



# Canada-Nunavut Geoscience Office Activities 2018

*Linda J. Ham*

*Chief Geologist*

*Canada-Nunavut Geoscience Office, Iqaluit, Nunavut*

*Presented at Nunavut Mining Symposium April 3 2019*



Natural Resources  
Canada

Ressources naturelles  
Canada



Crown-Indigenous Relations  
and Northern Affairs Canada

Relations Couronne-Autochtones  
et Affaires du Nord Canada

Canada



# The Canada-Nunavut Geoscience Office

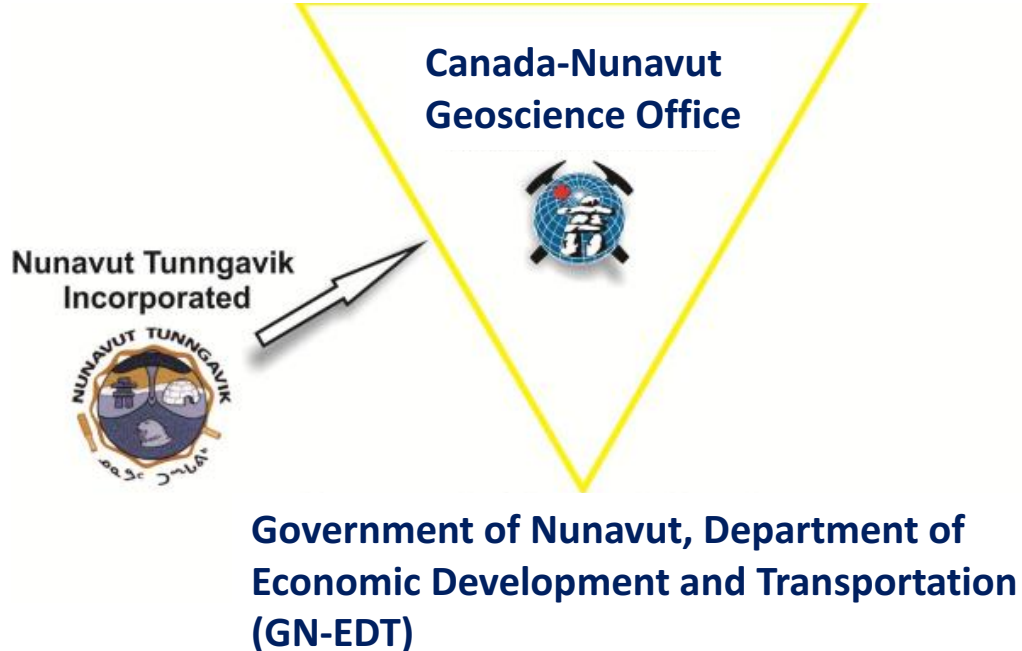


The Canada-Nunavut Geoscience Office (CNGO) – a partnership office – was established in 1999 by governments

**Natural Resources Canada, Lands and Minerals Sector (NRCan-LMS-GSC)**

**Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)**

The CNGO Management Board – representatives from the three governments, and an ex-officio representative from NTI – provides direction to the Chief Geologist of CNGO



# Canada-Nunavut Geoscience Office



The CNGO is considered Nunavut's 'de-facto' Geological Survey

Six-person office in Iqaluit, Nunavut  
Chief Geologist, Paleozoic geologist,  
Bedrock mapper, Surficial mapper, GIS  
specialist, and data dissemination  
specialist/computer programmer.



Funding to/for CNGO is provided:

- 1) Through the Office Agreement (five-year; 2018-2023) between NRCan, CIRNAC and GN-EDT; funds for running and managing the office.
- 2) From other sources, mainly Strategic Investments in Northern Economic Development (SINED) funds from **Canadian-Northern Economic Development Agency (CanNor)**.

# In the Beginning



## Leading up to 1999:

- With the realities and challenges within NU (young population, lack of skilled workforce, educational shortfalls, small population spread over vast land), mineral development and extraction are two areas that have significant economic potential.
- When Nunavut became a territory, 70% of it was inadequately mapped and poorly understood.
- This meant that informed decisions about use of land and land-use planning, including where to explore, by all including exploration companies could not be made.
- Decision was made by governments to open CNGO in 1999.

# Beginnings – 1999



- The office was opened in September by the federal Minister of Natural Resources, Ralph Goodale, who said:
- *"Nunavut has remarkable natural resources potential. A key to unlocking that potential and to bringing exploration and investment north is expanding geoscience knowledge in the region."*
- Loosely modeled on Yukon's geoscience centre, the rationale for the office included:
  - Spearheading and improving geological research into the geology of Nunavut
  - Helping to co-ordinate research efforts by Nunavut's then-Department of Sustainable Development (GN), the Geological Survey of Canada (NRCan) and DIAND.

# Why invest in geoscience?



- Nunavut's diverse geology has demonstrated potential for gold, diamonds, base metals, uranium and hydrocarbon deposits.
- Public geoscience provides exploration companies with new data and innovative ideas intended to reduce the risk of exploration and improve chances for successful discoveries. Geoscience outputs have a long 'shelf life', but do need updating.
- Public investments in geoscience are needed to sustain the exploration expenditures that the private sector has invested in Nunavut since 1999.

Carving stone studies





# What work does CNGO do? – Needs Studies



- Before office opened and 1999
- 2002
- 2005
- 2010-2011
- Today



Sunrise Camp, Hall Peninsula 2011

# Questions asked



- What type of geoscience information is needed and for what purpose?
- Where and what are the highest priority areas for generating new geoscience information?
- How will the partners (NRCCan/GSC, GN-EDT, CIRNAC) and CNGO work together and as individual organizations?



Newly discovered  
mafic intrusion



# Mandate of the CNGO



To provide accessible geoscience information and expertise in Nunavut to support:

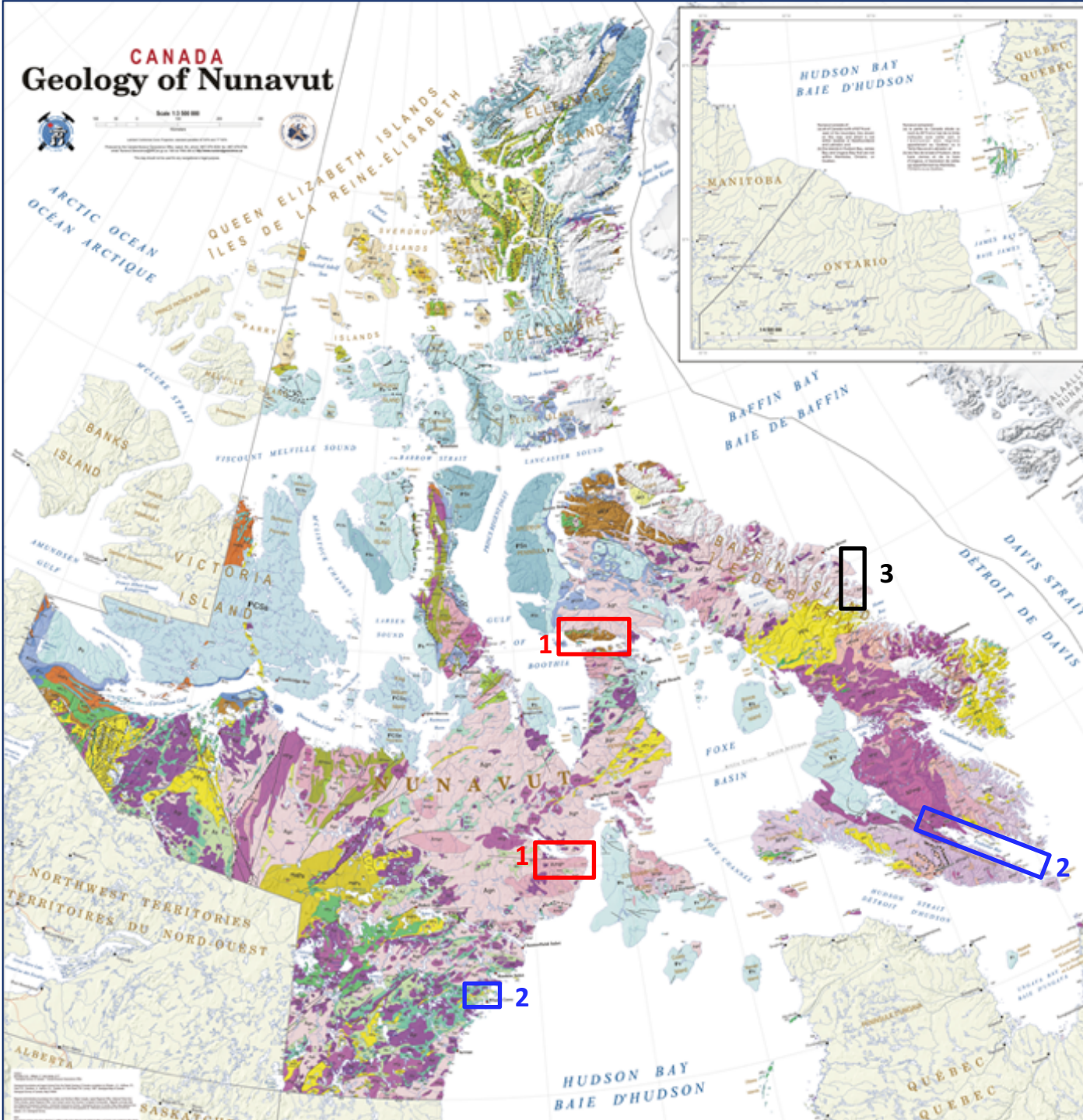
- 1) responsible resource exploration and development,
- 2) responsible infrastructure development,
- 3) geoscience capacity building, and
- 4) geoscience education, training and awareness.

