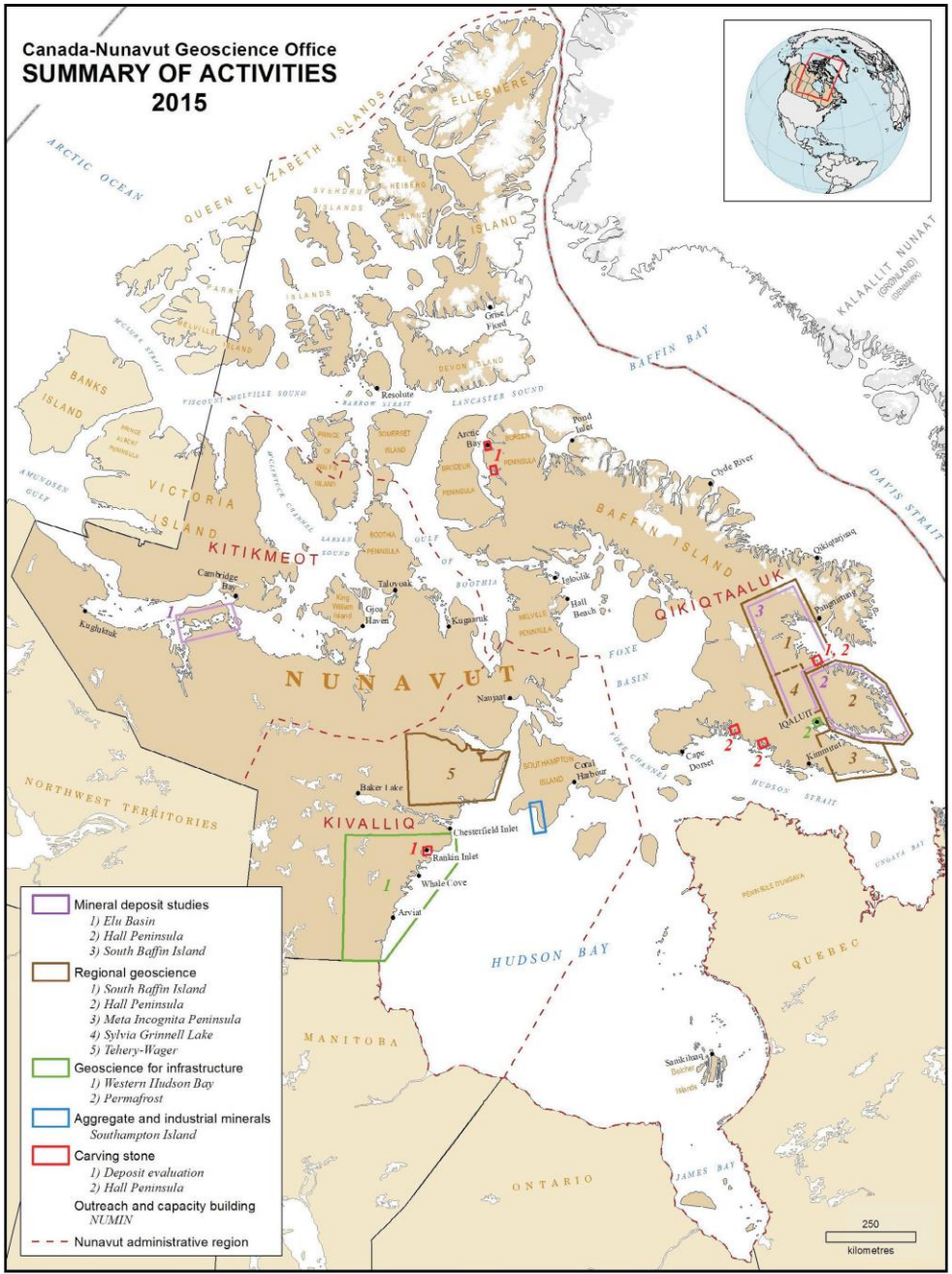
By providing accessible geoscience information and expertise in Nunavut, CNGO will:

- Develop capacity (human and otherwise) in geoscience
- Build and maintain an accessible geoscience knowledge base
- Promote sustainable development of mineral and energy resources for Nunavut
- Increase awareness of the importance of Earth Science for Nunavummiut

To accomplish this mission, the CNGO endeavours to:

- Map, interpret and report on the geological features and resources of Nunavut in collaboration with our geoscience partners, and
- Engage the public on key geoscience issues

CNGO Geoscience Program (2015-2016)



Mineral deposit studies

Regional geoscience

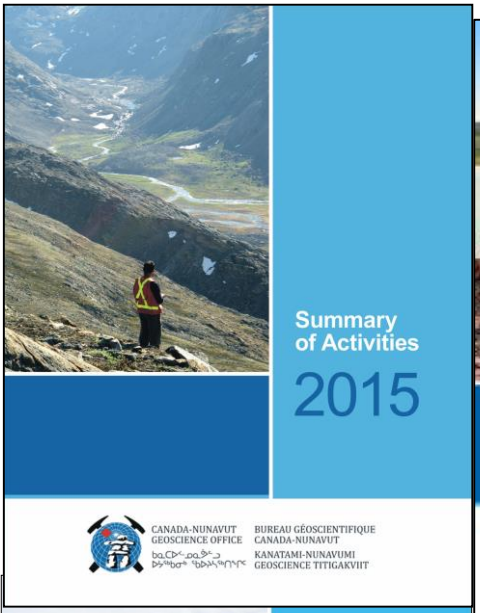
Geoscience for infrastructure

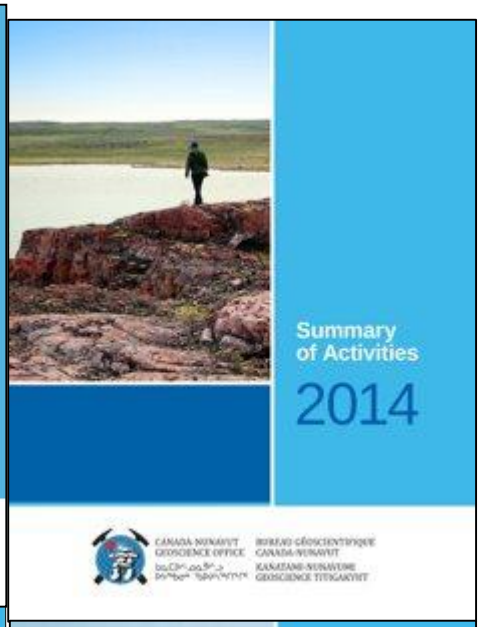
Aggregate and industrial minerals

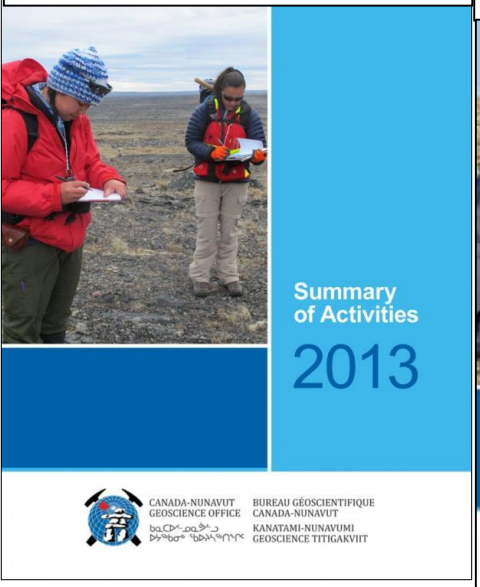
Carving stone

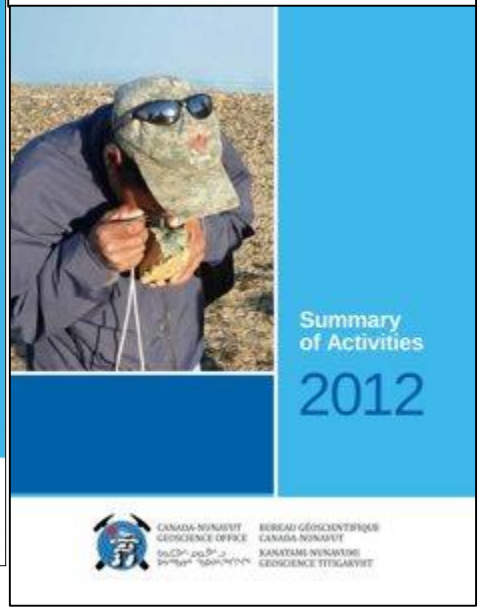
Outreach and capacity building

Summary of Activities









Publication to disseminate results annually
First published in 2012
2015 volume produced December 31, first one produced in research year

Sections

1. Mineral Deposit Studies
2. Regional Geoscience
3. Geoscience for Infrastructure
4. Carving Stone
5. Aggregate and Industrial Minerals
6. Outreach and Capacity Building

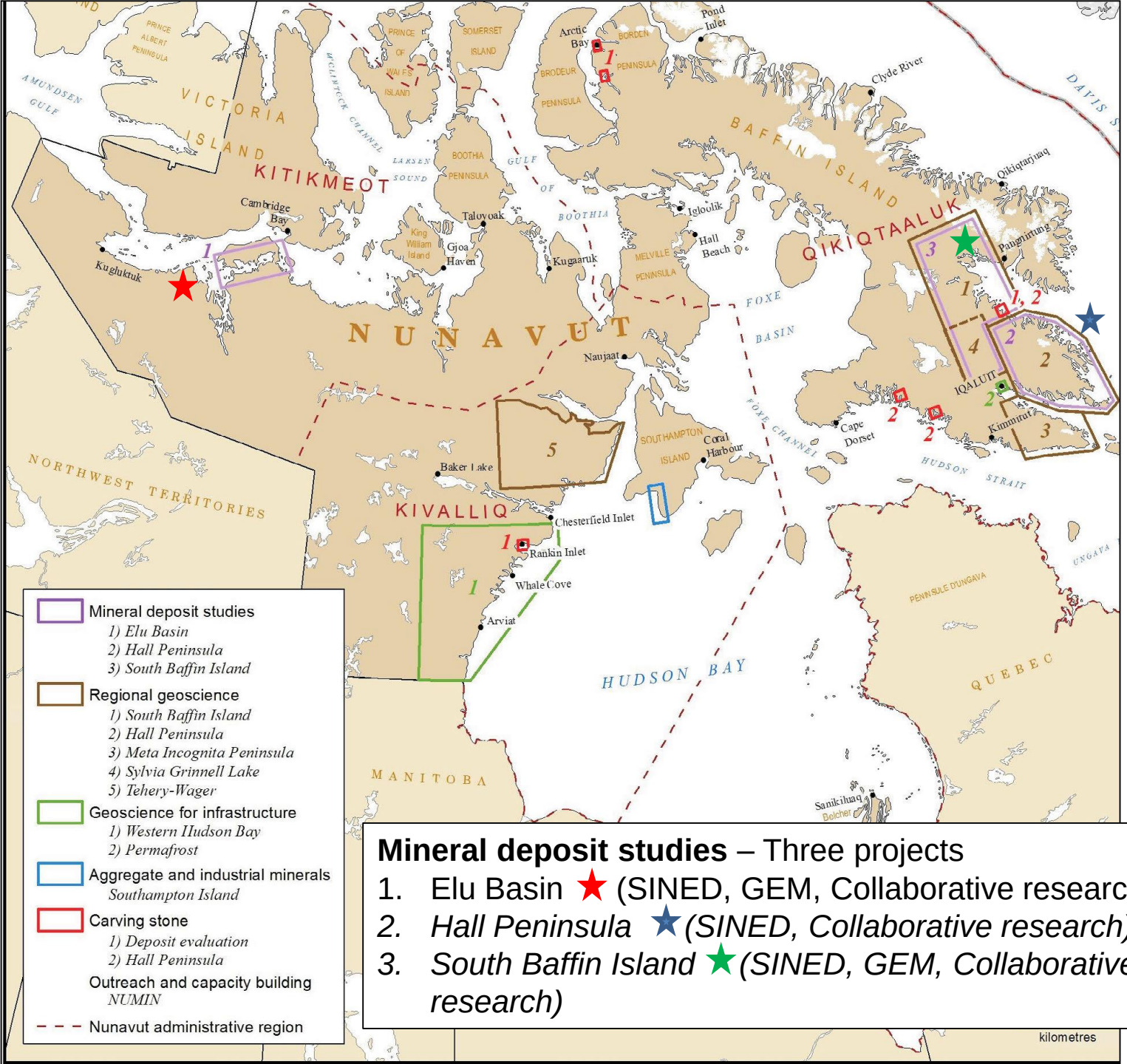
2012-2014 – SoA disseminated at Roundup (January)
2015 – available on-line December 31; hard copies available at Roundup January
CNGO also is disseminating data and other products

Geoscience Data Series released annually also, tied in with the SoA.

