DESCRIPTIVE NOTES

The Touak Fiord map sheet, east-central Cumberland Peninsula, Baffin Island, exposes Archean plutonic basement and a metasedimentary-dominated cover sequence, designated the Hoare Bay group (Jackson 1971). Plutonic basement comprises biotite tonalite (unit Atn) and tonalitic orthogneiss (unit Atg) cut by foliated biotite±orthopyroxene±garnet monzogranite (charnockite) and granodiorite. Orthogneiss consists of well-layered tonalite-trondjemite-diorite, typically containing enclaves of gabbro/amphibolite and cut by foliated monzogranite veins. Although not currently dated in this map sheet, tonalitic and orthogneissic basement rocks are elsewhere dated on southern Cumberland Peninsula at ca. 2.99 Ga and ca. 2.79 Ga (N. Rayner, pers comm. 2010). Narrow screens of semipelitic rock in the southern part of the map sheet are established as Archean on the basis of contact relationships with tonalite and independent isotopic data. For instance, a metasedimentary enclave south of Nallussiaq Fiord records metamorphism (U-Pb monazite) at ca. 2.78 and ca. 2.7 Ga. Foliated granodiorite (unit Agd) and charnockite (unit Amz) exposed in the Exaluin Fiord area yield crystallization ages of ca. 2.7 Ga (N. Rayner, pers. comm 2010), consistent with both phases containing rafts of tonalitic orthogneiss.

A profound west-southwest-striking tectonic contact between Archean basement, to the south, and the Paleoproterozoic Hoare Bay group, to the north, transects this map sheet. Along the basement-cover contact, thin units of tectonized marble ±calcsilicate (unit Pc$_H$) and quartzite (unit Pqz$_H$) in contact with mylonitic orthogneiss are exposed. Less-strained psammite (unit Pps$_H$) and semipelite (unit Psp$_H$) are dominant further to the north. The highly strained nature of the basement-cover contact obscures insight into whether it originated as a depositional contact. Narrow strands of fragmental mafic and ultramafic volcanic rocks (unit Puv$_H$) comprise part of the cover sequence, most typically associated with laminated chert (Ct), oxide facies ironstone (O$_f$) and/or orthoquartzite. Spatially associated ultramafic (unit Pum) and gabbroic (unit Pgb) sills may be genetically related to the metavolcanic rocks. Mylonitic plutonic rocks along the contact include ca. 1.88 Ga tonalite (unit Ptn) and ca. 1.87 Ga aplite (unit Pgd) suggesting Paleoproterozoic intrusions lubricated faults that juxtaposed the basement and cover rocks.

As established elsewhere across southern Cumberland Peninsula (Sanborn-Barrie et al. 2011a, b) fabrics and structures throughout the basement complex provide evidence of two regionally developed penetrative deformation events, the youngest of which is penetratively recorded by fabrics and structures in the cover sequence.

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Dyke, A.S., in press b, Surficial geology, Pangnirtung south, Baffin Island, Nunavut; Geological Survey of Canada, Canadian Geoscience Map 19, (preliminary version), 1:100 000. doi:10.4095/288964

