DESCRIPTIVE NOTES

The Touak Fiord map sheet, east-central Cumberland Peninsula, Baffin Island, exposes Archean plutonic, gneissic and metasedimentary basement rocks and Paleoproterozoic cover rocks of the Piling 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 (unit Agd) and by foliated to locally gneissic biotite monzogranite (unit Agg). Minor mafic dykes (unit Ad) are 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 xenolithic rock in the southern part of the map sheet are established as Archean on the basis of contact relationships with Agd and charnockite (unit Amc) exposed in the Exalulin Fiord area (see below). South of Nallussiaq Fiord records metamorphism (Lu-Hf) monazite) at ca. 2.76 and ca. 2.7 Ga. Foliated granodiorite (unit Agd) and charnockite (unit Amc) exposed in the Exalulin Fiord area yield crystallization ages of ca. 2.72 Ga (N. Rayner, pers. comm 2010), consistent with both phases containing rafts of tonalitic gneiss.

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 lectonized marble (unit Pc_{ls}) and quartzite (unit Pqz_{ls}) in contact with basement rocks are commonly overlain by mylonitic mafic rocks (unit Pmy) derived from Agd, the 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 Pv_{ma}) comprise part of the cover sequence, most typically associated with laminated chert (Cl), oxide facies ironstone (Cj) and/or orthoquartzite. Spatially associated ultramafic (unit Pum) and mafic (unit Pgb) sills are also commonly associated with the basement-cover contact. Other rocks along the contact include ca. 1.88 Ga tonalite (unit Pto) and ca. 1.87 Ga sölite (unit Pgd) suggesting Paleoproterozoic intrusions lubricated faults that juxtaposed the basement and cover rocks.

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

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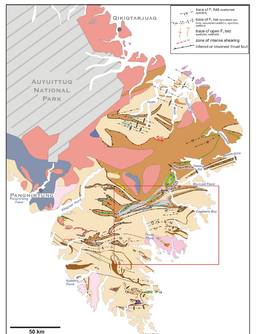


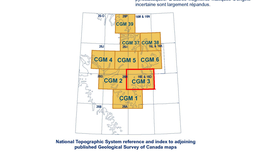
Figure 1. Generalized bedrock geology of Cumberland Peninsula, eastern Baffin Island, showing location of the Touak Fiord map sheet (CGM 3) outlined in red.

Abstract

Cumberland Peninsula, eastern Baffin Island, is an underexplored, frontier region with significant diamond, base- and precious-metal potential. Plutonic, gneissic and metasedimentary basement rocks underlie southern Cumberland Peninsula form the structural basement to supracrustal rocks that dominate its northern part. The latter are cover rocks of the Hoare Bay group 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 (Piling Group of Jackson 1971) include the Ujukta Fiord formation, chert, graphite-pyrrhotinue shale, minor quartzite, and marble, with widespread psammite-semipelite turbidite. At several localities, mafic to ultramafic volcanic rocks preserve primary textures and structures. Mafic sills and dykes and 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 dalite quartzique, formant dans le sud de la péninsule le socle structural des roches supracrustales qui dominent la partie nord. La toute première roches tonalitiques sont de faible 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, sont présumées remonter à l'Archéen. Dans le nord, une couverture étendue de roches métasédimentaires du groupe de Hoare Bay comprend une formation de lit à faciès silicaté et oxydé, de chert, de shale graphitique pyriteux, un peu de quartzite et de marbre, avec prédominance générale de turbidites de psammite-semipélite. A plusieurs endroits, des roches volcaniques mafiques à ultramafiques préservent 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

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2nd EDITION

CANADIAN GEOSCIENCE MAP 3

GEOLOGY

TOUAK FIORD

Nunavut

1:100 000

Preliminary

Canadian Geoscience Maps
Cartes géoscientifiques du Canada

Canada

ess.nrcan.gc.ca

Four trim marks around perimeter of map sheet. Trim map sheet first, then fold at folding marks.

Cover is 17cm wide when folded.

Authors: M. Sanborn-Barrie, M. Young, J. Whalen, D. James, and M.R. St-Onge

Geology by M. Sanborn-Barrie, M. Young, B. Hamilton, C. Nagy, R. Kevin, M. Pointing, R. Talapatra-Brehm, J. Whalen, L. Sheldon, M.R. St-Onge, K. Rubingh and J. Day, Geological Survey of Canada; D. James, Canada-Nunavut Geoscience Office, 2009

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

Remote image analysis by T. Lynds, 2006–2010

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

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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°59'W in the NW corner of the map.

The Geological Survey of Canada welcomes corrections or additional data for this publication. This map conforms to the ISO 9001:2008 standard used by the Scientific and Technical Publishing Services Quality Management System.