To accomplish these mandates, the CNGO:

- Maps, interprets and reports on the geological features and resources of Nunavut in collaboration with geoscience partners, and
- Engages the public on key geoscience issues.



# CANADA Geology of Nunavut



## *CNGO Activities in 2018*

1. Regional geoscience (mapping)
2. Geoscience for infrastructure
3. Other studies
4. Data dissemination
5. Outreach



# Regional Geoscience – Mapping

Includes bedrock and surficial mapping, mineral deposit research

Targeted work is integrated with airborne geophysical surveys and focussed surveys – geophysical, geochemical and geochronological

Completes coverage in areas with inadequate information

Provides information (geological data), new ideas and answers

Allows decision-makers to make better decisions for resource development, land-use planning and infrastructure



# Fury and Hecla Geoscience Project

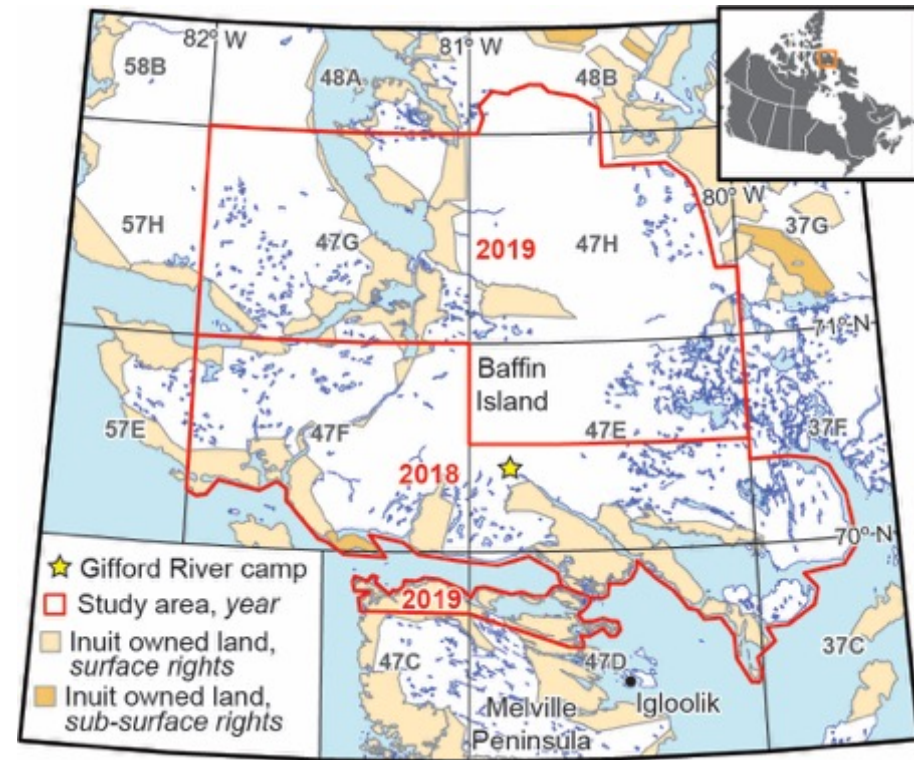


2017–2020

CNGO-led, multi-disciplinary project with four university collaborators

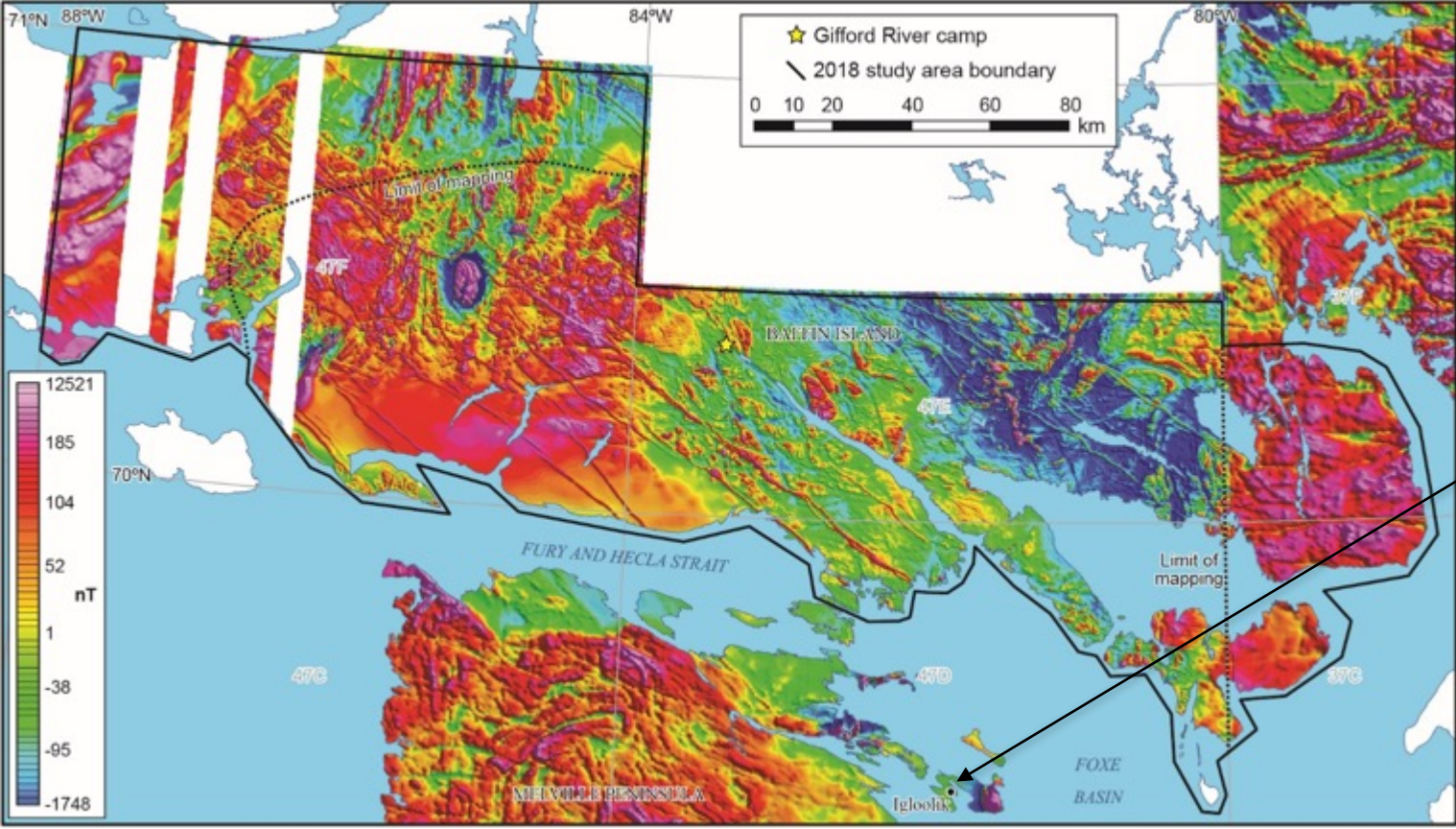
## FIVE COMPONENTS

1. Airborne geophysical surveys (2017-2019)
2. Regional bedrock mapping (2018,2019)
3. Precambrian thematic research (2018, 2019)
4. Paleozoic stratigraphy and sampling (2018)
5. Surficial geology studies and sampling (2019, 2019)