Performance Measures 2009-2015

Public Information Performance Measures 2009-2015							
Indicator		**2009-2010***	**2010-2011***	**2011-2012***	**2012-2013***	**2013-2014***	**2014-2015**
# of New Maps			1		1	1	1
Data Sets		1	5	1			
# of New Data Sets	GDS Series					3	8
# of Raw Data Sets	Raw data sets; GDS Series					1	9
# of New Reports, Papers		27	12	15	9	12	20
Summary of Activities papers					18	22	18
# of Conference Presentations		5	10	18	24	23	25
Thesis		3			1	3	1
Posters		8	7	4	2	1	2
Other:							
Mineral showings created, updated and rewritten							87 new; 42 updated; 8 rewritten
Satellite imagery obtained (sets)							1

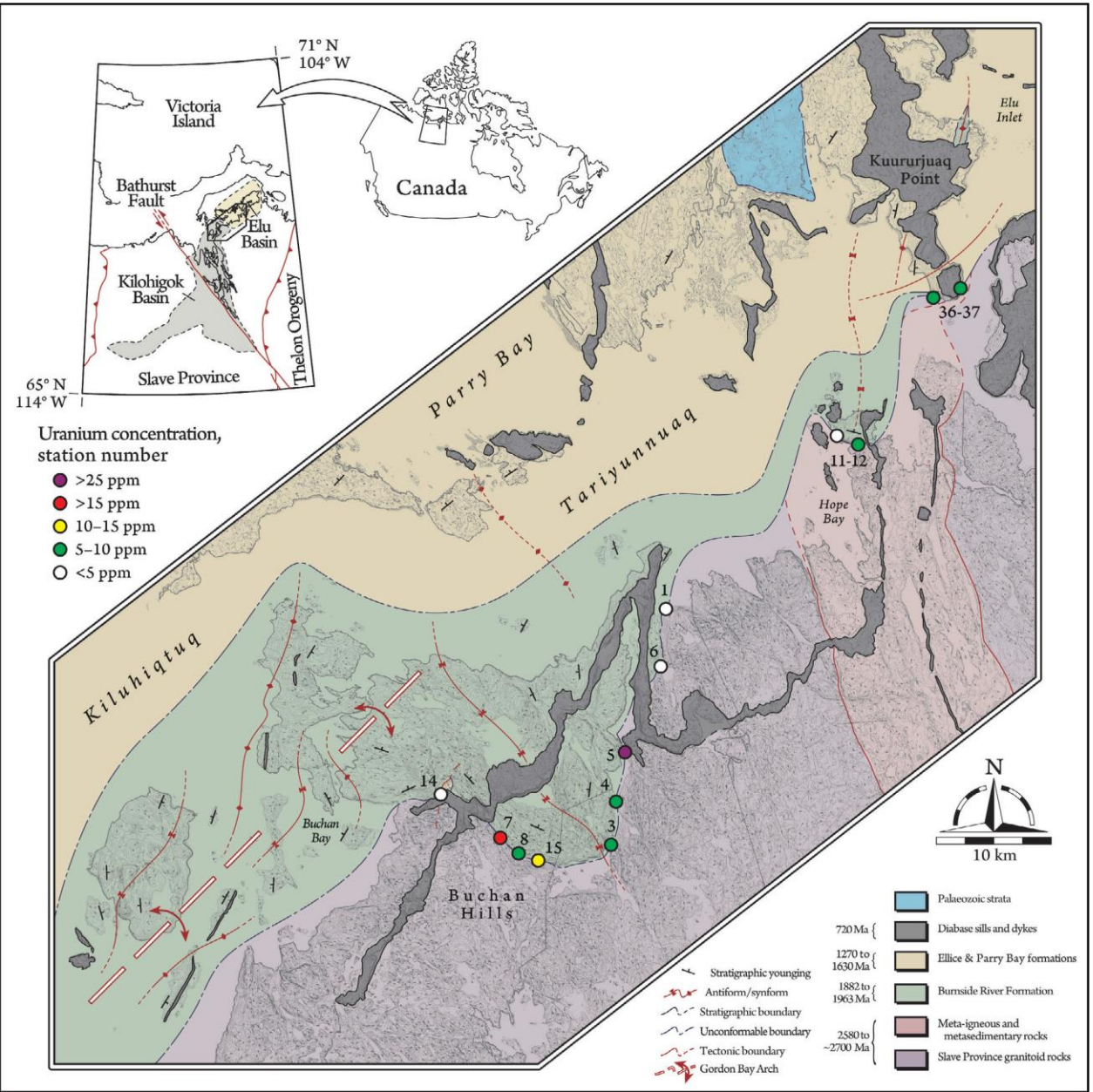
Earlier years may be incomplete, as performance measures implemented in 2014-2015 only



Mineral deposit studies – Three projects

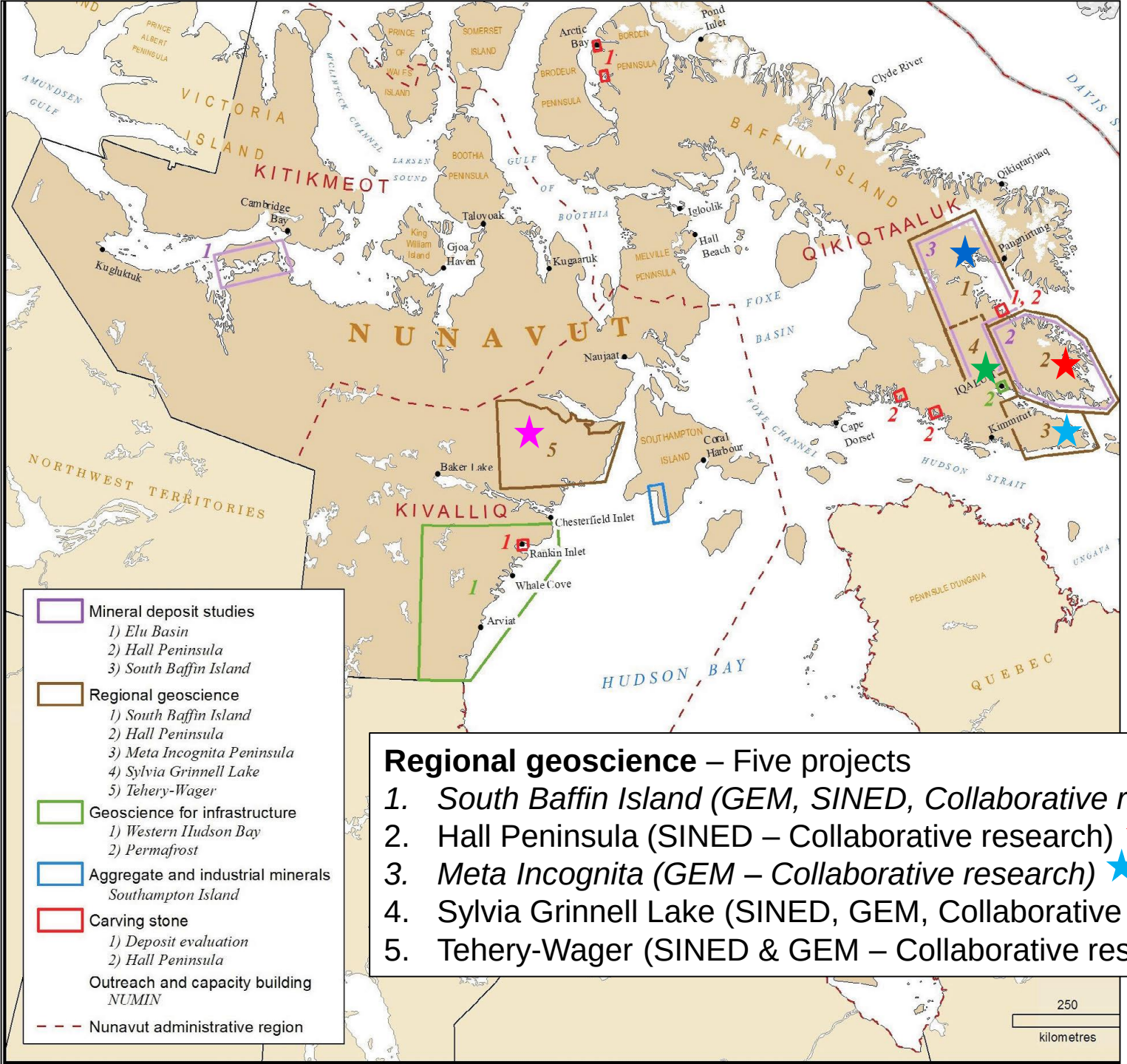
1. Elu Basin ★ (SINED, GEM, Collaborative research)
2. *Hall Peninsula ★(SINED, Collaborative research)*
3. *South Baffin Island ★(SINED, GEM, Collaborative research)*

Mineral Deposit Studies – Elu Basin Project



Elu Basin:
Under-explored
Has similarities to the Thelon Basin and Athabasca Basin

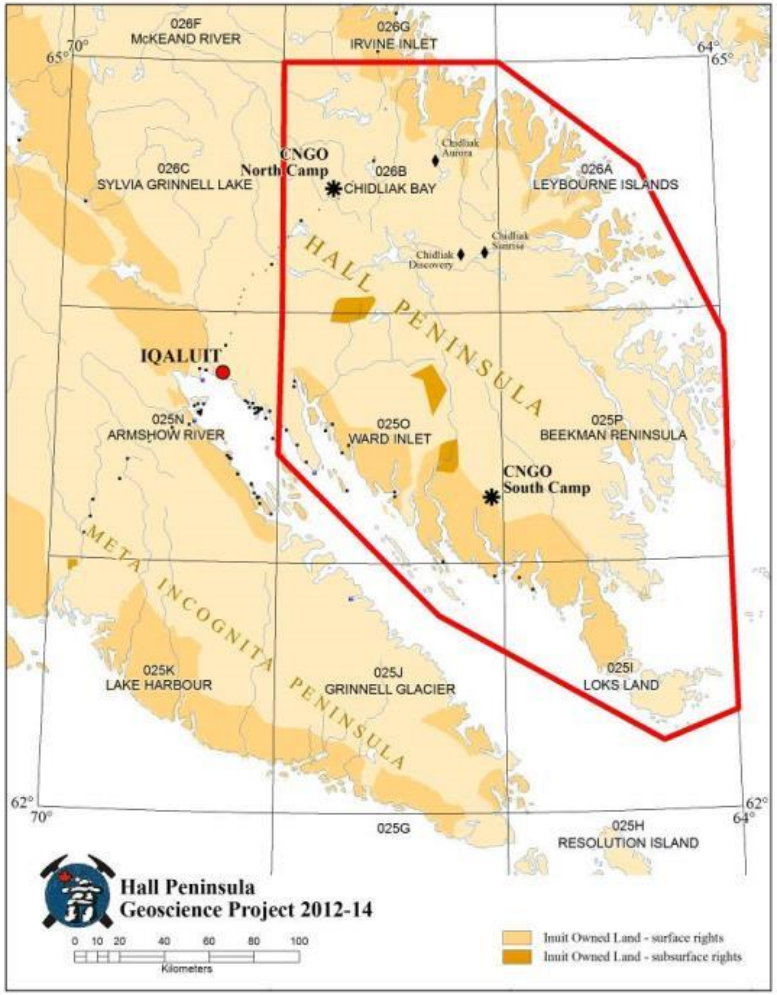
This work:
Focused on stratigraphy and gamma-ray spectrometry of exposed rocks, and developed underlying paleosol soil.
Suggests that future uranium exploration focus on rock and granitoid-derived alteration ‘soil’, and conglomeratic bodies directly overlying stratigraphic surfaces of nonconformity or unconformity.