This publication, including digital data, can be downloaded free of charge from GeoPub (http://geopub.nrcan.gc.ca/). It is also available from the Geological Survey of Canada Bookstore (http://gsc.nrcan.gc.ca/bookstore).

This map is not to be used for navigational purposes.

Preliminary

CANADIAN GEOSCIENCE MAP 3

GEOLOGY

TOUAK FIORD

Nunavut

1:100 000

2 0 2 4 6 8 km

Preliminary

LEGEND

This legend is common to CGM 1, CGM 2, and CGM 3.
Coloured legend blocks not in this area do not 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

Granite/pegmatite: unstrained to weakly foliated, coarse-grained to pegmatitic, pink to white weathering, equigranular to porphyritic granite to granodiorite, pegmatitic less commonly pink weathering syenogranite with 1–3% 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

Porphyritic monzogranite: Beige-weathering, leucratic, weakly foliated biotite-muscovite±garnet granodiorite occurring as 1–2 m thick sills characteristically associated with the basement shallow-dipping tectonic fabric in basement plutonic rocks and cover rocks of the Hoare Bay group. Dated at 1838 ± 2 Ma at Canyon Weak locality M107.

Hornblende quartz diorite/dacite: post-D, pre-D; medium-grained, foliated hornblende-bearing diorite – quartz diorite, characterized by abundant mere mafic, hornblende-bearing inclusions of more mafic composition, possibly of related (cogenetic) origin.

PRE- to SYN-TECTONIC PLUTONIC ROCKS

Tonalite: light grey to white weathering, variably foliated homogeneous biotite tonalite±orthopyroxene±granodiorite, locally containing xenoliths of marble (Pc_{ls}) and semipelite (Pa_{ss}).

QIKIQTARJUAQ PLUTONIC SUITE

Granodiorite: weakly foliated, light grey to beige-weathering, medium-grained, equigranular biotite-magnetite-garnet±orthopyroxene granodiorite; 2% burgundy garnet typically as aggregates; may be quartz porphyritic; up to 1 cm; patchy granular-fluctuies assemblages and colouring.

Charnockite: weakly to strongly foliated, coarse-grained, biotite-orthopyroxene monzogranite±granodiorite±tonalite±diorite) with distinctive greasy brown fresh surface indicative of attainment of granulite facies, commonly containing elliptical, 1 cm long quartz eyes, orthopyroxene partially retrogressed to biotite and sagenitite (basitic); locally containing 10–15% K-feldspar phenocrysts, up to 10 cm long (e.g., Kingnait Fiord), creating porphyritic charnockite; sills at M76 & M88 and is commonly cut by monzogranite pegmatite veins.

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

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±ilmenite 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- to medium-grained, massive hornblende gabbro±pyroxenite sills commonly 3–8 m thick, forming resistant ridges exposed as discontinuous black outcrops in the 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 curving stone locality designated with ca.

SUPRACRUSTAL ROCKS

HOARE BAY GROUP

Semipelite/psammite±sillimanite: light brown-, grey- and/or rusty-weathering layered semi-pelite±psamite 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 (fasetkraser); 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.

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.

Iron formation: oxide- (C_j) and/or silicate-facies (S_j); 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.

Shale±siltstone: grey to black weathering shale±siltstone±pelite; black shale is generally 1–3 m wide with abundant graphite and sulphides, commonly pyrrhotine 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_s.

Chert: massive to laminated chert, typically 1–3 m wide, locally up to 5 m wide; generally deep purple- to rusty-weathering (possenous) but locally pale grey- and white-weathering and thinly to thickly laminated (i.e. near Exeter Sound); observed to occur structurally above and below metamorphic rocks (Pv_{ma}).

Pink orthoquartzite: vitreous, hematized, pink-weathering, fine- to medium-sand size orthoquartzite; 1–2 m thick, spatially associated with Pv_{ma}; may have associated minor intercalated, chalky grey-weathering psammite and/or chert.

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 (Tsimeo Road) or as massive, aphanitic slightly plagioclase-phyric flows immediately west of Mermaid Fiord; minor interbedded, cream-weathering psammite to quartzite (e.g., Kingnait Fiord); up to 5 m thick, generally thin and discontinuous in the east and northeast, and thickest or absent in the western map area.

Marble – Calc silicate: pale brown- to light-grey weathering marble, typically composed of calcite, olivine-clinohumite assemblages; average 1–3 m thick; lesser associated psammite to semi-calc-silicate generally as thin (<20 cm) interbeds and nodules of clinohumite±chondrodite; contains up to 25% diopside; up to 25% phlogopite±clinohumite±spinel; rare, thin (<1 m) interbedded amphibolite; marble/calc-silicate <2 m wide denoted by turquoise line labelled Pc_{ls}.