# FHGP COMPONENT 1: AIRBORNE GEOPHYSICAL SURVEY

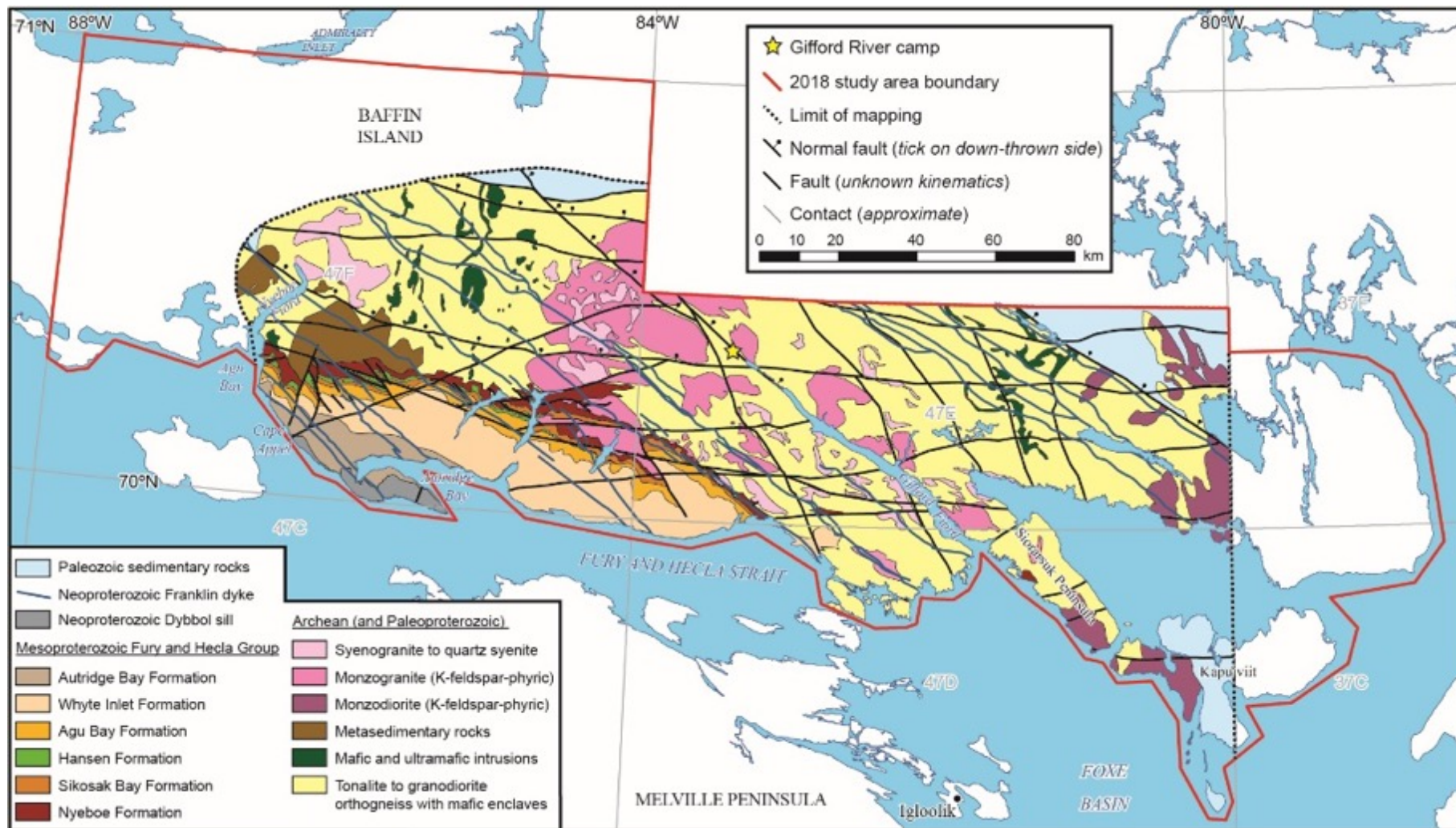


Igloolik

Eight CNGO  
Open File Maps  
published  
December 2018

Feb-Mar 2017; May 2018; April-May 2019 – community information sessions Igloolik and Arctic Bay  
Sept-Nov 2017 and Feb-Mar 2018, regional airborne-geophysical survey flown over parts of NTS  
37C and F, and 47D–F 125 m above ground level  
March 2019-May, June 2019 – completion of survey in the northern portion; will guide 2019 mapping

# FHGP COMPONENT 2: BEDROCK MAPPING



725 bedrock stations, maps being compiled



# FHGP COMPONENTS 2 AND 3: BEDROCK MAPPING AND THEMATIC RESEARCH PROJECTS



## THEMATIC PROJECTS

One thematic research project on Archean basement gneisses

Three thematic research projects on Mesoproterozoic Fury and Hecla Group

## BEDROCK GEOLOGY HIGHLIGHTS

Layered mafic–ultramafic intrusions in basement gneiss (mag highs)

Basement rocks similar to rocks mapped northeast and east of study area

Metasedimentary rocks, possibly related to Archean Mary River Group

Fury and Hecla Basin development and architecture better defined



Layered mafic–ultramafic intrusion



Monzodiorite



MRG(?) banded iron formation



Nyeboe Fm  
stromatolite

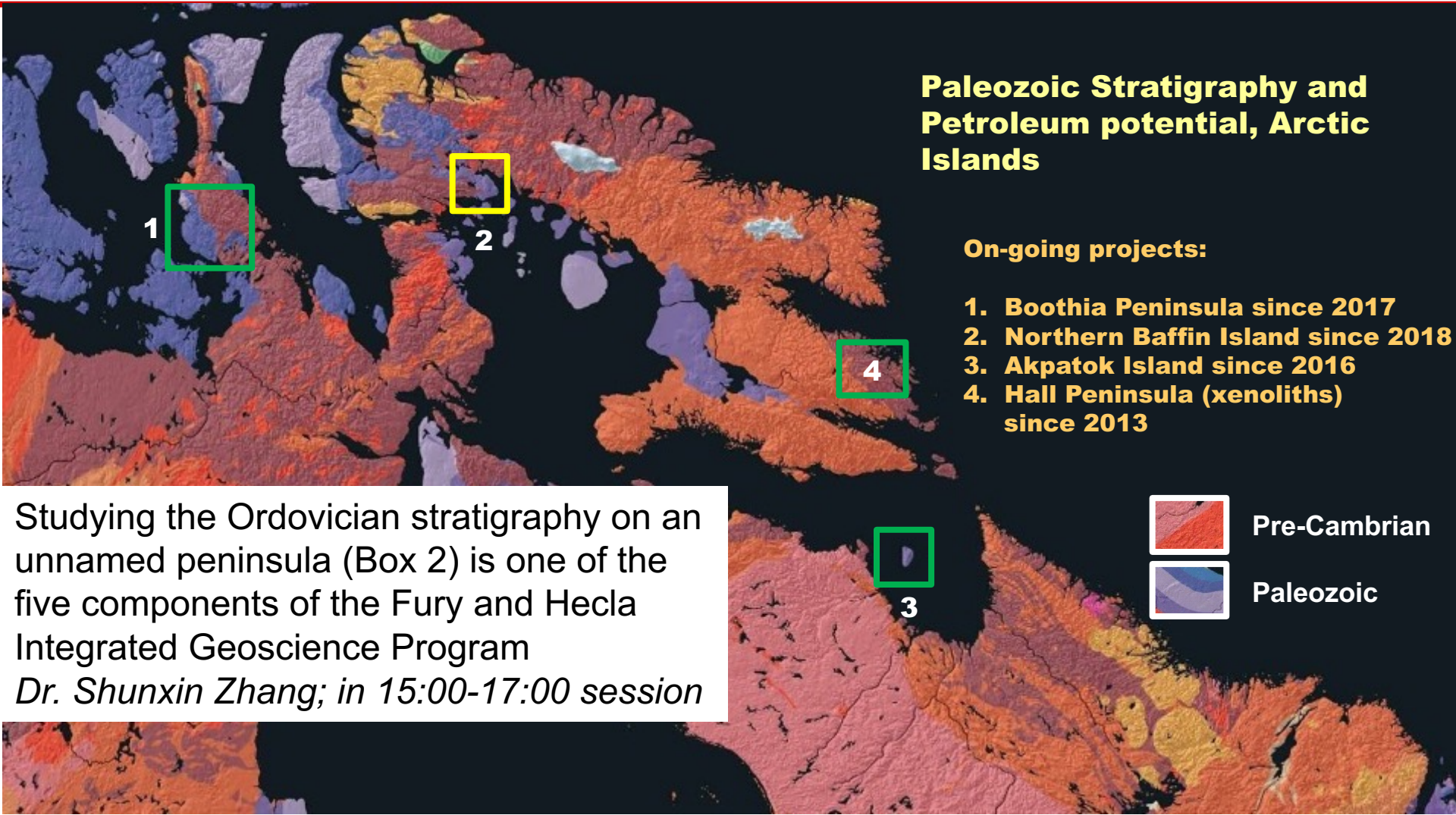
# FHGP COMPONENT 4: PALEOZOIC (ORDOVICIAN) STRATIGRAPHY



## Paleozoic Stratigraphy and Petroleum potential, Arctic Islands

### On-going projects:

1. Boothia Peninsula since 2017
2. Northern Baffin Island since 2018
3. Akpatok Island since 2016
4. Hall Peninsula (xenoliths) since 2013



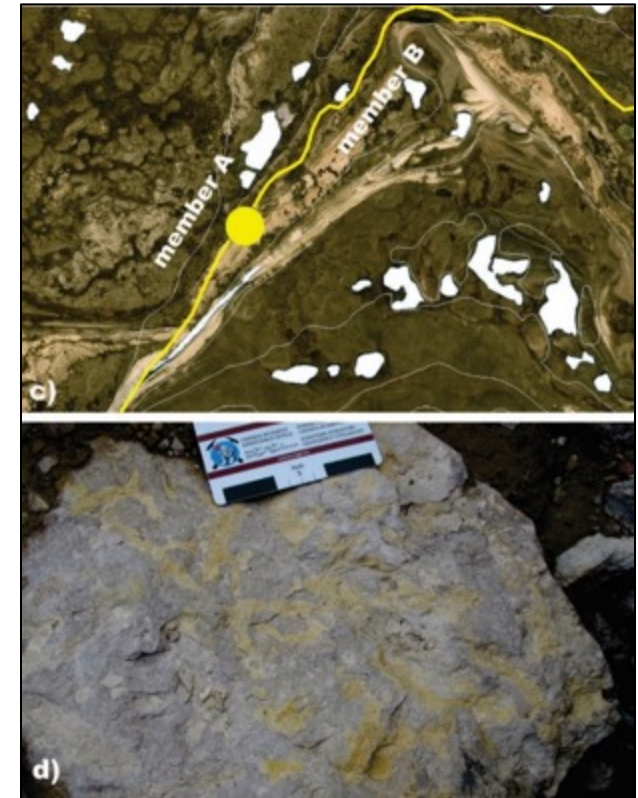
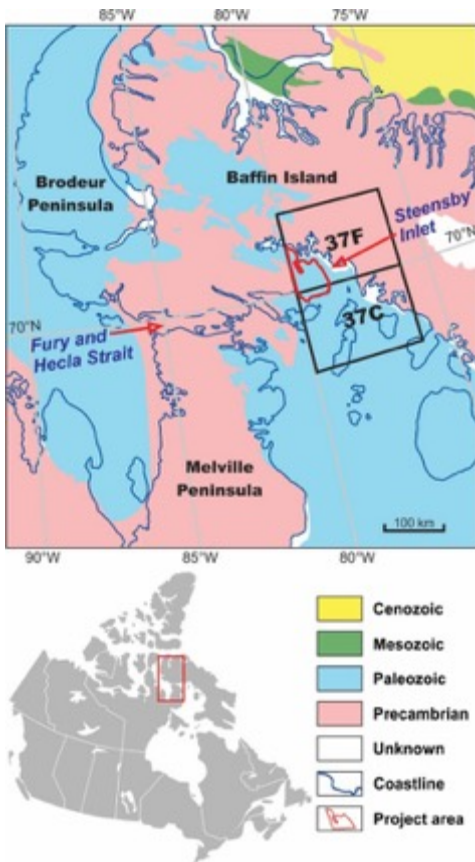
Studying the Ordovician stratigraphy on an unnamed peninsula (Box 2) is one of the five components of the Fury and Hecla Integrated Geoscience Program  
*Dr. Shunxin Zhang; in 15:00-17:00 session*



