



# Canada-Nunavut Geoscience Office

## Nunavut Mining Symposium

April 25-28, 2023

*By: Linda J. Ham, Chief Geologist*



Natural Resources  
Canada

Ressources naturelles  
Canada



Crown-Indigenous Relations  
and Northern Affairs Canada

Relations Couronne-Autochtones  
et Affaires du Nord Canada

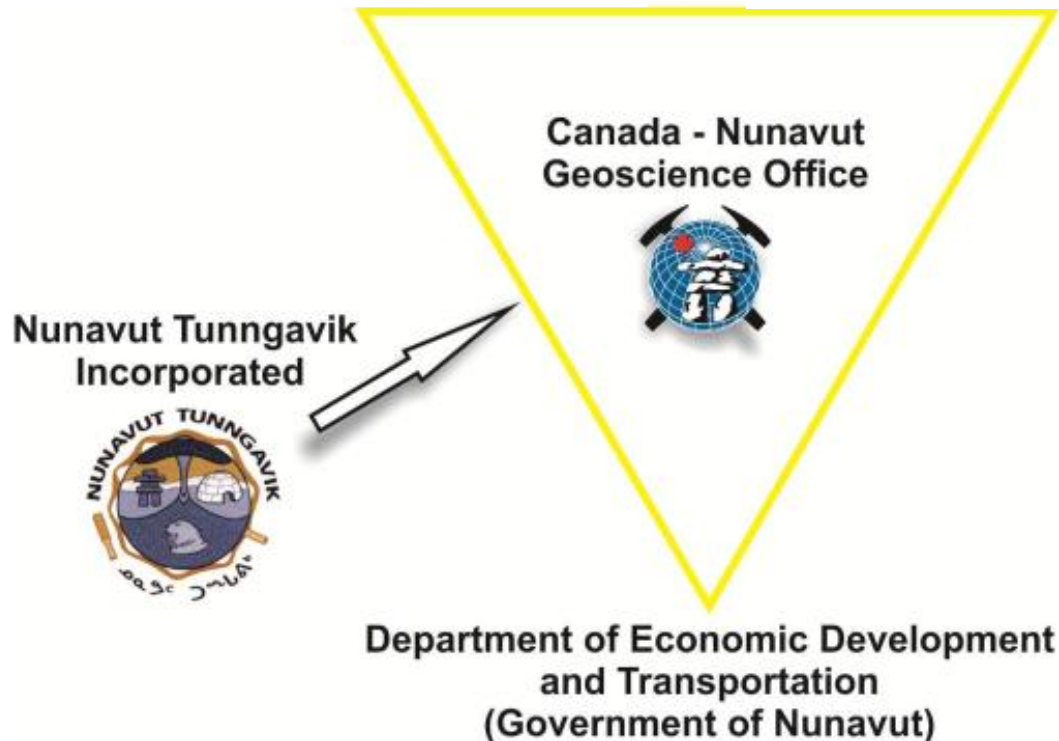
Canada

# The Canada-Nunavut Geoscience Office (CNGO)

A partnership office, co-managed and co-funded by NRCan (LMS-GSC), CIRNAC and GN-EDT

Geological Survey of Canada (Natural Resources  
Canada, Lands and Minerals Sector [LMS])

Crown-Indigenous Relations  
and Northern Affairs Canada



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

# Operational Framework

Five-person office, with one vacancy (will be filled shortly by another geologist)

- Chief Geologist; Paleozoic Stratigrapher (and energy geologist); Bedrock geologist; Surficial geologist, and GIS specialist



Agreement-in-principle was signed in 2019 between the Government of Canada and the Government of Nunavut and NTI for devolution negotiations to start for Nunavut assuming control over Crown land and natural resources. Final agreement is imminent.


With devolution on the horizon (~2026), the CNGO (and most of the Nunavut Regional Office of CIRNAC) will devolve to the GN.

# Mission Statement and Mandate

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To investigate, understand, and explain the geology of Nunavut.

