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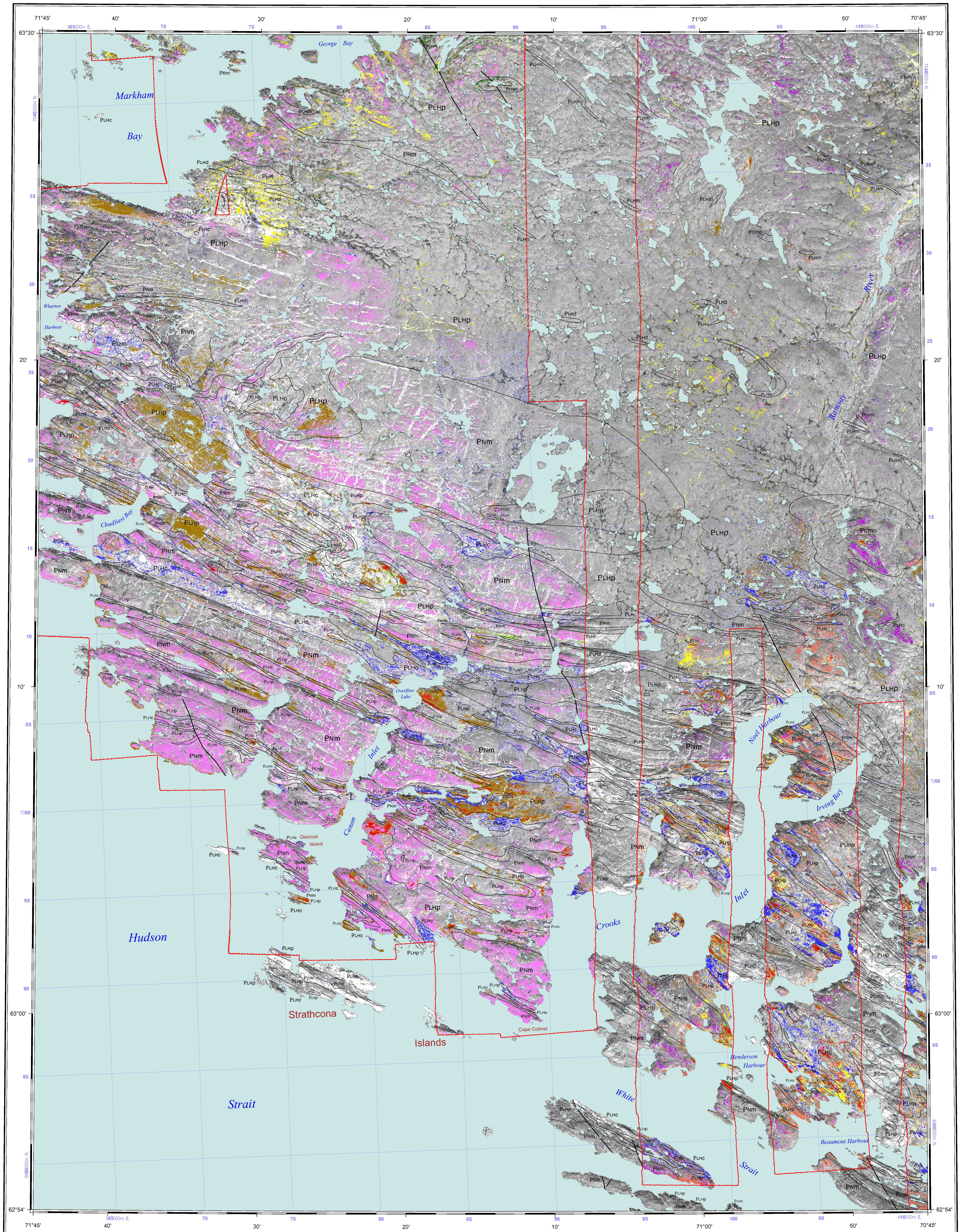

LEGEND

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' HE/LP (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 analysed, thus areas of snow, ice, water, vegetation, and thick till were excluded and, (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 PRm)

Carbonate rocks (PLHc)

Psammite, semipelite (PLHp and psammitic sub-unit of PBBp)

Quartzite (*silicic sub-unit of* (PBBp)

Leucodiorite, tonalite (PLHd)

Mafic rocks (PLHm)

BEDROCK UNITS

STRUCTURAL LEVEL 3

PALEOPROTEROZOIC

Cumberland Batholith

PCmo Othropyroxene-biotite monzogranite to syenogranite; locally with K-feldspar megacrysts

