NATURAL RESOURCES CANADA - INVENTIVE BY NATURE

Completing the bedrock mapping of southern Baffin Island: stratigraphic, structural and geophysical context for the mafic-ultramafic Frobisher suite

Marc St-Onge[1], Nicole Rayner[1], Owen Weller[1], Victoria Tschirhart[1]
Brendan Dyck[2], Tim Chadwick[3], Dustin Liikane[3]
Sean Noble-Nowdluk[4], Terry Milton[4], Tyler Rowe[4]

[1]*Geological Survey of Canada*
[2]*University of Oxford*
[3]*Carleton University*
[4]*Nunavut Arctic College*

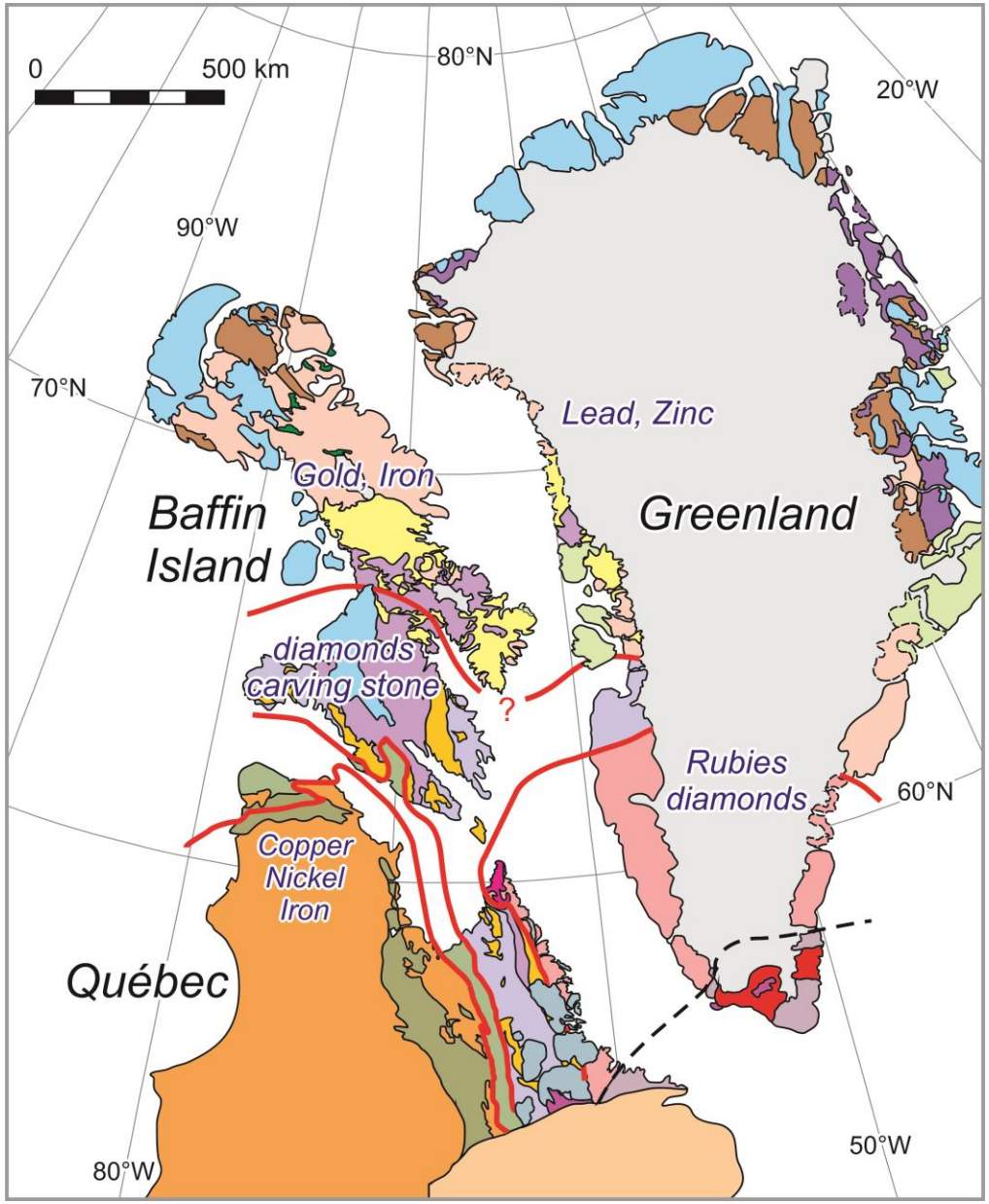
GEM

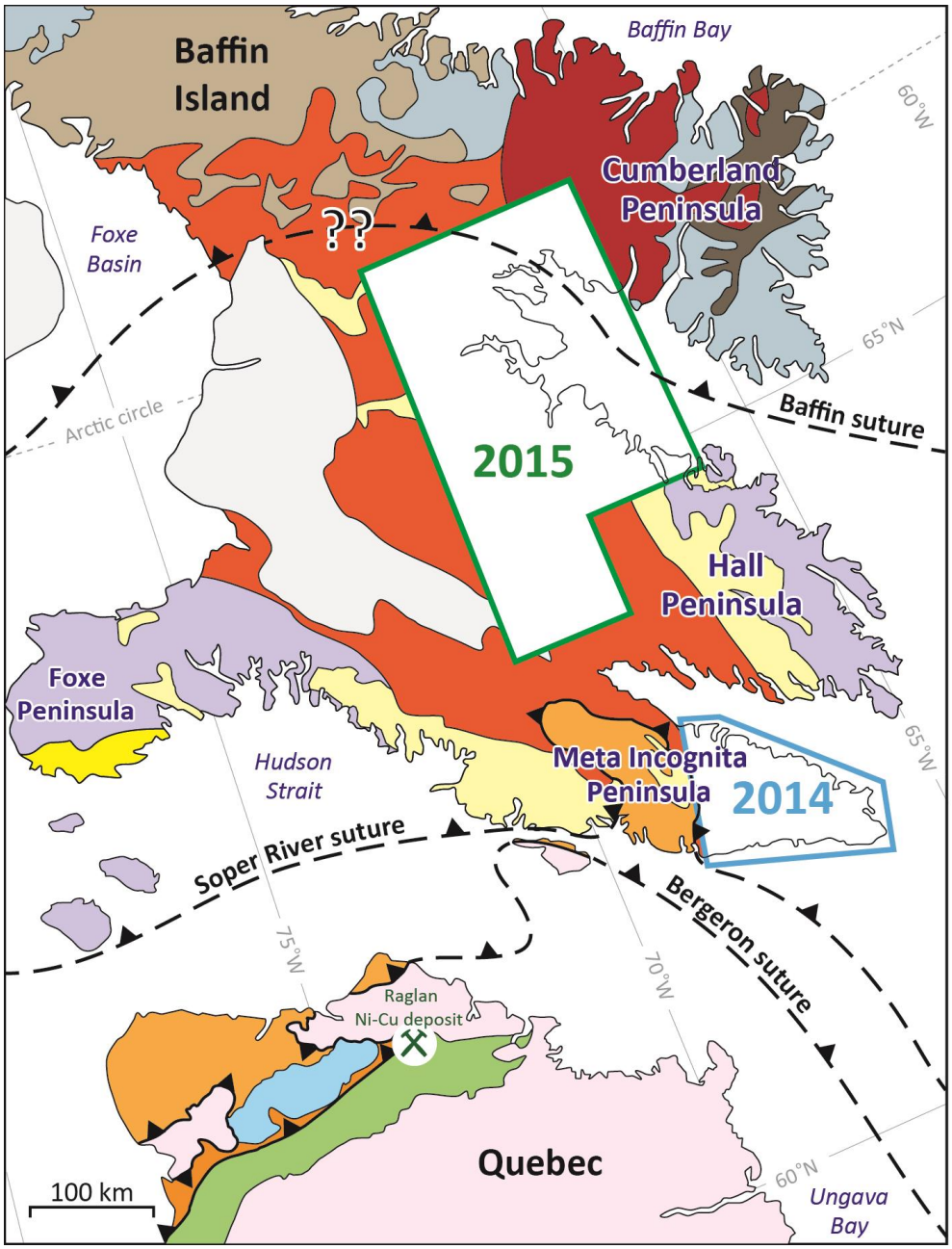
The Geo-mapping for Energy and Minerals (GEM) program:

- provide modern public geoscience
- support evidence-based exploration for new mineral and energy resources
- enable northern communities to make informed decisions about their land, economy and society

Southern Baffin Island project initiated in 2014:

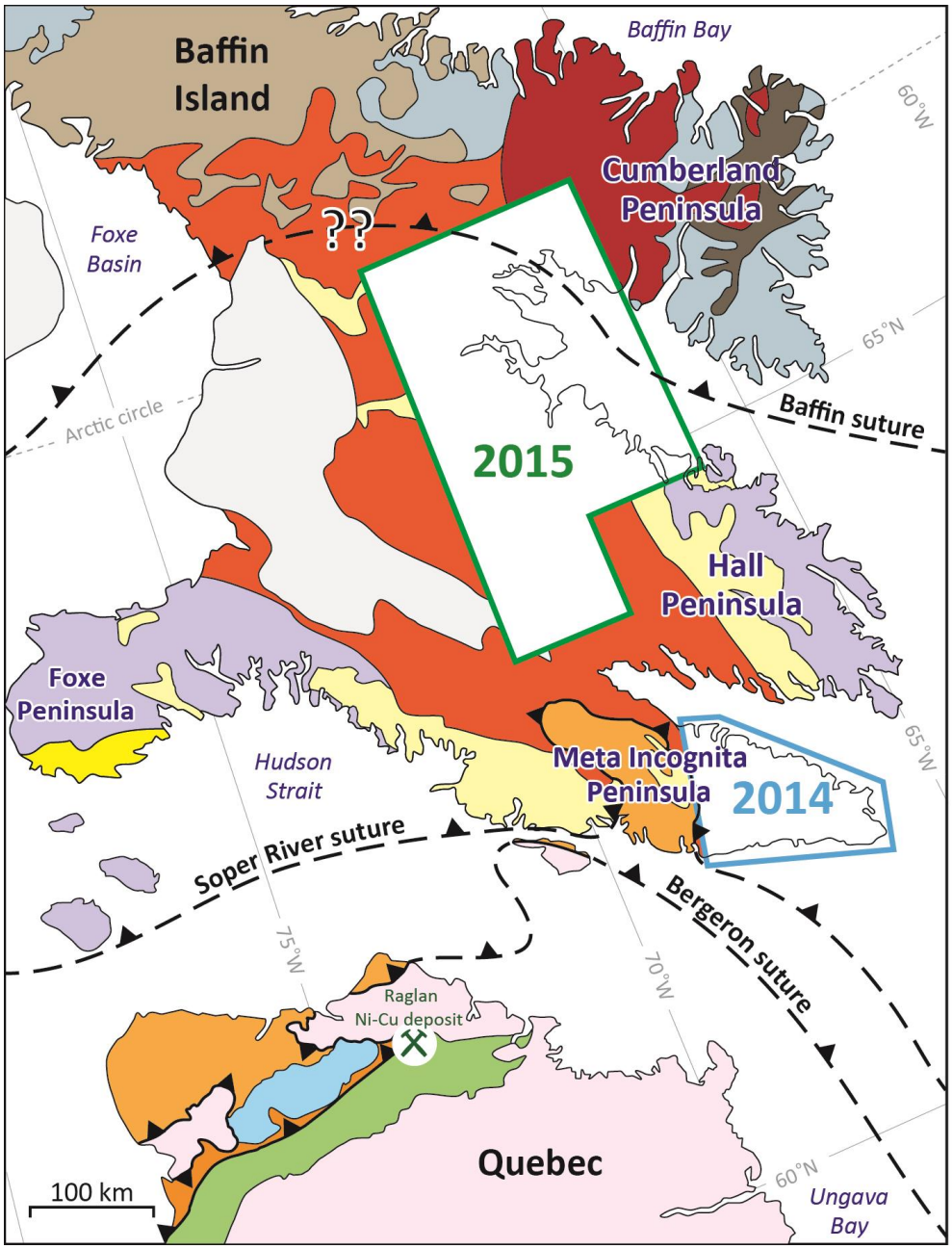
- portions of southern Baffin Island represent some of the last major missing tectonic pieces in our understanding of Nunavut geology
- targeted bedrock tectonostratigraphic, geochronological, structural, petrological and geophysical studies would largely resolve this uncertainty





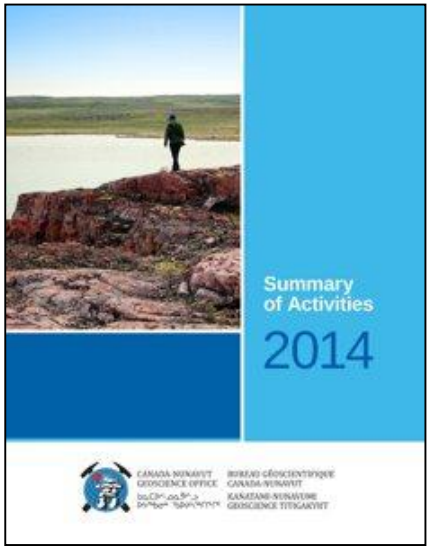
Scientific Questions:

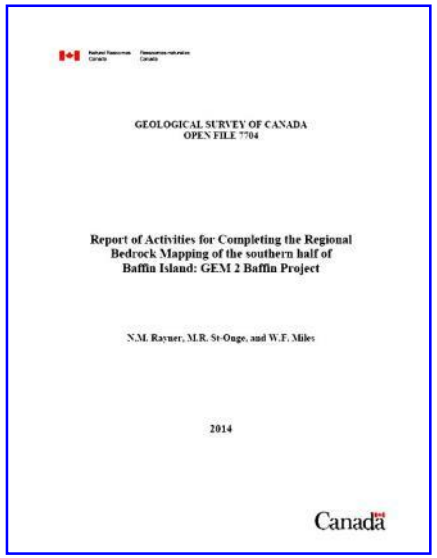
- Does the Lake Harbour Group metasedimentary assemblage and it's suite of mafic-ultramafic sills previously mapped on southern Baffin Island extend east onto Meta Incognita Peninsula and north onto Hall Peninsula and if so, what are the implications for the present architecture and past assembly of Baffin Island?
- Does the Archean Hall Peninsula Gneiss Complex (host to the Chidliak diamond district) extend south onto eastern Meta Incognita Peninsula or west on western Hall Peninsula?
- How does the geology of Hall Peninsula match that of the Cumberland Peninsula and does a Paleoproterozoic tectonic suture (Baffin suture) separate these two areas?



Summer 2014: Completing the mapping of Meta Incognita Peninsula

- four weeks of field work
- based out of Iqaluit
- team of 9 including cook and helicopter crew
- partnered between GSC, CNGO, AANDC, PCSP and the University of Ottawa