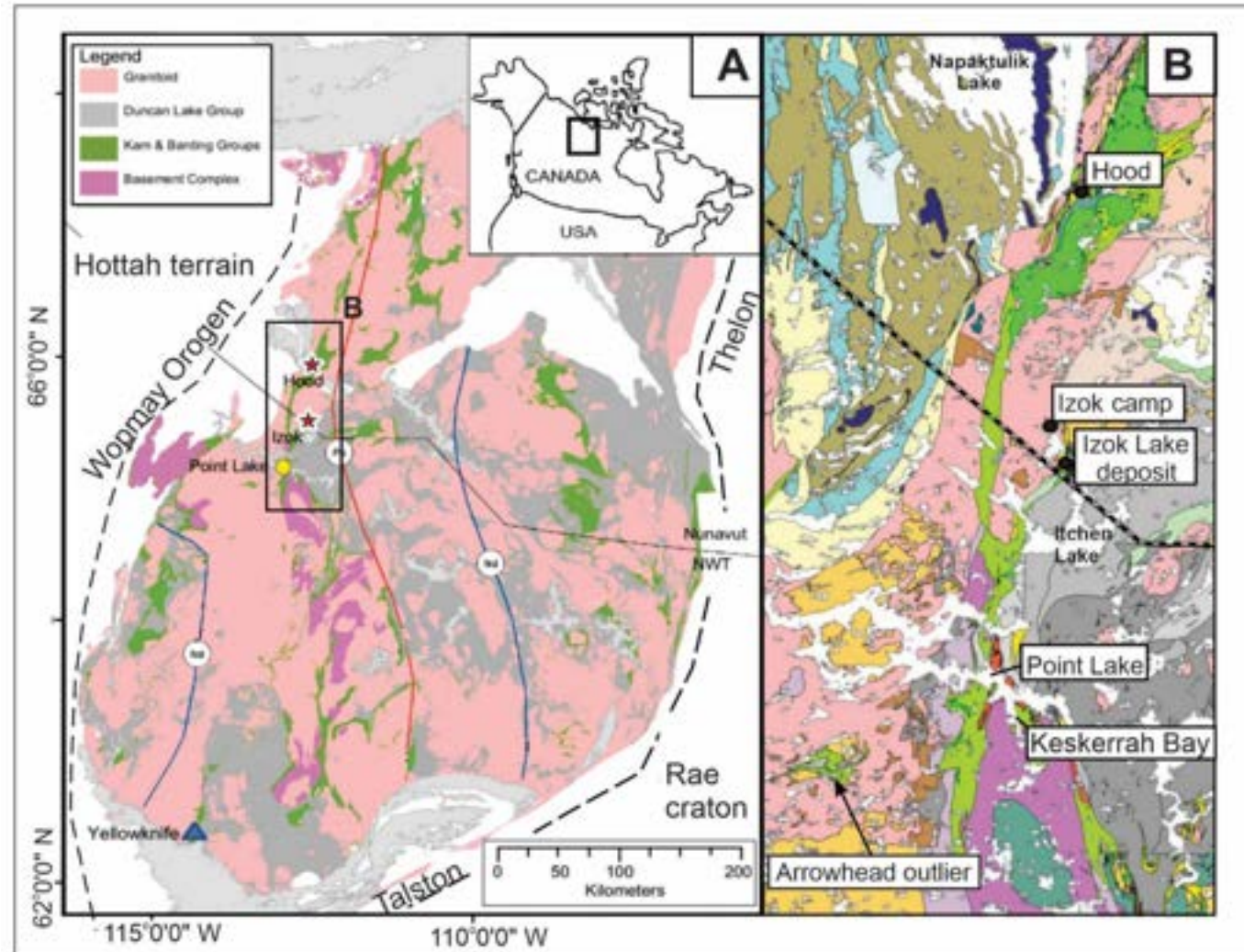
The purpose of the Canada-Nunavut Geoscience Office is to:

- Build and maintain an accessible geoscience knowledge base,
  - Promote development of mineral (and energy) resources for Nunavut, with particular emphasis on the 'critical minerals' and metals.
  - Develop capacity (human and otherwise) in geoscience, and
  - Increase awareness of the importance of Earth Science for Nunavummiut.
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# Geoscience – Bedrock Mapping 2022