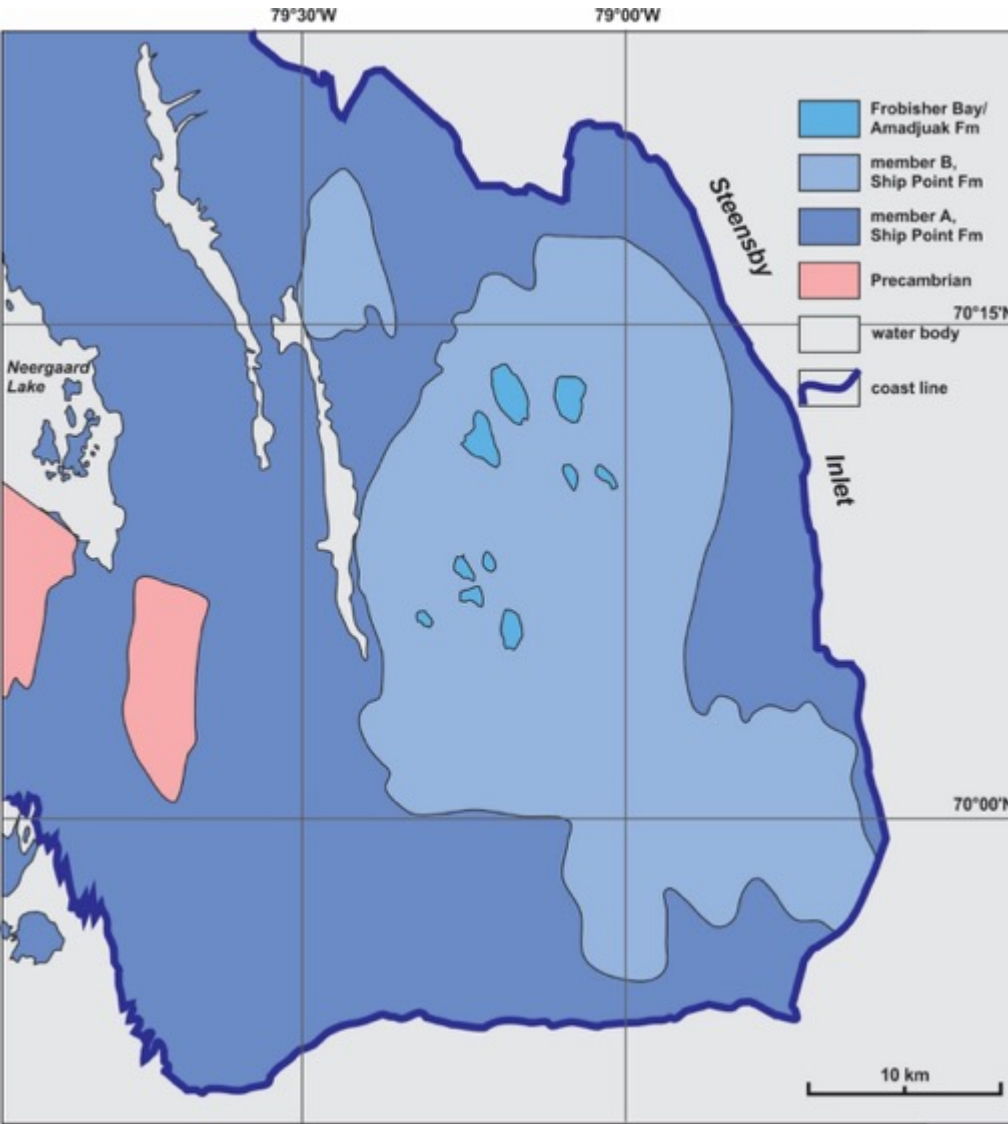
# FHGP COMPONENT 4: PALEOZOIC (ORDOVICIAN) STRATIGRAPHY



- The aim was to evaluate the Ordovician stratigraphy and the presence/absence of an organic-rich interval (i.e. the source rock of the petroleum system)



# FHGP COMPONENT 4: PALEOZOIC (ORDOVICIAN) STRATIGRAPHY



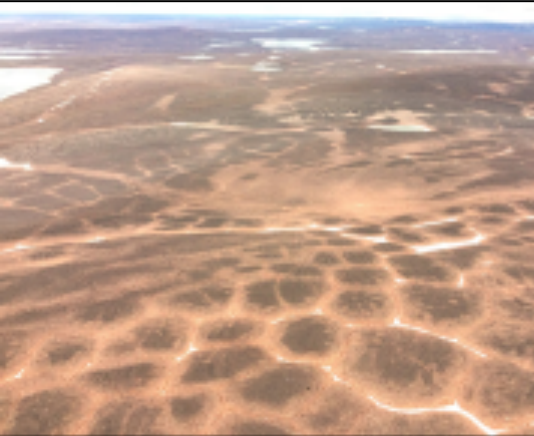
Zhang considers that the organic-rich interval was already eroded from the studied area

Post-field studies on conodont microfossils will provide detailed data to improve the age assignment of the stratigraphic units and correlation within the Foxe Basin and to other regions of the Arctic and Hudson Bay Basin.





# FHGP COMPONENT 5: SURFICIAL GEOLOGY



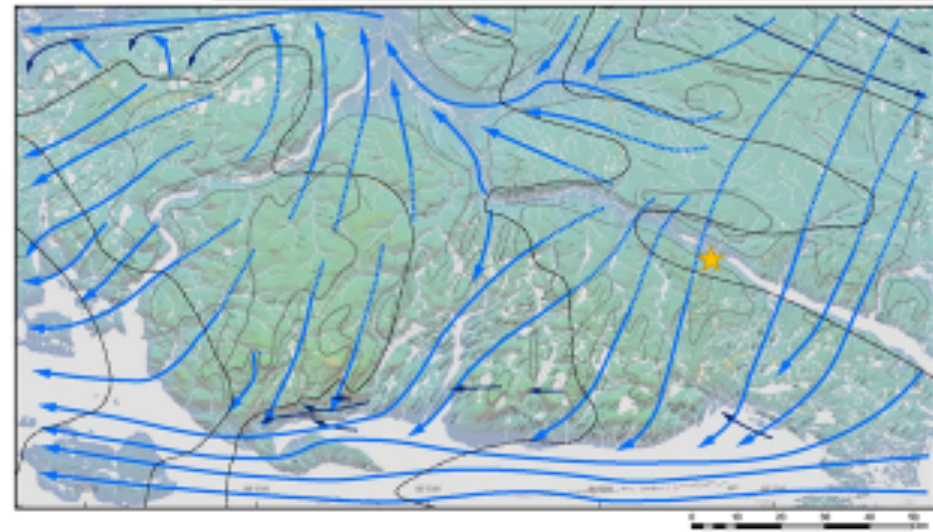
*Summer 2018 field work*  
Glacial transport history  
Till sampling  
Boulder sampling



*Hematite iron formation glacial erratic*



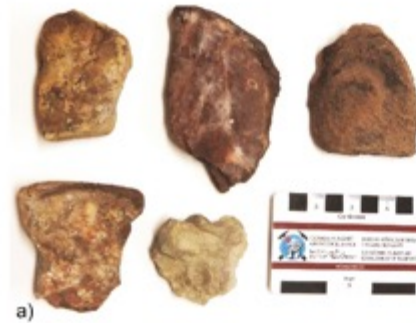
Results in:  
Trenblay, T. and Godbout,  
P.M. : Surficial geology of the  
north coast of Fury and Hecla  
strait, northwestern Baffin  
Island, Nunavut; in Summary  
of Activities 2018, Canada-  
Nunavut Geoscience Office



