DESCRIPTIVE NOTES

The Durban Harbour map sheet, on the remote northeastern tip of Cumberland Peninsula, Baffin Island, exposes four main lithological components that were surveyed by ground mapping, aerial observations and regional magnetic data. From oldest to youngest, these include an Archean plutonic-dominated complex, a clastic-dominated Paleoproterozoic metasedimentary sequence, a chamockitic intrusion, and Paleocene volcaniclastic rocks.

Variably foliated to gneissic tonalitic-granodioritic rocks (unit Atn, unit Atg) are exposed west and east of Boas Fiord and on most islands. These light grey weathered, biotite-bearing rocks commonly contain mafic plutonic layers and lenses and are typically cut by cm-scale granitic veins that are concordant to tectonic foliation. Although not dated in this map sheet, rocks similar in composition and texture from elsewhere on the peninsula yield ages of 2.99 Ga and 2.79 Ga (Rayner et al., 2012). Gabbro (unit PAgb) and diorite (unit PAdr) exhibit similar strain state and fabrics as the tonalitic rocks with which they are associated. In the northern part of the sheet, panels of metasedimentary rocks (unit PAsp), including a 20m thick oxide facies iron-formation (unit O), exhibit an apparent intrusive contact with tonalite and are suspected to be Archean.

Much of this map sheet exposes relatively homogeneous semipelite and psammite. Semipelite (unit Psp_{Pt}) is rusty-brown weathering with 15-25% biotite and up to 10% garnet. Psammite (unit Pps_{Pt}) is light grey weathering with 5-10% biotite, rare (<2%) garnet, and calcareous layers or concretions. These clastic rocks have a low magnetic expression (Figure 2) that extends southwest to Boas Fiord, where their association with thin (<10m thick) layers of marble and/or calc-silicate (unit Pc_{Pt}), potential mafic volcanics (unit Pum_{Pt}) and chert (unit Ct) is consistent with deposition as part of the Paleoproterozoic Hoare Bay group (Jackson 1971; Sanborn-Barrie et al., 2011b). Contacts between tonalite and the cover sequence are generally poorly exposed, but locally are tectonized and inferred to coincide with thrust faults. At supracrustal localities where diagnostic cover units are absent and where contact relationships with tonalite are not observed, the age of the clastic rocks is uncertain. For instance, southern Padloping Island exposes narrow strands of semipelite and possible mafic volcanic rocks that cannot confidently be assigned as Archean or Paleoproterozoic, since similar units form part of the Archean basement complex in the south (Sanborn-Barrie et al., 2011a).

Undeformed pelsaye rocks form a northeast-trending, ~15 km wide pluton that transects the map sheet. These rocks are characterized by a lack of tectonic foliation, weak magnetism, and monomagmatic composition (unit Pmz_1) with up to 15% orthopyroxene in various stages of retrogression to biotite. They display greasy green fresh surfaces, reflecting high-temperature modification of feldspar crystal structure, attributed to post-emplacement, high-grade metamorphism. This pluton yielded a U-Pb zircon age of ca. 1884 Ma (Rayner et al., 2012) establishing it as part of the Qikiqtarjuaq plutonic suite, that extends more than 300 km from Pangnirtung to Qikiqtarjuaq (Figure 1). The relatively low aeromagnetic response of this pluton, atypical of the main plutonic belt, may be due to its shallow depth extent with underlying magnetically low metasedimentary rocks (unit Psp_{Pt}, unit Pps_{Pt}).

Tonalitic rocks exhibit foliation and/or gneissic layering that contains small-scale, isoclinal recumbent folds (F_2). Widespread evidence exists across the map area that the main strong shallow foliation/layering is a S_1+S_2 transposition foliation. Accordingly, upright folds that modify S_1+S_2 transposition foliation across this map sheet are F_3. Chamockitic rocks display a moderately developed, west-striking foliation that generally dips moderately (25-35°N) although steeply dipping foliation is noted at several localities. This fabric likely correlates with S_3, measured in chamockite and granodiorite to the northwest (Sanborn-Barrie et al., 2013).

Unconformably overlying the deformed, Precambrian rocks are flat-lying basaltic strata and associated clastic rocks (unit Cv) (cover photo) that are reflected by magnetic highs (Figure 2). Several northwest-striking, near-vertical post-tectonic gabbro dykes (unit Mg) transect the map sheet.

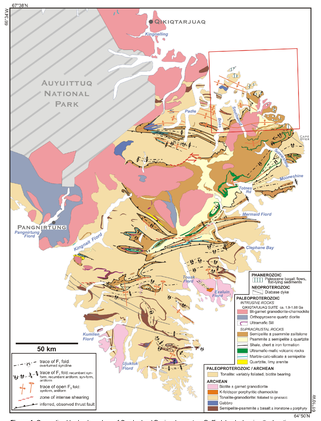


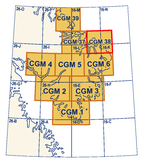
Figure 1. Generalized bedrock geology of Cumberland Peninsula, eastern Baffin Island, showing the location of the Durban Harbour map sheet (CGM 38) outlined in red.