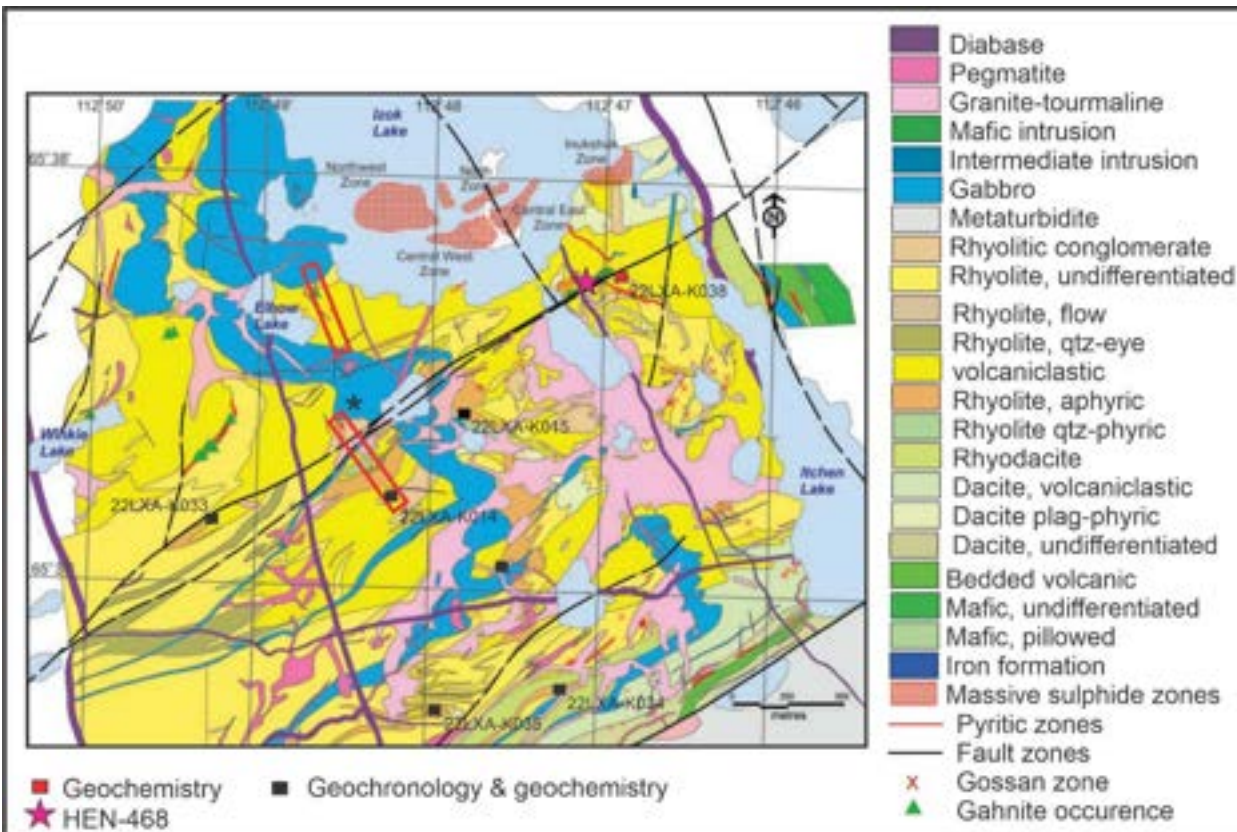
Bedrock mapper  
(Lorraine Lebeau)

- Spent three weeks on MMG's (dormant) Izok Lake property, located at the NT/NU border.
- The Izok Lake deposit, considered to be one of the highest-grade copper-zinc deposits in the world, has been explored privately by mineral exploration and mining companies from the 1970's through to 2015.