# FHGP COMPONENT 5: SURFICIAL GEOLOGY



- Striations were mapped
- Till samples were collected and will be analyzed to evaluate the mineral potential
- Pebbles in till samples were divided into rock types; will help determine the direction and distance of ice flow
- Some of the rock fragments (e.g., carbonate rocks and sandstone) were transported over great distances
- Of particular interest is one hematitic ironstone rock fragment found in the east-central part of the study area; region may have potential for iron mineralization



hematitic ironstone



# Regional Geoscience (Bedrock) Mapping – Tehery Lake-Wager Bay



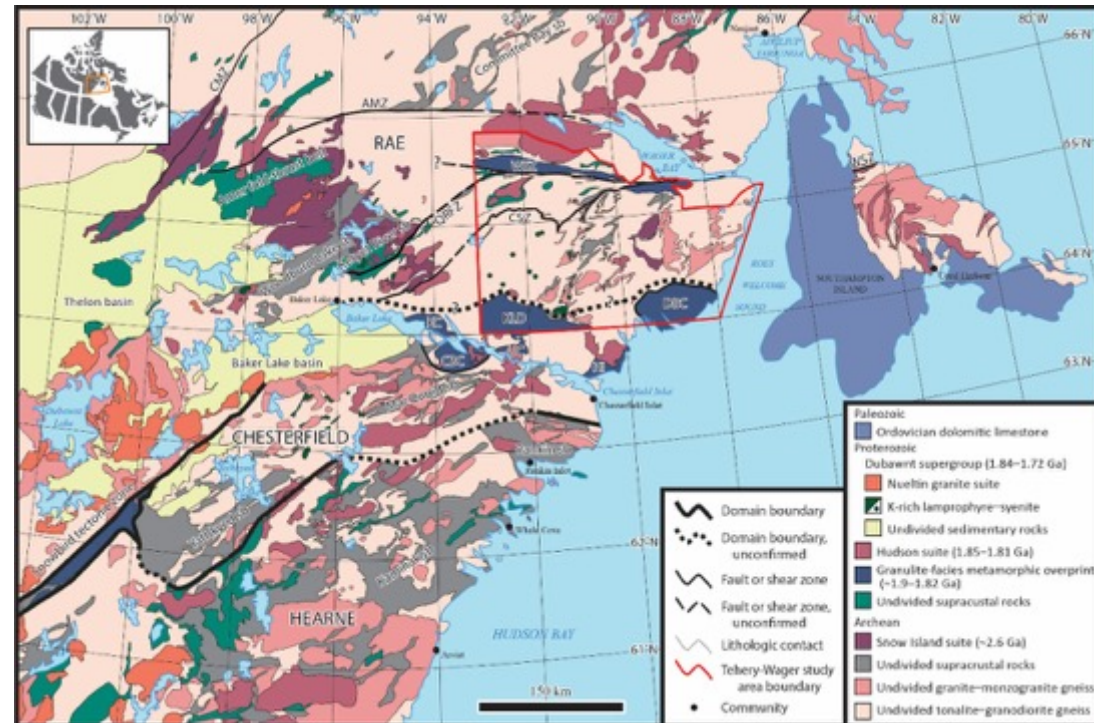
In 2012, GSC led a two week reconnaissance survey in the Tehery Lake-Wager Bay area

2015-2017 mapping a collaborative project between GSC (GEM 2) and CNGO (SINED) conducted to map eight NTS map sheets

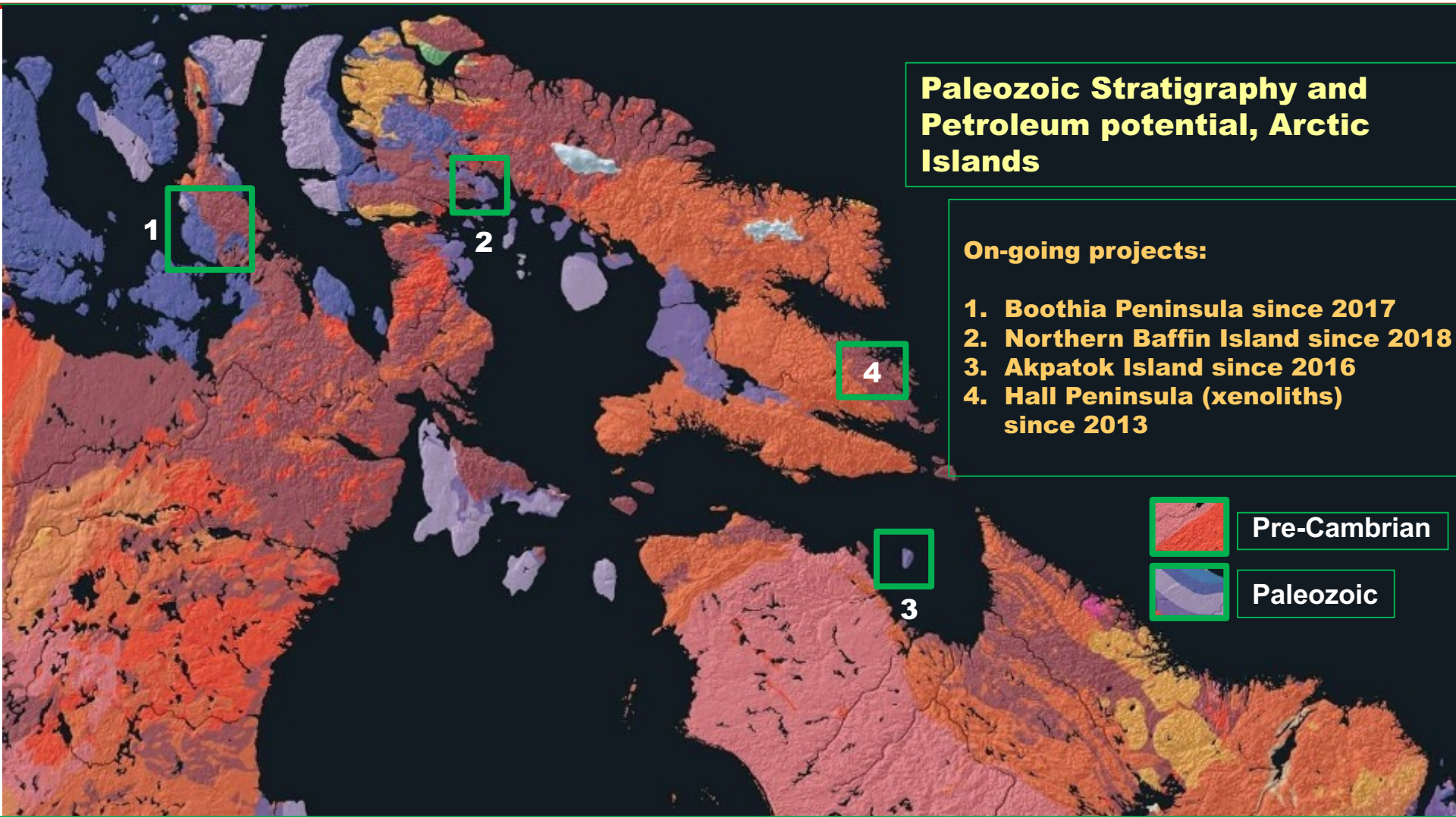
Overall goals are to increase the geoscience knowledge and understanding and evaluate the mineral potential

Ph.D. thesis (H. Steenkamp, Laval) is looking at the thermo-tectonic history in the TL-WB area

M.Sc. thesis (I. Therriault, UBC-O) is studying the geochronological constraints on deformation in the Wager shear zone