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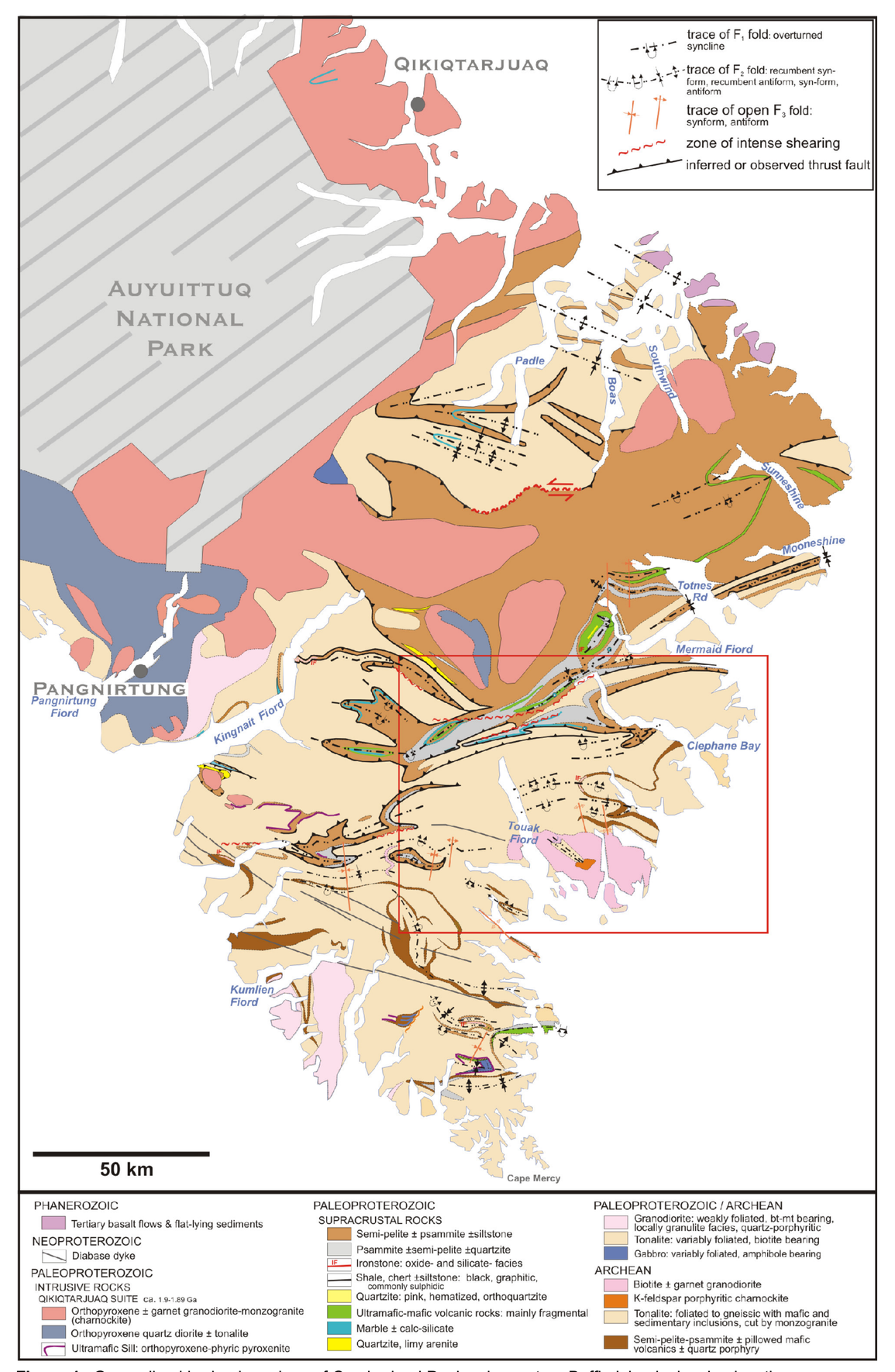


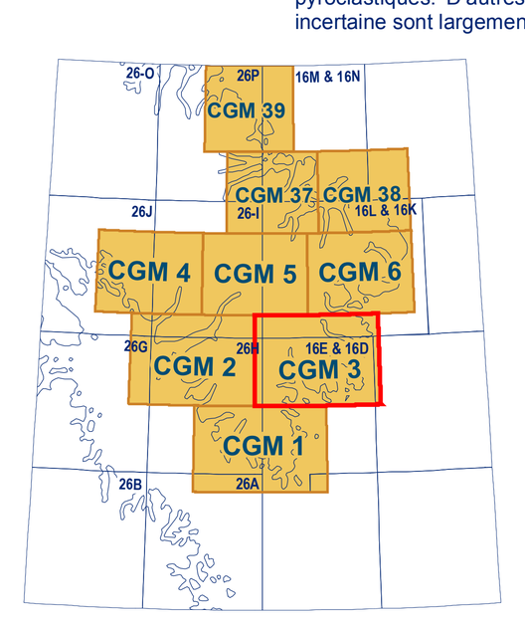
Figure 1. Generalized bedrock geology of Cumberland Peninsula, eastern Baffin Island, showing location of the Touak Fiord map sheet (CGM 3) outlined in red.

Abstract

Cumberland Peninsula, eastern Baffin Island, is an under-explored, frontier region with significant diamond, base- and precious-metal potential. Plutonic rocks of tonalitic to quartz dioritic composition across southern Cumberland Peninsula form the structural basement to supracrustal rocks that dominate its northern part. Tonalitic rocks are variably foliated to gneissic with preliminary Archean ages of ca. 2.9–2.77 Ga. Supracrustal rocks occurring as isolated strands in the south are inferred to be of Archean age. Extensive metasedimentary cover rocks of the Hoare Bay group in the north include silicate- and oxide-facies iron-formation, chert, graphitic-pyritiferous shale, minor quartzite, and marble, with widespread psammite-semipelite turbidite. At several localities, mafic to ultramafic volcanic rocks preserve primary textures supporting both flow and pyroclastic origin. Additional mafic panels of uncertain origin are widespread.