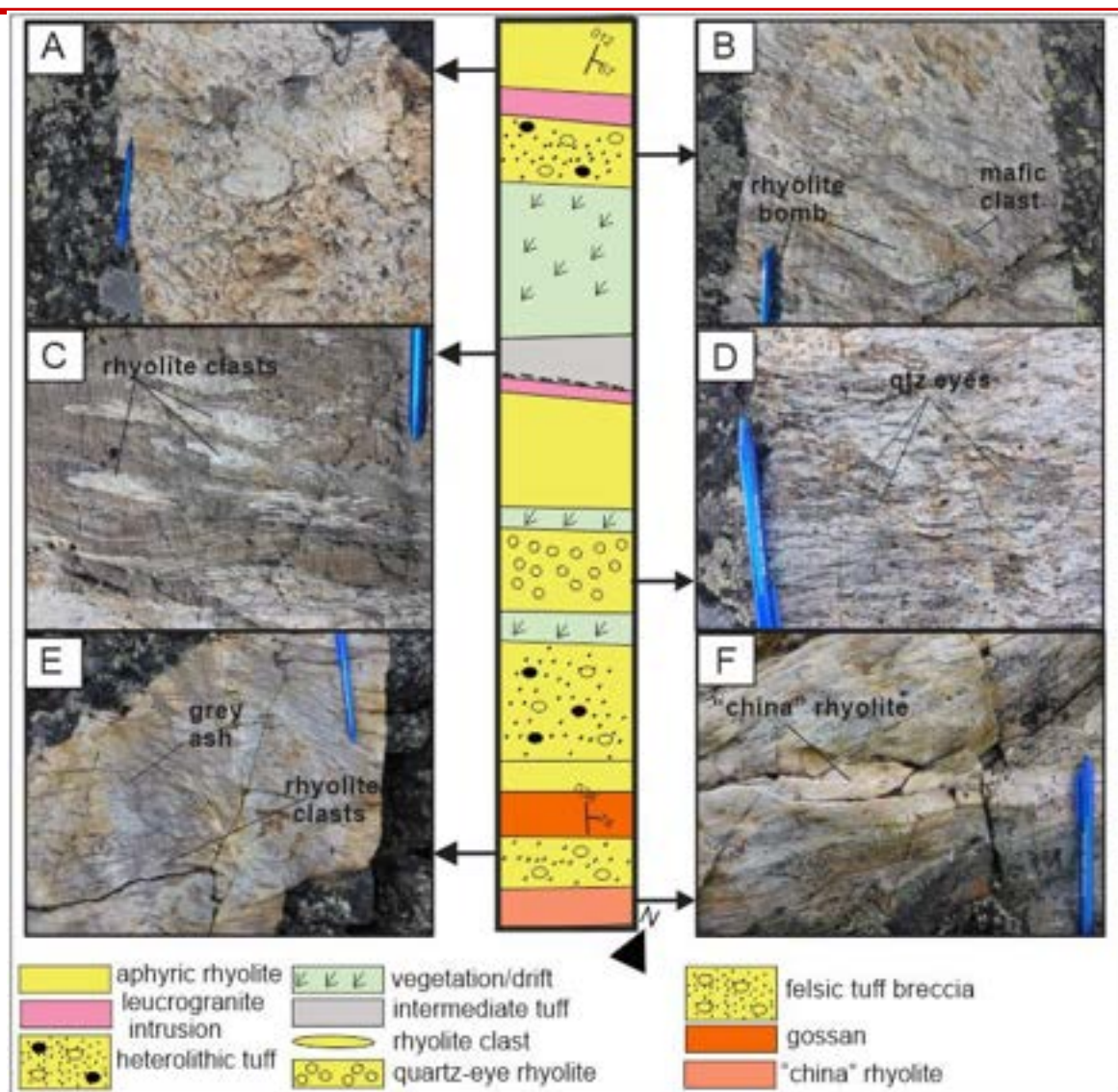
# Izok Lake project

- However, little of this private data (e.g., limited drill-core logs, geological maps of the property, etc.) has ever been made publicly available.
- Rich in precious and base metals (some of which also known as critical minerals, e.g., zinc, copper, lead, silver, and some trace REE); Ga has also been identified at Izok in earlier studies.



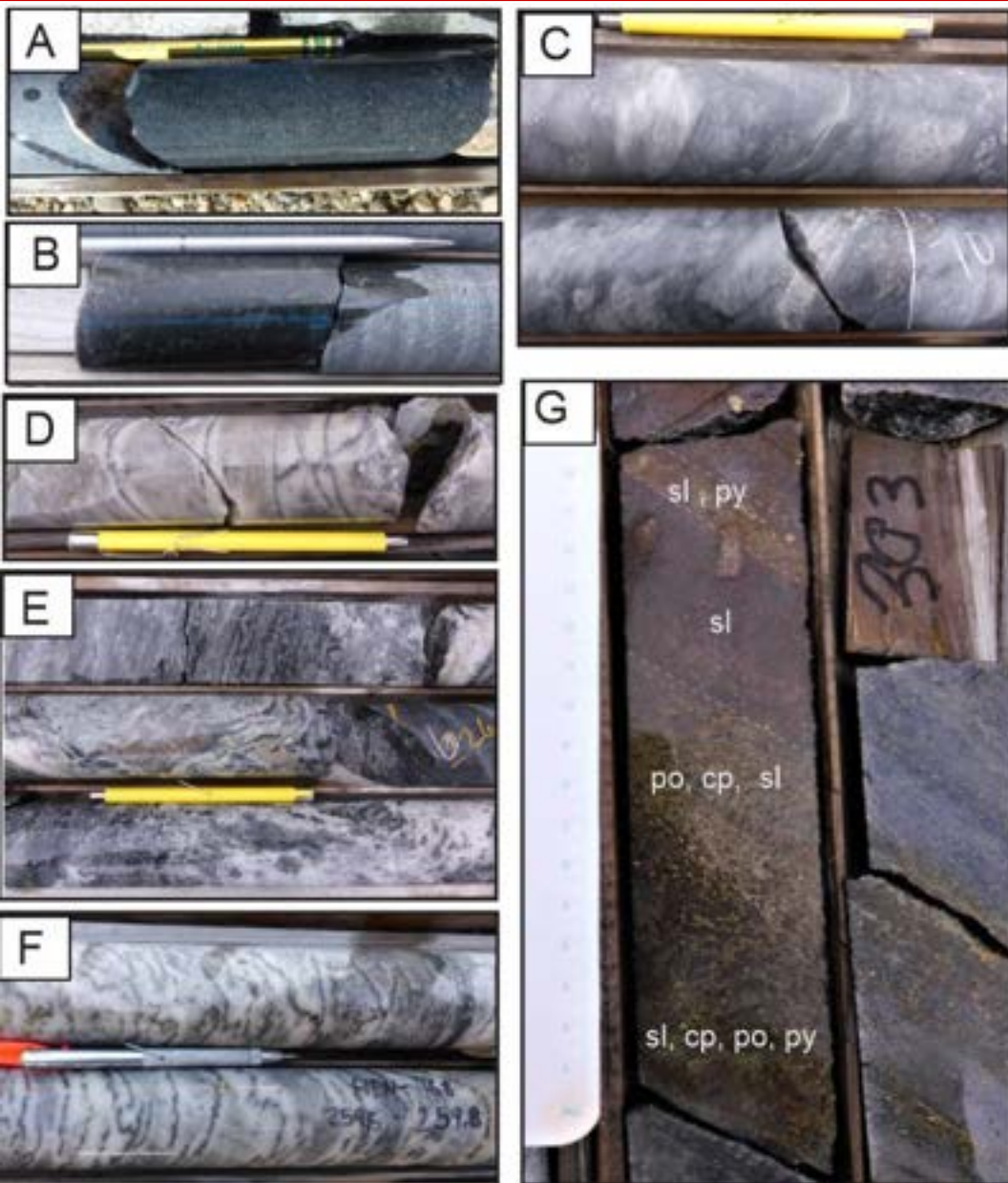
- Project is focussed on increasing understanding of geological relationships surrounding the deposit, re-examining the deposit specifically for the critical minerals, and to age-date the host rocks.