Regional geoscience – Five projects

1. *South Baffin Island (GEM, SINED, Collaborative research)* ★
2. Hall Peninsula (SINED – Collaborative research) ★
3. *Meta Incognita (GEM – Collaborative research)* ★
4. Sylvia Grinnell Lake (SINED, GEM, Collaborative research) ★
5. Tehery-Wager (SINED & GEM – Collaborative research) ★

Regional Geoscience – Hall Peninsula



Hall Peninsula Integrated Geoscience Program was CNGO's flagship mapping project (2012-2014).

This project was planned, organized, and carried out by the CNGO.

Funding for the project was provided by CanNor through SINED funding.

Work was completed with cooperation from Peregrine Diamonds and DeBeers.

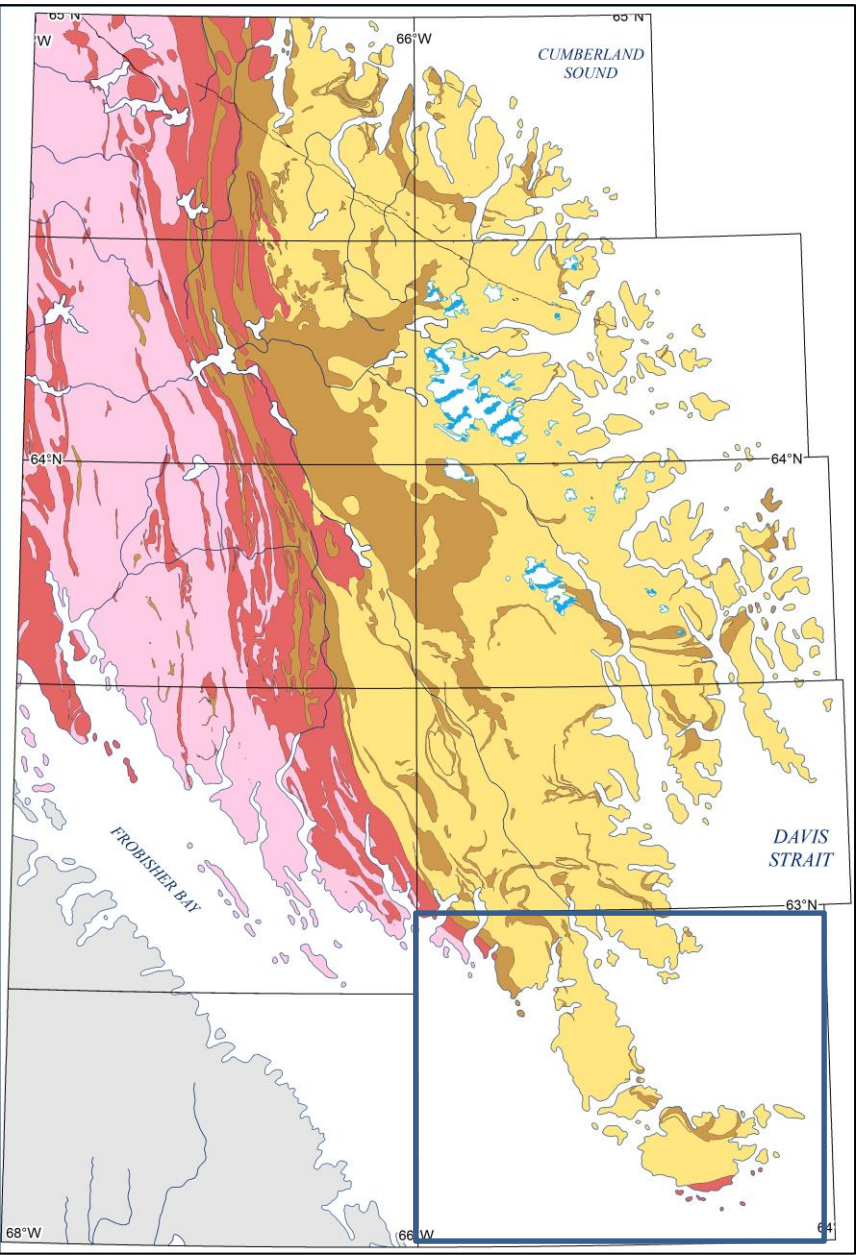
Collaborative research with:

Universities: Alberta; Ottawa; Dalhousie; Laval; Saskatchewan; Manitoba; Waterloo

Government: GN-EDT, INAC, GSC

Nunavut Arctic College

Hall Peninsula – Bedrock mapping



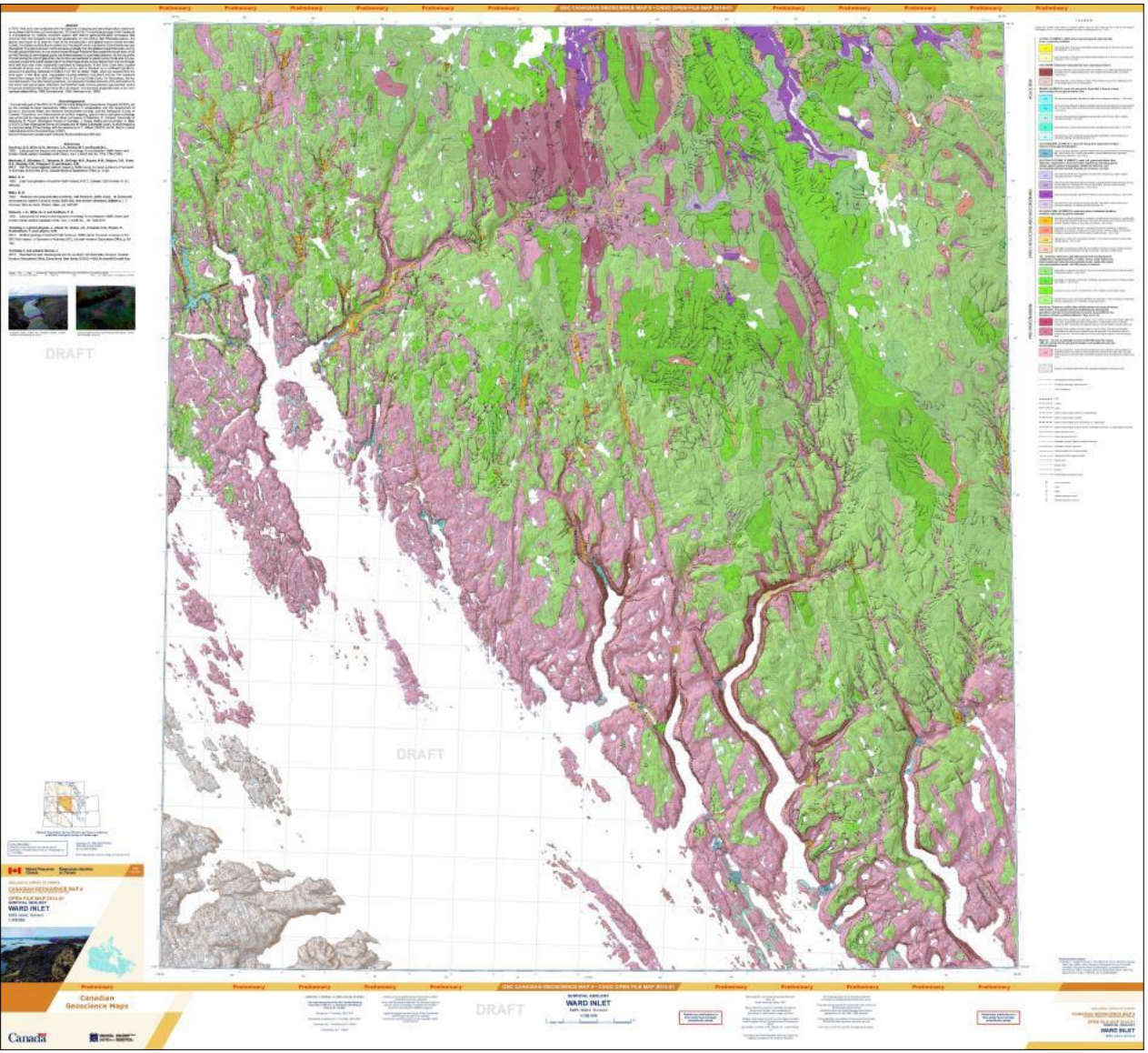
First bedrock map to be published (25I) is available today, April 5th
Eight additional Open File bedrock regional maps to be released April 2016

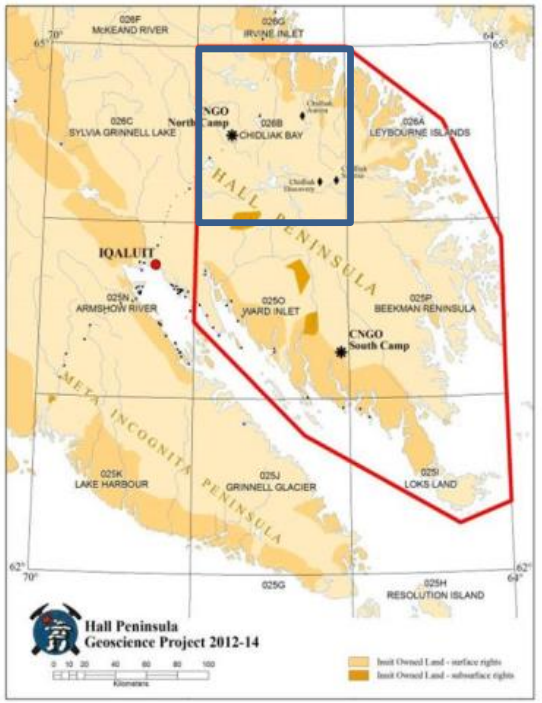
Layered Mafic Intrusions

Carving Stone

New kimberlite dike discovered (CH-64) on the Chidliak property (Peregrine)

Hall Peninsula – Surficial Mapping

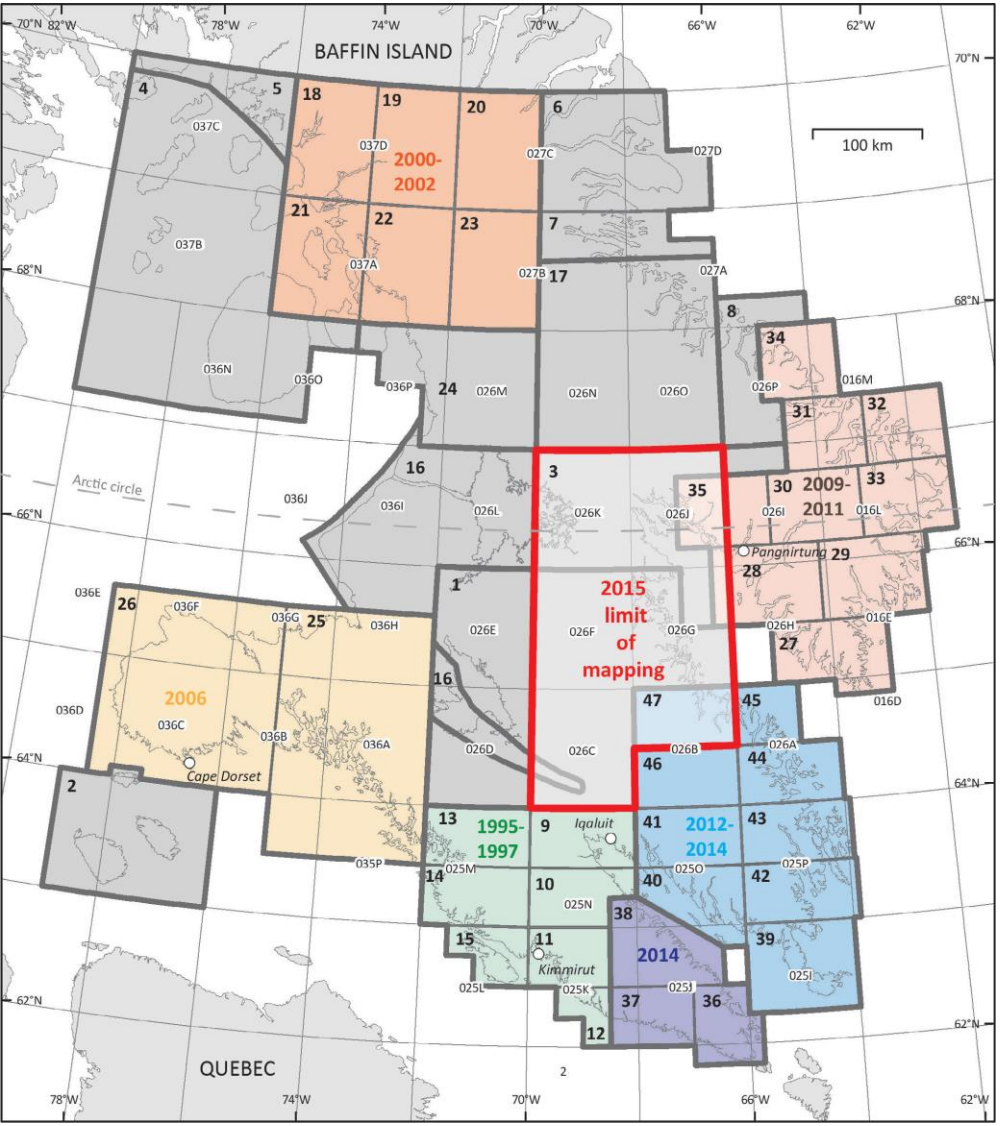




26B (1:10,000; outlined in blue) has been released. Three sheets – 25I, 25P and 26A – will be released early in 2016. Maps include till geochemistry, ice flow and glacial erosion studies.