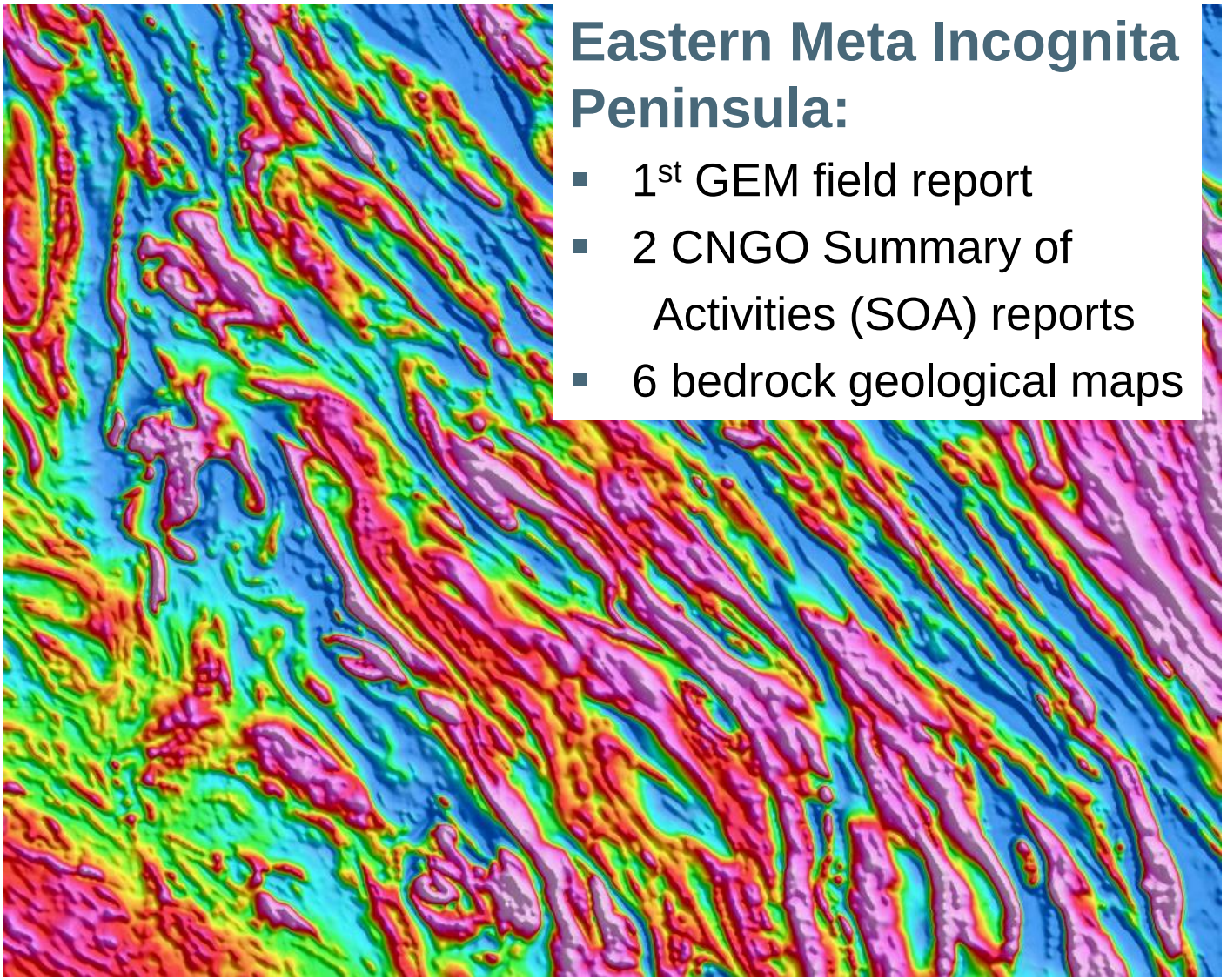

GEOLOGICAL SURVEY OF CANADA
OPEN FILE 7704

Report of Activities for Completing the Regional Bedrock Mapping of the southern half of Baffin Island: GEM 2 Baffin Project

N.M. Rayner, M.R. St-Onge, and W.F. Miles

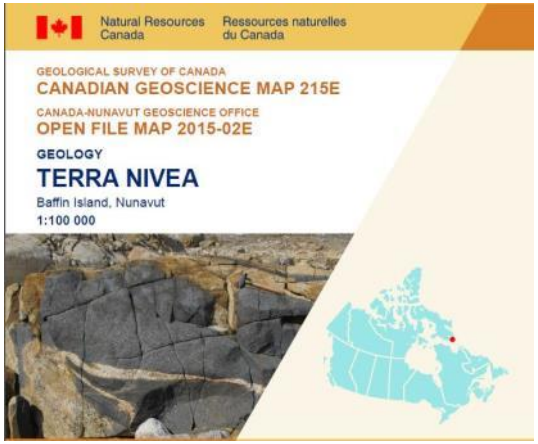
2014

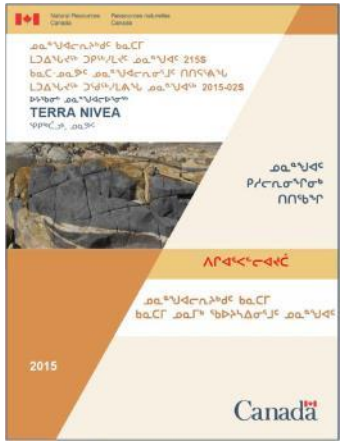
Canada

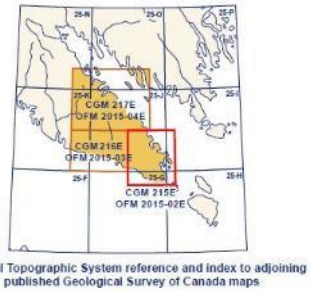


Eastern Meta Incognita Peninsula:

- 1st GEM field report
- 2 CNGO Summary of Activities (SOA) reports
- 6 bedrock geological maps







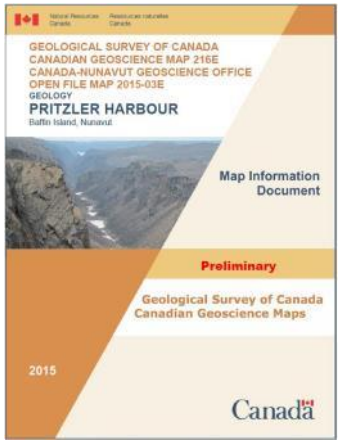
National Topographic System reference and index to adjoining published Geological Survey of Canada maps

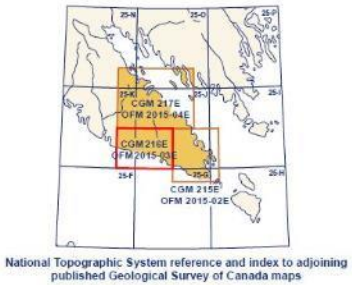
100:000 scale maps: released 14 April 2015 (Nunavut Mining Symposium)

Free download

http://geoscan.nrcan.gc.ca

http://cngo.ca/





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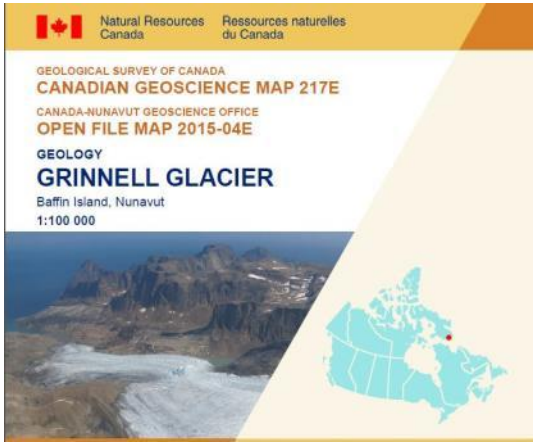