# Geology of the Izok Lake deposit



Intensely altered aphyric and quartz-phyric rhyolite  
 Lesser altered andesite flows  
 Volcaniclastic rocks in various forms  
 Locally pillowed basaltic flows  
 gabbroic sills and dykes, and  
 silicate facies iron formation and  
 turbiditic greywacke of the  
 Contwoyto Formation.  
 The deposit is hosted in rhyolite  
 near the stratigraphic top of the  
 Point Lake formation -  
 dominantly felsic volcanics with  
 lesser intermediate and mafic  
 metavolcanic and volcanoclastic  
 rock

# Mineralization at Izok Lake



The known deposit = five separate massive sulphide lenses with varied combinations of sp, py, cp, ga, and po

Rhyolite – classified into seven groups (i.e., R1, R2, R3) based on  $Al_2O_3/TiO_2$  and Zr/Nd ratios

Lowest rhyolitic sequence (R1) in the stratigraphy has relatively high  $Al_2O_3/TiO_2$  and low Zr/Nd ratio value

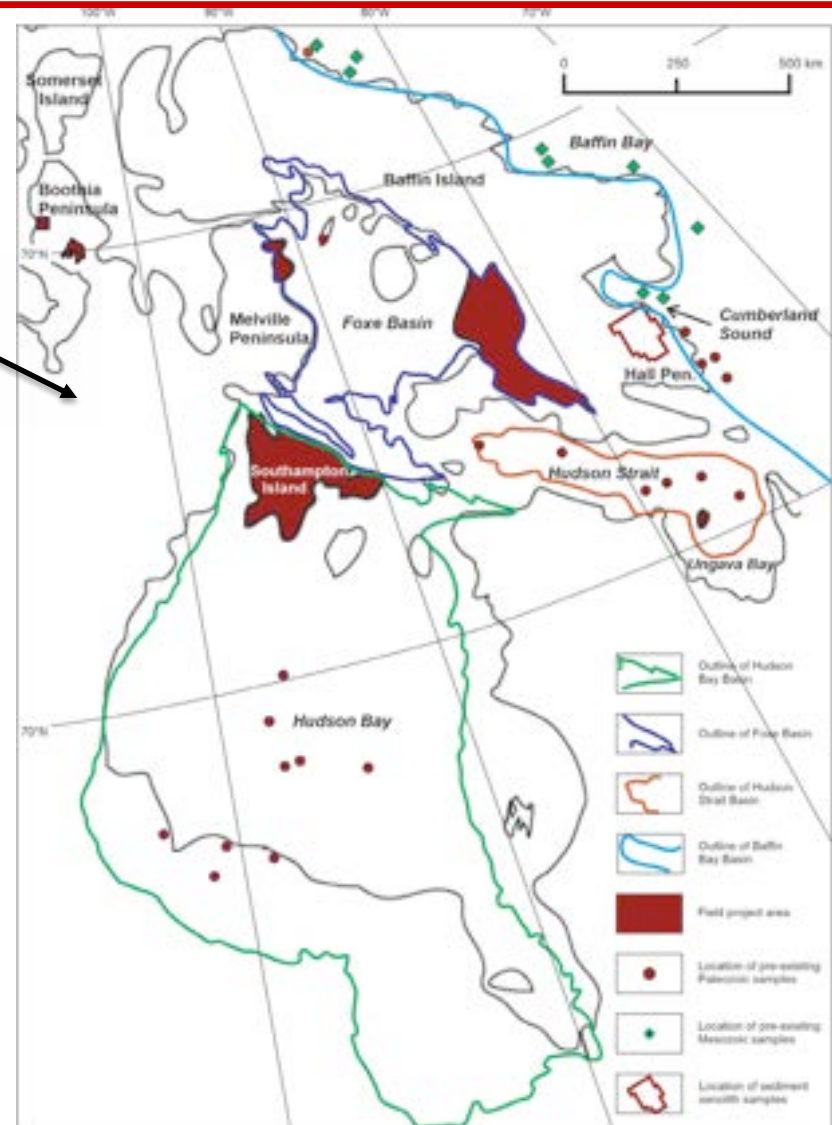
**R1 exclusively hosts all known massive sulphide mineralization**

Ultimately, the goal of the project is to renew interest in base metal (and critical mineral) exploration from both private industry and government.