Talk: Tuesday 4:20 p.m., Tommy Tremblay

Regional Geoscience – Hall Peninsula



CNGO's Hall Peninsula Integrated Geoscience Program leveraged a much bigger GEM initiative to regionally map all of southern Baffin Island ***(Marc St-Onge talk: 11:30 today)***

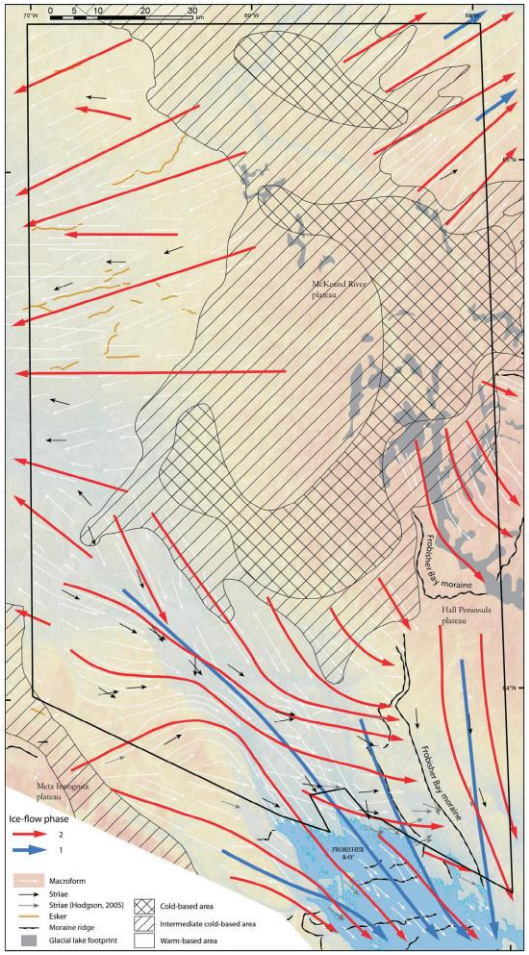
Work 2000-2015 is by CNGO and GSC under both SINED mapping and GEM mapping programs.

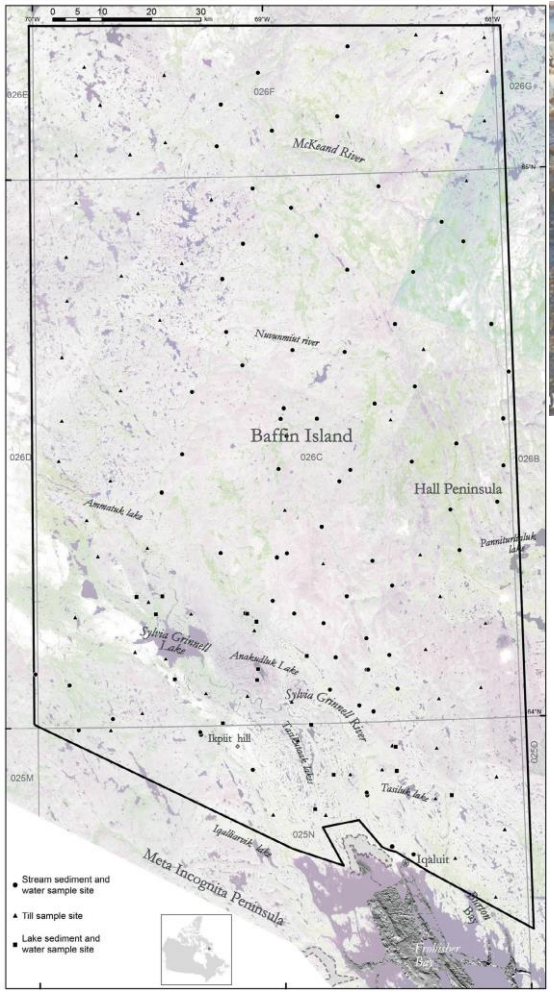
All earlier mapping work was conducted by GSC.

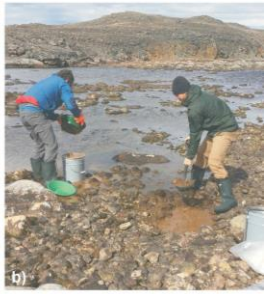
Figure taken from Weller et al., 2015 (Summary of Activities)

Summary of all bedrock mapping undertaken over Baffin Island

Regional Geoscience – Sylvia Grinnell Lake

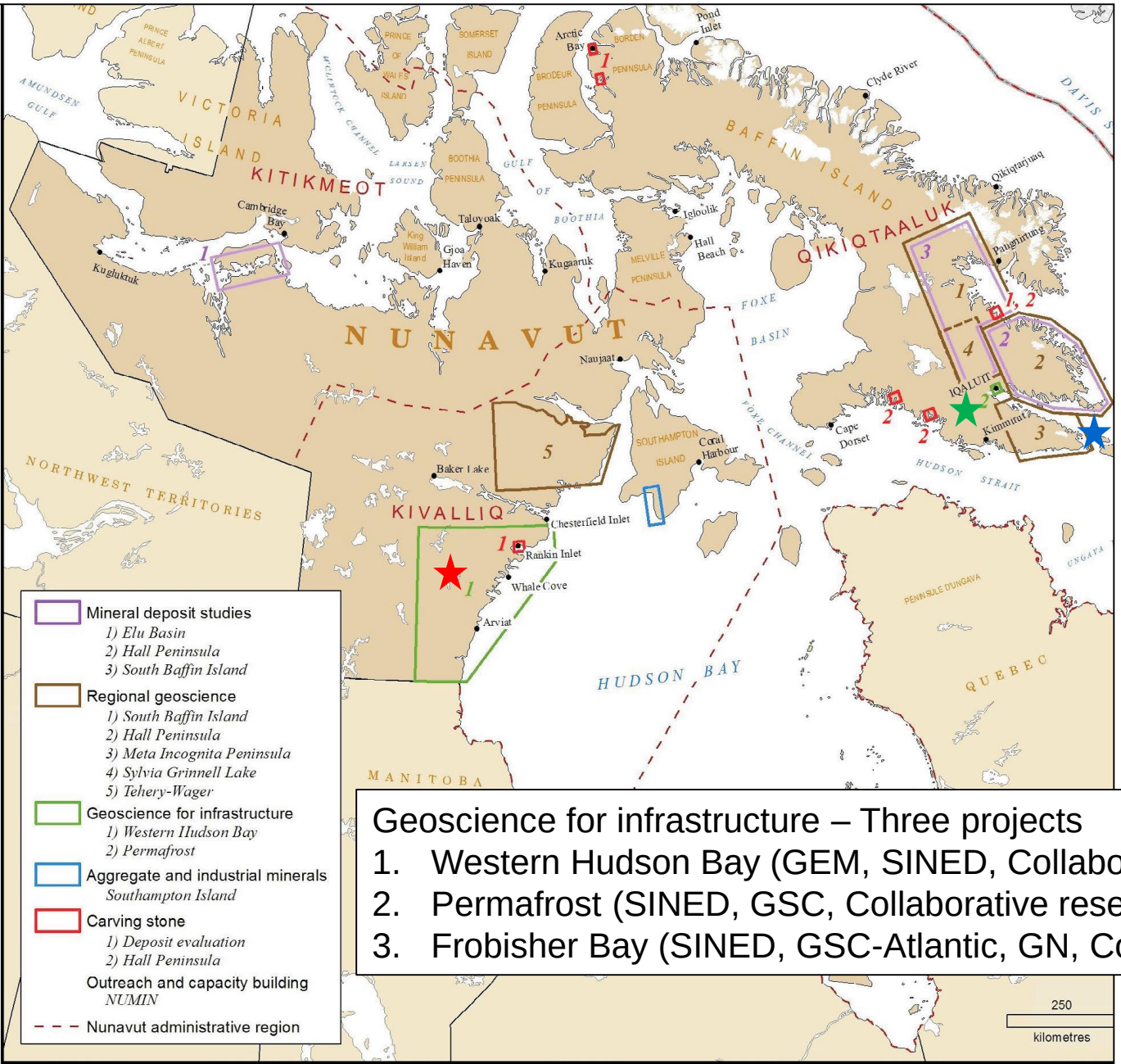






- Samples of till, stream sediment, lake sediment, stream water and lake water collected
- Field observations made of surficial sediments and geomorphological features (glacial macroforms, proglacial lakes, eskers)
- Compiling and drafting new 1:100,000 surficial geology maps for study area

Geoscience for Infrastructure



Geoscience for infrastructure – Three projects

1. Western Hudson Bay (GEM, SINED, Collaborative research) ★
2. Permafrost (SINED, GSC, Collaborative research) ★
3. Frobisher Bay (SINED, GSC-Atlantic, GN, Collaborative research) ★

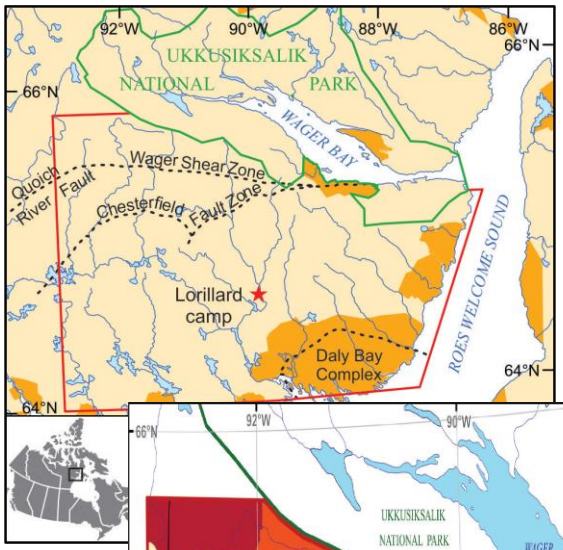
Geoscience for Infrastructure – Tehery-Wager mapping

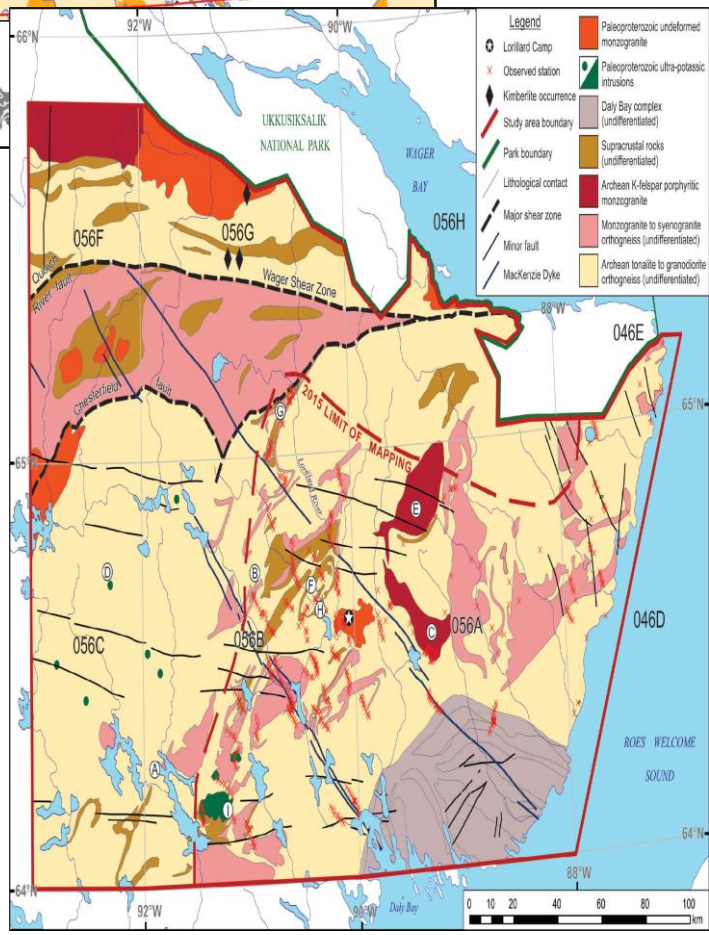
In 2012, GSC led a two week reconnaissance survey in the Tehery Lake-Wager Bay area to evaluate the need for a future, higher resolution mapping campaign. Current project (2015-2019) to map eight NTS map sheets is being conducted by the GSC and CNGO under GEM-2 programming.