Abstract

Cumberland Peninsula, eastern Baffin Island, is an under-explored, frontier region with significant diamond, base- and precious-metal potential. Archean (2.97-2.77 Ga) foliated to gneissic tonalitic plutonic rocks with enclaves of >2.77 Ga semipelites, ca. 2.88 Ga gabbro and rare ca. 2.92 Ga

Résumé

La péninsule Cumberland, dans l'est de l'île de Baffin, est une région pionnière sous-explorée qui revêt un important potentiel en diamants, métaux usuels et métaux précieux. Des roches plutoniques foliées à gneissiques de composition tonalitique de l'Archéen (2.97-2.77 Ga), renfermant des enclaves de



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

Cover illustration
View north of flat-lying Tertiary volcaniclastic rocks unconformably overlying rust-weathering semipelite and black-weathering volcanic rocks of the Paleoproterozoic Hoare Bay group, south shore of Durban Harbour. Photo by M. Young, 2012-062

Catalogue No. M183-1/38-2011E-PDF
ISBN 978-1-100-18076-7
doi:10.4095/292015

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CANADIAN GEOSCIENCE MAP 38
GEOLOGY
DURBAN HARBOUR
Baffin Island, Nunavut
1:100 000

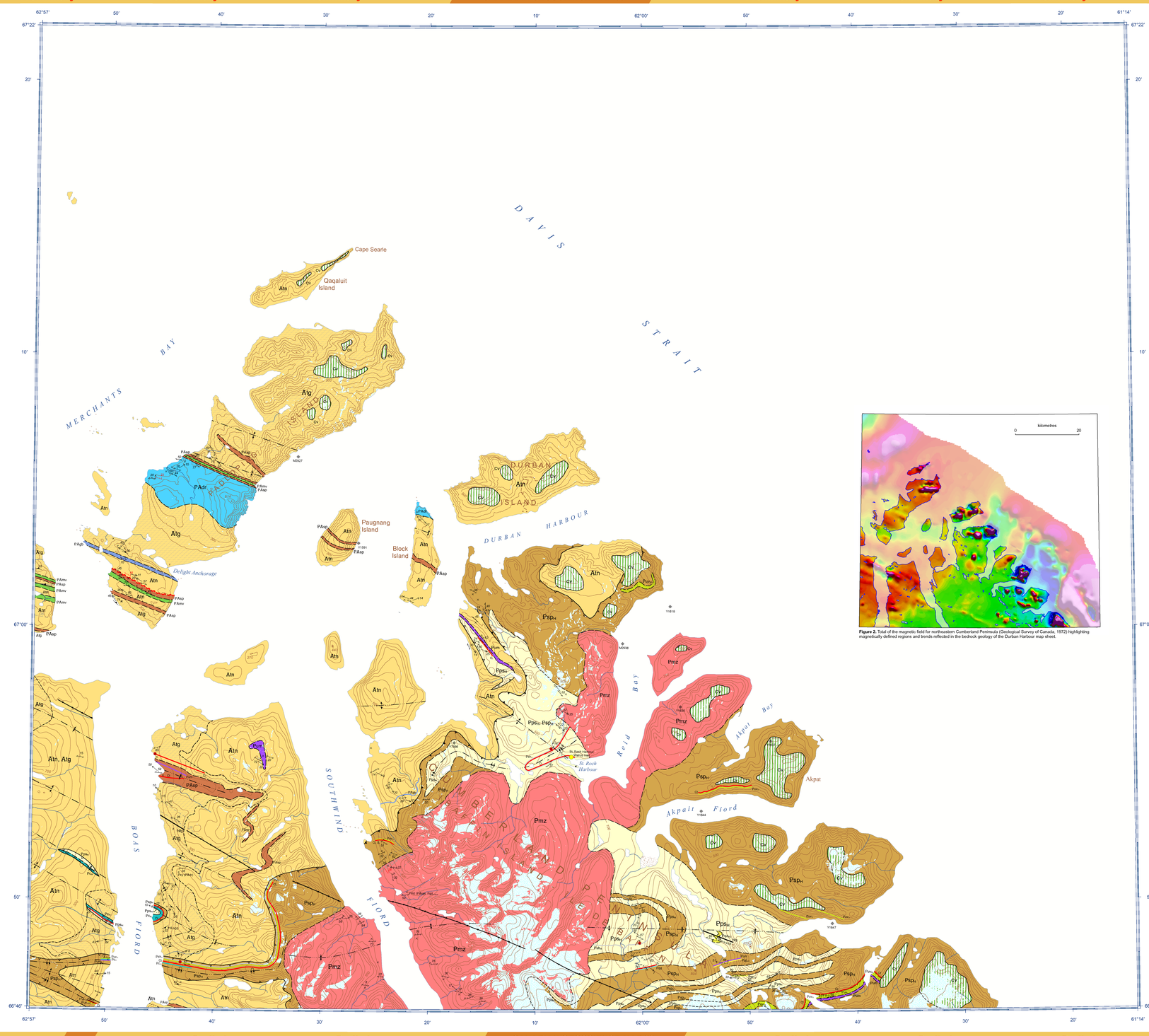

Figure 2. Total of the magnetic field for northeastern Cumberland Peninsula (Geological Survey of Canada, 1972) highlighting magnetically defined regions and trends reflected in the bedrock geology of the Durban Harbour map sheet.

LEGEND

UNDERSTANDING THE LEGEND

The age category (Eon) of bedrock material is indicated by the first upper case letter, the lithology indicated by abbreviated lower case, e.g., tg (tonalite gneiss), and formational name, if applicable, e.g. Hr (Hoare Bay Group) in subscripted. Combined units are used where, for reasons of scale, the units cannot be separated. The main unit, covering over 50% of the geologic polygon, is separated by a comma (,) from the secondary unit and, in rare cases, the secondary unit is separated by a comma (,) from the tertiary unit. The digital geodatabase denotes primary, secondary and tertiary units as separate fields. Brackets denote unit occurring as inclusion in the host unit, where notable.

This legend is common to CGM 4, CGM 5, CGM 6, CGM 37, CGM 38 and CGM 39 and is slightly modified from that for CGM 1, CGM 2 and CGM 3.

Coloured legend blocks indicate map units that appear on this map.

QUATERNARY
PLEISTOCENE–RECENT

Unconsolidated deposits: mainly glacial till and fluvial deposits.

CENOZOIC
PALEOCENE