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

Lake Harbour Group

PLHl White biotite-garnet leucogranite, monzogranite; commonly interlayered with meta-sedimentary rocks

PLHd Metaleucodiorite, metatonalite

PLHm Metagabbro, amphibolite, metaperidotite, layered metaperidotite-metagabbro, metapyroxenite

PLHu Metaperidotite, metapyroxenite, metadunite

PLHc Marble, calc-silicate; minor silicilcastic layers; white biotite-garnet leucogranite pods and seams

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

- - - - - - - - - - *unconformity?* - - - - - - - - - -

ARCHEAN AND PROTEROZOIC

Ramsay River Orthogneiss

PRm Orthopyroxene-biotite±hornblende monzogranite-tonalite orthogneiss; hornblende-biotite-clinopyroxene±orthopyroxene quartz diorite; orthopyroxene-biotite±hornblende monzogranite to syenogranite veins

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

STRUCTURAL LEVEL 2

PALEOPROTEROZOIC

Narsajuaq Arc

PNm Orthopyroxene-biotite±hornblende monzogranite, layered orthopyroxene-biotite± hornblende±garnet ±clinopyroxene tonalite, granodiorite and quartz diorite gneiss; hornblende anorthosite layers; amphibolite, hornblendite and metapyroxenite enclaves; orthopyroxene-biotite±hornblende monzogranite to syenogranite veins

Geological contact . . . .

Fault . . . .

Limit of hyperspectral mapping . . . .

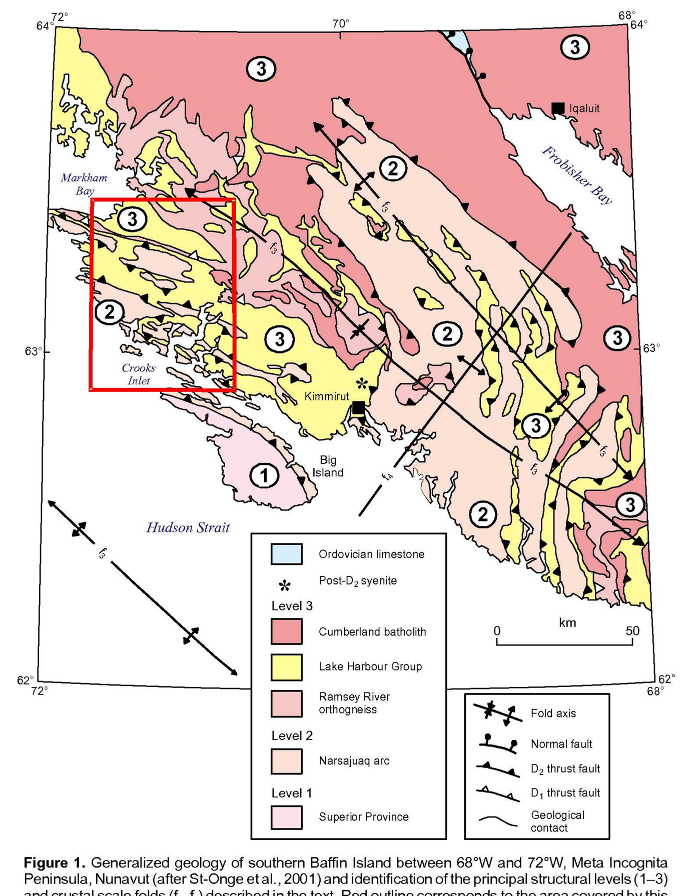

Figure 1. Generalized geology of southern Baffin Island between 68°W and 72°W, Meta Incognita Peninsula, Nunavut (after St-Onge et al., 2001) and identification of the principal structural levels (1–3) and crustal scale folds (f_3–f_4) described in the text. Red outline corresponds to the area covered by this Open File map.

DESCRIPTIVE NOTES

TECTONOSTRATIGRAPHIC UNITS (LEVEL 2)

Narsajuaq arc (unit PNm)

Orthopyroxene-bearing, compositionally layered metaplutonic rocks (i.e. layered monzogranite-granodiorite-tonalite gneiss; monzogranite gneiss) occur at the intermediate structural levels (level 2, Fig. 1) exposed along the Meta Incognita Peninsula and specifically in the Canon Inlet 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, 1998). 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 tonalitic orthogneiss with subordinate grey orthopyroxene-biotite±hornblende granodiorite layers and pink monzogranite 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 tonalitic, granodioritic, and monzogranitic components are crosscut by concordant to discordant veins of coarse-grained hornblende-biotite±orthopyroxene syenogranite. Large areas of Narsajuaq arc (Fig. 1) are underlain by medium-grained orthopyroxene-biotite±hornblende monzogranite gneiss that intrudes the layered tonalite-monzogranite 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. The scale of mapping did not allow the monzogranite gneiss to be mapped separately from the tonalite-monzogranite 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 PRm)