Goals are to:

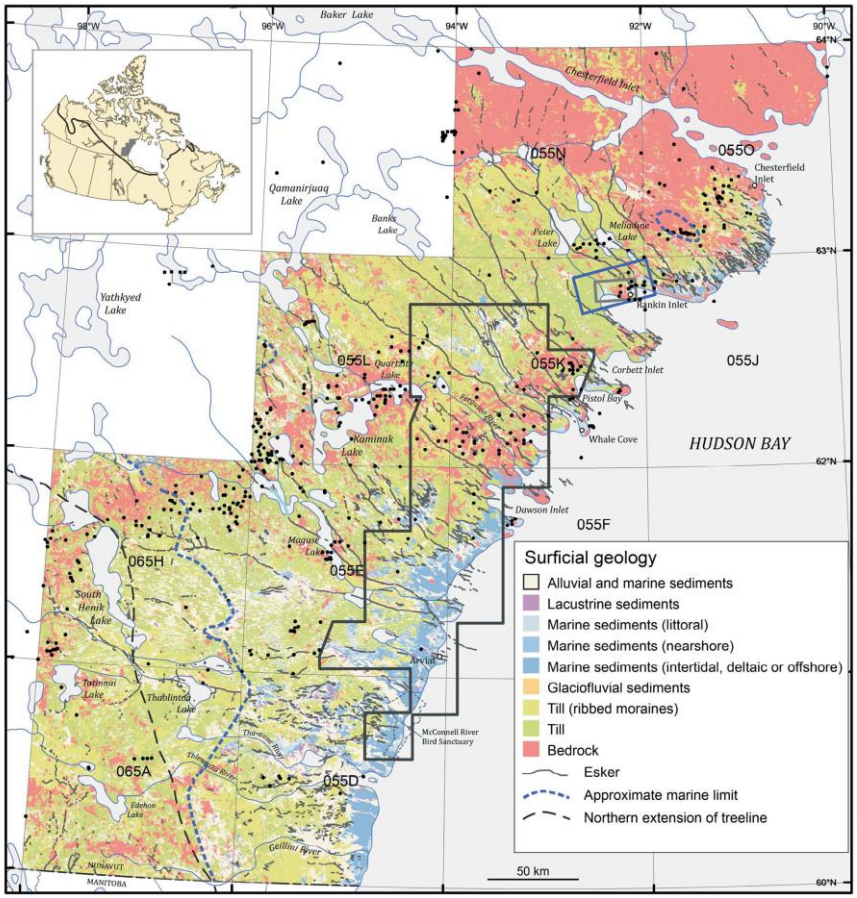
- Increase the level of geoscience knowledge through targeted bedrock and surficial geology mapping and sampling
- Mapping will involve regional and focused thematic studies to evaluate the mineral potential
- Increase the geological understanding of the area to allow stakeholders to make informed land-use decisions regarding future economic development

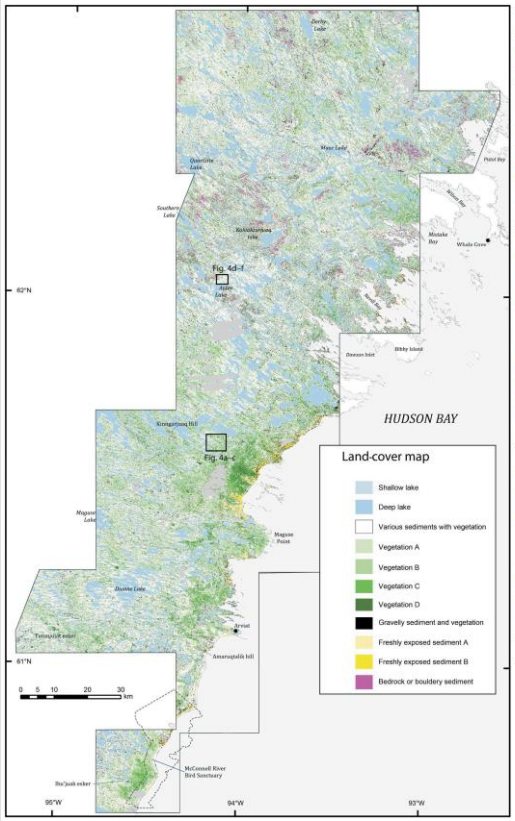
Talk: Tuesday, 2:30 p.m., Natasha Wodicka, GSC

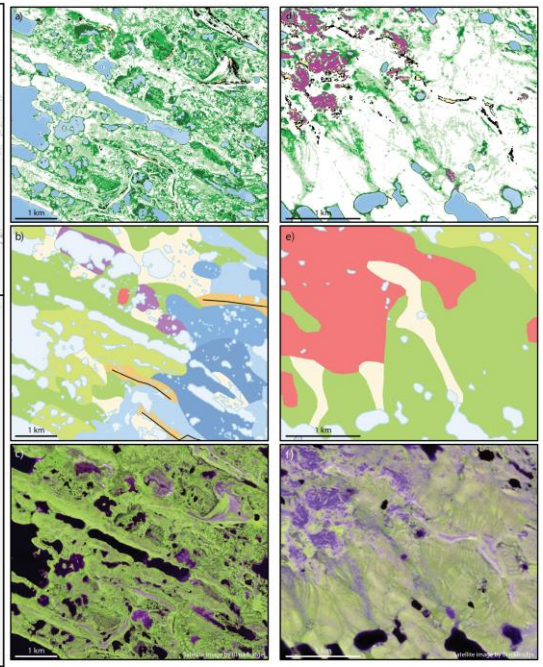




Geoscience for Infrastructure – Western Hudson Bay Surficial mapping



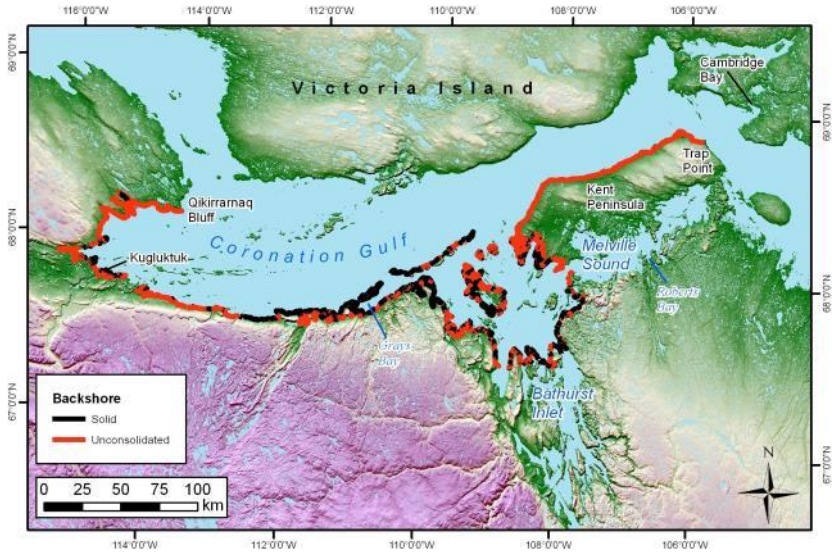


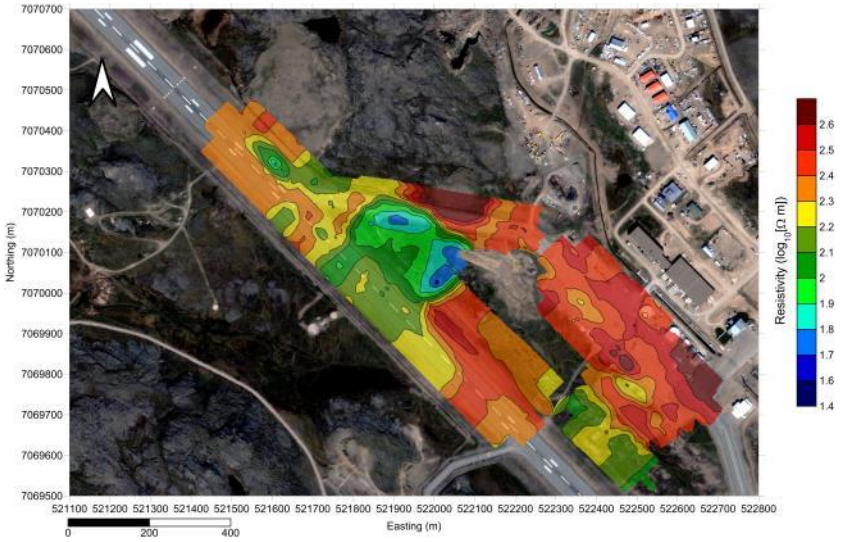


Digital compilation of surficial geology for the area, derived from various maps published during the 1970s and 1980s.

Maps were refined by the use of RapidEye image land-cover interpretation which delimited locations of some gravel deposits, bedrock outcrops, bouldery tills, freshly eroded sediments and vegetation. ***Talk: Tuesday, 4:40 p.m., Paul Budkewitsch***

Geoscience for Infrastructure – Permafrost



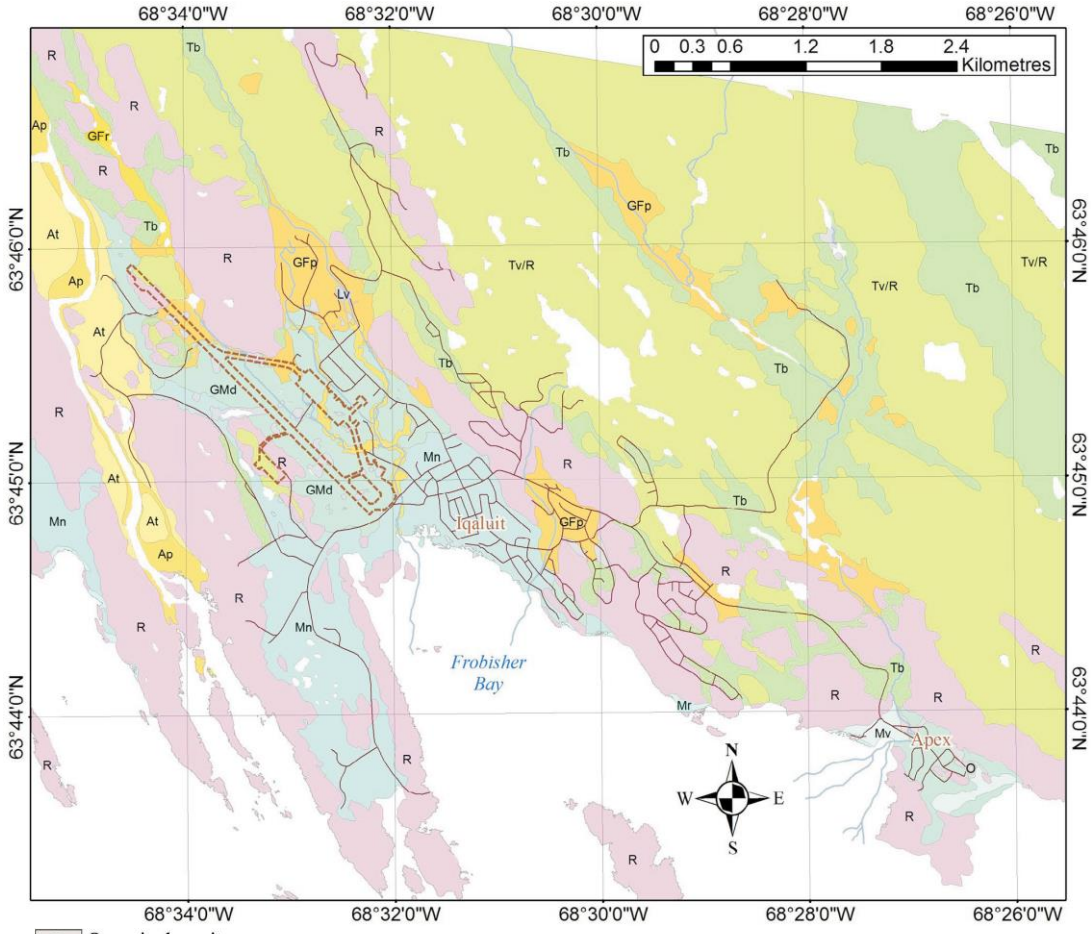


Coastal climate change issues with an emphasis on coastal mapping in southern Coronation Gulf and sea-level change in Hudson Bay.