Résumé

La péninsule Cumberland, située dans l'est de l'île de Baffin, est une région pionnière peu explorée offrant un important potentiel en diamants ainsi qu'en métaux communs et précieux. Des roches plutoniques, de composition allant de la tonalite à la diorite quartzique, forment dans le sud de la péninsule le socle structural des roches supracrustales qui dominent dans sa partie nord. La texture des roches tonalitiques varie de foliée à gneissique; selon des datations préliminaires, ces roches dateraient de l'Archéen, vers 2,77 Ga. Des roches supracrustales, sous forme de segments isolés dans le sud, dateraient également de l'Archéen. Dans le nord, une couverture étendue de roches métasédimentaires du groupe de Hoare Bay comprend une formation de fer à faciès silicaté et oxydé, du chert, du shale graphitique pyriteux, un peu de quartzite, et du marbre, avec une présence répandue de turbidites de psammite-semipélite. À plusieurs endroits, des roches volcaniques mafiques à ultramafiques conservent des textures primaires indiquant des origines de coulée et des origines pyroclastiques. D'autres fragments mafiques d'origine incertaine sont largement répandus.



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

Cover illustration:
Aerial view to north of rust-weathering Hoare Bay strata cut by black ultramafic sill exposed 15 km north of head of Touak Fiord, Cumberland Peninsula, Nunavut. Photograph by M. Sanborn-Barrie. 2011-033

Printed map:
Catalogue No. M183-1/3-1-2011E
ISBN 978-0-660-20117-7
Digital map:
Catalogue No. M183-1/3-1-2011E-PDF
ISBN 978-1-100-19353-3

doi:10.4095/289239

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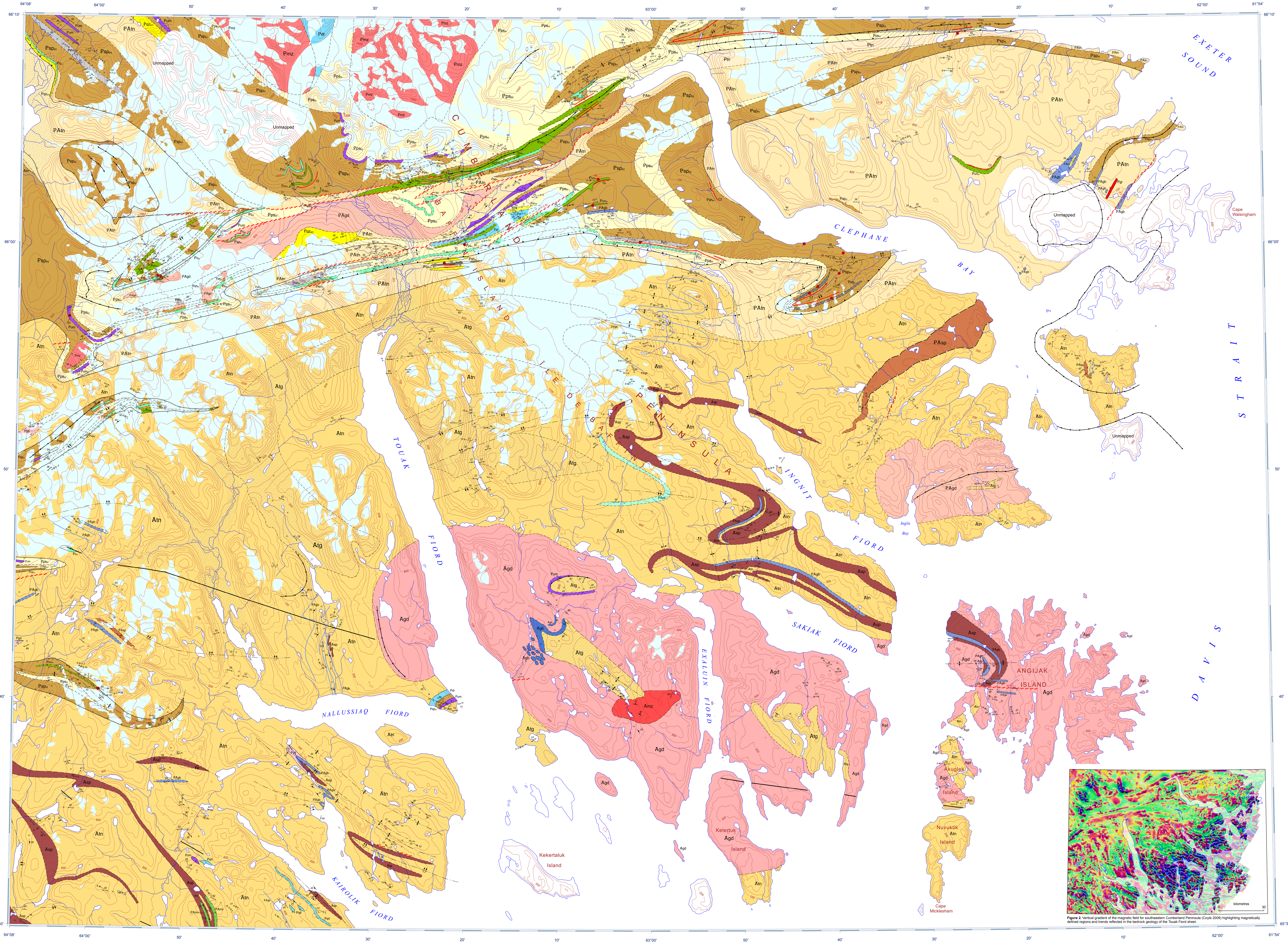
2nd EDITION

