

LEGEND

HYPERSPECTRAL UNITS

The legend below was derived directly from analysis of the airborne PROBE hyperspectral data. Training areas for 12 of the mapped units (see below) were identified by consulting the GSC 1:100 000 scale geology maps, Landsat imagery and available mineral assessment reports. Spectra were generated for each training site and input to A.U.G. Signals' HELP (Hyperspectral Exploration/Lithological Processing) algorithm, which produced abundance images for each lithological class. The resulting colours on the map represent areas with a high confidence in the match with the training spectra for each lithological unit. Many areas appear unmapped for two reasons: (1) only areas of exposed rock where analyses, thus areas of snow, ice, water, vegetation, and thick till were excluded; (2) only areas with the highest spectral match to the training areas (as described above) are shown. The abundance maps have been overlaid on a LANDSAT band 8 TM image (panchromatic band) for geographic reference. Further details on the hyperspectral imaging process can be found in the hyperspectral notes on sheet 2.

UNCLASSIFIED - includes areas excluded from hyperspectral analysis (water, vegetation, thick glacial cover, ice, and snow) as well as areas with lower matches to training spectra

Areas of strong iron oxidation

White granite (PLhw)

Granitoid - Type 1 (Pnm)

Granitoid - Type 2 (PCmo and/or Pfm)

Carbonate rocks (PLhc)

Psammite, semipelite (PLhp and psammite sub-unit of Pfbp)

Quartzite (basic sub-unit of Pfbp)

BEDROCK UNITS

STRUCTURAL LEVEL 3 PALEOPROTEROZOIC

Cumberland Batholith

Pcd Hornblende-orthopyroxene-clinopyroxene quartz diorite, locally layered with compositions ranging from leucodiorite to anorthosite

PCmo Orthopyroxene-biotite monzonite to syenogranite; locally with K-feldspar megacrysts

----- intrusive contact -----

Lake Harbour Group

PLhm Metagabbro, amphibole, metapsedinite, layered metapelite-metagabbro, metapsedinite

PLhu Metapsedinite, metapsalmite, metatuffite

PLhc Marble, calc-silicate; minor siliceous layers; white biotite-garnet leucocratic pods and seams

PLhp Dominantly psammite, feldspathic quartzite; semipelite, orthoquartzite, pelite; minor marble and calc-silicate; white biotite-garnet leucocratic pods and seams

----- unconformity? -----

ARCHEAN AND PROTEROZOIC

Ramsay River Orthogneiss

Pfm Orthopyroxene-biotite-hornblende monzonite-lonelle orthogneiss; hornblende-biotite-clinopyroxene-orthopyroxene quartz diorite; orthopyroxene-biotite-hornblende monzonite to syenogranite veins

----- major tectonic break (suture) -----

STRUCTURAL LEVEL 2 PALEOPROTEROZOIC

Narsajuaq Arc

Pnd Hornblende-clinopyroxene-orthopyroxene-biotite quartz diorite; orthopyroxene-biotite hornblende monzonite and hornblende-biotite tonalite veins

Pnm Orthopyroxene-biotite-hornblende monzonite, layered orthopyroxene-biotite hornblende-garnet orthopyroxene tonalite, granodiorite and quartz diorite gneiss; hornblende anorthosite layers; amphibole, hornblende and metapsedinite endives; orthopyroxene-biotite-hornblende monzonite to syenogranite veins

----- Geological contact -----

Fault

Limit of hyperspectral mapping

TECTONOSTRATIGRAPHIC UNITS (LEVEL 2)

Narsajuaq arc (unit Pnm-Pnd)

Orthopyroxene-bearing, compositionally layered metaplutonic rocks (i.e. layered monzonite-granodiorite-tonalite gneiss; monzonite gneiss) occur at the intermediate structural levels (level 2; Fig. 1) exposed along the Meta Incognita Peninsula and specifically in the eastern Livingstone River area. These metaplutonic rocks are in physical continuity with and/or are lithologically similar to plutonic rocks in the Kimmirut area (Fig. 1) that have been dated between 1.84–1.82 Ga by Scott (1997), Wodicka and Scott (1997), and Scott and Wodicka (1998). These authors have correlated the level 2 metaplutonic rocks with similar units in the 1.86–1.82 Ga Narsajuaq arc of northern Quebec (St-Onge et al., 1992; Dunphy and Ludden, 1996). Crosscutting field relationships indicate that the oldest Narsajuaq arc plutonic unit is a layered, fine- to medium-grained, grey to buff, orthopyroxene-biotite-hornblende-garnet tonalite orthogneiss with subordinate grey orthopyroxene-biotite hornblende granodiorite layers and gneiss monzonite sheets and veins (unit Pnm). Compositional layering in the orthogneiss is typically a few centimetres in thickness and is continuous laterally for several tens of metres. The tonalite, granodiorite, and monzonite components are crosscut by discordant veins of coarse-grained hornblende-biotite-orthopyroxene syenogranite. Large areas of Narsajuaq arc (Fig. 1) are underlain by medium-grained orthopyroxene-biotite hornblende monzonite gneiss that intrudes the layered tonalite-monzonite unit described above. These rocks weather light grey to pink, and are composed of variably foliated, less than 10 cm thick layers that differ principally in biotite content. Coarse-grained and locally megacrystic layers can be up to 100 metres in thickness. Hornblende-clinopyroxene-orthopyroxene-biotite quartz diorite layers (unit Pnd) are common. The scale of mapping did not allow the monzonite gneiss to be mapped separately from the tonalite-monzonite unit it intrudes and consequently both are included in the composite (unit Pnm) unit on existing bedrock maps for southern Baffin Island (St-Onge et al., 2001).