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

Orthoquartzite: pale grey, blue-grey to white-weathering, equigranular, fine- to medium-sand size orthoquartzite; typically massive and thickly bedded, with no sedimentary structures visible; rarely as thin (<20 cm) interbeds up to 20 m and thickens to 400 m at the "igloo" Kingnait outcrop on the southeast; locally 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

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±charnockite veins.

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

Gabbro: black, dark grey to brown weathering, fine- to medium-grained, variably foliated non-magnetic gabbro typically with colour index between 40 and 85 occurring as 1–5 m wide layers, up to 20 m wide; mafica consist dominantly of hornblende (40–80%), biotite (up to 30%), locally clinopyroxene (5–10%), and 1–2% visible titanitic; 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 Ujukta Fiord); continuous mafic layers <2 m wide are denoted by a blue line labeled PAgb.

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

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

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

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

Granodiorite: light grey weathered, medium-grained orthopyroxene garnet granodiorite to monzogranite, typically weakly foliated and equigranular, locally K-feldspar porphyritic; commonly cut by monzogranite/charnockite veins; yields a preliminary age of ca. 2.79 Ga on Exalulin Fiord.

Orthopyroxene monzogranite: K-feldspar porphyritic, orthopyroxene-monzogranite; moderately foliated; occurring as xenoliths in Agd; yields a preliminary age of ca. 2.79 Ga on Exalulin Fiord.

Tonalite: variably foliated, fine- to medium-grained biotite tonalite±granodiorite, locally gneissic; commonly contains xenoliths of amphibolite and metasedimentary rock; monzogranite and trondhjemite and typically containing xenoliths of diorite and quartz diorite; locally of homogeneous tonalitic composition; yields preliminary ages of ca. 2.77 Ga at the head of Kumdlen Fiord (CGM 1) and ca. 2.91 Ga northeast of Fishing Fiord (CGM 2).

Tonalite gneiss: compositionally layered orthogneiss dominated by tonalitic phase interlayered with diorite, gabbroic and biotitic layers.

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 (40–80%), biotite (up to 30%), locally clinopyroxene (5–10%); and minor basaltic cocumb as layers, enclaves and xenoliths in plutonic rocks either known, or presumed, to be of Archean age.

SUPRACRUSTAL ROCKS

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 (>60%) "gametite" layers, 20–40 cm wide, amphibolite 1–4 m wide, and/or grey chert; 'gp' denotes graphite-bearing.

Mafic volcanic rocks: dark green weathering, pillowed flow with brown-weathering vesicular 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 Aeligarfiuan Fiord; may also include amphibolite associated with Asp.

Lithological contact
- observed
- approximate
- inferred

Limit of mapping

Structural form line
- S_m may have representative dip
- S_b may have representative dip and plunge
- S_p 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, L_1-S_1
- intersection lineation, L_2-S_2
- mineral, stretching, first generation
- mineral, stretching, second generation
- mineral, stretching, third generation

Extension (direction and plunge indicated)

Folds**
- S_1 fold, first generation; showing dip of axial plane and plunge of fold axis
- S_2 fold, second generation; showing dip of axial plane and plunge of fold axis
- S_3 fold, third generation; showing dip of axial plane and plunge of fold axis
- U_1 fold, first generation; showing dip of axial plane and plunge of fold axis
- U_2 fold, second generation; showing dip of axial plane and plunge of fold axis
- U_3 fold, third generation; showing dip of axial plane and plunge of fold axis
- U_x fold, unknown generation; showing dip of axial plane and plunge of fold axis
- Z_1 fold, first generation; showing dip of axial plane and plunge of fold axis
- Z_2 fold, second generation; showing dip of axial plane and plunge of fold axis
- Z_x 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/mmrs/) (originally published by Indian and Northern Affairs Canada)

NU assessment reports (http://nunavusgeoscience.ca/nsattic_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/mineo/) or (http://apps1.gdr.nrcan.gc.ca/gac_mineralindex/index.phtml?language=en-CA)

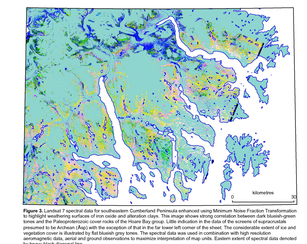

Figure 3. Landsat 7 spectral data for southeastern Cumberland Peninsula enhanced using Minimum Noise Fraction Transformation to highlight weathering surfaces of iron oxide and alteration clays. This image shows strong correlation between dark blueish-green tones and the Paleoproterozoic cover rocks of the Hoare Bay group. Little indication in the data of the screens of supracrustals preserved in the basement rocks. Subtle differences in the spectral data between different surficial deposits 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.

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2nd EDITION

Preliminary publications in this series have not been scientifically edited.

CANADIAN GEOSCIENCE MAP 3

GEOLOGY

TOUAK FIORD

Nunavut