Buff- to pink-weathering, layered orthopyroxene-biotite±hornblende dominantly monzogranite-tonalite orthogneiss (unit PRm) occurs in the Canon Inlet area. The orthogneiss unit is in physical continuity with metaplutonic gneiss mapped to the north (St-Onge et al., 2001) and dated by Scott and Wodicka (1998) at ca. 1.95 Ga. In most outcrops the monzogranite-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 monzogranite 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 monzogranite and syenogranite veins are related and possibly co-magmatic with the plutons of the Cumberland batholith (*see* below) which intrude this unit thoughout 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 (units PLHp-PLHl)

The marble, psammite, and semipelite units in the Canon Inlet area are along strike from, or are lithologically similar to rocks of the Lake Harbour Group examined in the type Kimmirut area (Fig. 1). Within these supracrustal rocks, two lithologically and geographically distinct successions are recognized. Along the southern coastal inlets and river valleys between Crooks Inlet and 68°W (Fig. 1), the Lake Harbour Group comprises interlayered garnetiferous psammite, orthoquartzite, semipelite, and pelite (unit PLHp) overlain by prominent, laterally continuous to boudinaged bands of pale grey to white marble and calc-silicate rocks (unit PLHc) ("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 garnetiferous 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, PLHm, PLHd).

Within the PLHp unit, semipelite is generally rusty, thinly layered at the centimetre scale, and characterized by abundant graphite. Garnet±cordierite±sillimanite pelite typically occurs as thin layers within the garnet-biotite semipelite. Compositional layers in psammite range from centimetres to tens of centimetres in thickness, and can be traced for as much as hundreds of metres along strike. The layers are defined by variations in the modal abundance of quartz, biotite, lilac garnet, cordierite, sillimanite, and granitic melt pods. Semipelite and pelite are generally subordinate within the psammite and both are generally rusty weathering and characterized by trace amounts of disseminated graphite, pyrite, chalcopyrite, and pyrrhotite. Orthoquartzite occurs as discrete layers with total thicknesses of several metres. It is often graphite bearing, locally contains minor plagioclase, and is strongly recrystallized. Primary sedimentary features such as crossbedding are only rarely preserved within the siliciclastic rocks. White monzogranite, rich in lilac garnet, is a ubiquitous constituent within the siliciclastic package, occurring as concordant layers or pods less than 0.5 m thick. Locally, the white garnetiferous monzogranite outcrops as discrete tabular bodies several hundred metres thick. Some bodies (unit PLHl) are large enough to show on maps such as that for the Canon Inlet area.

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, diopside, tremolite, phlogopite, spinel, wollastonite, and at least in the Kimmirut area (Fig. 1) corundum (sapphire). 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 siliciclastic 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 Canon Inlet area to about 200 m 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 sequences of the Lake Harbour Group. Individual bodies are typically 10–20 m thick, but range up to a few hundred metres thick, and continue 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, tabular shape, and sharp contacts suggest that these bodies are sills. Several ultramafic bodies (unit PLHu), either clinopyroxene-orthopyroxene±hornblende metapyroxenite or olivine-clinopyroxene- orthopyroxene metaperidotite were observed. Metaleucodiorite sills and metatonalite bodies (unit PLHd) are also emplaced in the siliciclastic rocks of the Lake Harbour Group.

Cumberland batholith (unit PCmo)

Coarse- to medium-grained, massive to foliated metaplutonic rocks northeast of Markham Bay, 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, 1999) Cumberland batholith on southern Baffin Island (Fig. 1; Blackadar, 1967; Jackson and Taylor, 1972). The principal rock type mapped in the Cumberland batholith in the Canon Inlet area is a tan- to pink-weathering orthopyroxene-biotite monzogranite (unit PCmo) that is massive to weakly foliated. Along a number of well exposed contacts, septa of monzogranite truncate Ramsay River orthogneiss and Lake Harbour Group host rocks, indicating intrusion following initial juxtaposition of the orthogneiss and the supracrustal units. Isolated, kilometre-scale plutons of pink orthopyroxene-biotite monzogranite 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.