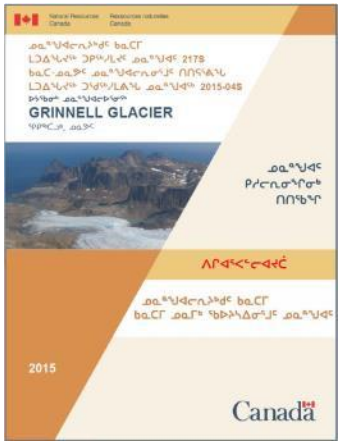

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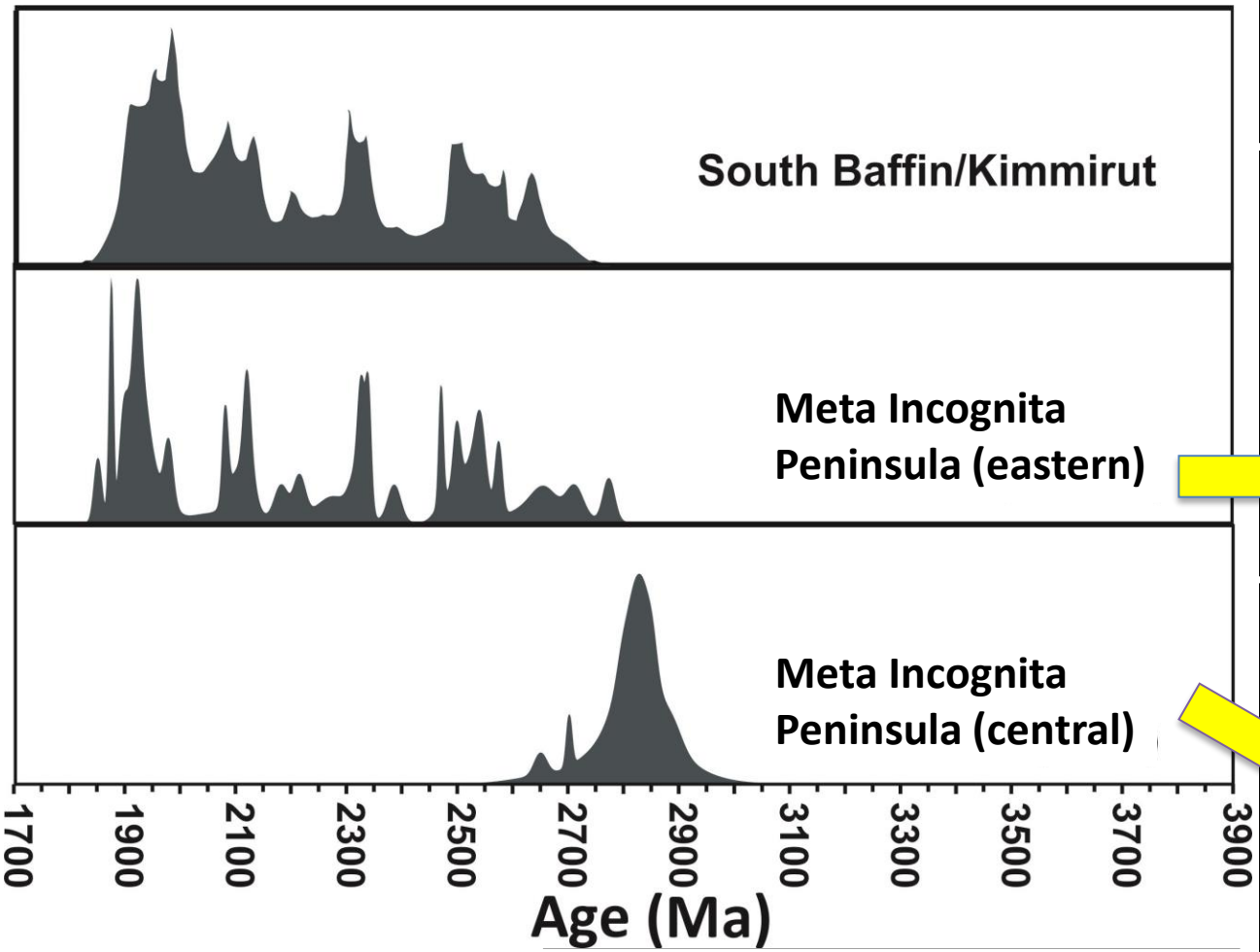
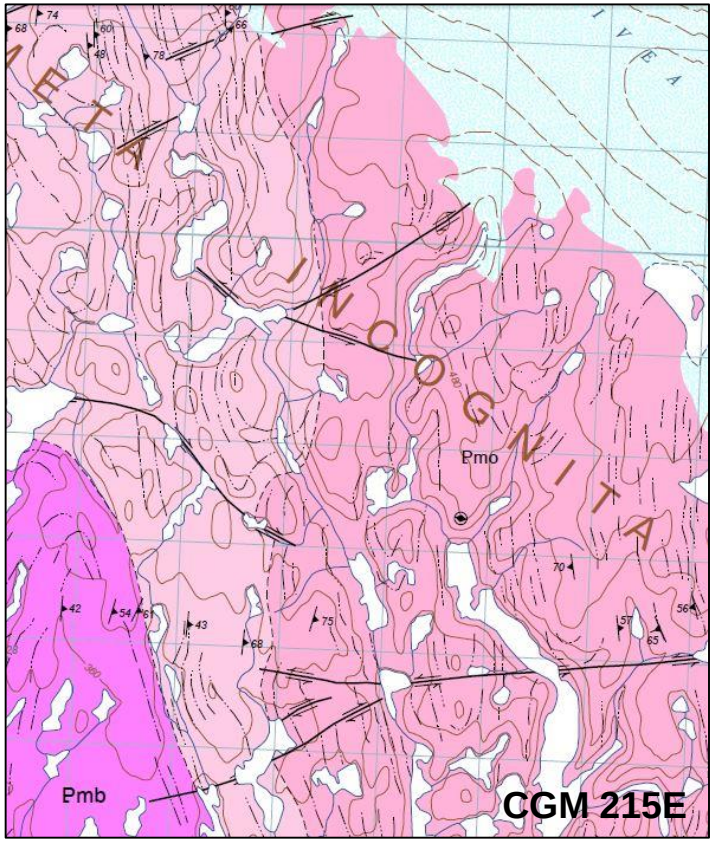
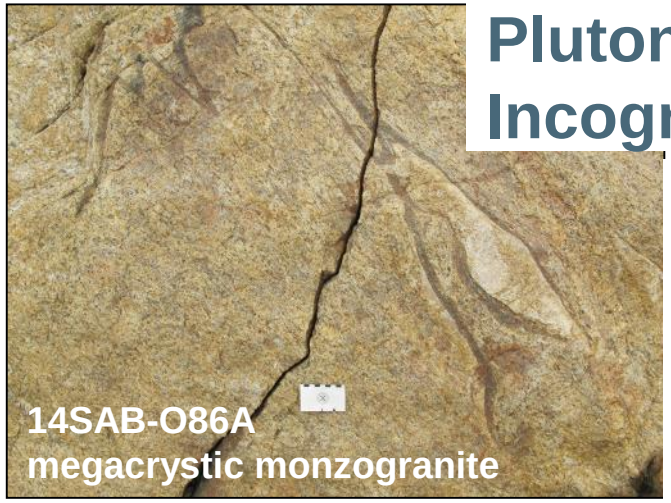
Metasedimentary rocks of Meta Incognita Peninsula: Lake Harbour Group

- **Detrital zircon ages (SHRIMP)**

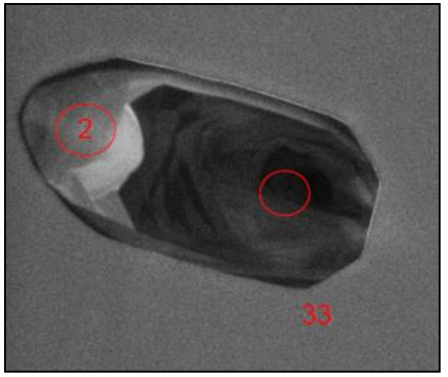


Plutonic rocks of Meta Incognita Peninsula





- tan weathering to a pink sugary texture
- Bt-Opx-Hbl-Ilm to Bt-Mag bearing
- massive to well foliated
- equant to megacrystic
- diorite enclave rich to absent



- 1.87 Ga to 1.84 Ga crystallization ages
- local 1.89 Ga inheritance
- field and geochronology document no equivalent to the Archean Gneiss Complex on Hall Peninsula (present erosion levels)

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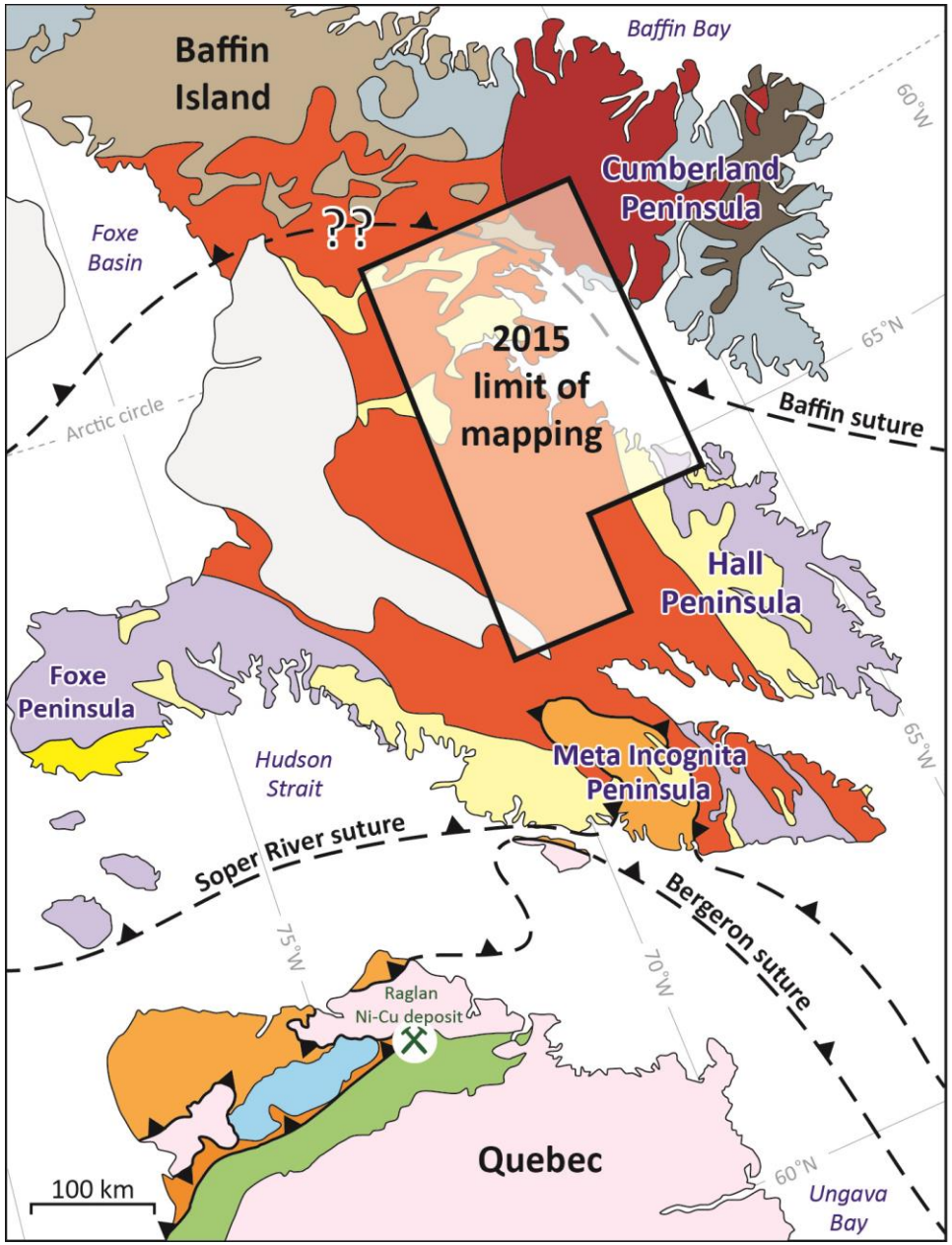