# Geoscience – Paleozoic Stratigraphy

- Nunavut is underlain ~30% by Paleozoic rocks (sedimentary rocks including carbonates, shales) in four basins on the Boothia and Melville peninsulas, Southampton Island, and the High Arctic islands.
- Shunxin Zhang has been unravelling the stratigraphy of these rocks (by microfossil analyses), determined the source of xenoliths in the diamondiferous kimberlites of Chidliak, and determining the energy (oil) potential of the rocks.
- Future plans include re-evaluating these rocks for the 'critical minerals'



# Geoscience – Surficial geology and database



Database of the locations of surficial sample stations in Nunavut.

Data from the analyses of surficial materials in Nunavut, found in various publications and reports, are currently being compiled into a database by the CNGO.

In 2019, an initial database was created that included the geographic co-ordinates of all stations where surficial materials were sampled.


Associated publications, type of material and survey name are linked to each of the samples.

By adding compilations of the geochemical, mineralogical and sedimentological data for each of the samples, this database will be completed.

# Collaboration and the CNGO

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GEM – Geo-mapping for Energy and Minerals programs (GEM 1 (2008-2013) and GEM 2 (2014-2020), and now GEM GeoNorth (2020-2027) involve geoscience research led by NRCan (GSC) for the benefit of people and communities in the North.

- New data, maps and ideas intended to generate opportunities for responsible research development leading to long-term economic and social prosperity.
  - Geologic tools for making land-use decisions.
  - Opportunities for education and employment for young people – opportunities for development of sustainable skills.
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# NRCan's GEM-GeoNorth Program

NRCan's Geological Survey of Canada's GEM-GeoNorth program (2020 to 2027) creates innovative and relevant geoscientific data, knowledge, and maps to support geoscience work in the context of a changing climate



**Renewed for \$100M until 2027**



**Geoscience for sustainable and economic development in the context of a changing climate**



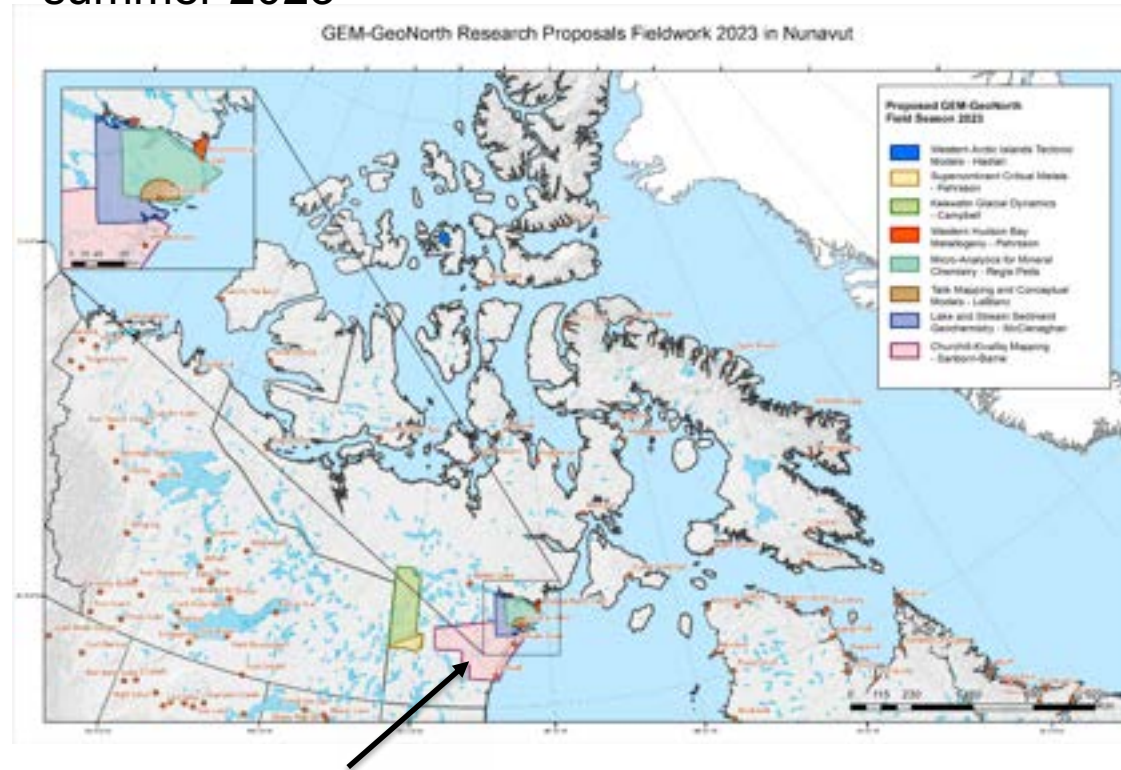
**Focus on areas of the North where development is likely to occur and will benefit Northern communities**