TECTONOSTRATIGRAPHIC UNITS (LEVEL 3)

Ramsay River orthogneiss (unit Pfm)

Buff- to pink-weathering, layered orthopyroxene-biotite-hornblende monzonite-tonalite orthogneiss (unit Pfm) occurs in the western Livingstone River area. The orthogneiss unit is in physical continuity with metaplutonic rocks mapped to the west (St-Onge et al., 2001) and dated by Scott and Wodicka (1998) at ca. 1.85 Ga. In most outcrops the monzonite-tonalite gneiss is interlayered with subordinate, boudined and discontinuous layers of quartz diorite. All components of the gneiss are crosscut by white to pink biotite monzonite and syenogranite veins that range from well foliated to relatively massive and from a few centimetres to more than ten metres thick. Similarities in rock type, mineral assemblage, and strain state suggest that the monzonite and syenogranite veins are related and possibly co-magmatic with the plutons of the Cumberland batholith (see below), which intrude this unit throughout southern Baffin Island (Fig. 1). The orthogneiss may represent the stratigraphic basement to Lake Harbour Group units described below. However, this is difficult to evaluate in the field as all observed contacts between orthogneiss and supracrustal units are tectonic. Nevertheless, the age of the orthogneiss and its spatial association with the younger Lake Harbour Group, both restricted to level 3 (Fig. 1), suggest that a primary stratigraphic link is possible.

Lake Harbour Group (unit PLhp-PLhm)

The marble, psammite, and semipelite units in the Livingstone River area are along strike from, or are lithologically similar to, rocks of the Lake Harbour Group examined in the type Kimmirut area to the south (Fig. 1). Within these supracrustal rocks, two lithologically and geographically distinct successions are recognized. Along the southern coastal rocks and valleys between Crooks Inlet and 68°W (Fig. 1), the Lake Harbour Group comprises interlayered gabbroic psammite, orthoquartzite, semipelite, and pelite (unit PLhp) overlain by prominent, laterally continuous to boudinaged bands of pink grey marble and calc-silicate rocks (unit Pnh) (Kimmirut sequence" of Scott et al. (1997)). Inland and in the Markham Bay area (Fig. 1), exposures of the Lake Harbour Group are dominated by gabbroic psammite interlayered with semipelite and pelite (unit PLhp) and are essentially devoid of marble and calc-silicate rocks (Markham Bay sequence" of Scott et al. (1997)). Both successions are intruded by generally concordant sheets of mafic to ultramafic rocks (units PLhu, PLhc).

Within the PLhp unit, semipelite is generally rusty, thinly layered at the centimetre scale, and characterized by abundant graphite, pyrite, chalcopyrite, and pyrrhotite. Orthoquartzite occurs as discrete layers with total thicknesses of several metres. It often contains locally massive, locally columnar, locally columnar, and is strongly recrystallized. Primary sedimentary features such as cross bedding are only rarely preserved within the siliceous rocks. While monzonite, rich in iliac garnet, is a ubiquitous constituent within the siliceous package, occurring as concordant layers or pods less than 0.5 m thick. Locally, the white gabbroic monzonite outcrops as discrete tabular bodies several hundred metres thick.

Most of the calcareous rocks (unit PLhc) are medium- to coarse-grained, and are locally characterized by compositional layering defined by varying modal proportions of calcite, forsterite, humite, diaspore, tremolite, phlogopite, spinel, wollastonite, and at least in the Kimmirut area (Fig. 1) corundum (sapphirine). Individual layers range from centimetres to metres in thickness and can be traced for tens of metres along strike. Calc-silicate rocks are commonly interlayered with siliceous rocks and are generally associated with marble. Thicknesses of individual calcareous rock sequences range typically between about 2000 m north of Kimmirut and in the Crooks Inlet area to about 200m at 68°W. Individual marble units can be traced from 5 to 40 km along strike. Primary structures were not observed in the calcareous rocks.