Cv — **Basaltsandstone**: Flat-lying pacific basalt flows and breccia with local underlying impure sandstone, shale, conglomerate and coal (Clarke and Upton, 1971).

NEOPROTEROZOIC ca. 723 Ma

Mg — **Diabase dyke**: WNW-trending, medium brown weathering, equigranular, magnetite-bearing gabbro dykes of the ca. 723 Ma Franklin swarm (Heaman et al., 1992); typically 1–3 m wide, up to 6 m wide; local sills (Cape Dyer).

PALEOPROTEROZOIC

POST-TECTONIC PLUTONIC ROCKS

E'gr — **Granitetzyenogranite**: unstrained to weakly foliated, coarse-grained to pegmatitic, typically white-weathering granite, commonly muscovite-biotite-garnet±tourmaline pegmatite; less commonly pink weathering syenogranite with 1–5% biotite as coarse books, locally up to 10% muscovite and/or 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_{Hope} — **Peraluminous granodiorite**: Beige-weathering, leucocratic, 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, 25 km east of Kingnait Fiord (CGM 5).

Pgd — **Hornblende quartz diorite/tetdiorite**: post-D_1, pre-D_2, medium-grained, foliated hornblende-bearing diorite–quartz diorite, characterized by abundant 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±tondjemite±granodiorite; locally containing xenoliths of marble (Pc_{Pt}) and semipelite (Psp_{Pt}).

QIKIQTARJUAG PLUTONIC SUITE ca. 1.88–1.9 Ga

Pgd — **Granodiorite-monzogranite**: weakly foliated, light grey to beige-weathering, medium-grained, equigranular biotite±magnetite-garnet±orthopyroxene granodiorite-monzogranite; 3% burgundy garnet typically as aggregates; may be K-feldspar or quartz porphyritic; 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 retrogressed to biotite and serpentine (bastite); locally containing 10–15% K-feldspar phenocrysts at times displaying orbicular structure; cuts cpx-porphyritic ultramafic sills at two localities and is commonly cut by monozogranite-pegmatite veins. Hatch lines denote agmatite with abundant predominantly psammitic±calc-silicate inclusions.

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. Hatch lines denote agmatite structure with abundant predominantly psammitic±calc-silicate inclusions.

Pum_{Pt} — **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±biotite±garnet ultramafite occurring as 50–100 m thick sills intrusive into supracrustal rocks and tonalitic gneiss, and cut by K-feldspar porphyritic charnockite (unit Pmz); pyroxenite displays diagnostic weathered surface due to 15% olivine porphyroblasts which weather as brown 5-8 mm pits; 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. Sills <10 m wide are denoted by a purple line labeled Pum.