Better characterize permafrost conditions and processes at the Iqaluit airport.

Collaboration with ESS Climate Change Geoscience Program and Canadian Universities

Geoscience for Infrastructure – Permafrost work, Iqaluit



O	Organic deposits
Ap	Alluvial floodplain sediments
At	Alluvial terraced sediments
Lv	Lacustrine veneer
Mr	Littoral and nearshore sediments (current)
Mn	Littoral and nearshore sediments (postglacial)
Mv	Marine veneer
GMd	Glaciomarine delta
GFr	Glaciofluvial esker deposits
GFp	Glaciofluvial subaerial outwash plain
Tb	Till blanket
Tv/R	Till veneer over bedrock
R	Bedrock

Iqaluit is an important city for the social and economic development of Nunavut.

To date, there has been sparse knowledge about permafrost conditions in Iqaluit.

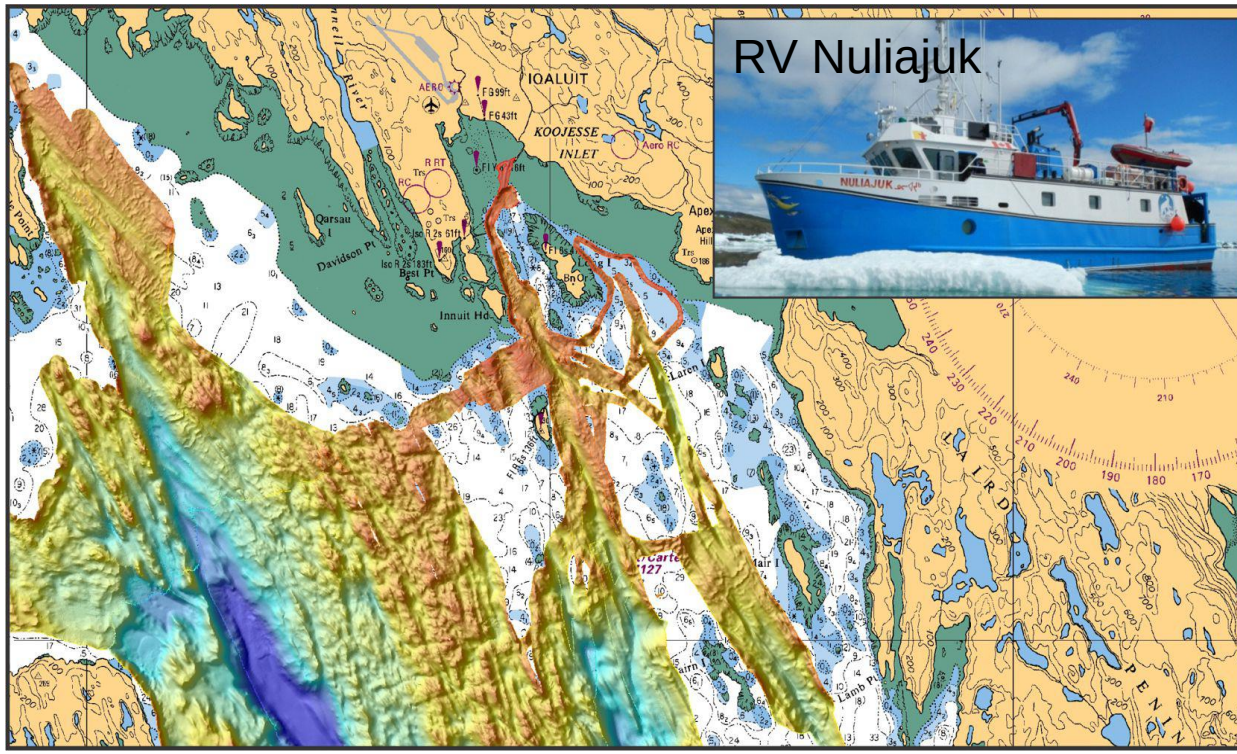
To support informed decision-making and to develop adaptation strategies to cope with the impacts of climate change (warming), a joint study was launched in 2010 (CNGO-GSC-Université Laval)

Results indicate that permafrost conditions in Iqaluit, such as ice-rich soils, are highly variable spatially and with depth.

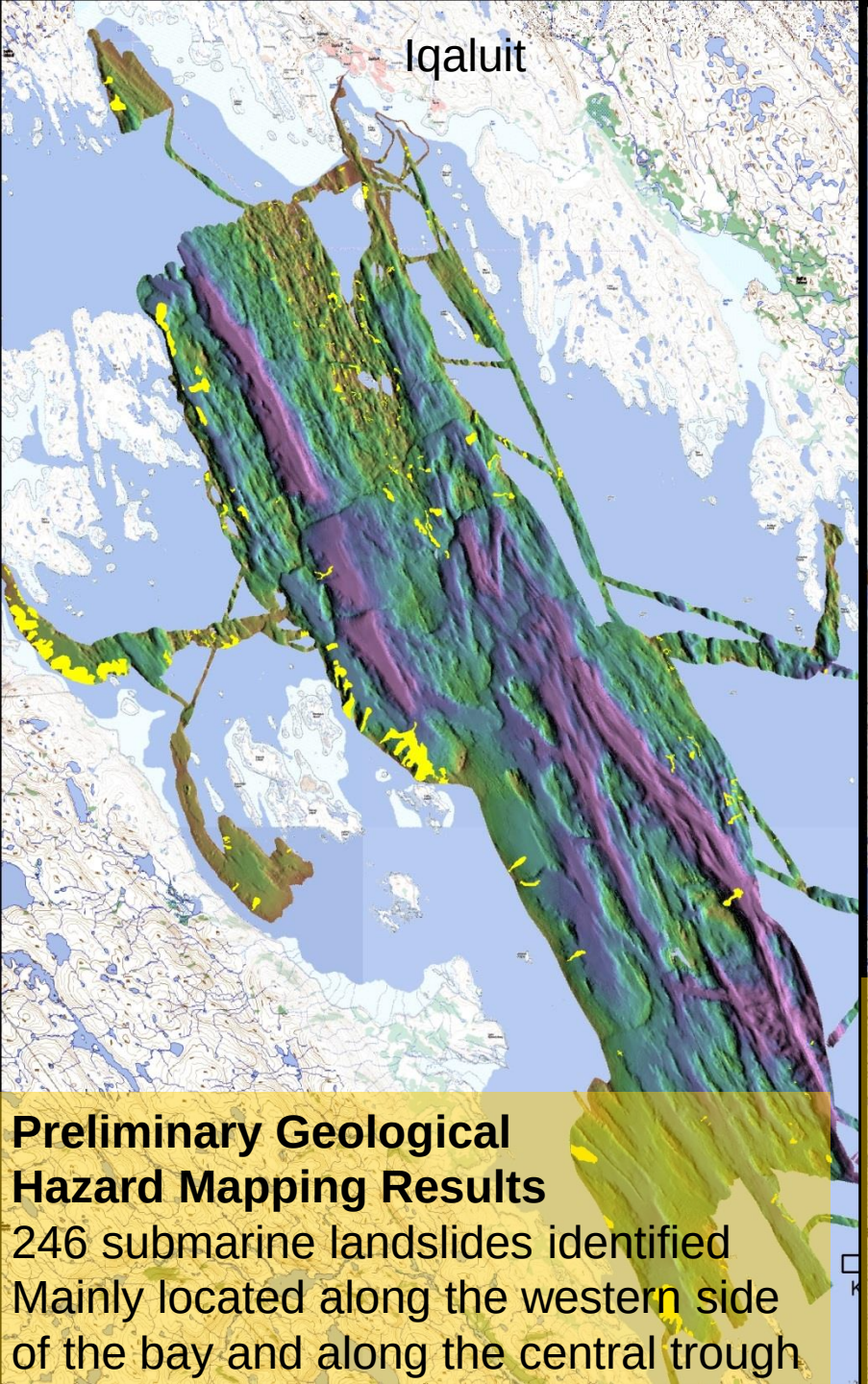
Thick snow cover is a major influence on the thermal regime of Iqaluit permafrost, increasing the ground temperature at 10 m depth by at least 2° C.

Geoscience for Infrastructure
Mapping the bottom of Frobisher Bay

- To investigate the seabed geology of Frobisher Bay
- Seabed mapping of potential areas suitable for port and seabed infrastructure in Frobisher Bay.
- Evaluation of potential marine geological hazards which may impact public safety and Arctic port development.



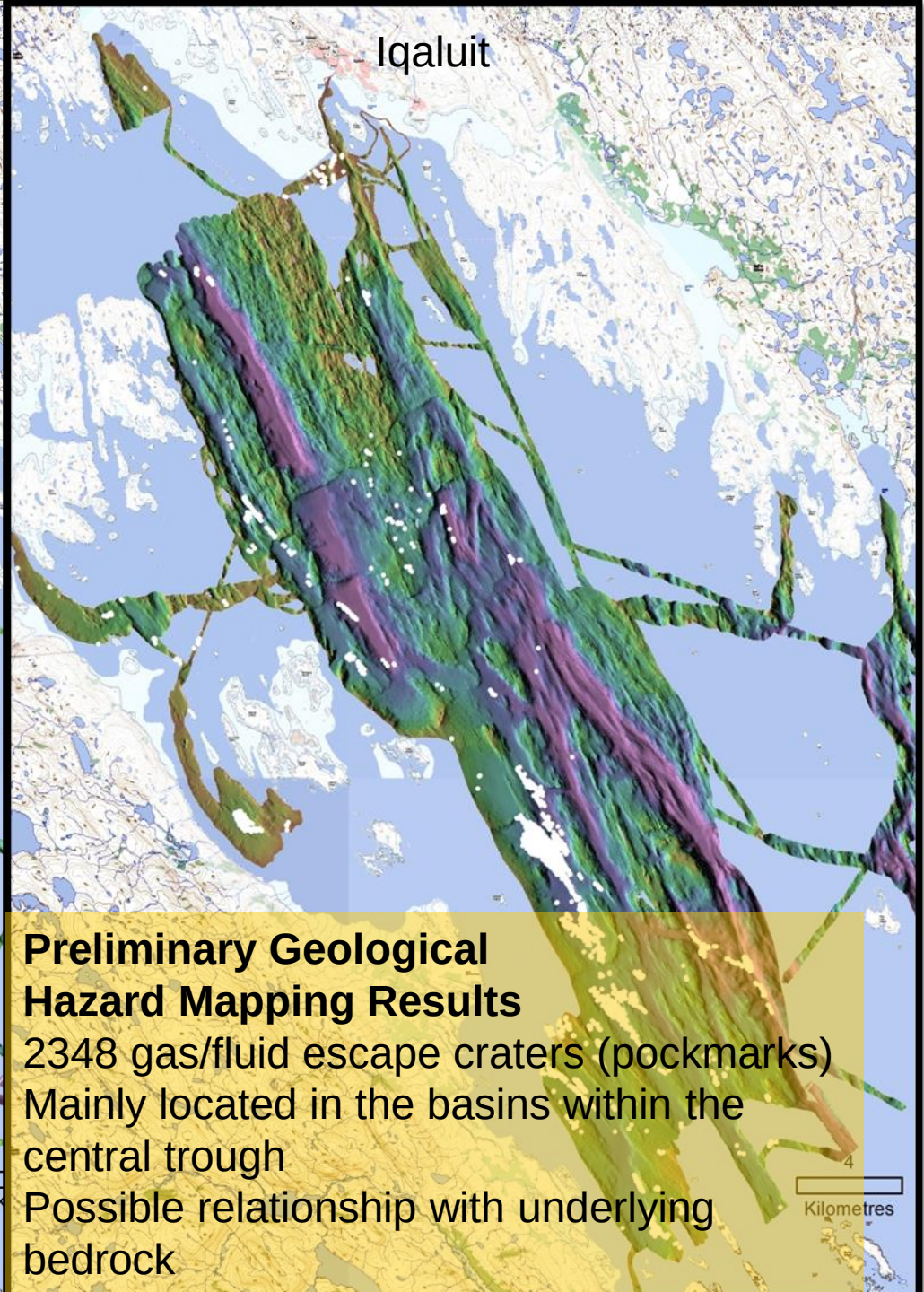
- Confirmation and/or identification of natural petroleum seeps at the mouth of Frobisher Bay.
- Correlation of bedrock exposures at the seabed to the bedrock geology on land between the Hall Peninsula and Meta Incognita in order to define the geological setting and mineral potential.



