## INTRODUCTION

This map is one of a set of seven bedrock geological maps which present the results of 1:100 000 scale mapping by the Geological Survey of Canada (GSC) in the Frobisher Bay (Map 1979A), Hidden Bay (Map 1980A), McKellar Bay (Map 1981A), Wight Inlet (Map 1982A), Blandford Bay (Map 1983A), Crooks Inlet (Map 1984A), and White Strait (Map 1985A) map areas, Meta Incognita Peninsula, southern Baffin Island (Fig. 1, 2). An overview of the principal Archean and Paleoproterozoic plutonic and supracrustal units mapped during the three-year (1995-1997) field project are presented in St-Onge et al. (1996, 1998) and Scott et al. (1997). An outline of the deformation-metamorphism history for the Hudson Strait region is presented in St-Onge et al. (1999). Scott (1997), Wodicka and Scott (1997), and Scott and Wodicka (1998) present recent U-Pb geochronological results for the Meta Incognita Peninsula and highlight the distinct and/or common tectonic histories of different tectonostratigraphic assemblages. Examination of the surficial deposits at 1:250 000 scale and the identification of ice flow domains from the last (late Foxe) glaciation are outlined in Hodgson (1997) with field observations presented in Hodgson (unpub. map manuscript, 1999). Geological work on southern Baffin Island prior to 1965 is summarized in Blackadar (1967). With local exceptions (e.g. in the Frobisher Bay (Map 1979A), Hidden Bay (Map 1980A), and Crooks Inlet (Map 1984A) map areas, Fig. 2), bedrock exposure throughout the GSC project area on Meta Incognita Peninsula is excellent.

## GEOLOGICAL FRAMEWORK

### Trans-Hudson Orogen

The metasedimentary rocks and orthogneisses of the project area (Fig. 1, 2) are part of the northeastern (Quebec-Baffin Island) segment of the Paleoproterozoic Trans-Hudson Orogen (Fig. 3; Lewry and Stauffer, 1990) which comprises tectonostratigraphic assemblages accumulated on, or accreted to, the northern margin of the Archean Superior Province during more than 200 Ma of tectonic activity (Lucas and St-Onge, 1992; Lucas et al., 1992; Scott et al., 1992, 1997; St-Onge et al., 1992, 1996, 1999; Scott, 1997, 1999). Preserved within the northeastern segment of the orogen, from the external zone peripheral to the Superior Province in northern Quebec (Fig. 1) to the internal zone exposed on southern Baffin Island (Fig. 2) are the following: 1) lower plate parautochthonous plutonic and supracrustal rocks of the Archean Superior Province (Lucas and St-Onge, 1991; St-Onge and Lucas, 1992; St-Onge et al., 1992, 1996); 2) lower plate parautochthonous sedimentary and volcanic units (Povungnituk and Chukotat groups) associated with Paleoproterozoic rifting of the Superior Province (Hynes and Francis, 1982; Francis et al., 1983; Picard et al., 1990; St-Onge and Lucas, 1990a, b, 1992; Lucas and St-Onge, 1991; St-Onge et al., 1992, 1996; Dunphy et al., 1995); 3) upper plate (i.e. allochthonous) Paleoproterozoic crustal elements, interpreted as i) an ophiolite (Watts Group) (Scott and Bickle, 1991; Scott et al., 1991, 1992), ii) a fore-arc clastic apron (Spartan Group) (St-Onge et al., 1992), iii) a magmatic arc terrane (Narsajuaq arc, Parent and Sugluk groups) (Picard et al., 1990; St-Onge and Lucas, 1990b, 1992; Lucas and St-Onge, 1991; Lucas et al., 1992; Scott, 1997; Dunphy and Ludden, 1998), iv) a clastic-carbonate platformal sequence (Lake Harbour Group) (Davison, 1959; Blackadar, 1967; Jackson and Taylor, 1972; Scott, 1997; Scott et al., 1997) and its potential basement (Ramsay River orthogneiss; St-Onge et al., 1998; Scott and Wodicka, 1998), v) a foreland basin sequence (Blandford Bay assemblage) (Scott et al., 1997), and vi) an extensive suite of monzogranitic plutons (Cumberland batholith) (Jackson and Taylor, 1972; Jackson et al., 1990) which intrude the platformal, basement and foreland basin rocks; and 4) an upper-plate domain of Archean orthogneiss and Paleoproterozoic supracrustal rocks interpreted by Scott (1999) as the western edge of the North Atlantic craton.