# GEM Summer 2023 Field Season

## GEM-GeoNorth is based on five program pillars:

- Refine geological knowledge regarding untapped resource potential in Canada's North.
- Enhance understanding of rapidly changing landscapes and coasts to support economic development via critical infrastructure.
- Develop and provide new public geoscience to inform environmental assessments.
- Leverage innovative data-driven predictive methods to forecast cumulative impacts in a changing climate.
- Align research priorities and products with Northerners and Indigenous peoples.

## Proposed field activities in Nunavut in summer 2023



Lorraine Lebeau's and Sally Pehresson project on Western Hudson Bay





# NUNAVUT

## Critical Mineral Exploration

2002 - 2023

Geological Information System  
 Nunavut Geological Survey, 2023  
 1:500,000 Scale  
 Geographical Coordinates: 60°N 0°W  
 UTM Zone 18N  
 WGS 84  
 Canadian Geomatics Centre  
 2023-03-23



**LEGEND**

**Minerals**

- Green circle: Iron Ore
- Blue circle: Nickel
- Red circle: Copper
- Yellow circle: Gold
- Purple circle: Silver
- Orange circle: Platinum
- Light blue circle: Uranium
- Dark blue circle: Rare Earth Elements
- Light green circle: Lithium
- Light purple circle: Vanadium
- Light orange circle: Manganese
- Light yellow circle: Zinc
- Light pink circle: Cobalt
- Light brown circle: Potash
- Light grey circle: Other

**Other Symbols**

- Green square: Mineral Potential
- Blue square: Mineral Potential
- Red square: Mineral Potential
- Yellow square: Mineral Potential
- Purple square: Mineral Potential
- Orange square: Mineral Potential
- Light blue square: Mineral Potential
- Dark blue square: Mineral Potential
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- Light grey square: Mineral Potential

Map No.	Project	Comminities	Active Status/Description
101	Arctic Metals	Fe, Cu, Ni	Stratex Resources Inc.
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This is a Critical Mineral Exploration map compiled by CIRNAC March 2023 from the NUMIN database showings and compiled from Exploration Overview compilation s since 2002.



# Data Dissemination

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- One of our highest priorities is to meet client demands for searching, viewing, and accessing geoscience data.
- To attract exploration spending and to serve a global exploration industry, Nunavut must be competitive in disseminating high-quality geoscience data.
- This is a shared priority for geoscience partners and agencies (CNGO, CIRNAC, GN, NTI and NRCan).
- Nunavutgeoscience.ca was launched in September 2006; updating and revising needed.
- CNGO has its own website [www.cngo.ca](http://www.cngo.ca).
- Both websites are undergoing updating and revisions.

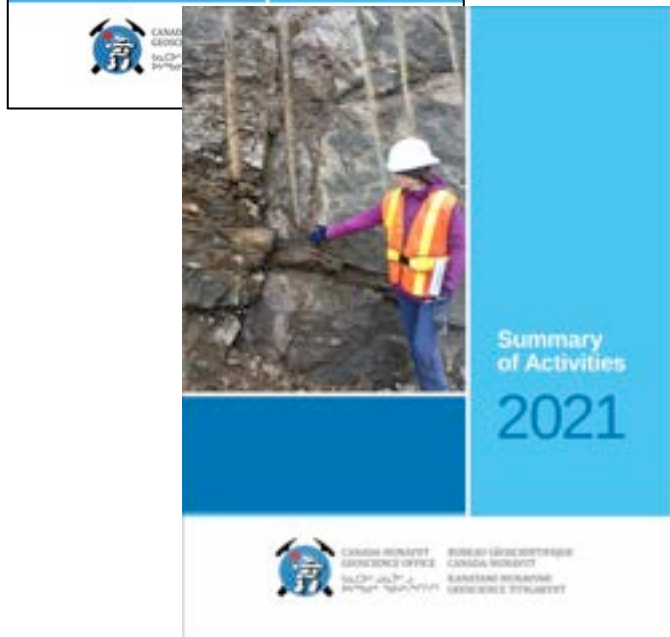
# Summary of Activities

**First published in 2012; work from 2022 about to be released as Open File Reports**

6-10 articles annually in both English and French (since 2021)

