DESCRIPTIVE NOTES

INTRODUCTION

In 2012, the Canada-Nunavut Geoscience Office (CNGO) initiated a targeted regional bedrock mapping project (1:250 000 scale) on Hall Peninsula, southern Baffin Island, (NTS map sheets 25-I, part of 25-J, 25-O, 25-P, 26-A and 26-B) as part of the office's long-term objective to upgrade the geoscientific knowledge base for Nunavut (Machado et al., 2013).

The geology of Hall Peninsula remains poorly known, in spite of the first geological observations dating back to Frobisher's 1576 voyage (Hogarth, 1994). The peninsula has only been mapped once, at reconnaissance scale, during the Geological Survey of Canada's (GSC) Operation Amadjuak in the 1960's (Blackadar, 1967). Later, Scott (1996) carried out detailed mapping of a narrow transect in the northern part of NTS map sheet 25-O and sampled the main rock types for geochronology (Scott, 1999). This information was incorporated into a compilation map published in 2006 (St-Onge et al., 2006). Recent work has focused on the diamondiferous kimberlites and surrounding rocks of the Chidliak kimberlite province in the northern part of the peninsula (Pell et al., 2012; Heaman et al., 2012; Ansdell et al., 2012).

In preparation for field mapping, the CNGO and the GSC flew an aeromagnetic survey in 2009 (Dumont and Dostaler, 2010). Last summer six weeks from the end of June to the beginning of August were devoted to mapping the southern portion of the peninsula (NTS map sheets 25-P, 25-I, parts of 25-O and parts of 25-J) covering approximately 20 000 km^2.

GEOLOGICAL FRAMEWORK

Previous work on Hall Peninsula indicated that it is underlain by Paleoproterozoic plutonic rocks that may be the westward continuation of the Cumberland Batholith, Paleoproterozoic metasedimentary rocks that may be the northeastern continuation of the Lake Harbour Group, and Archean orthogneisses of unknown tectonic affinity (Blackadar 1967; Scott 1996, 1999; St-Onge et al. 2006).

The map area is underlain by two lithological domains with a Hall Peninsula Block (older rocks, likely of Archean age) domain in the East and a domain in the West (younger rocks, likely of Paleoproterozoic age). The boundary between the eastern and western domains corresponds approximately with a high aeromagnetic anomaly situated close to the limit between NTS map sheets 25-O and 25-P. On the ground, this boundary corresponds to a tonalite-granodiorite suite intrusive into both domains.

DETAILED GEOLOGY

Eastern Lithological Domain

Migmatitic to gneissic tonalite underlies most of NTS map sheets 25-P and 25-I and is the structural (and depositional?) crystalline basement to other rock types in the eastern portion of the peninsula. The tonalite was dated by Scott (1999) at 2920 Ma. It contains numerous partly resorbed amphibolite enclaves. In some areas, the tonalite tends towards a more granodioritic composition. In map sheets 25-P and 25-I sequences of rusty-weathering supracrustal rock either overlie or occur as imbricate panels with the tonalite described above. The supracrustal units mostly comprise psammite, semipelite and pelite alternating with amphibolite and diorite sills and/or equivalent metamorphosed volcanic rocks.

The eastern domain is also characterized by two main intrusive suites. A large, moderately deformed, porphyritic granite pluton, centered on Cornelius Grinnel Bay (NTS 25-P), intrudes the gneissic tonalite and associated supracrustal units. It contains diorite and amphibolite enclaves and is characterised by rapakivi and porphyritic or megacrystic textures. A distinct granitic intrusive suite characterized by a high aeromagnetic signature that correlates with the presence of magnetite is found in this domain.

Western Lithological Domain

At the boundary between the eastern and western domains, a felsic intrusive suite with a tonalitic to granodioritic composition was mapped. It was dated by Scott (1999) at 1877 Ma. Several thick panels of metasedimentary rocks, which are contiguous with the Lake Harbour Group of southern Baffin Island (St-Onge et al., 2006), characterize the domain. They consist of biotite-garnet-sillimanite semipelite, psammite and pelite, with minor marble, quartzite and silicate-iron-formation.