Preliminary Geological Hazard Mapping Results

246 submarine landslides identified

Mainly located along the western side of the bay and along the central trough



Preliminary Geological Hazard Mapping Results

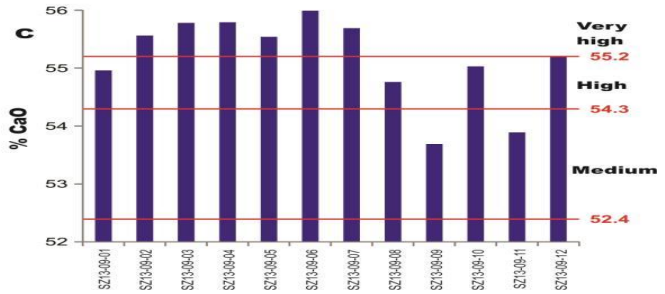
2348 gas/fluid escape craters (pockmarks)

Mainly located in the basins within the central trough

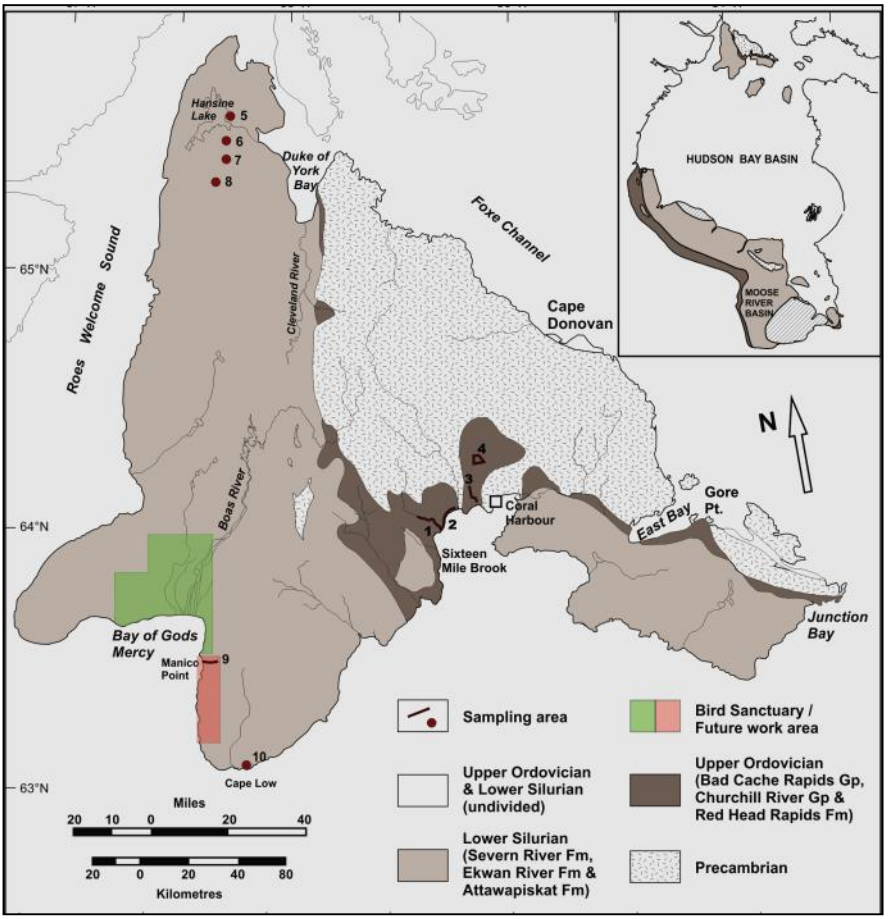
Possible relationship with underlying bedrock

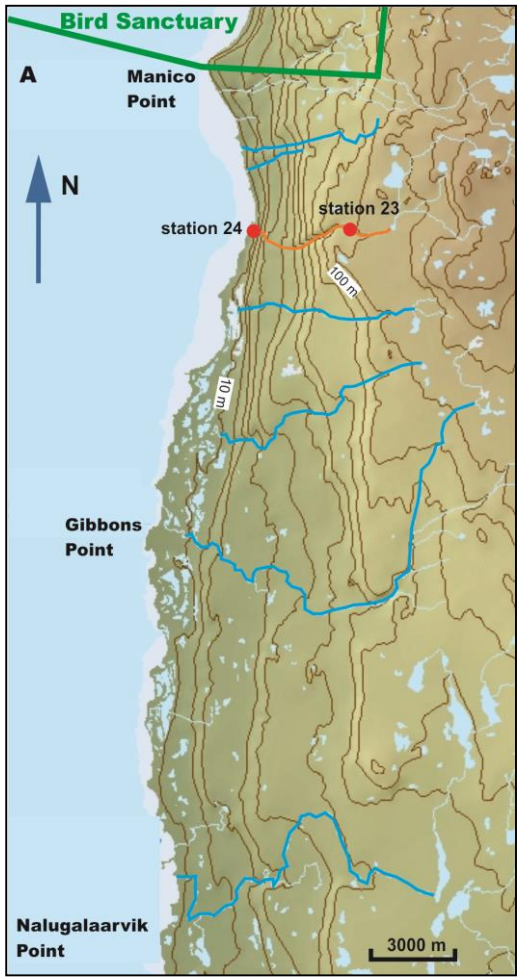
Aggregate and Industrial Minerals

- Quicklime (CaO) is a product of thermal decomposition of limestone.
- Limestone containing >97% calcite (CaCO3), or >54.3% CaO, is classified as high purity or very high purity, and is ideal for producing quicklime.
- Quicklime as a chemical reagent has many uses in the mining industry.
- With the projected growth of the mining industry in the Kivalliq Region of Nunavut alone, up to 10 000 tonnes of quicklime would be required annually at the Meadowbank mine (gold) and the proposed Kiggavik (uranium) and Meliadine (gold) mines.
- Since 2009, CNGO has been conducting research to evaluate the industrial-limestone potential in the Upper Ordovician sequence and in the Lower Silurian sequence on Southampton Island.



Aggregate and Industrial Minerals





In 2014, a new study was initiated by the CNGO and GN-EDT on western Southampton Island.

Results:

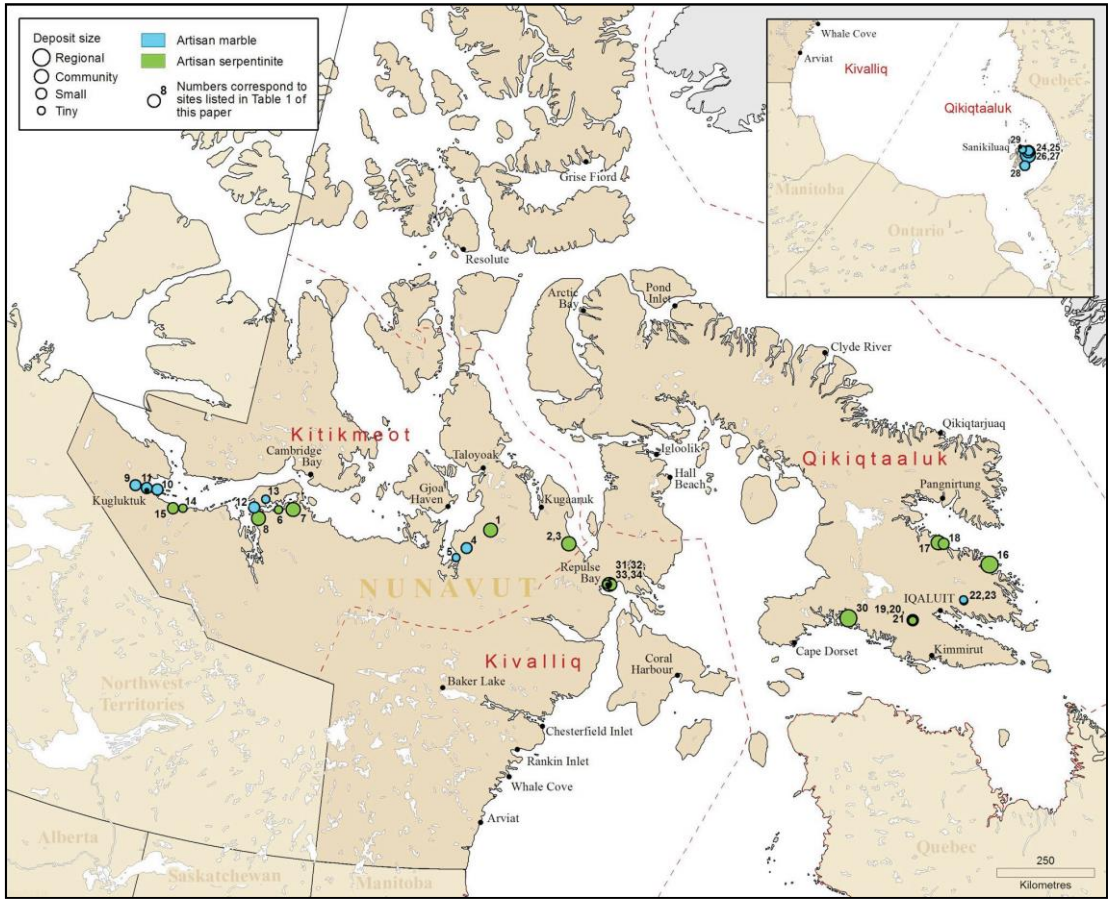
- Locally mineable high-calcium limestone deposits exist between Manico Point and Nalugalaarvik Point.
- These rocks could become an extremely valuable resource for Nunavut and the community of Coral Harbour.

Carving Stone

Led by:
Mike Beauregard (GN-EDT) in collaboration with CNGO, INAC, GSC, RIAs, carvers, and communities

- The Nunavut Carving Stone Deposit Evaluation Program (NCSDEP) is a multiyear collaborative project that was initiated in 2010.
- The primary goals of this program – to assess traditional carving stone sites and to identify new deposits – are based on the rights of Inuit to collect carving stone as set out in Article 19 of the NLCA.
- The guidance of ongoing fieldwork and reporting of new sites by local carvers from every community in Nunavut was an integral part of the NCSDEP.