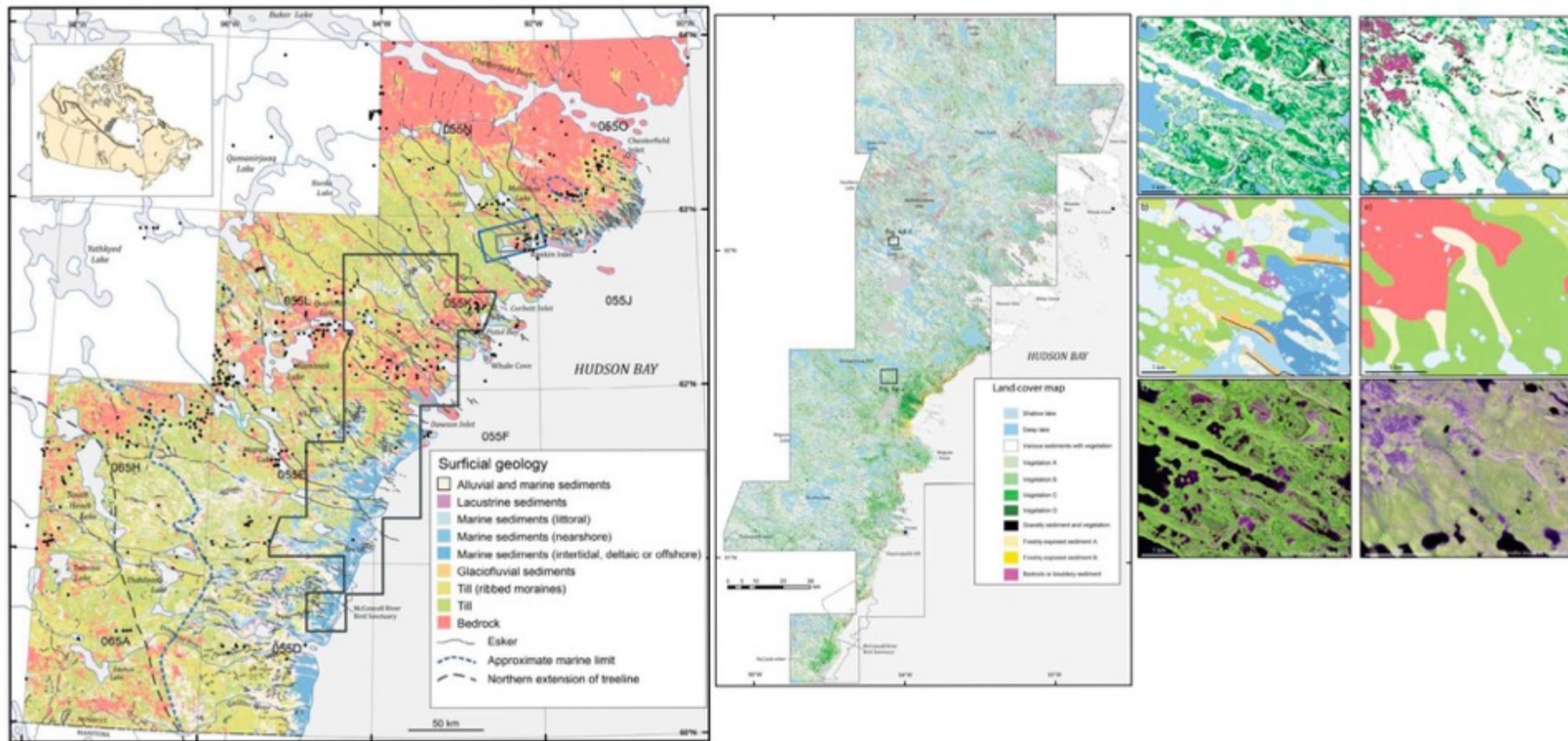


# Paleozoic (Ordovician) Stratigraphy Research





# Geoscience for Infrastructure Western Hudson Bay – Surficial mapping



Digital compilation of surficial geology

Maps were refined by the use of RapidEye image land-cover interpretation

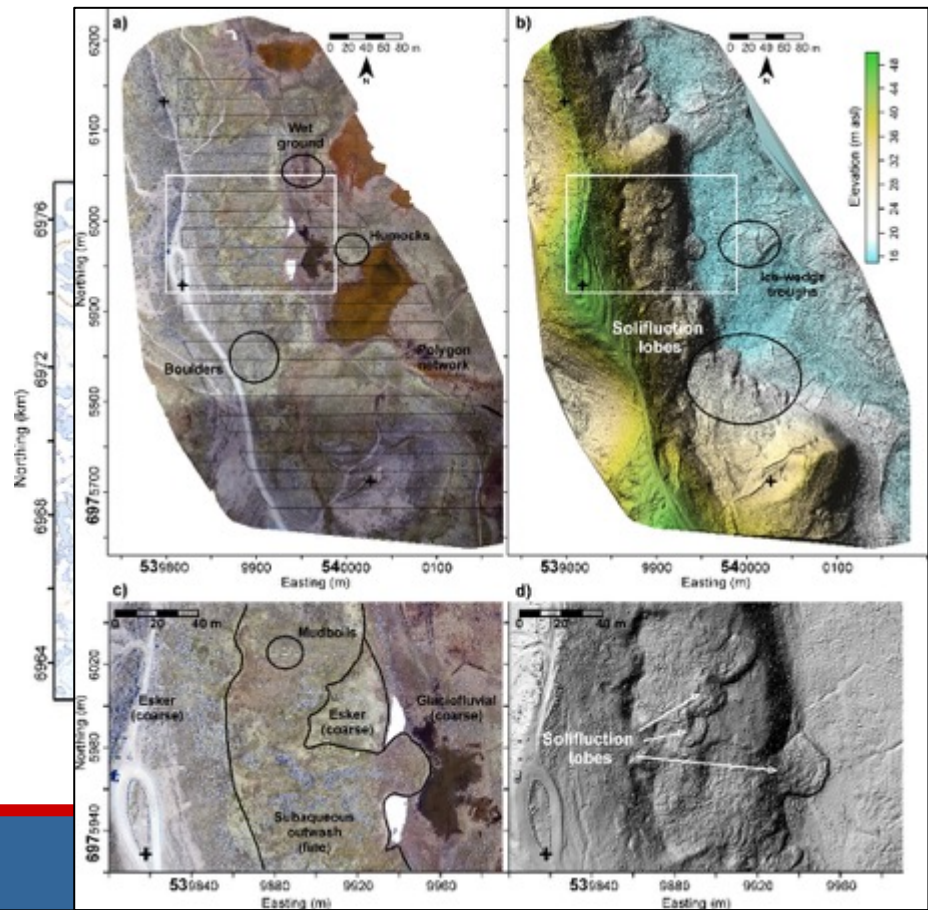
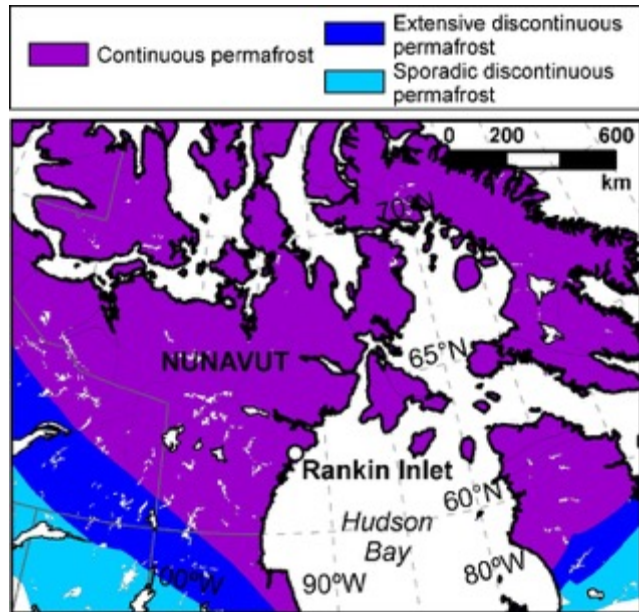
Gravel deposits, bedrock outcrops, bouldery tills, freshly eroded sediments and vegetation were identified

# Geoscience for Infrastructure – Permafrost studies in the Kivalliq region, western Hudson Bay



Compile all existing aggregate, mineral potential, surficial geology, land cover and permafrost data for this area

These studies involve studying the ground temperature and permafrost involves the development of methods for regional characterization of permafrost conditions by integrating observations from different sources across different scales, from site-based data to remote sensing.





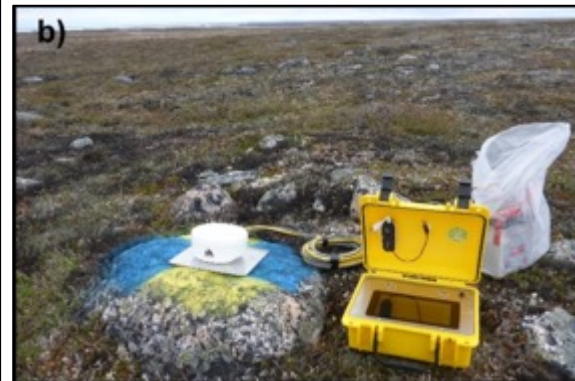
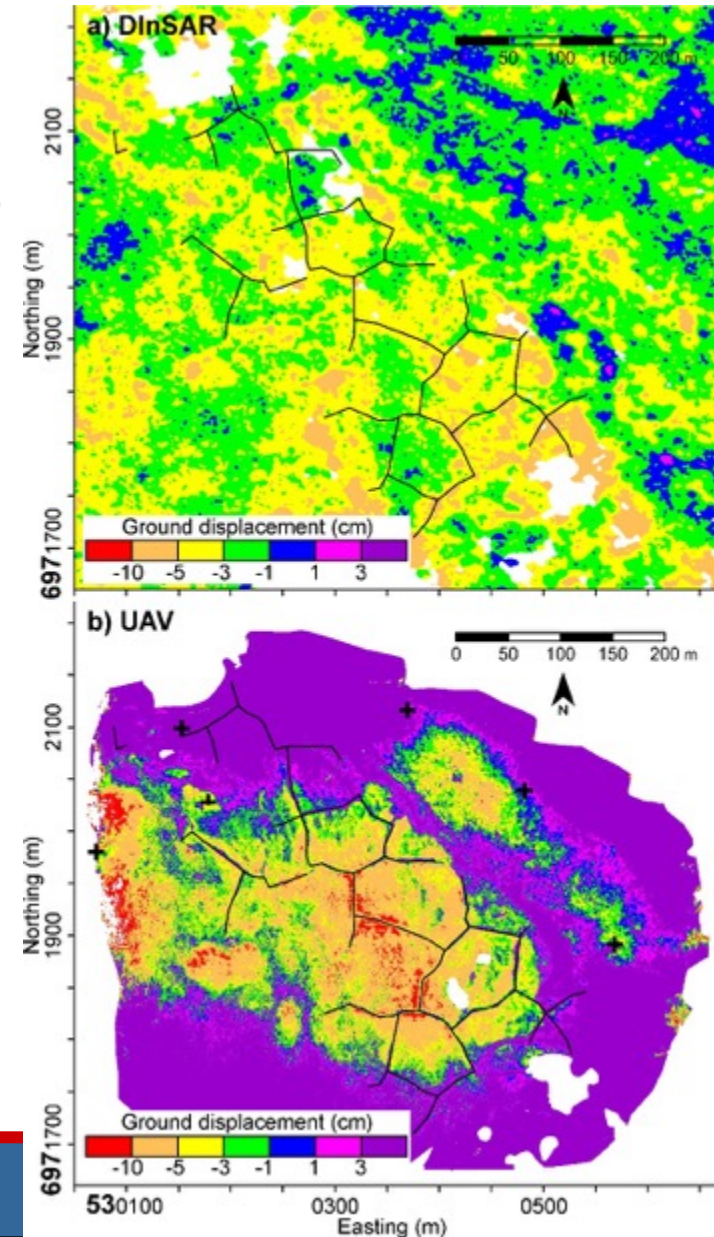
# Permafrost studies in the Kivalliq region