SUPRACRUSTAL ROCKS

HOARE BAY GROUP

Psp_{Pt} — **Semipelite±psammite±pelite**: light brown- , grey- and/or rusty-weathering layered semipelite±pelite commonly containing 15–40% biotite, 1-2 mm, 1 to 10% 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 (fiserkeiser); 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 open oval symbol.

Pps_{Pt} — **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, rare andalusite±staurolite; lenticular to elongate calc-silicate concretions denoted by pale green open oval symbol.

O_1 — **Iron-formation**: oxide- (O1) and/or silicate-facies (S_1): typically thin (<1 m) and lenticular bands 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-area.

Psh_{Pt} — **Shale±siltstone**: grey to black weathering shale±siltstone; 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, may be associated with dolomitic marble±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_{Pt}.

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 (Pum_{Pt}).

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

Pum_{Pt} — **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 (Totes 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. Block Island); this unit is thickest in the east and northeast, and thinnest or absent in the western map area.

Pc_{Pt} — **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) layers and nodules/concretions/boudins, contains up to 25% diopside, up to 25% amphibole±grossular; locally with psammite and semipelite layers; marble±calc-silicate <2 m wide denoted by turquoise line labelled Pc_{Pt}.

Par_{Pt} — **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_{Pt} — **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); 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) variably foliated, diorite has colour index of 45–60 with either hornblende or biotite as dominant mafic mineral and minor clinopyroxene; quartz rock with 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; minor marble.

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. Mafic units <2 m wide, thought to be of extrusive origin, are denoted by a green line labelled PAmv.

ARCHEAN ca. 2.71–2.99 Ga

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 (unit Amz); yields a U-Pb age of ca. 2.7 Ga western of Exukan Fiord (CGM 3).

Amz — **Orthopyroxene monzogranite**: K-feldspar porphyritic, orthopyroxene-monzogranite; moderately foliated; occurring as xenoliths in unit Agd; yields a U-Pb age of ca. 2.77 Ga on Exukan Fiord (CGM 3).

Atn — **Tonalite-granodiorite**: 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 tondjemite and typically containing xenoliths of diorite and quartz diorite; locally of homogeneous tonalite composition; yields ages of ca. 2.78 Ga at the head of Kumlien Fiord (CGM 1).

Atg — **Tonalite gneiss**: compositionally layered orthogneiss dominated by tonalitic ±granodioritic phases interlayered with diorite, gabbroic and biotitic layers; yields U-Pb ages of 2.99 Ga (CGM 2) and ca. 2.94 Ga (southern CGM 5).

Agb — **Gabbro-dioritе±gabbroic anorthosite**: black, dark grey to brown weathering, fine- to medium-grained, variably foliated to mylonitic gabbro with colour index of 60 to 85 and typically hornblende > biotite (40–60%), biotite (< 20%), with locally clinopyroxene (5–8%) and minor titanite; rarely light grey weathering leucogabbro to gabbroic anorthosite (i.e. mafic complex east of Ujakuk Fiord) 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 vesicles 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 Aklijartukan 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
- Inclined, normal, may be reactivated thrust fault
- Vertical, normal
- 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

Regional 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.

Dyke, vein
- Dyke
- Dyke, sill
- Vein: inclined, vertical
- Prominent joint, vertical

Observation from air, number corresponds to jpeg photo image (see \Data\Field\Reports\Photos.)

*Sources of information for Mineral Showings

NWT assessment reports http://www.nwtgeoscience.ca/romtrz (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/mineos/ or http://apps1.gdr.nrcan.gc.ca/gsc_minerals/index.phtml?language=en-CA

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Recommended citation
Sanborn-Barrie, M. and Young, M., 2013. Geology, Durban Harbour, Baffin Island, Nunavut; Geological Survey of Canada, Canadian Geoscience Map 38 (preliminary), scale 1:100 000. doi:10.4095/292015

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Canadian Geoscience Maps

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Geological interpretation and notes by M. Sanborn-Barrie, 2010–2012

Remote image analysis by T. Lynds, 2008–2012

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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 Program as part of its mandate to promote scientific research in the Canadian North. PCSP 002-09 and 014-10.

CANADIAN GEOSCIENCE MAP 38
GEOLOGY
DURBAN HARBOUR
Baffin Island, 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 metres above mean sea level.

Mean magnetic declination 2013, 33°54'W, decreasing 29.8' annually. Readings vary from 37°27'W in the SE corner to 34°20'W in the NW corner of the map.

The Geological Survey of Canada welcomes corrections or additional information from users.

Data may include additional features not portrayed on this map. *See* documentation accompanying the data.

This publication is available for free download through GEOSCAN (http://geoscan.ess.nrcan.gc.ca/).

This map is not to be used for navigational purposes.

Preliminary publications in this series have not been scientifically edited.

CANADIAN GEOSCIENCE MAP 38
GEOLOGY
DURBAN HARBOUR
Baffin Island, Nunavut