CANADIAN GEOSCIENCE MAP 3

GEOLOGY
TOUAK FIORD
Nunavut
1:100 000



LEGEND

This legend is common to CGM 1, CGM 2, and CGM 3.
Coloured legend blocks indicate map units that appear on this map.
Not all symbols shown in this legend appear on this map.

QUATERNARY
PLEISTOCENE–RECENT

Unconsolidated deposits: mainly glacial till and fluvial deposits, *see* Dyke (in press a, b, c) for detailed surficial geology.

NEOPROTEROZOIC

Diabase dyke: WNW-trending, medium brown weathering, equigranular, magnetite-bearing mafic dykes; typically 1–3 m wide, up to 6 m wide.

PALEOPROTEROZOIC

POST-TECTONIC PLUTONIC ROCKS

Pgr — **Granite±syenogranite**: unstrained to weakly foliated, coarse-grained to pegmatitic, typically white-weathering peraluminous muscovite-biotite-garnet±tourmaline pegmatite; less commonly pink weathering syenogranite with 1–5% biotite as coarse books, locally up to 10% muscovite±garnet±tourmaline; both rock types are rarely represented as a map-scale unit but are denoted by map code, where prevalent in outcrop.

SYN- to LATE-TECTONIC PLUTONIC ROCKS

Pgd$_{S-type}$ — **Peraluminous granodiorite**: Beige-weathering, leucratic, weakly foliated biotite-muscovite±garnet granodiorite occurring as 1–2 m thick sills characteristically concordant to the dominant shallow-dipping tectonic fabric in basement plutonic rocks and cover rocks of the Hoare Bay group. Dated at 1836 ± 2 Ma at Canyon Wash locality M107.

Pqd — **Hornblende quartz diorite±diorite**: post-D, pre-D, medium-grained, foliated hornblende-bearing diorite – quartz diorite, characterized by abundant more mafic, hornblende-bearing inclusions of more mafic composition, possibly of related (cognate) origin.

PRE- to SYN-TECTONIC PLUTONIC ROCKS

Ptn — **Tonalite**: light grey to white weathering, variably foliated homogeneous biotite tonalite±trondjemite±granodiorite; locally containing xenoliths of marble (Pc$_H$) and semipelite (Psp$_H$).

QIKIQTARJUAQ PLUTONIC SUITE

Pgd — **Granodiorite**: weakly foliated, light grey to beige-weathering, medium-grained, equigranular biotite-magnetite-garnet±orthopyroxene granodiorite; 3% burgundy garnet typically as aggregates; may be quartz porphyritic, up to 1 cm; patchy granulite-facies assemblages and colouring.

Pmz — **Charnockite**: weakly to strongly foliated, coarse-grained, biotite-orthopyroxene monzogranite±granodiorite (charnockite±enderbite) with distinctive greasy brown fresh surface indicative of attainment of granulite facies, commonly containing elliptical, 1 cm long quartz eyes; orthopyroxene partially retrograded to biotite and sepentine (bastite); locally containing 10–15% K-feldspar phenocrysts, up to 10 cm (e.g. NW of Pangnirtung Fiord); cuts opx-porphyritic ultramafic sills at M79 & M98 and is commonly cut by monzogranite pegmatite veins.

Pdr — **Quartz-diorite – tonalite**: Variably foliated, olive-brown weathering, equigranular, medium-grained, orthopyroxene±biotite-bearing quartz diorite – tonalite, well-exposed, prevalent unit on the peninsula between Pangnirtung and Kingnait fiords.