Summer 2015: completing the mapping of Baffin Island south of latitude 70°N

- eight weeks of field work
- based out of Iqaluit and a temporary field camp
- team of 13 including cook and helicopter crew
- partnered between GSC, CNGO, PCSP, University of Oxford, Carleton University and Nunavut Arctic College
- with…

Consultation and engagement

- community engagement visits successfully completed in March 2015
- project permits and licences acquired prior to the start of field work in mid-June 2015

AJUNGI GROUP

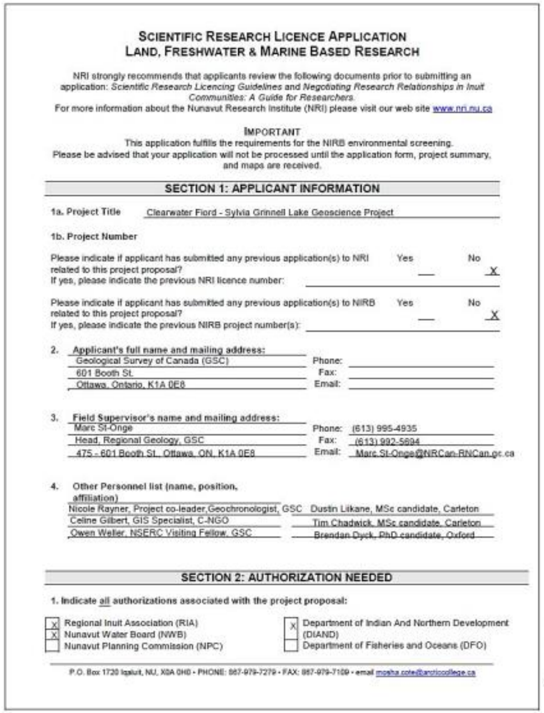
Ressources naturelles Canada | Natural Resources Canada

Taukie Qappik
Chairperson, Innnamariit Piqusingit
PO Box 603
Pangnirtung, NU X0A 0R0

ᐊᐱᕆᓕ 4, 2015

Ms. Qappik

Canada



SCIENTIFIC RESEARCH LICENCE APPLICATION
LAND, FRESHWATER & MARINE BASED RESEARCH

NRI strongly recommends that applicants review the following documents prior to submitting an application: *Scientific Research Licencing Guidelines* and *Negotiating Research Relationships in Inuit Communities: A Guide for Researchers*.
For more information about the Nunavut Research Institute (NRI) please visit our web site www.nri.nu.ca

IMPORTANT
This application fulfills the requirements for the NIRB environmental screening.
Please be advised that your application will not be processed until the application form, project summary, and maps are received.

SECTION 1: APPLICANT INFORMATION

1a. Project Title: Clearwater Fiord - Sylvia Grinnell Lake Geoscience Project

1b. Project Number

Please indicate if applicant has submitted any previous application(s) to NRI related to this project proposal? Yes ___ No X
If yes, please indicate the previous NRI licence number:

Please indicate if applicant has submitted any previous application(s) to NIRB related to this project proposal? Yes ___ No X
If yes, please indicate the previous NIRB project number(s):

2. Applicant's full name and mailing address:
Geological Survey of Canada (GSC)
601 Booth St.
Ottawa, Ontario, K1A 0E8
Phone:
Fax:
Email:

3. Field Supervisor's name and mailing address:
Marc St-Onge
Head, Regional Geology, GSC
475 - 601 Booth St., Ottawa, ON, K1A 0E8
Phone: (613) 995-4935
Fax: (613) 992-5694
Email: Marc.St-Onge@NRCan-RNCan.gc.ca

4. Other Personnel list (name, position, affiliation)
Nicole Rayner, Project co-leader, Geochronologist, GSC
Celine Gilbert, GIS Specialist, C-NGO
Owen Weller, NSERC Visiting Fellow, GSC
Dustin Likane, MSc candidate, Carleton
Tim Chadwick, MSc candidate, Carleton
Brendan Dyck, PhD candidate, Oxford

SECTION 2: AUTHORIZATION NEEDED

1. Indicate all authorizations associated with the project proposal:

- [X] Regional Inuit Association (RIA)
- [X] Nunavut Water Board (NWB)
- [ ] Nunavut Planning Commission (NPC)
- [X] Department of Indian And Northern Development (DIAND)
- [ ] Department of Fisheries and Oceans (DFO)

P.O. Box 1720 Iqaluit, NU, X0A 0H0 • PHONE: 867-979-7279 • FAX: 867-979-7109 • email mosha.cote@arcticcollege.ca

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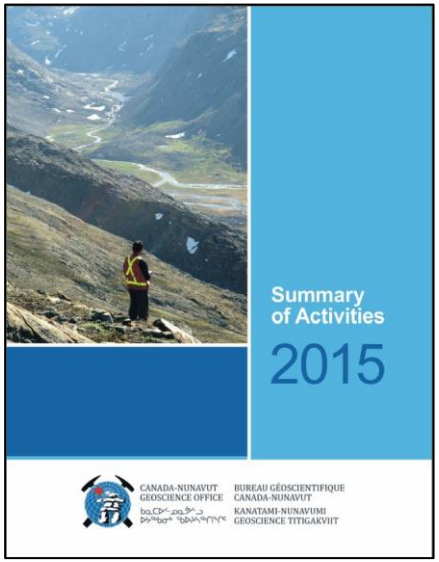
- low impact, small footprint, temporary field research camp

- on-the-job, in-the-field training of Nunavut Arctic College students



- glacial valley west of Chidliak Bay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2015

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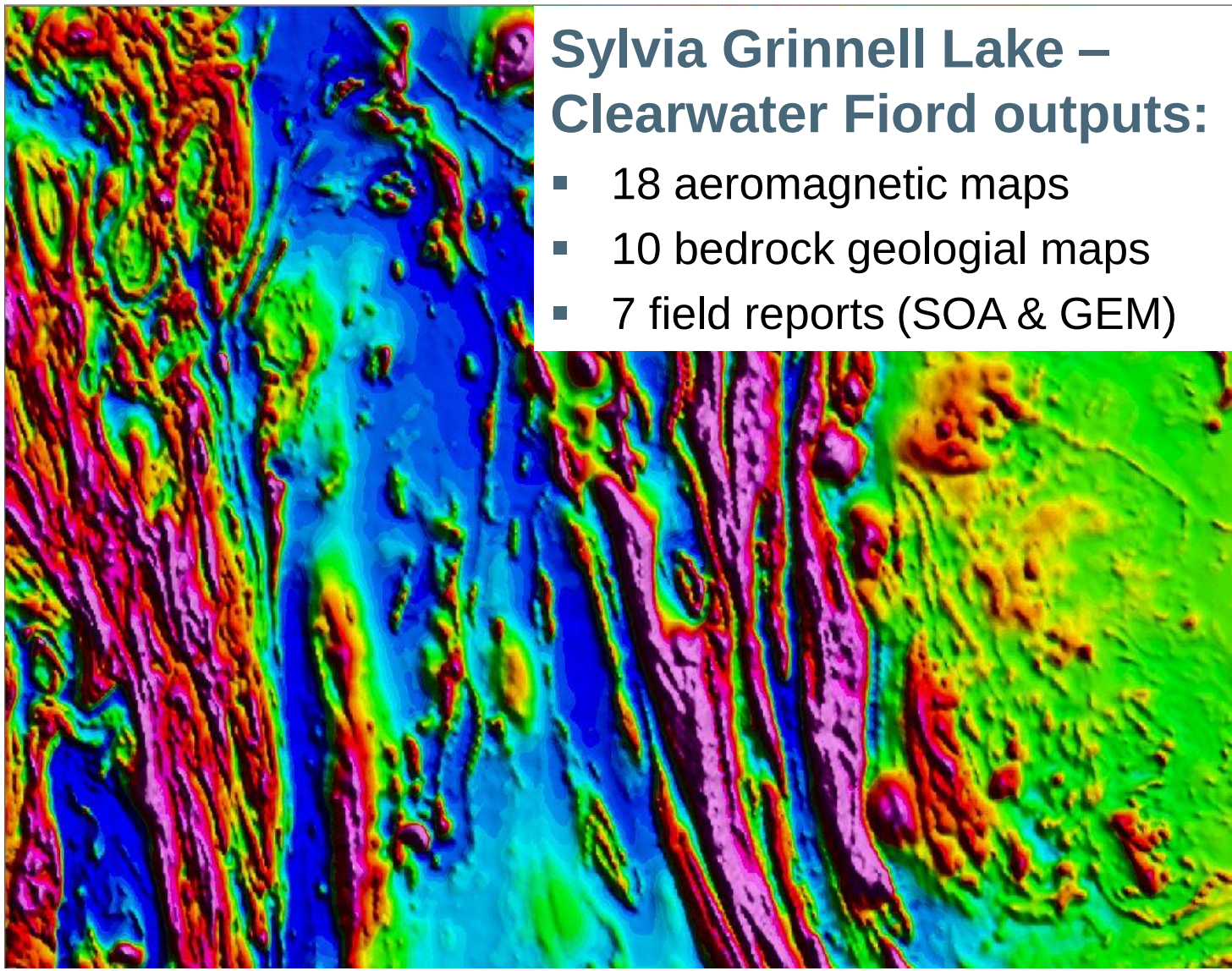
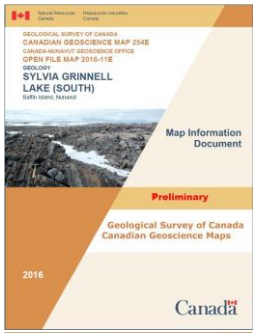
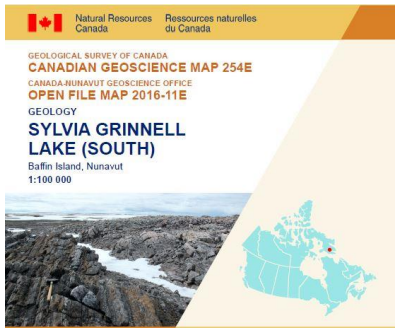
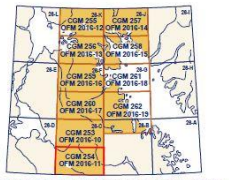