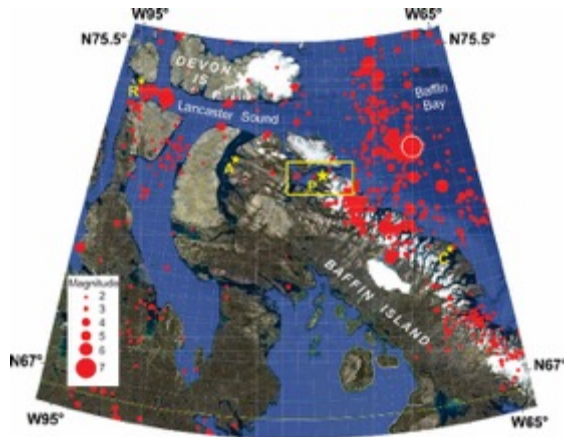
Unmanned aerial vehicles (UAV) can be used for landscape reconnaissance and mapping periglacial features in permafrost terrain

These images are then processed using structure-from-motion (SfM) photogrammetry to create digital elevation models (DEM)

Differential DEMs generated from repeated UAV surveys can be used for mapping ground surface displacement.



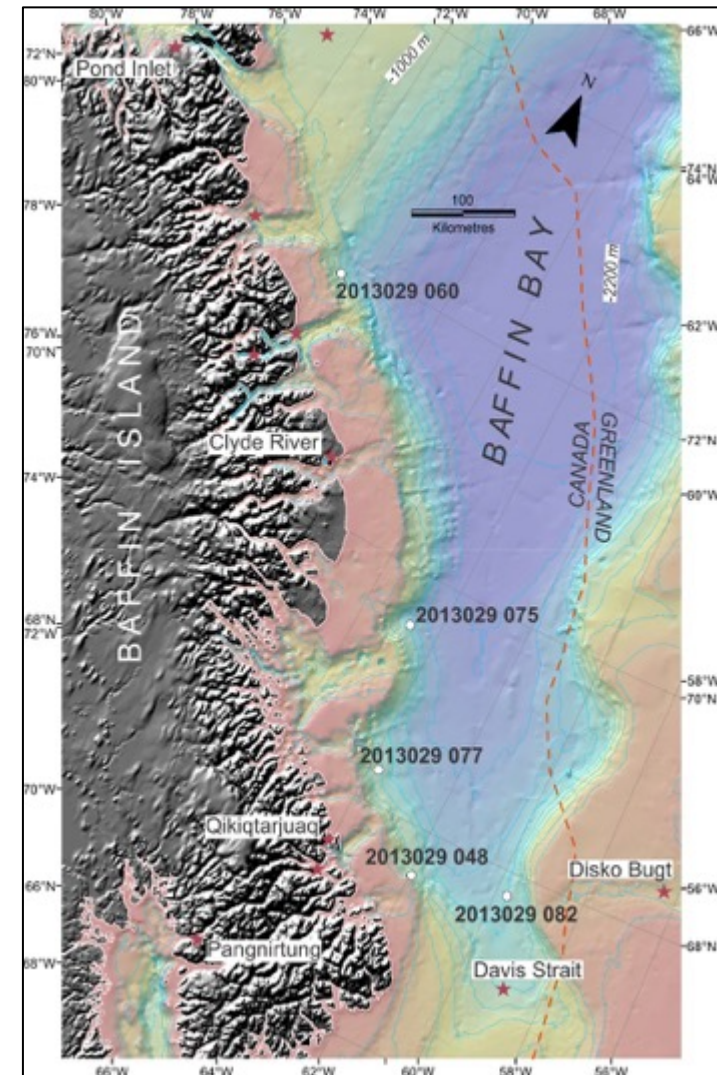
# Geoscience for Infrastructure – Marine Geological Hazards in Baffin Bay



Since 2012, GSC-Atlantic and ArcticNet, supported in part by CNGO (SINED funds), have studied marine geological hazards in Baffin Bay using CCGS *Hudson* and *Amundsen*

Researchers can delimit the extent of hazards and likelihood of future event by using data collected (seabed shape, shallow subsurface geology, and engineering properties of the seabed)

Researchers (GSC-A and Dalhousie University) have determined that underwater landslides have occurred in the Pond Inlet fjord in Northern Baffin Bay



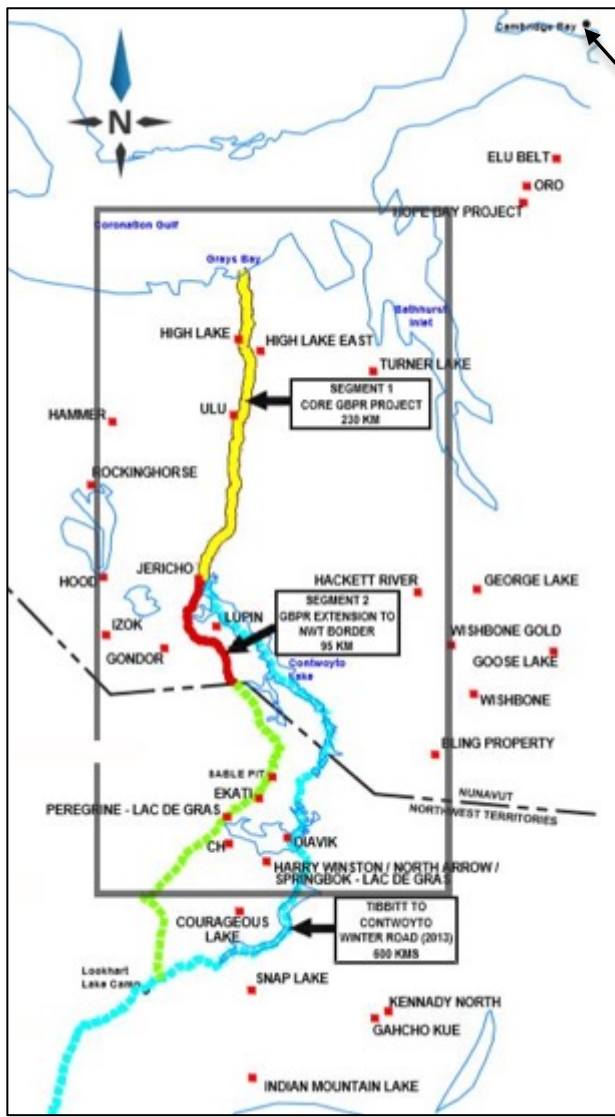


# Geoscience for Infrastructure



We have heard much about the Grays Bay project in the Kitikmeot region

Permafrost and surficial scientists in NRCan and CNGO are studying air photos over the area of the potential Grays Bay road to determine glacial history and information