Pum — **Ultramafic sills**: concordant sills of ultramafic composition are represented by three main types: 1) most prevalent is dark green- to brown-weathering clinopyroxene-orthopyroxene-magnetite±actinolite pyroxenite occurring as 50–100 m thick sills intrusive into supracrustal rocks and tonalitic gneiss, and cut by K-feldspar porphyritic charnockite of the Cumberland Batholith; pyroxenite displays diagnostic weathered surface due to 15–20% brown-weathering pits, 5–8 mm, thought to represent altered and preferentially weathered orthopyroxene; 2) black-weathering, fine-grained, equigranular, non-magnetic, ilmenite-bearing ultramafic sills, average 3–5 m thick, forming resistant layers exposed as discontinuous black rubble in till-covered region SE of Kingnait Fiord; 3) minor <2 m wide, bright green-weathering clinopyroxenite with pale green to white pegmatitic plagioclase-rich interiors are denoted by a purple line labeled Pum. Potential carving stone locality designated with cs.

SUPRACRUSTAL ROCKS

HOARE BAY GROUP

Psp$_H$ — **Semipelite±psammite±siltstone**: light brown-, grey- and/or rusty-weathering layered semi-pelite±pelite commonly containing 15–40% biotite, 1–2 mm, 1–5% garnet as 2–4 mm porphyroblasts, rarely up to 2 cm and up to 10% sillimanite as fibrous, felty crystals or as white-weathering nodules (faserkeisel); brick red weathering units contain up to 15% graphite; rarely muscovite-bearing; typically occurring as 2–4 m thick panels, but may be up to 12 m thick; interlayered with psammite, rarely quartzite; lenticular to elongate calc-silicate concretions denoted by pale green oval symbol.

Pps$_H$ — **Psammite±semipelite**: grey, white, creamy-beige weathering psammite as cm- to m-scale layers, up to 5 m thick, generally with semipelite, rarely with calc-silicate; contains 5–15% biotite 0.5–1 mm, <5% garnet, rarely andalusite±staurolite; lenticular to elongate calc-silicate concretions denoted by pale green oval symbol.

O$_f$ / S$_f$ — **Iron-formation**: oxide- (O$_f$) and/or silicate-facies (S$_f$) : typically thin (<1 m) and lenticular interbeds of silicate-facies iron-formation in the western map area and thicker (up to 5–10 m), predominantly oxide-facies, in the eastern and northeastern map areas.

Psh$_H$ — **Shale±siltstone**: grey to black weathering shale±siltstone±pelite; black shale is generally 1–3 m wide with abundant graphite and sulphides, commonly gossanous or marked by white chalky sulphur coating on weathered surface; locally bedding and cleavage coated by pyrite; grey shale is 1–100 m wide, fissile to flaggy, is locally associated with dolomitic marble and calc silicate and locally appears to transition up section into black shale. Shale horizons < 1 m wide are denoted by a grey line labeled Psh$_H$.

Ct — **Chert**: massive to laminated chert, typically 1–3 m wide, locally up to 5 m wide; generally deep purple- to rusty-weathering (gossanous) but locally pale grey- and white-weathering and thinly to thickly laminated (i.e. near Exeter Sound); observed to occur structurally above and below metavolcanic rocks (Puv$_H$).

Pqz$_{H2}$ — **Pink orthoquartzite**: vitreous, hematized, pink-weathering, fine- to medium-sand size orthoquartzite; 1–2 m thick, spatially associated with Puv$_H$; may have associated minor intercalated, chalky grey-weathering psammite and/or chert.

Puv$_H$ — **Ultramafic-Mafic volcanic rocks**: komatiitic, basaltic-komatiitic to basaltic volcanic rocks, variably textured including fragmental, pillowed and massive flows; typically bright green weathering, characteristic of high-Mg composition; locally dark green-black, Fe-tholeiite as pillowed flows with light buff-weathering elliptical varioles (Totnes Road) or as massive, aphanitic slightly plagioclase-phyric flows immediately west of Mermaid Fiord; minor interbedded, cream-weathering psammite to quartzite occurs as 1 m wide beds (i.e. Ilikok Island); this unit is thickest in the east and northeast, and thinnest or absent in the western map area.

Pc$_H$ — **Marble – Calc silicate**: pale brown- to light-grey weathering marble, typically composed of calcite, olivine-clinohumite assemblages; average 1–3 m thick; lesser associated pale-green to white calc-silicate generally as thin (<20 cm) interbeds and nodules/concretions/boudins, contains up to 25% diopside, up to 25% amphibole±tremolite±grossular; locally with psammite and semipelite interbeds; marble±calc silicate <2 m wide denoted by turquoise line labelled Pc$_H$.

Par$_H$ — **Limy arenite**: immature quartz-rich clastic rocks characterized by 5–15% pale green diopside±tremolite, an indication of metamorphosed limy component, also commonly containing <3% muscovite and graphite; occurs as cm- to m-thick layers, associated with quartzite.