Those metasedimentary units are intruded by a charnockite and is in turn intruded by a garnet bearing monzogranite. This monzogranite contains up to 20% red-brown to lilac-colored garnet and was initially interpreted by Scott (1996, 1999), to be the product of partial melting of metasedimentary rocks.

STRUCTURAL AND METAMORPHIC PETROLOGY

Three regional deformational events were recognized in some crystalline rock units of Hall Peninsula. The first two deformational events (D1 and D2) are together responsible for the overall northwest-southeast trends in the map pattern, both are characterized by west- to southwest-dipping penetrative foliation and northwest- or southeast-plunging fold axes and mineral lineations and both are accompanied by amphibolite-facies metamorphism (Skipton et al., 2013). Evidence of an older granulite-facies metamorphic event predating both D1 and D2 is locally observed in the Archean gneisses (Skipton et al., 2013).

MINERAL POTENTIAL

Mineral exploration in the area began in 1577, when Martin Frobisher mined "black ores" in the Countess of Warwick Sound area during his second voyage and brought them back to London to be tested for gold and silver (Hogarth and Loop, 1986). In the late 20th century, following GSC Operation Amadjuak, mineral exploration for base and precious metals resumed but was still scarce. At the turn of the 21th century, exploration for diamonds started and resulted in the discovery of diamond-bearing kimberlites in the northern part of the peninsula (Pell et al., 2012).

Considering the overall geological context of Hall Peninsula, the potential for finding new occurrences of mineralization is multifaceted. The discovery of ultramafic rocks within supracrustal packages points to possibly interesting new sources of carving stone and these may have potential for nickel-copper-PGE mineralization. The large area underlain by crystalline basement (eastern domain) could be host to more diamond-bearing kimberlites. Also, marble correlated with the Lake Harbour Group has potential to host gemstones as is the case in the Kimmirut area. Other possible types of mineralization may include gold associated with iron-formation and VMS deposits associated with supracrustal packages.

Abstract

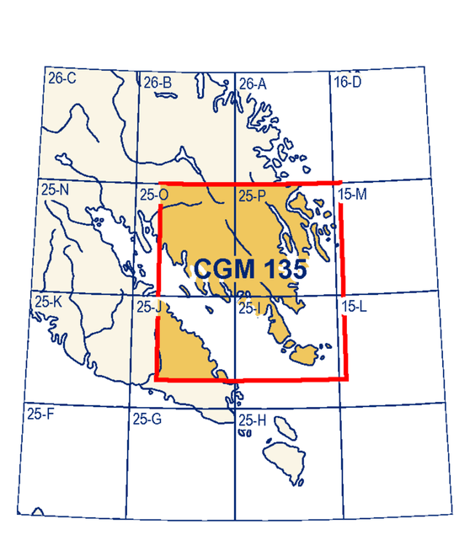
In 2012, the Canada-Nunavut Geoscience Office initiated a targeted regional bedrock mapping project on Hall Peninsula, southern Baffin Island. During the first field season, mapping focussed on the southern portion of the peninsula covering approximately 20 000 km^2. Mapping defined two lithological domains: an eastern domain comprising a tonalite gneissic basement overlain or imbricated with supracrustal rocks, and intruded by two granitic suites; and a western domain characterized by metasedimentary rocks intruded by a tonalite-granodiorite suite, charnockite and garnet monzogranite.

The discovery of ultramafic rocks points to possibly interesting new sources of carving stone and may also have potential for nickel-copper-PGE mineralization. The large area underlain by orthogneiss basement units could be host to diamond-bearing kimberlites similar to the ones found in the northern portion of the peninsula. Based on the reported geology, other types of mineralization can also be considered, such as gold associated with iron-formation and VMS deposits associated with supracrustal packages.