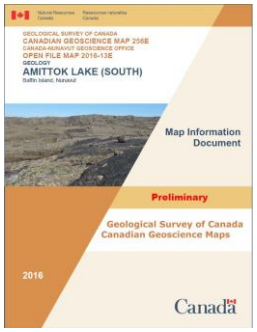
Sylvia Grinnell Lake – Clearwater Fiord outputs:

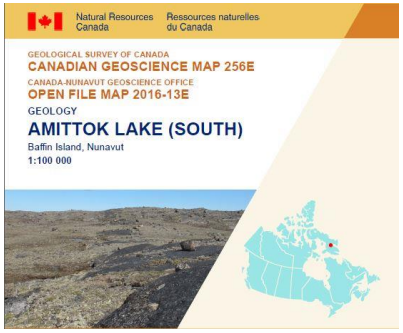
- 18 aeromagnetic maps
- 10 bedrock geologial maps
- 7 field reports (SOA & GEM)

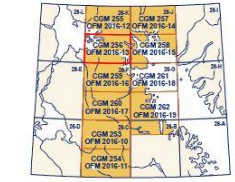


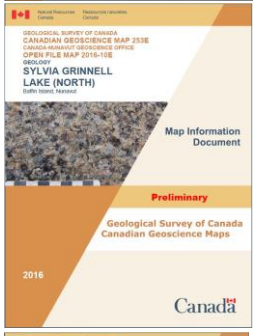


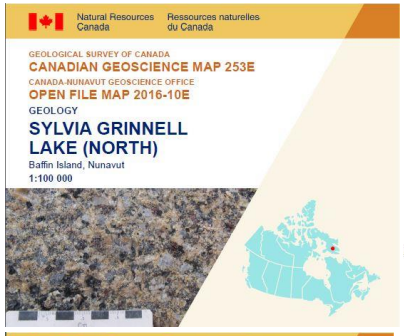


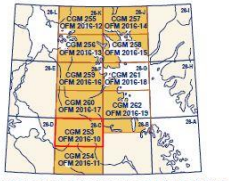


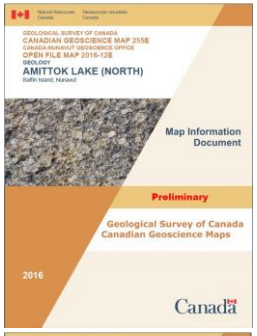


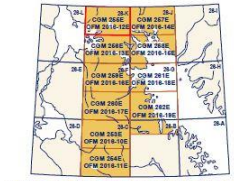


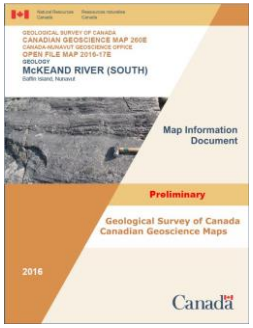


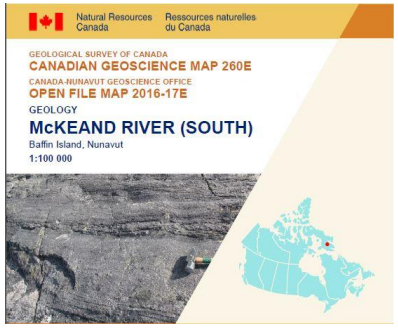


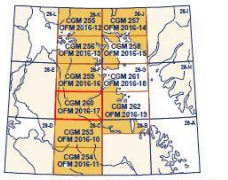


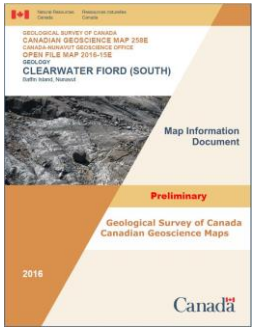


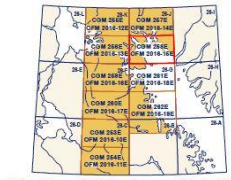


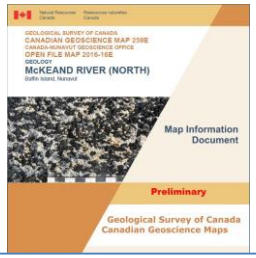


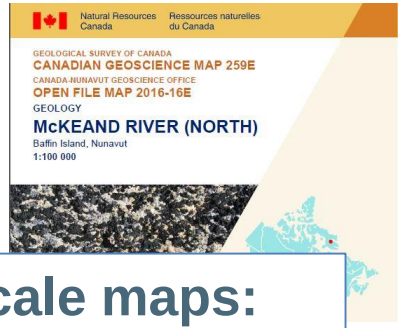


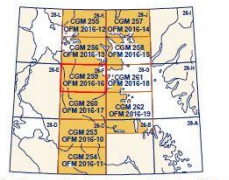


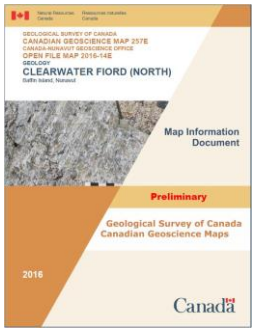


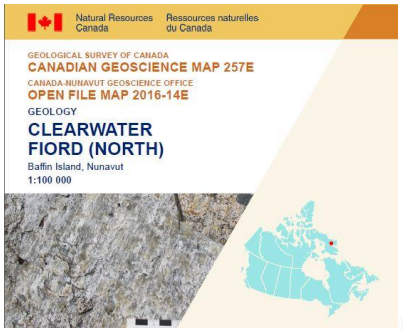


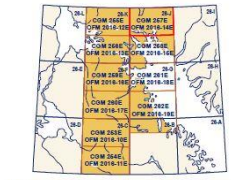








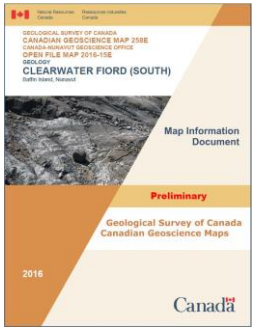


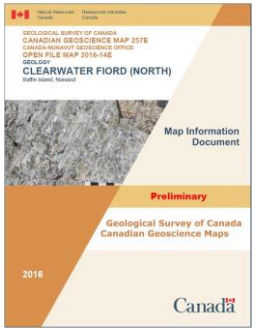


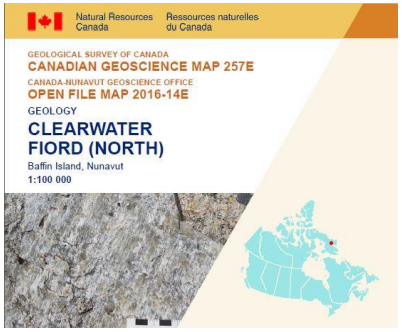
100:000 scale maps: released 5 April 2016

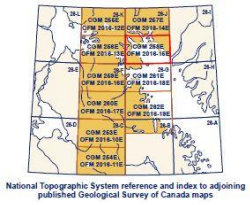
http://geoscan.nrcan.gc.ca or http://cngo.ca/

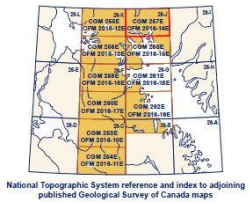
Canada









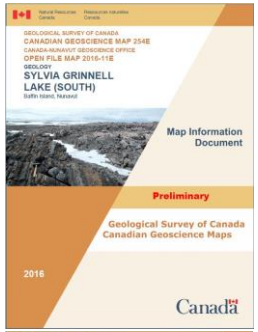


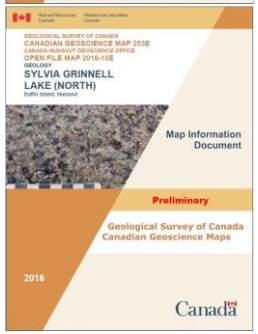
Sylvia Grinnell Lake – Clearwater Fiord outputs:

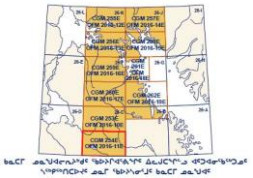
- PDF of the bedrock geology map
- related map information document (descriptive notes)
- a *full digital release package* with GDB and MXD files
- lithological and sample point data

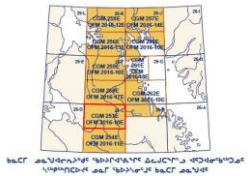
Sylvia Grinnell Lake – Clearwater Fiord outputs:

- Inuktitut version of published map
- Inuktitut version of map information document (descriptive notes)
- pilot project to continue gauging uptake



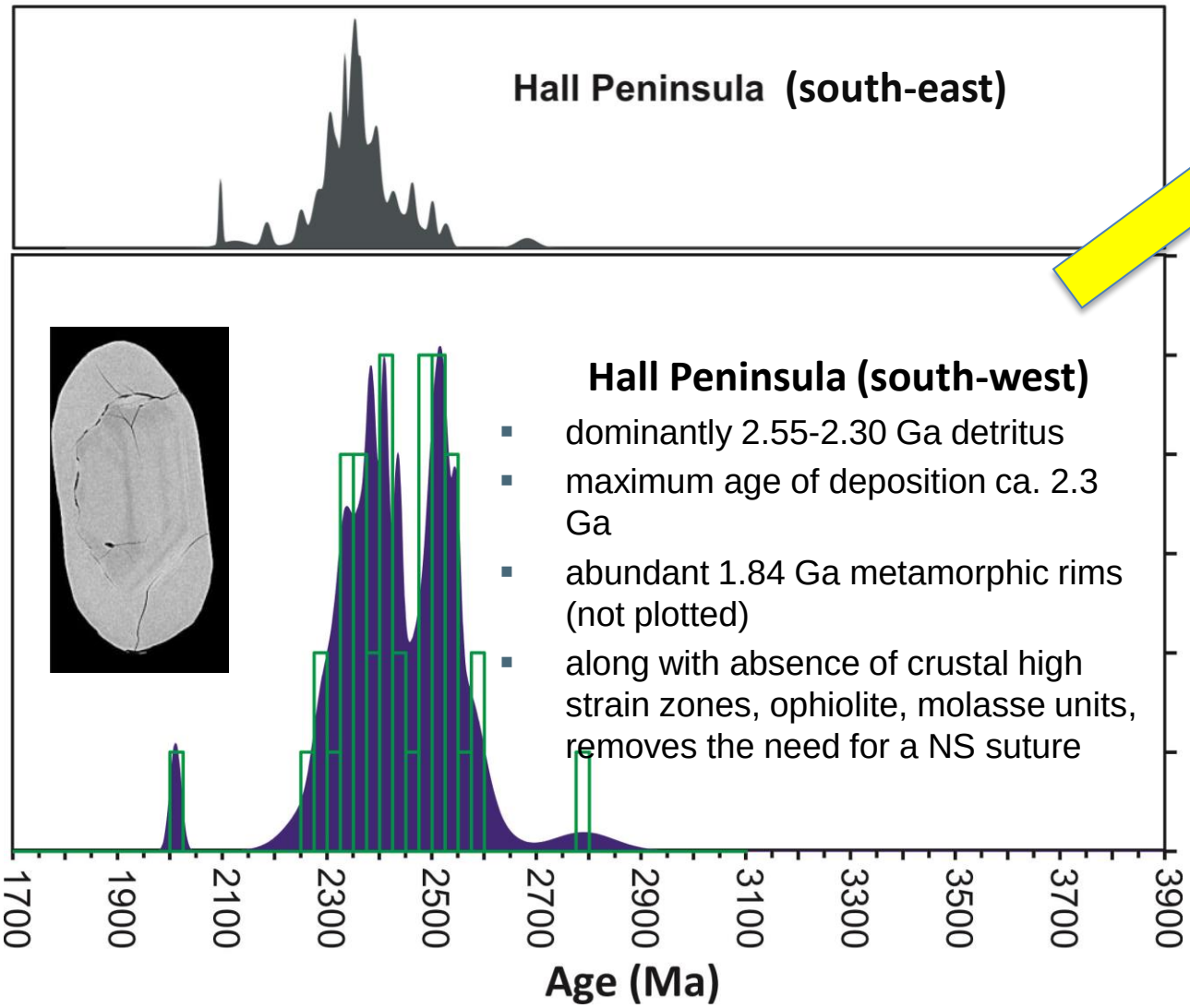






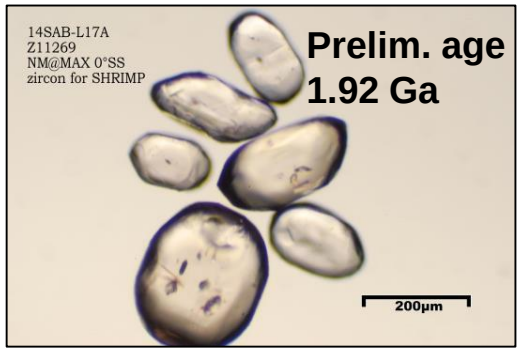
Metasedimentary rocks of Hall Peninsula: Lake Harbour and Piling groups

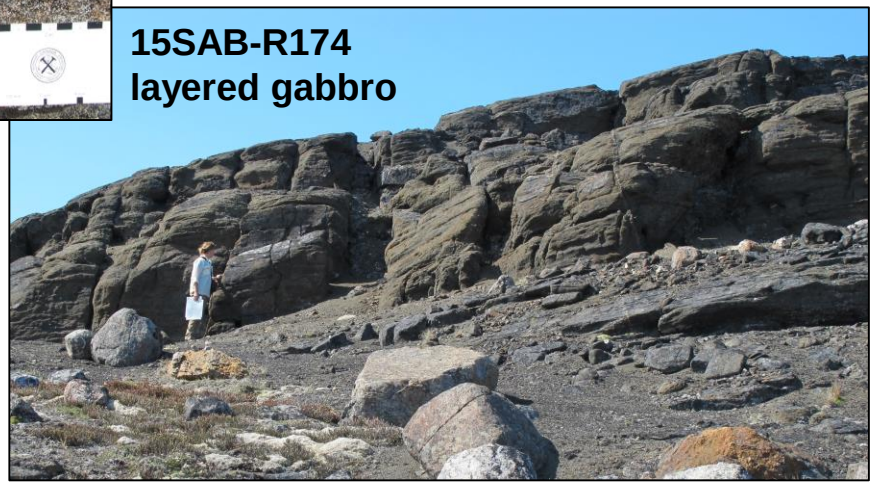
- **Detrital zircon ages (SHRIMP)**



Frobisher suite mafic, ultramafic and layered mafic-ultramafic sills

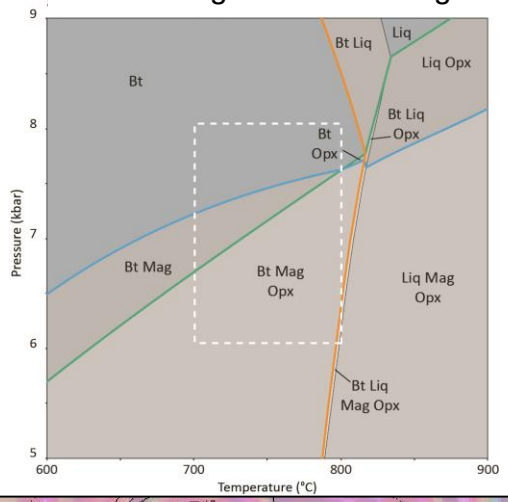
- emplaced in the metasedimentary rocks of the Lake Harbour Group
- leucogabbro tops with locally well-developed subophitic texture
- cm- to metre-scale rhythmic layering in metagabbro defined by the amount of hornblende, clinopyroxene and plagioclase
- ultramafic rocks layered at the cm- to metre-scale defined by amount of pyroxene, talc, and derivatives of olivine
- gossans and local ferricrete in host strata
- disseminated sulphides including chalcopyrite