Pqz$_{H1}$ — **Orthoquartzite**: pale grey, blue-grey to white-weathering, equigranular, fine- to medium-sand size orthoquartzite; typically massive and thickly bedded, with no recognizable primary structures; across the map area, this unit averages 5–20 m and thickens to 400 m at the "type" Kingnait exposure on the southeast shore of Kingnait Fiord; may contain up to 2% pale pink garnet and <5% biotite; locally interbedded with psammite and semipelite.

PALEOPROTEROZOIC / ARCHEAN (undetermined age)

PRE- to SYN-TECTONIC PLUTONIC ROCKS

PAgd — **Granodiorite**: light grey weathered, medium-grained biotite±orthopyroxene±garnet granodiorite to monzogranite; variably foliated to mylonitic, locally K-feldspar porphyritic or porphyroclastic; commonly cut by monzogranite±charnockitic veins.

PAtn — **Tonalite**: light grey to white weathering, weakly to moderately foliated homogeneous biotite tonalite.

PAgb — **Gabbro**: black, dark grey to brown weathering, fine- to medium-grained, variably foliated non-magnetic gabbro typically with colour index between 60 and 85 occurring as 1–5 m wide layers, up to 20 m wide; mafics consist dominantly of hornblende (40–60%), biotite (up to 20%), locally clinopyroxene (5–10%), and 1–2% visible titanite; locally medium grey-green weathering gabbro contains both orthopyroxene (opx) and clinopyroxene (cpx); rarely light grey weathering leucogabbro to gabbroic anorthosite (i.e. mafic complex east of Ujuktuk Fiord); continuous mafic layers <2 m wide are denoted by a blue line labeled PAgb.

PAdr — **Diorite - Quartz diorite**: medium green-grey (diorite) to light grey (quartz diorite), weak to moderately foliated, diorite has colour index of 45–60 with either hornblende or biotite as dominant mafic mineral and minor clinopyroxene; quartz diorite has colour index of 30–40 and typically hornblende > biotite with 5–20% quartz, non-magnetic.

SUPRACRUSTAL ROCKS

PAps — **Psammite**: light grey to rusty weathering psammite±quartzite±chert of undetermined age, may have 10% pale green diopside.

PAsp — **Semipelite**: occurs as panels, layers and inclusions, average 20–50 m wide, within foliated plutonic rocks; typically brown-weathering, biotite-garnet±sillimanite±graphite semipelite.

PAmv — **Mafic volcanic - Amphibolite**: black to dark green weathering, fine- to very fine-grained amphibolite with 50–70% hornblende and locally up to 5% garnet; occurs as layers up to 10 m thick; suspected to be extrusive in origin, but lacking diagnostic primary features.

ARCHEAN

PRE- to SYN-TECTONIC PLUTONIC ROCKS

Agd — **Granodiorite**: light grey weathered, medium-grained orthopyroxene± garnet granodiorite to monzogranite; typically weakly foliated and equigranular, locally K-feldspar porphyritic; commonly cut by monzogranite±charnockitic veins (Amz); yields a preliminary age of ca. 2.7 Ga west of Exaluin Fiord.

Amz — **Orthopyroxene monzogranite**: K-feldspar porphyritic, orthopyroxene-monzogranite; moderately foliated; occurring as xenoliths in Agd; yields a preliminary age of ca. 2.75 Ga on Exaluin Fiord.

Atn — **Tonalite**: variably foliated, fine- to medium-grained biotite tonalite±granodiorite, typically cut by mm- to cm-wide veins of medium- to coarse-grained quartz diorite, monzogranite and trondjemite and typically containing xenoliths of diorite and quartz diorite; locally of homogeneous tonalite composition; yields preliminary ages of ca. 2.77 Ga at the head of Kumlien Fiord (CGM 1) and ca. 2.97 Ga northeast of Fishing Fiord (CGM 2).

Atg — **Tonalite gneiss**: compositionally layered orthogneiss dominated by tonalitic phase interlayered with dioritic, gabbroic and biotitic layers.

Agb — **Gabbro**: black, dark grey to brown weathering, fine- to medium-grained, variably foliated gabbro, typically with colour index of 60 to 85 and mafics dominantly as hornblende (40–60%), biotite (up to 20%), with locally clinopyroxene (5–8%) and minor titanite; occurring as layers, enclaves and xenoliths in plutonic rocks either known, or presumed, to be of Archean age.

SUPRACRUSTAL ROCKS

Asp — **Semipelite**: occurs as panels, layers and inclusions, average 20–50 m wide, within foliated to gneissic tonalite; typically brown-weathering, biotite-garnet±sillimanite±graphite semipelite, may be interlayered with garnet-rich (>80%) "garnetite" layers, 20–40 cm wide, amphibolite 1–4 m wide, and/or grey chert; 'gp' denotes graphite-rich unit.