Résumé

Le Bureau Géoscientifique du Canada-Nunavut a débuté, en 2012, un projet de cartographie régionale du socle rocheux de la péninsule de Hall, située au sud de l'île de Baffin. Au cours de la première saison de terrain, la cartographie a couvert approximativement 20 000 km2 de la portion sud de la péninsule. Ces travaux ont défini deux domaines lithologiques : Un domaine oriental composé d'un socle de gneiss tonalitique sous jacent ou imbriqué avec des roches supracrustales et de deux suites granitiques intrusives; et un domaine occidental caractérisé par une suite tonalitique-granodioritique, une charnockite et un monzogranite a grenat intrusifs dans des roches métasédimentaires.

La découverte de roches ultramafiques pointent vers de nouvelles sources intéressantes de pierre sculpturales et ont aussi le potentiel de minéralisation en nickel-cuivre-ÉGP. Le secteur couvert par le socle d'orthogneiss pourrait contenir des kimberlites diamantifères similaires à celles retrouvées dans la portion nord de la péninsule. Finalement, la géologie de la péninsule suggère la possibilité de retrouver d'autres types de minéralisation, comme de l'or associé avec les formations de fer et des gisements volcanogènes associés avec les roches supracrustales.



National Topographic System reference

Cover illustration
Folded supracrustal rocks and tonalite gneiss, south Baffin Island, Nunavut.
Photograph by C. Bilodeau. 2013-077

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Natural Resources Canada — Ressources naturelles du Canada

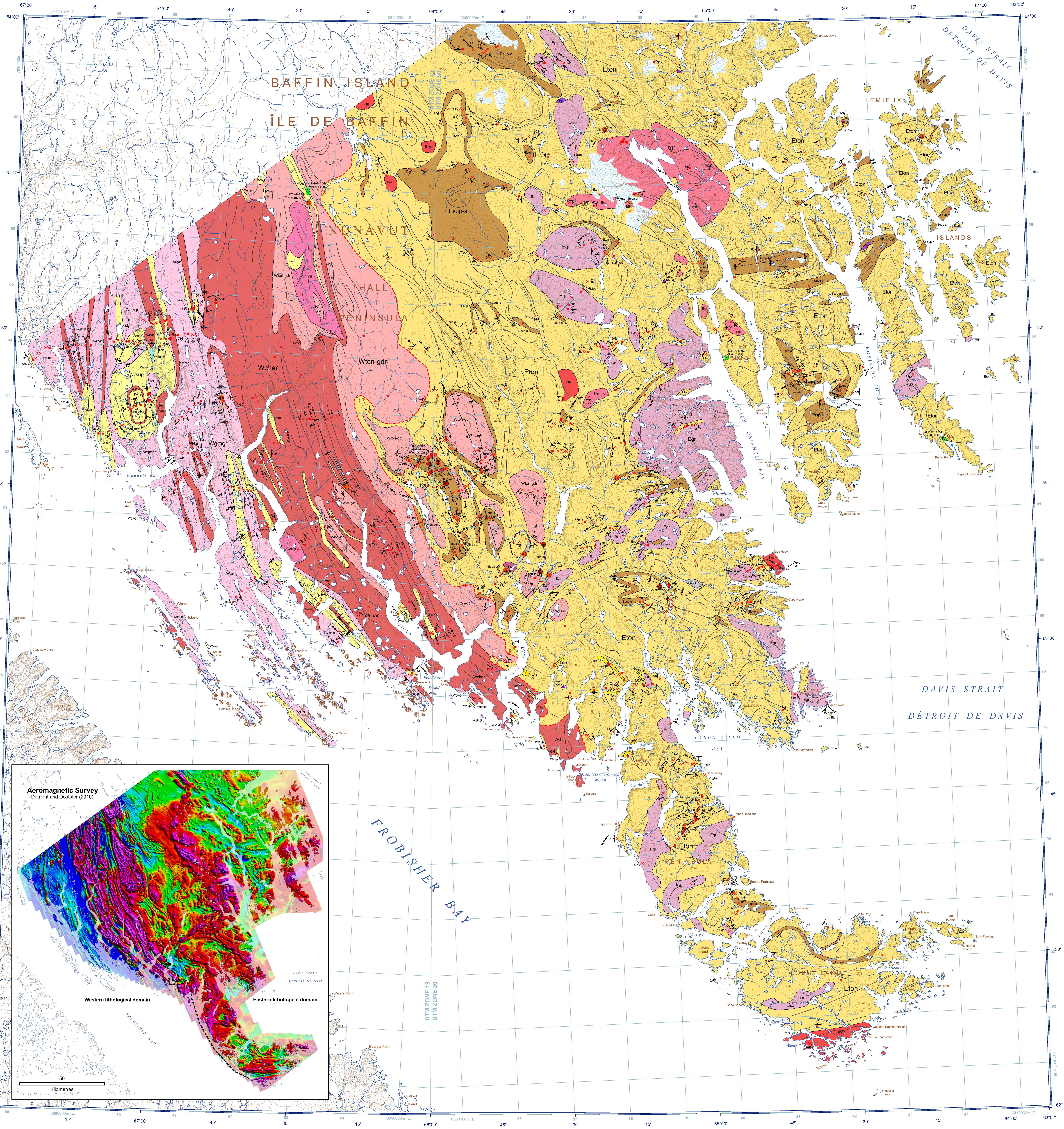
GEOLOGICAL SURVEY OF CANADA
CANADIAN GEOSCIENCE MAP 135
CANADA-NUNAVUT GEOSCIENCE OFFICE
OPEN FILE MAP 2013-1