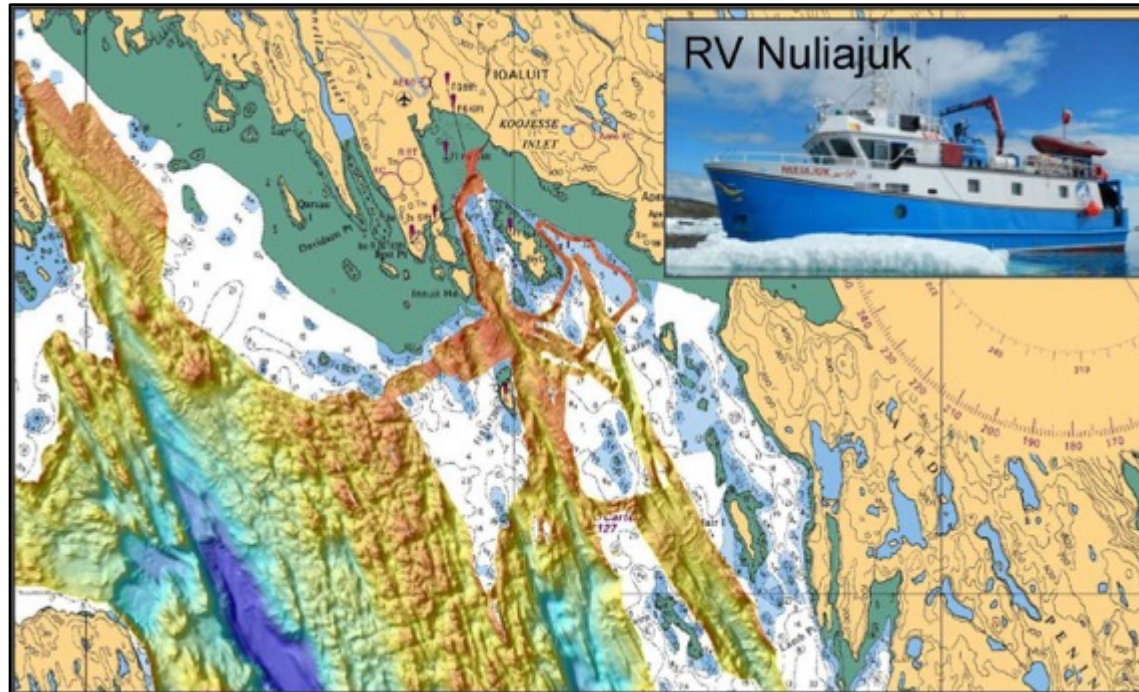
Cambridge Bay

# Geoscience for Infrastructure – Mapping the bottom of Frobisher Bay



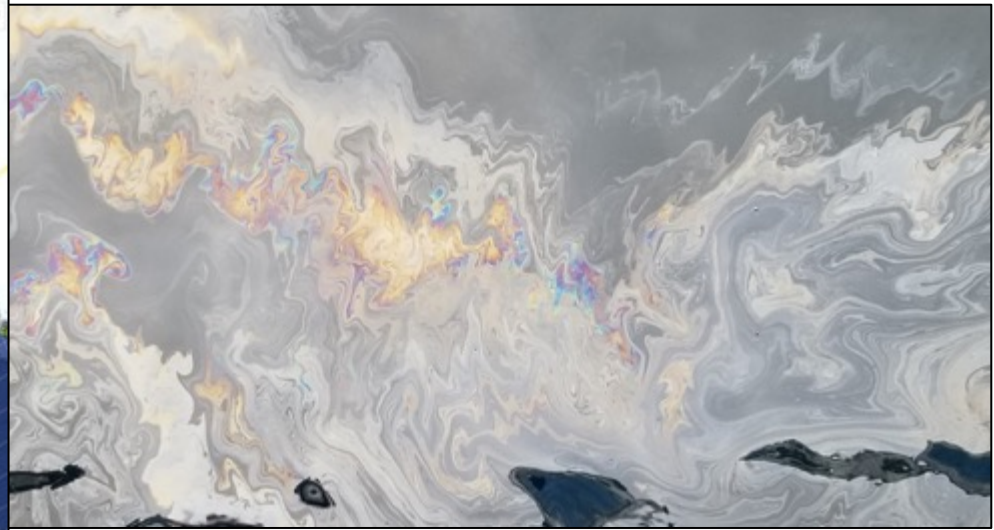
Mapping of the seabed geology for:

- Potential areas suitable for port and seabed infrastructure
- Evaluation of potential marine geological hazards
- Confirmation and/or identification of natural petroleum seeps
- Correlation of seabed bedrock exposures to exposures on land between the Hall Peninsula and Meta Incognita in order to define the geological setting and mineral potential of the seabed



***Projects since 2014 have been collaborative with GN-DoE, GSC-Atlantic, Dalhousie University and ArcticNet***

# Other studies – Nunavut Seep Study



Areas monitored by satellite and oil slick pictures from 2018 aboard the GN RV *Nuliajuk*

GN-EDT led project with the following partners:

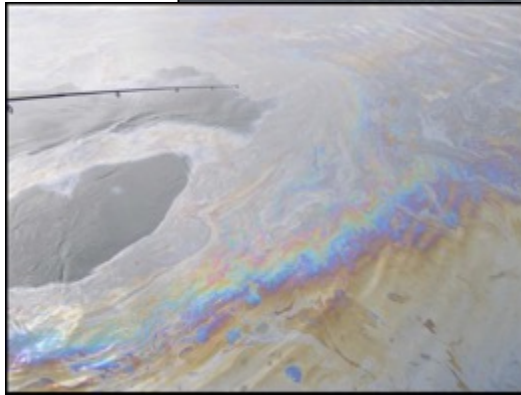
- Geological Survey of Canada
- Marine Institute
- Nunavut Arctic College (ETP Program)
- Nunavut Tunngavik Incorporated
- CIRNAC



# Nunavut Seep Study – Oil slick research



Addition to the team for this: CNGO!



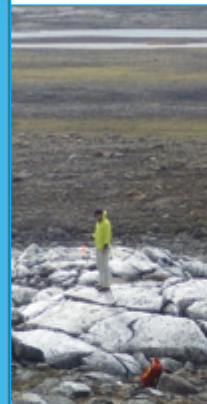
# Data Dissemination – Summary of Activities



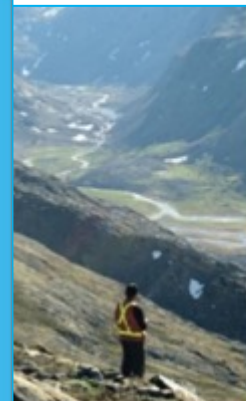
Summary  
of Activities  
2018



Summary  
of Activities  
2017



Summary  
of Activities  
2016



Summary  
of Activities  
2015



Summary  
of Activities  
2014



Summary  
of Activities  
2013



Summary  
of Activities  
2012



Annual publication disseminates results

First published in 2012

2018 – available on-line December 31

Hard copy disseminated at Roundup  
(January)

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



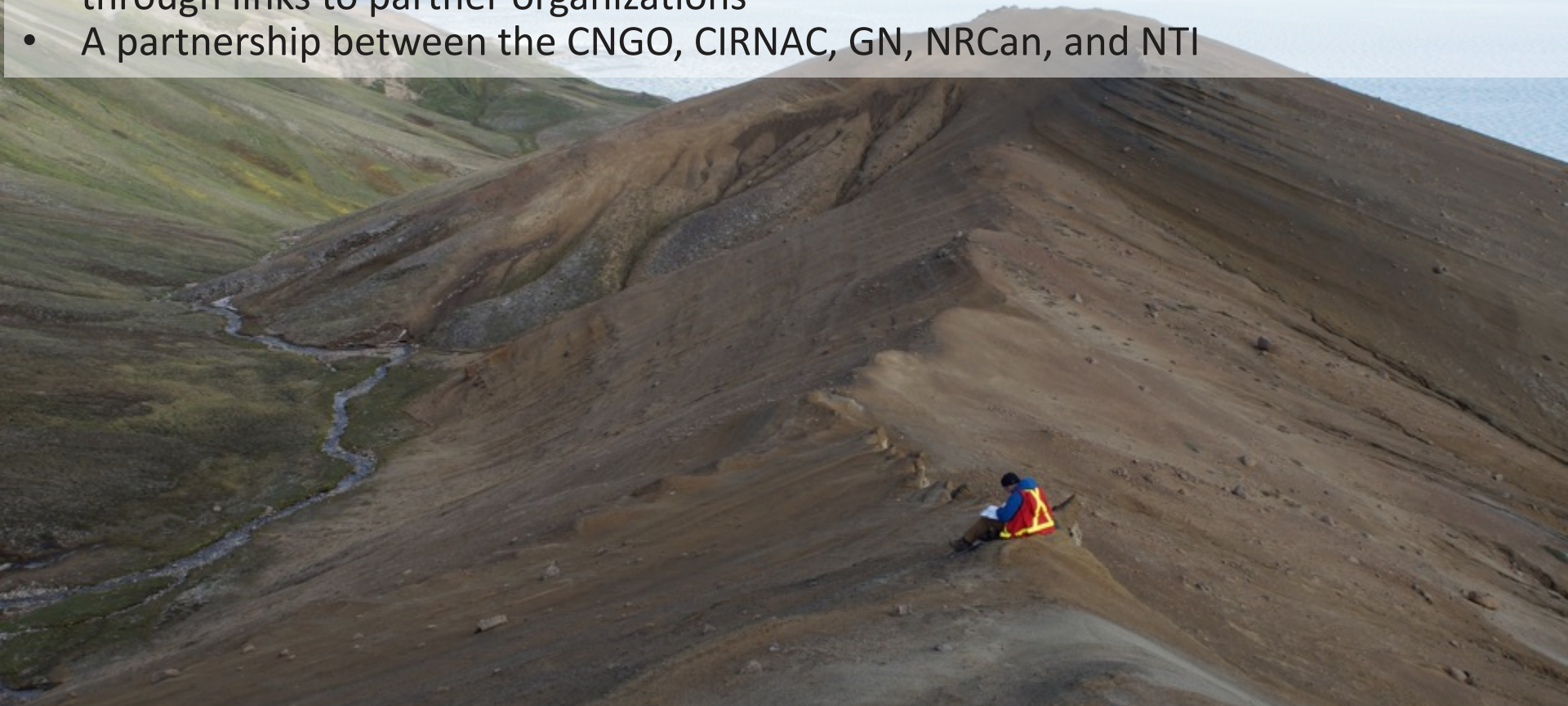
# Data Dissemination

[www.cngo.ca](http://www.cngo.ca), [Nunavutgeoscience.ca](http://Nunavutgeoscience.ca)



NunavutGeoscience.ca:

- 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
- A partnership between the CNGO, CIRNAC, GN, NRCan, and NTI



*Contact us on the CNGO website for questions or downloads: [www.cngo.ca](http://www.cngo.ca)*

# Closing Thoughts



The Canada-Nunavut Geoscience Office, Nunavut's 'de-facto' geological survey, is co-funded and co-managed (overseen by three government departments) and conducts an ambitious geoscience program

The success of the CNGO and our programs is principally due to effective collaborations between the CNGO and many researchers (other governments, organizations, academia)







***Thank you***

***Merci beaucoup***

***Qujannamiik***