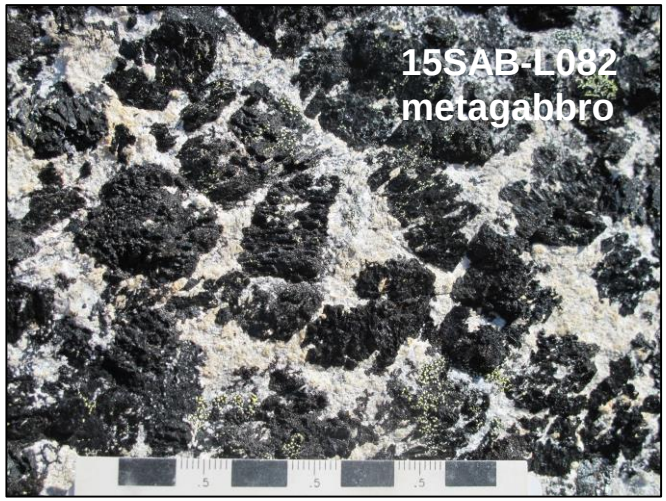




- ferricrete below ultramafic sill

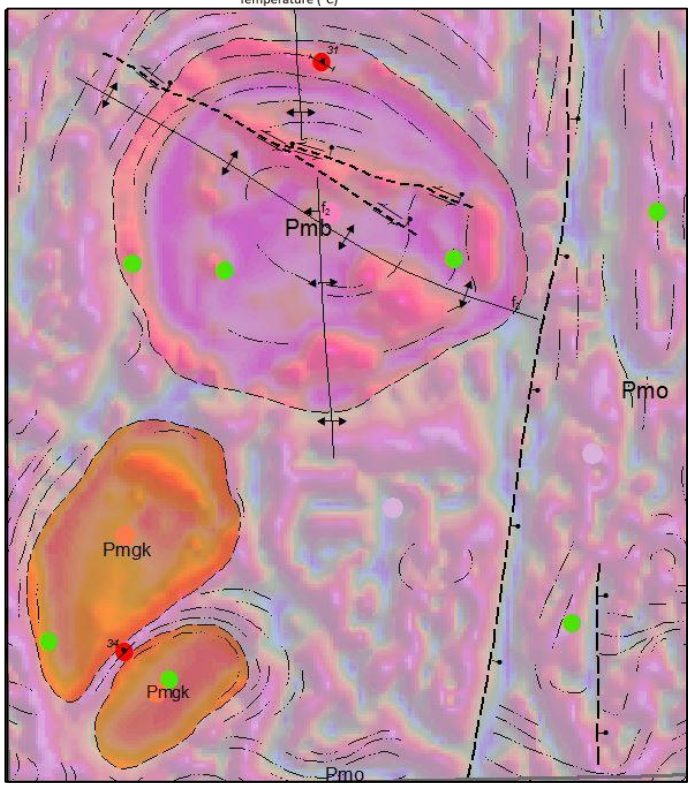
Phase diagram for monzogranite



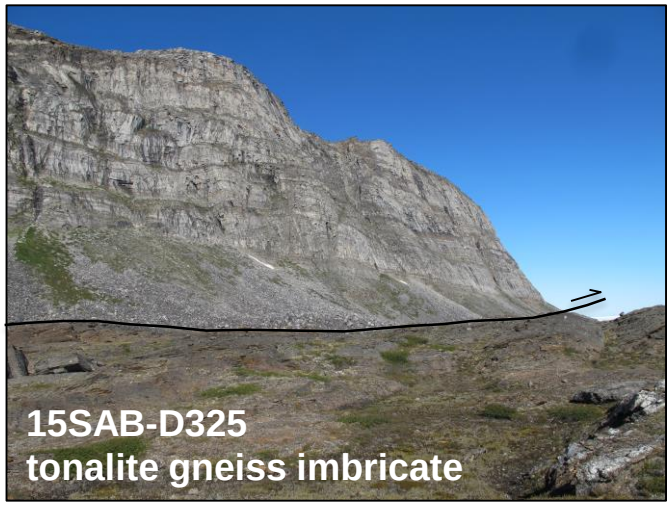


Plutonic rocks

- range in composition from metagabbro to leucogranite
- variably Bt-Opx-Hbl-Grt-Mag-Ilm bearing
- clear cross-cutting relationships
- aeromagnetic signature related to mineralogy via phase diagram modelling

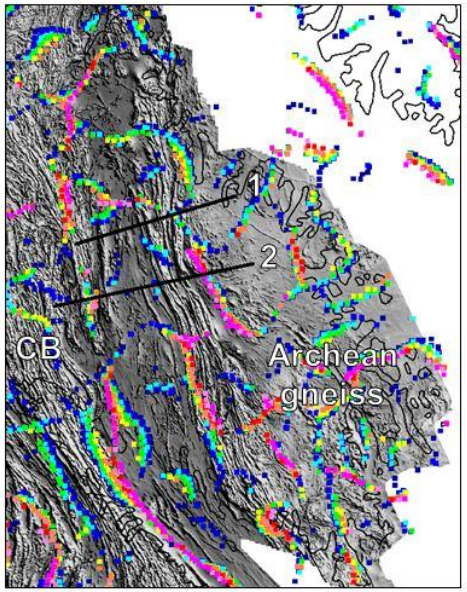


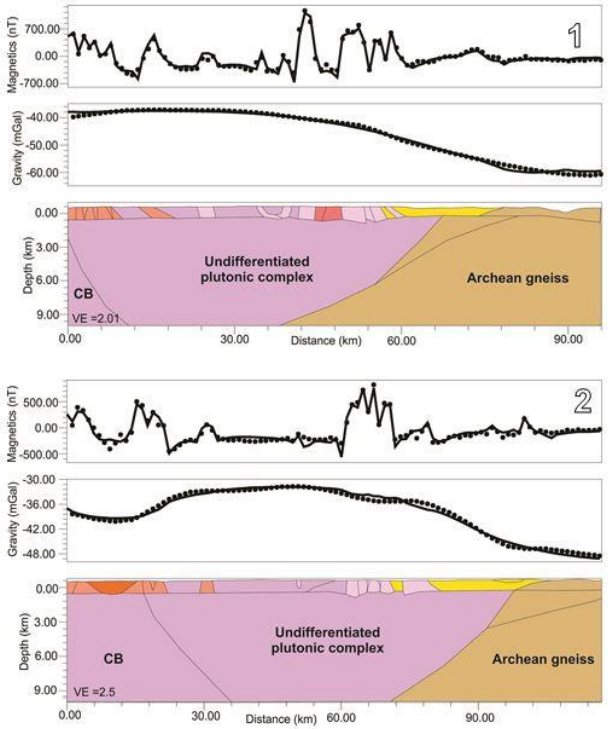
- Preliminary 1.86 Ga crystallization age for megacrystic monzogranite
- 1.89 Ga inheritance



Hall Peninsula Gneiss Complex

- Bt-Hbl-Mag tonalite to monzogranite
- massive to gneissic; locally enclave-rich
- dated between 3.21 – 2.68 Ga
- host to Chidliak diamond field





- western margin thrust-imbricated
- constrained at depth with geophysical forward modelling

Carving stone

- known occurrences and new ones documented on the published maps
- visit by the Government of Nunavut Department of Economic Development and Transportation (GN-EDT) carver/geologist evaluation team

Conclusions

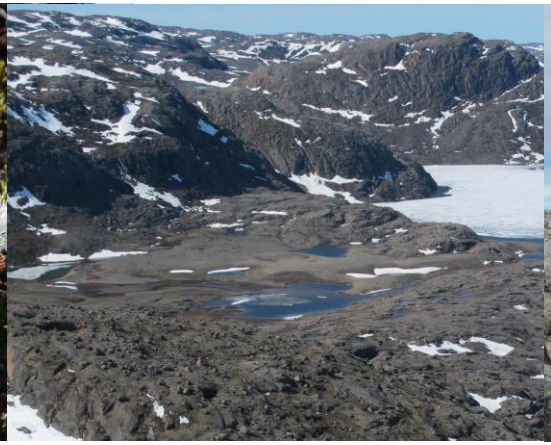
- Field work in 2015, covering 49,855 km^2, completed the partnered CNGO /GSC objective to update the bedrock coverage of Baffin Island south of latitude 70°N. Initiative was started in 1995 and supported by various programs including NRDP, GEM1, GEM2 and SINED.

- Documented a regional suite of layered mafic to ultramafic sills in the SGL – CF area that are intrusive into metasedimentary strata correlated with the middle Paleoproterozoic Lake Harbour Group. Many bodies contain disseminated sulphide, some associated with gossan or ferricrete.

- Constrained the 3-D geometry of the western margin of the Hall Peninsula Gneiss Complex, host to the Chidliak diamond field, both in map view and at depth. Margin characterized by spectacular thick-skinned thrust imbricates of Archean basement and Paleoproterozoic cover.

- Followed by publication of *full digital release packages (GDB and MXD files)* for 10 maps, as well as Inuktitut versions, therefore delivering *meaningful* results, and communicating these results in a *meaningful* way to northern Canadians.

Thank you ♦ Merci ♦ Nakurmiik

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