GEOLOGY

SOUTHERN PART OF HALL PENINSULA

south Baffin Island, Nunavut

1:250 000



LEGEND

Permanent ice.

WESTERN LITHOLOGICAL DOMAIN

- **Wgmgr** — **Garnet monzogranite:** biotite-garnet white monzogranite containing up to 20% red-brown to lilac-coloured garnet weathering a patchy white-rusty pattern. The amount of garnet increases when unit contains enclaves of metasedimentary rocks. Locally the monzogranite contains graphite±sillimanite associated with lilac garnets.
- **Wchar** — **Charnockite:** hornblende-biotite charnockite with greasy green fresh surface and an orange-brown weathering surface, contains local mafic enclaves and/or garnet. The charnockite is generally very friable in outcrop. Forms alternating bands of white-rusty and brown rocks with the garnet bearing monzogranite (Wgmgr).
- **Wfmgr** — **Foliated monzogranite:** leucocratic, homogeneous, medium-grained monzogranite locally with a greasy-green colour. In some areas, foliation is weak and unit contains 1% garnet.
- **Wton-gdr** — **Tonalite±granodiorite:** felsic suite intrusive into both the eastern and western lithological domains. Granodiorite and tonalite components are fine to medium grained, foliated, weather brown and contain variable amounts of biotite, orthopyroxene and magnetite.

------------------------*intrusive contact*------------------------

SUPRACRUSTAL ROCKS

- **Wsup-if** — **Iron formation:** beds (5–10 m thick) of silicate and/or sulphide facies iron formation in garnet monzogranite. Associated with minor garnetite and grunerite layered rock.
- **Wsup-m** — **Marble:** white marble with phlogopite, diopside, spinel and/or humite.
- **Wsup** — **Semipelite± psammite±pelite:** alternating beds (less than 10 m thick) of biotite-garnet-sillimanite semipelite, psammite and pelite with light brown and/or rusty weathering. Locally with minor quartzite.