Uranium-lead (zircon) age determinations for plutonic units within the Superior Province basement of northern Quebec range between ca. 3.22 - 2.74 Ga (Parrish, 1989, R.R. Parrish, pers. comm., 1991; St-Onge et al., 1992; Scott and St-Onge, 1995; Wodicka and Scott, 1997). Rhyolite flows and gabbro sills from the Povungnituk and Chukotat groups (rift sequences) yield zircon and baddeleyite ages between ca. 2.04 - 1.96 Ga and 1.92 - 1.87 Ga, respectively (Parrish, 1989; St-Onge et al., 1992; Machado et al., 1993). Zircons from a gabbroic layer in the Watts Group (ophiolite) yield an age of ca. 2.00 Ga (Parrish, 1989). Plutons and felsic volcanic rocks of the Narsajuaq arc-Parent Group (magmatic arc terrane) in northern Quebec range in age between ca. 1.86 - 1.82 Ga (Parrish, 1989, R.R. Parrish, pers. comm., 1992; St-Onge et al., 1992; Machado et al., 1993; Scott, 1997; Wodicka and Scott, 1997; Scott and Wodicka, 1998), whereas monzogranite samples of the Cumberland batholith on Baffin Island yield ages between ca. 1.86 - 1.85 Ga (Jackson et al., 1990; Wodicka and Scott, 1997; Scott, 1999). Uranium-lead zircon geochronological constraints indicate that the Lake Harbour Group (platform sequence) and the Blandford Bay assemblage (foreland basin sequence) were deposited between ca. 1.93 and 1.86 Ga (Scott and Gauthier, 1996; Scott, 1997; Scott et al., 1997). The potential depositional basement to the Lake Harbour Group (Ramsay River orthogneiss) has yielded a U-Pb age of ca. 1.95 Ga (Scott and Wodicka, 1998). Finally, the upper plate orthogneiss units correlated with the North Atlantic craton have been dated by Scott (1999) between ca. 2.92 and 2.80 Ga.

### Meta Incognita Peninsula

Meta Incognita Peninsula is characterized by three orogen-scale, stacked tectonic elements (Fig. 4; Wodicka and Scott, 1997; St-Onge et al., 1999). From lowest to highest structural level, these include the following map units (Table 1): level 1 - Superior Province basement and Povungnituk Group cover; level 2 - Narsajuaq arc terrane; level 3 - Ramsay River orthogneiss, Lake Harbour Group, Blandford Bay assemblage, and Cumberland batholith.

The geological map pattern of Meta Incognita Peninsula (Fig. 4) is largely controlled by the interference between late orogenic, orogen-parallel folds (north to northwest trending) and cross folds (northeast trending). In the White Strait (Map 1985A) map area (Fig. 2), at the lowest structural levels exposed along the northeastern flank of a northwest-plunging, orogen-parallel anticlinorium underlying Hudson Strait (Fig. 4, 5), level 1 comprises Archean tonalite-granodiorite-monzogranite orthogneiss units and associated Paleoproterozoic clastic, mafic and ultramafic supracrustal rocks. The orthogneiss has been dated between 2.88 - 2.86 Ga (Wodicka and Scott, 1997) and is interpreted as correlative (and continuous) with metaplutonic units which belong to the Archean Superior Province of northern Quebec (Fig. 5; St-Onge et al., 1999). Based on lithological association, field characteristics, and mineral assemblages (St-Onge et al., 1996), as well as detrital zircon U-Pb age determinations (D.J. Scott, M.R. St-Onge, and R. Stern, unpub. manuscript, 1991), the Paleoproterozoic cover units of level 1 are correlated with the Povungnituk Group rift margin units exposed south of Hudson Strait (St-Onge et al., 1996, 1999).

In the Hidden Bay (Map 1980A), McKellar Bay (Map 1981A), and Wight Inlet (Map 1982A) map areas (Fig. 2), at intermediate structural levels exposed along the antiformal hinge zone of a northeast-trending cross fold southeast of Kimmirut (Fig. 4), level 2 comprises layered monzogranite-granodiorite-tonalite gneiss with quartz diorite and rare anorthosite sheets. These units, which are dated between 1.84-1.82 Ga (Scott, 1997; Wodicka and Scott, 1997; Scott and Wodicka, 1998), have been correlated with the Narsajuaq arc in northern Quebec (Fig. 5; Scott, 1997).