Amv — **Mafic volcanic rocks**: dark green weathering, pillowed flow with brown-weathering vesicules and sparse 1 cm plagioclase phenocrysts; overlain by limy arenite and cut by quartz porphyry dated at ca. 2.91 Ga; restricted exposure in CGM 1 northeast of the head of Aktijartukan Fiord; may also include amphibolite associated with Asp.

Lithological contact
- observed
- approximate
- inferred

Limit of mapping

Structural form line
- S$_1$, may have representative dip
- S$_2$, may have representative dip and plunge
- S$_3$, may have representative dip

Faults
- thrust, teeth on upthrown side
- inferred thrust, teeth on inferred upthrown side

Ductile shear zone, sense of shear unknown

Linear aeromagnetic anomaly
- positive
- negative

Axial trace of first generation (F$_1$) synform
- upright
- overturned, north-dipping limbs

Axial trace of second generation (F$_2$) antiform, synform
- upright
- overturned, north-dipping limbs

Axial trace of third generation (F$_3$) antiform, synform

Bedrock outcrop examined for this study

Gossans

Mineral showings*

Bedding
- inclined: facing known, facing unknown
- overturned, facing known (NW)
- igneous layering, inclined, tops unknown
- S$_0$+S$_1$, transposed

Cleavage
- inclined, first generation
- inclined, second generation

Schistosity
- schistosity, first generation: inclined, vertical
- schistosity, second generation: inclined, vertical
- schistosity, third generation: inclined, vertical

Gneissosity
- gneissosity, first generation: inclined, vertical
- gneissosity, second generation: inclined

Ductile shear zone
- shear zone with dip

Mineral lineation
- intersection lineation, S$_0$-S$_1$
- intersection lineation, S$_1$-S$_2$
- mineral, stretching, first generation
- mineral, stretching, second generation
- mineral, stretching, third generation

Extension (direction and plunge indicated)

Folds**
- S fold, first generation; showing dip of axial plane and plunge of fold axis
- S fold, second generation; showing dip of axial plane and plunge of fold axis
- S fold, third generation; showing dip of axial plane and plunge of fold axis
- U fold, first generation; showing dip of axial plane and plunge of fold axis
- U fold, second generation; showing dip of axial plane and plunge of fold axis
- U fold, third generation; showing dip of axial plane and plunge of fold axis
- U fold, unknown generation; showing dip of axial plane and plunge of fold axis
- Z fold, first generation; showing dip of axial plane and plunge of fold axis
- Z fold, second generation; showing dip of axial plane and plunge of fold axis
- Z fold, unknown generation; showing dip of axial plane and plunge of fold axis

** Fold axis may occur without axial plane.

Fault
- inclined, normal
- vertical, normal

Dyke, vein
- dyke
- dyke, sill
- vein: inclined, vertical

Ice movement
- direction known
- direction unknown

*Sources of Information for Mineral Showings

NWT assessment reports http://www.nwtgeoscience.ca/normin/ (originally published by Indian and Northern Affairs Canada)

NU assessment reports http://nunavutgeoscience.ca/numin_e.html (originally published by Indian and Northern Affairs Canada)

Geological Survey of Canada's Canadian and world mineral deposit databases, http://gdr.nrcan.gc.ca/minres/ or http://apps1.gdr.nrcan.gc.ca/gsc_minerals/index.phtml?language=en-CA

Figure 2. Vertical gradient of the magnetic field for southeastern Cumberland Peninsula (Coyle 2009) highlighting magnetically defined regions and trends reflected in the bedrock geology of the Touak Fiord sheet.