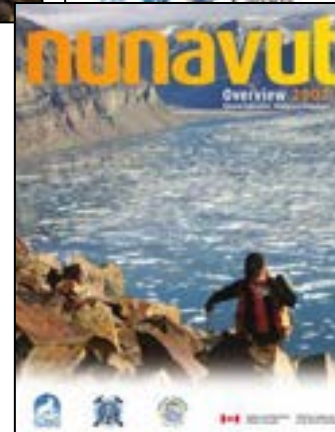
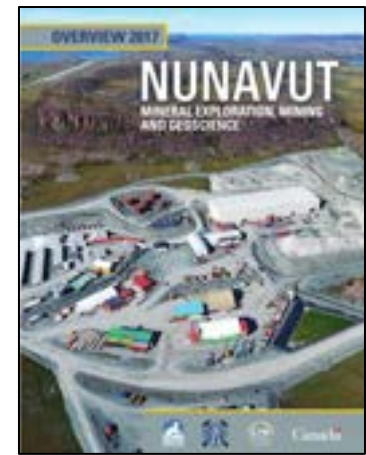
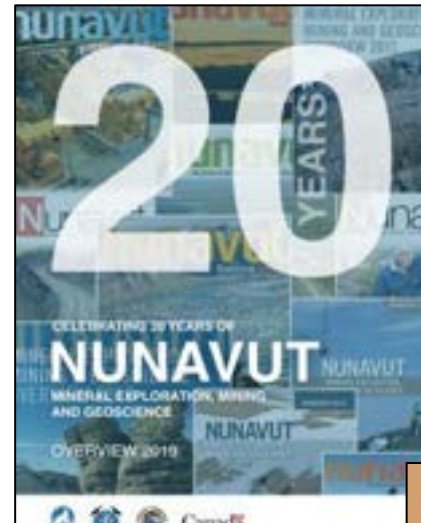
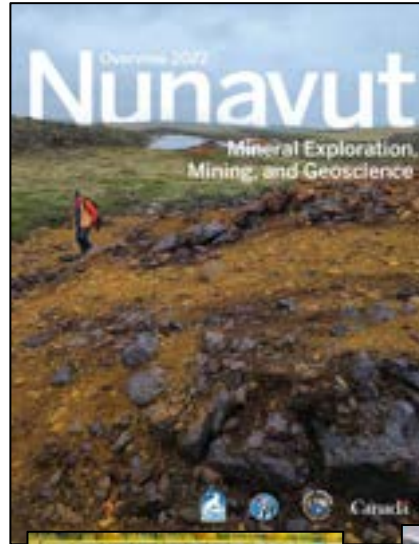
Publication to disseminate results annually

Also disseminate data and other products



# Exploration Overview

- Published annually since 1997; in this booklet form since 2002
- This publication is a combined effort of four partners; CIRNAC, GN, NTI, and CNGO.
- In both official languages since 2013.



# Geological Tour of Iqaluit



## GEOLOGICAL TOUR OF IQALUIT

1.8 Billion Years of Earth's History



In 2019, the CNGO embarked on producing a Geological Walking (and driving) Tour of Iqaluit. This followed on two earlier projects – one being a walk through downtown Iqaluit led by the late Mike Hine, and the second (unpublished) being a brochure prepared by former CNGO employee Dr. Joyia Chakungal and summer students hired by the CNGO for the summer of 2008.

This brochure was a fun project, first started by an ILDP (Inuit Learning and Development Program) participant, then finished by the geologists of the CNGO.

This brochure is now published and will be available this week at NMS and at places like the Visitor's Centre.

# Geological Tour of Iqaluit

## LEGEND

- |   |   |
|---|---|
| 1. Unikkaavik Visitor Centre (pg 3)             | 10. Thermosyphons beside Building 1104A and buildings on stilts (pg 11) |
| 2. Nunatta Sunakkutaangit Museum (pg 4)         | 11. Fault beside Aqsarnit Hotel (pg 11)                                 |
| 3. Sculpture Garden (pg 5)                      | 12. Nunavut Arctic College, main campus (pg 12)                         |
| 4. NTI Sculpture (pg 6)                         | 13. Nioqungusierioq Road (pg 13)  |
| 5. Igluvut Building (pg 6)                      | 14. Road to Nowhere (pg 14)   |
| 6. Nunavut Legislative Assembly (pg 7)          | 15. Sylvia Grinnell Territorial Park (pg 15)                            |
| 7. Mace of Nunavut (pg 8)                       | 16. Iqaluit Dump (pg 15)  |
| 8. Government of Canada Building (pg 9)         | 17. Iqaluit Airport (pg 16)   |
| 9. The Canada-Nunavut Geoscience Office (pg 10) | 18. RCMP Monument (pg 17)   |



# Conclusion

The Canada-Nunavut Geoscience Office is currently co-managed and has an ambitious geoscience program with a small staff

CNGO is seen equivocally as a success story in partnership and collaboration