EASTERN LITHOLOGICAL DOMAIN

- **Esgr** — **Hematised syenogranite:** homogeneous, leucocratic, fine grained syenogranite with no foliation. Less than 10 percent biotite. Potassium feldspar is hematised.
- **Eum** — **Ultramafic rocks:** peridotite, metamorphosed to serpentinite, occurring both as xenoliths within the gneissic tonalite and as boudinaged sills within the supracrustal rocks. Ultramafic rocks are deep green on a fresh surface and weather brown.
- **Egab** — **Gabbro:** dark green to black sub-ophitic sills with orthopyroxene retrogressed to amphibole.
- **Egr** — **Magnetite granite:** magnetic granitic and locally dioritic suite containing enclaves of amphibole-biotite diorite, amphibolite or metasedimentarty rock. Granite is either massive or weakly foliated and strongly lineated. Locally it is porphyritic and contains up to 5% garnet.
- **Emgr** — **Monzogranite:** pink, fine-grained, foliated to gneissic biotite monzogranite with mafic xenoliths and syeogranite veins.
- **Ergr** — **Rapakivi granite:** porphyritic to megacrystic rapakivi pink biotite granite containing diorite and amphibolite enclaves. In some areas, unit is characterized by an augen gneiss texture.

SUPRACRUSTAL ROCKS

- **Esup** — **Psammite±semipelite:** psammite and semipelite, light brown and/or rusty weathering with up to 10% sillimanite and garnet porphyroblast.
- **Esup-if** — **Iron formation±semipelite±psammite±amphibolite:** thin beds (less than 10 m) of grunerite-rich BIF interbedded with semipelite, psammite and amphibolite.
- **Esup-a** — **Psammite±semipelite±pelite±amphibolite:** psammite, semipelite and pelite alternating with amphibolite and diorite sills and/or equivalent metamorphosed volcanic rocks. Light brown and/or rusty weathering with up to 10% sillimanite. Quartzite and calc-silicate (marl) are locally observed, but these are minor components of the eastern supracrustal sequences.

---------------*structural contact/unconformity?*---------------

ARCHEAN: ~2.92-2.84 Ma (Scott, 1999)

- **Eton** — **Gneissic tonalite:** migmatitic to gneissic grey tonalite with numerous partly resorbed amphibolite enclaves. Migmatitic tonalite is characterized by biotite schlieren, sillimanite-bearing leucosomes and garnetite-amphibolite restite. In some areas, the tonalite tends towards a more granodioritic composition.

Geological contact - defined
Geological contact - approximate
Geological contact - inferred
Domain boundary
Limit of mapping
Folds
- Unknown
- Antiform
- Synform
- Structural form line

Shear zone

Ground observation conducted for this project
Gossan
Geochronology
Mineral showing
Carvingstone

45 Bedding
45 Transposed bedding
45 Foliation
45 Gneissosity
Lineation
- 45 Mineral
- 45 Stretching

45 Fold hinge
45 Axial plane

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Canadian Geoscience Maps

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Geology by C. Bilodeau, M. Young, G. Machado, M. St-Onge, R. Tapkanie, N. Rayner, D. Skipton, R. From, C. MacKay, G. Creason and Z. Braden, 2012; D.J. Scott, 1996; R.G. Blackadar, 1965

Geological compilation by G. Machado, 2012

Cartography by C. Gilbert

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GEOLOGY

SOUTHERN PART OF HALL PENINSULA

south Baffin Island, Nunavut

1:250 000

5 0 5 10 15 20 km

Map projection Universal Transverse Mercator, zones 19 and 20
North America Datum 1983

Base map at the scale of 1:250 000 from Natural Resources Canada, with modifications.
Elevations in feet above mean sea level

Mean magnetic declination 2013, 29˚21'W, decreasing 24.0' annually. Readings vary from 28˚03'W in the SW corner to 30˚26'W in the NE corner of the map.

The Geological Survey of Canada and the Canada-Nunavut Geoscience Office welcomes corrections or additional information from users.

This publication is available for free download through GEOSCAN (http://geoscan.ess.nrcan.gc.ca) and the Canada-Nunavut Geoscience Office (http://cngo.ca).

This map is not to be used for navigational purposes.

Preliminary publications in this series have not been scientifically edited.

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CANADA-NUNAVUT GEOSCIENCE OFFICE
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GEOLOGY
SOUTHERN PART OF HALL PENINSULA
south Baffin Island, Nunavut