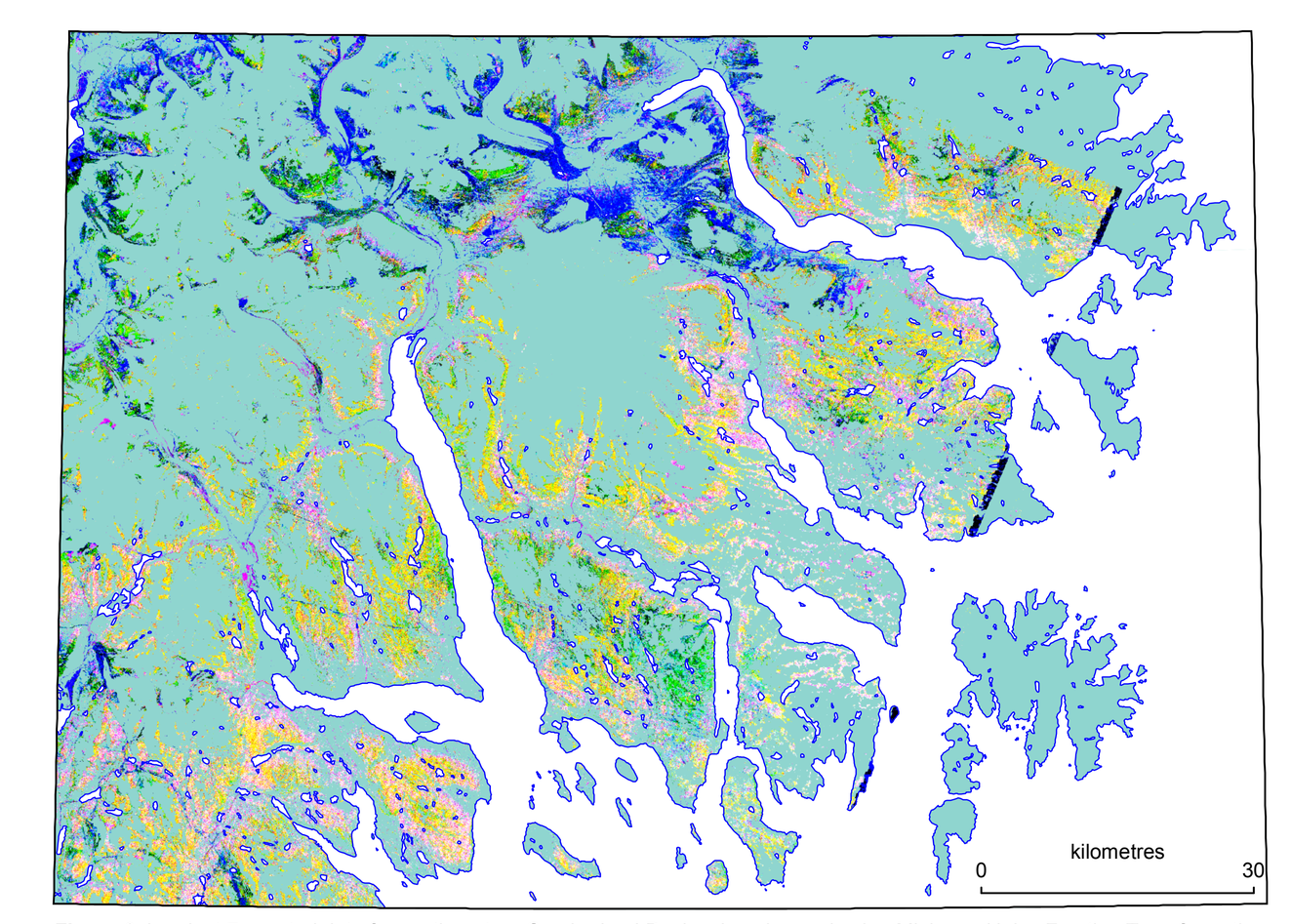


Figure 3. Landsat 7 spectral data for southeastern Cumberland Peninsula enhanced using Minimum Noise Fraction Transformation to highlight weathering surfaces of iron oxide and alteration clays. This image shows strong correlation between dark blueish-green tones and the Paleoproterozoic cover rocks of the Hoare Bay group. Little indication in the data of the screens of supracrustals presumed to be Archean (Asp) with the exception of that in the far lower left corner of the sheet. The considerable extent of ice and vegetation cover is illustrated by flat blueish grey tones. The spectral data was used in combination with high resolution aeromagnetic data, aerial and ground observations to maximize interpretation of map units. Eastern extent of spectral data denoted by heavy black diagonal line.

Recommended citation:
Sanborn-Barrie, M., Young, M., Whalen, J., James, D., and St-Onge, M.R., 2011. Geology, Touak Fiord, Nunavut; Geological Survey of Canada, Canadian Geoscience Map 3 (2nd edition, preliminary), scale 1:100 000. doi:10.4095/289239

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Geological compilation and notes by M. Sanborn-Barrie, 2009–2011

Remote image analysis by T. Lynds, 2008–2010

Cartography by P. O'Regan, B. Hillary, and O. Brown

Initiative of the Geological Survey of Canada, conducted under the auspices of Multiple Metals - Cumberland Peninsula (Nunavut) as part of Natural Resources Canada's Geomapping for Energy and Minerals (GEM) program.

Logistical support provided by the Polar Continental Shelf Project as part of its mandate to promote scientific research in the Canadian North. PCSP 002-09 and 014-10.

GEOLOGY
TOUAK FIORD
Nunavut
1:100 000

2 0 2 4 6 8 km

Map projection Universal Transverse Mercator, zone 20.
North American 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 2011, 33°16'W, decreasing 28.5' annually. Readings vary from 32°59'W in the SE corner to 33°53'W in the NW corner of the map.

CANADIAN GEOSCIENCE MAP 3
GEOLOGY
TOUAK FIORD
Nunavut