Generally concordant sheets of medium- to coarse-grained, mafic to ultramafic rocks occur within both successions of the Lake Harbour Group. Individual bodies are typically 10–20 m thick, but range up to a few hundred metres thick, and can extend up to several kilometres along strike. Metagabbroic textures and compositional layering defined by variations in modal abundance of clinopyroxene, orthopyroxene, hornblende, and plagioclase are commonly preserved in the mafic bodies (unit PLhm). The concordant nature, lobular shape, and sharp contacts suggest that these bodies are sills. Several ultramafic bodies (unit PLhu), either clinopyroxene-orthopyroxene-biotite hornblende metaxenite or olivine-clinopyroxene-orthopyroxene metapsedinite were observed.

Cumberland batholith (unit PCmo-Pcd)

Coarse- to medium-grained, massive to foliated metaplutonic rocks northeast of Markham Bay, in the western Livingstone River area, around Frobisher Bay, and at 68°W (Fig. 1) occur along strike from and are continuous with extensive regions underlain by the 1.86–1.85 Ga (Jackson et al., 1990; Wodicka and Scott, 1997; Scott, 1998) Cumberland batholith on southern Baffin Island (Fig. 1; Blackadar, 1987; Jackson and Taylor, 1972). The principal rock type mapped within the Cumberland batholith in the Livingstone River area is a tan- to pink-weathering orthopyroxene-biotite monzonite (unit PCmo) that is massive to weakly foliated. Sheets of hornblende-orthopyroxene-clinopyroxene diorite (unit Pcd), 10–500 m wide and up to several km long, are broadly coplanar with the dominant foliation in the host monzonite and are therefore interpreted as sills. These sheets are typically found along the southern margin of the batholith and highlight fold interference geometries between Markham Bay and Frobisher Bay (Fig. 1).

Along a number of well exposed contacts, sills of monzonite truncate Ramsay River orthogneiss and Lake Harbour Group host rocks, indicating initial juxtaposition of the orthogneiss and the supracrustal units. Isolated, kilometre-scale plutons of pink orthopyroxene-biotite monzonite northeast of Crooks Inlet and north and east of Kimmirut (Fig. 1), one of which has been dated at 1.85 Ga (Wodicka and Scott, 1997), are interpreted as part of the Cumberland magmatic system.

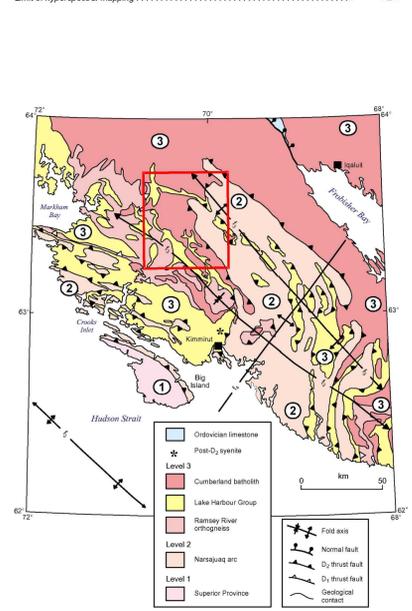


Figure 1. Generalized geology of southern Baffin Island between 68°W and 72°W, Meta Incognita Peninsula, Nunavut (after St-Onge et al., 2001), and identification of the principal structural levels (1–3) and tectonostratigraphic units (Pnm–Pnd) described in the text. Red outline corresponds to the area covered by this Open File map.

ACKNOWLEDGEMENTS

The Landsat-7 (ETM+) data has been orthorectified to a horizontal accuracy of better than 20 m. The new orthorectification procedure developed at the Canada Centre for Remote Sensing minimizes the accumulation of planimetric errors that accompanies traditional resampling, orthorectification and geographic registration steps and furthermore preserves the radiometric integrity of the spectral data. Since the Landsat-7 mosaic is more accurate than the existing geographic base (1:250 000) data which the original digital geologic data used, the geology has been warped to fit the Landsat data.

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OPEN FILE 5054
HYPER SPECTRAL UNITS
LIVINGSTONE RIVER
BAFFIN ISLAND
NUNAVUT

Scale 1:100 000 / Échelle 1/100 000

kilometres 2 0 2 4 6 8 kilometres

Universal Transverse Mercator Projection
North American Datum 1983
© Her Majesty the Queen in Right of Canada 2008

Projection transversale universelle de Mercator
Système de référence géodésique nord-américain, 1983
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Geology by M.R. St-Onge, D. Scott, and N. Wodicka, 2001

Hyperspectral units by M. Peshko, J. Harris, P. Budkewitch, M.R. St-Onge, R. McGregor, R. Hitchcock, 2004

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Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Magnetic declination 2006, 31°44'W, decreasing 28.5' annually. Readings vary from 31°10'W in the SW corner to 32°17'W in the NE corner of the map

OPEN FILE DOSSIER PUBLIC

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FEUILLE 1 DE 2

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