ACKNOWLEDGEMENTS

The Landsat-7 (ETM+) data has been orthorectified to a horizontal accuracy of better than 20 m. The new orthorectifcation 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 topographic 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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REFERENCES

Blackadar, R.G.
1967: Geological reconnaissance, southern Baffin Island, District of Franklin; Geological Survey of Canada, Paper 66-47, 32 p.

Dunphy, J.M. and Ludden, J.N.
1998: Petrological and geochemical characteristics of a Paleoproterozoic magmatic arc (Narsajuaq terrane, Ungava Orogen, Canada) and comparisons to Superior Province granitoids; Precambrian Research, v.91, p. 109–142.

Jackson, G.D. and Taylor, F.C.
1972: Correlation of major Aphebian rock units in the northeastern Canadian Shield; Canadian Journal of Earth Sciences, v. 9, p. 1650–1669.

Jackson, G.D., Hunt, P.A., Loveridge, W.D., and Parrish, R.R.
1990: Reconnaissance geochronology of Baffin Island, N.W.T.; *in* Radiogenic Age and Isotopic Studies: Report 3; Geological Survey of Canada, Paper 89-2, p. 123–148.

Scott, D.J.
1997: Geology, U-Pb & Pb-Pb geochronology of the Lake Harbour area, southern Baffin Island: implications for the Paleoproterozoic tectonic evolution of NE Laurentia; Canadian Journal of Earth Sciences, v. 34, p. 140–155.
1999: U-Pb geochronology of the eastern Hall Peninsula, southern Baffin Island, Canada: a northern link between the Archean of West Greenland and the Paleoproterozoic Torngat Orogen of northern Labrador; Precambrian Research, v. 93, p. 5–26.

Scott, D.J. and Wodicka, N.
1998: A second report on the U-Pb geochronology of the Meta Incognita Peninsula, southern Baffin Island, Northwest Territories; *in* Radiogenic Age and Isotopic Studies, Report 11; Geological Survey of Canada, Current Research 1998-F, p. 47–57.

Scott, D.J., St-Onge, M.R., Wodicka, N., and Hanmer, S.
1997: Geology of the Markham Bay-Crooks Inlet area, southern Baffin Island, Northwest Territories; *in* Current Research 1997-C; Geological Survey of Canada, p. 157–166.

St-Onge, M.R., Lucas, S.B., and Parrish, R.R.
1992: Terrane accretion in the internal zone of the Ungava orogen, northern Quebec. Part 1: tectonostratigraphic assemblages and their tectonic implications; Canadian Journal of Earth Sciences, v. 29, p. 746–764.

St-Onge, M.R., Scott, D.J., and Wodicka, N.
2001: Geology, Meta Incognita Peninsula, Baffin Island, Nunavut; Geological Survey of Canada, Map 2009A (containing Maps 1979A–1985A), 1:100 000 scale.

Wodicka, N. and Scott, D.J.
1997: A preliminary report on the U-Pb geochronology of the Meta Incognita Peninsula, southern Baffin Island, Northwest Territories; *in* Current Research 1997-C; Geological Survey of Canada, p. 167–178.

Authors: Peshko, M., Harris, J., Budkewitsch, P., St-Onge, M.R., McGregor, R., Hitchcock, R., and Desnoyers, D.

Geology by M.R. St-Onge, D. Scott, and N. Wodicka, 2001

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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, 30°53'W, decreasing 27.7' annually. Readings vary from 30°15'W in the SW corner to 31°31'W in the NE corner of the map

LOCATION MAP

OPEN FILE 5053

HYPERSPECTRAL UNITS

CANON INLET

BAFFIN ISLAND

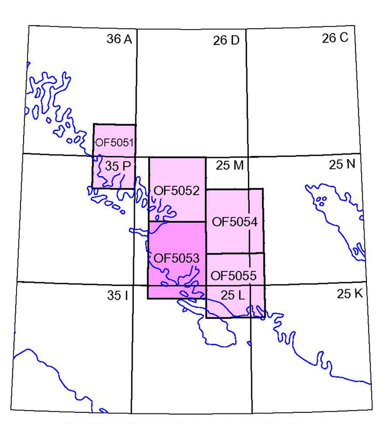
NUNAVUT

Scale 1:100 000/Échelle 1/100 000

kilometres 2 0 2 4 6 8 kilomètres

Universal Transverse Mercator Projection
North American Datum 1983

Projection transverse universelle de Mercator
Système de référence géodésique nord-américain, 1983



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SHEET 1 OF 2
FEUILLET 1 DE 2

Sheet 1 of 2, Hyperspectral units

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