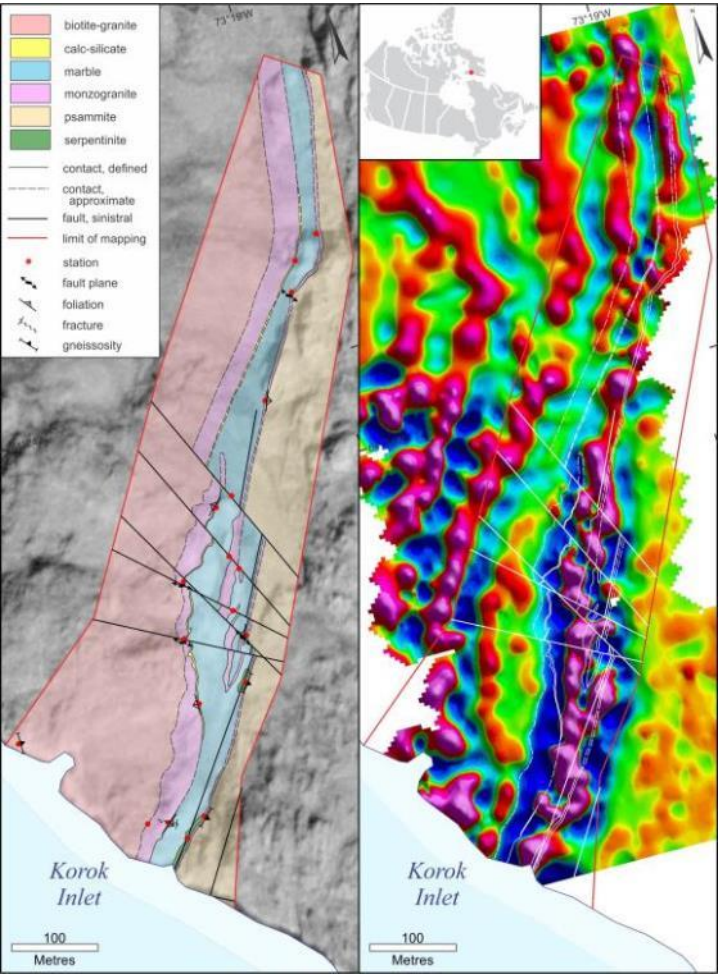
Carving Stone



2010-2011: Kivalliq
2011-2012: South Baffin
2012-2013: North Baffin
2013-2014: Kitikmeot
2014-2015: Follow-up work, Hall Peninsula

In total, there are 12 quarries and 20 additional undeveloped deposits = sufficient stone for artisans for several decades
17 out of Nunavut's 25 communities have access to local carving stone resources

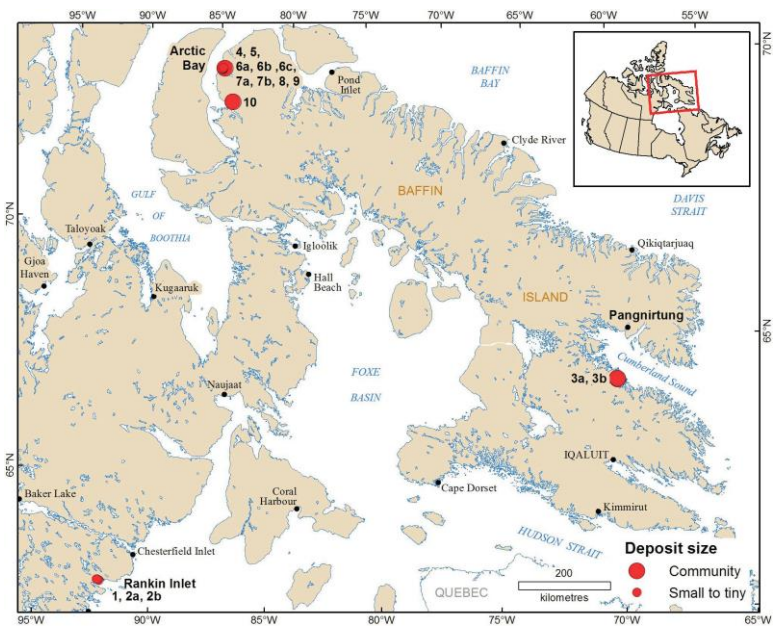
Kangiqsukutaaq (Korok Inlet), Cape Dorset

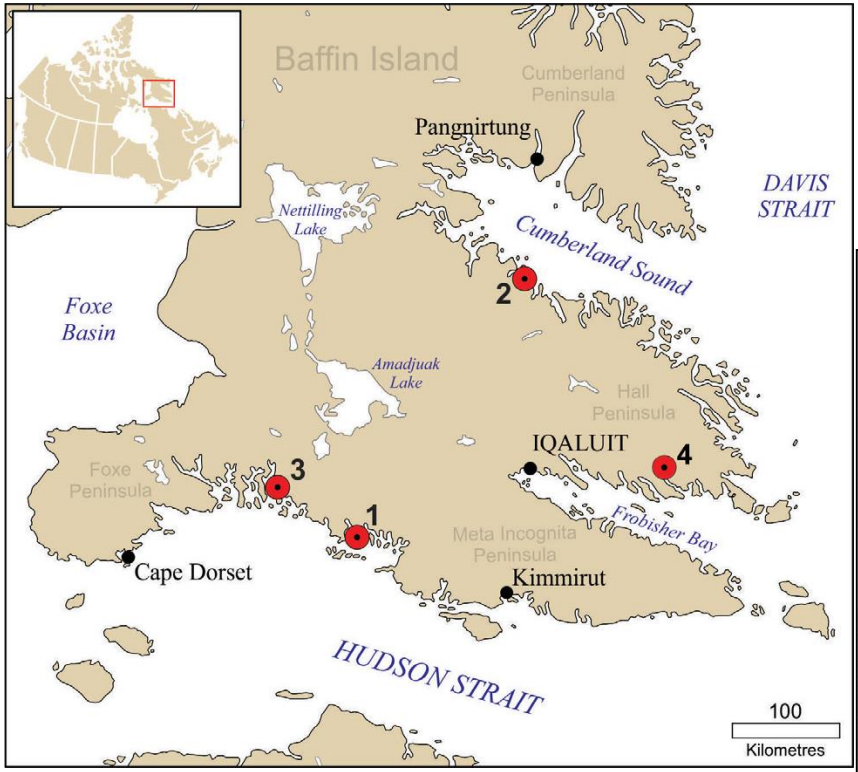


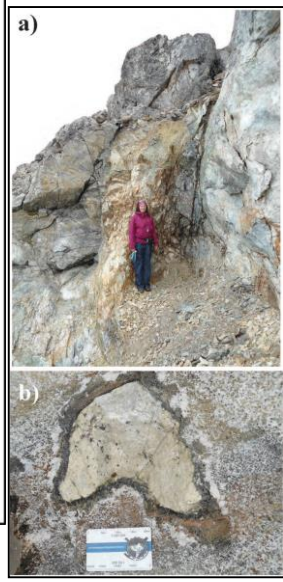
2014-2015
CNGO, QIA, GN and DeBeers Canada collaboration

2016 –
QIA-led; QIA-GN (EDT)-CNGO collaboration on further mapping of carving stone resources

Carving Stone 2015



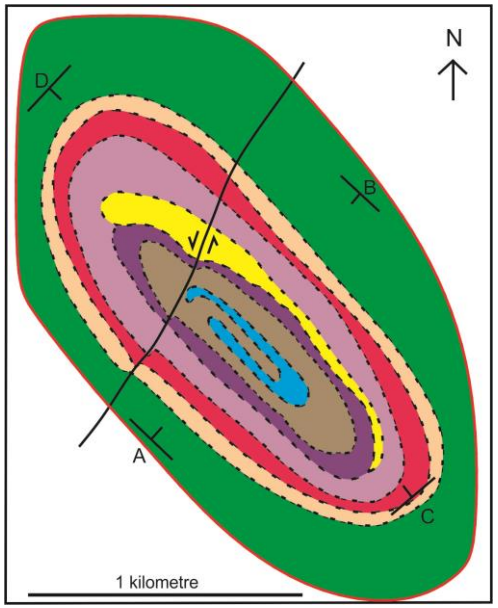




GN-EDT research:
2015-2016: Rankin Inlet, Cumberland Sound, Arctic Bay

2015-2016 – University of Manitoba research
Characterization of carving stone deposits in Aberdeen Bay, southern Baffin Island, Nunavut

Outreach and Capacity Building – Geoscience Training Program



Legend:

Monzogranite	Coarse grained; equigranular; tan to white weathering; porphyritic K-feldspar
Quartzite	Grey-blue; coarse-grained; biotite defines bedding; associated with rose quartz veins
Diorite Gneiss	Fine-grained; light and dark compositional layers with garnet, plagioclase, biotite and significant amounts of clinopyoxene
Iron Formation	Garnet and grunerite; silicified magnetite layers
Diorite Gneiss	Medium grained; rare clinopyroxene
Semi-Pelite	Rusty weathering; contains biotite, graphite, and quartz; associated with calc-clicate
Diorite Gneiss	Brown weathering; fine grained; contains biotite, hornblende, clinopyoxene, and garnet in east
Tonalite	White weathering; gneissic; contains biotite, quartz, plagioclase and rare clinopyroxene

Contact; *confirmed, approximate* Transform fault Limit of mapping

Nunavut-Dalhousie Field School: CNGO-Dalhousie 2013 to 2015; could resume in 2017

Outreach and Capacity Building

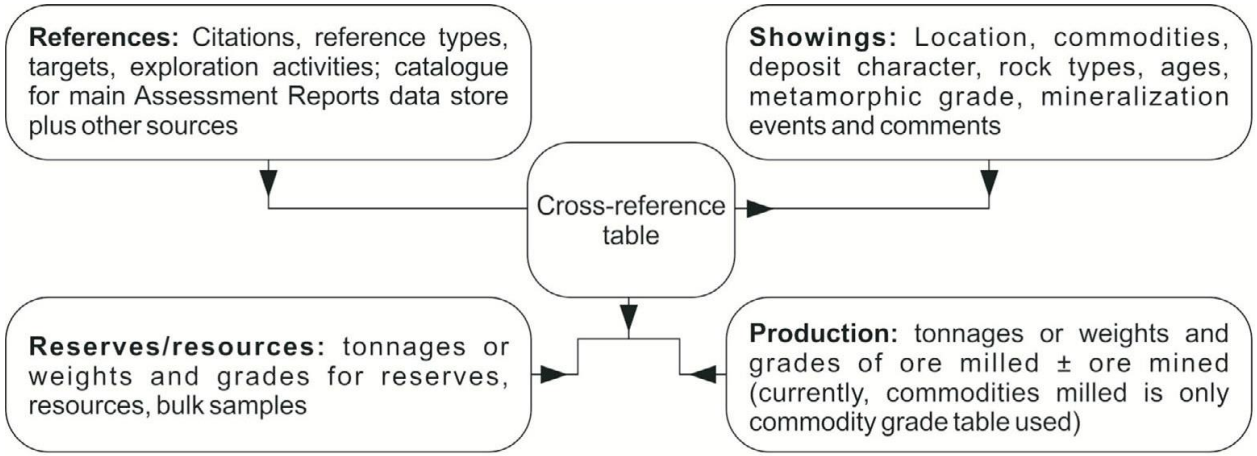
- Arctic College
  - Camp Cook Program
  - Environmental Technology Program
- Universities
  - Ph.D. students
  - M.Sc. students
- Local Businesses
- Community involvement
  - Field helpers

Data Dissemination – Nunavutgeoscience.ca, NUMIN

NunavutGeoscience.ca is:

- An open-access data portal to public geoscience information available for Nunavut.
- Enabled with search and direct-download capabilities, or indirect downloads through links to partner organizations.
- An initiative started in 2006.
- A partnership between the CNGO, INAC, GN, NRCan, and NTI.

NUMIN: online access to information about mineral showings and exploration-project documents at NunavutGeoscience.ca



Each of these 'entities' or NUMIN modules is linked through a cross-reference table in many-to-many relationships, and Showings is also linked one-to-many to Reserves and to Production.

Overview schematic illustrating the organization of the NUMIN database.

Final Points

The Canada-Nunavut Geoscience Office is co-funded and co-managed (overseen by three government departments) and conducts an ambitious geoscience program.

This “small but mighty” office is Nunavut’s ‘de-facto’ Geological Survey.

The many partnerships and collaborations are key to the success of the CNGO.