At the highest structural levels preserved in the project area (level 3, Fig. 4), the Lake Harbour Group includes marble, psammite, and semipelite that are intruded by mafic and locally layered mafic-ultramafic sills (Scott et al., 1997). Along the antiformal cross-fold hinge zone southeast of Kimmirut (Fig. 4), Lake Harbour Group supracrustal units are preserved within structural basins or klippen that result from the interference of the two regional fold sets (maps 1980A, 1981A, and 1982A, Fig. 2). Within level 3, kilometre-scale panels of Lake Harbour Group rocks are imbricated with panels of Ramsay River orthogneiss and Blandford Bay assemblage (maps 1983A and 1984A, Fig. 2). In a number of localities (maps 1983A and 1984A, Fig. 2) these imbricates are intruded by the monzogranite plutons of the Cumberland batholith.

## TECTONOSTRATIGRAPHIC UNITS (level 1)

### Superior Province (units Ast-Asg)

Biotite ± hornblende ± orthopyroxene ± clinopyroxene ± garnet tonalite gneiss (unit Ast) is the dominant lithology in the Archean basement exposed at the lower structural levels in the project area (level 1, Fig. 4). It is grey, medium grained, and equigranular. On Big Island (Map 1985A, Fig. 2), the tonalitic unit displays a well developed gneissic foliation and in some outcrops relic granulite-facies minerals (orthopyroxene, clinopyroxene) can be observed mantled by amphibolite-facies assemblages (hornblende, garnet). Mafic enclaves are locally abundant and entrained within the gneissic foliation. Massive to deformed concordant veins and sheets of biotite monzogranite comprise up to 20-25% of the orthogneiss.

Biotite ± hornblende ± orthopyroxene granitoid rocks (unit Asg) within the Archean domain exposed on Big Island (Map 1985A, Fig. 2) vary in composition from granodiorite to syenogranite, although monzogranite is overwhelmingly the most common rock type. The kilometre-scale granite bodies are medium to coarse grained, grey or pink, and vary from equigranular to K-feldspar megacrystic. As noted for the tonalitic orthogneiss units which they intrude, relict orthopyroxene in the monzogranitic plutons is commonly mantled by hornblende and biotite. The plutons are generally foliated and can contain centimetre- to kilometre-scale inclusions of layered tonalite gneiss, and more massive quartz diorite and amphibolite. The massive to deformed granitic veins observed in the host tonalitic orthogneiss units are interpreted as being related to emplacement of the granitic plutons.

### (?) Superior Province (unit Asmt)

A more mafic tonalite gneiss (unit Asmt), pervasively interlayered with quartz diorite at the metre scale, occurs separately (Big Island, Map 1985A, Fig. 2) from the more leucocratic tonalite gneiss described above. The medium-grained mafic gneiss is hornblende ± biotite ± orthopyroxene-bearing, and tonalite volumetrically composes 60-70% of the layered unit. Layers of hornblende-biotite ± orthopyroxene ± clinopyroxene quartz diorite range in thickness from 1-5 m and are often boudined. Replacement of granulite-facies minerals (orthopyroxene, clinopyroxene) by amphibolite-facies minerals (hornblende, garnet) is common. Metre-scale amphibolite, hornblendite, and particularly pyroxenite enclaves occur locally. All components of the layered tonalite-quartz diorite gneiss unit are crosscut by concordant pink biotite monzogranite to syenogranite veins. The granite veins vary from relatively massive to well foliated and range in thickness from several millimetres to over ten metres.

### Povungnituk Group (unit Ppm)

Panels of Paleoproterozoic supracrustal rocks (unit Ppm) occur in tectonic contact with the Archean orthogneiss units of level 1 and separate the biotite ± hornblende tonalite gneiss (unit Ast) and granite (unit Asg) bodies from the more mafic tonalite gneiss (unit Asmt) unit (Big Island, Map 1985A, Fig. 2). The panels, often several hundred metres in width, generally contain both siliciclastic rocks and hornblende-biotite-garnet ± clinopyroxene mafic rocks. The siliciclastic rocks comprise biotite ± garnet quartzite, garnet-biotite semipelite, and sillimanite-K-feldspar-biotite ± graphite pelite. Relatively homogeneous quartzite can be interlayered with semipelite and mafic bands, or with thin (millimetre scale) pelite bands. Layering in the metasedimentary rocks is assumed to be transposed bedding. In general, the mafic rocks are fine to medium grained, homogeneous amphibolite interpreted as mafic flows or intrusive units. These are locally interlayered with bands of medium-grained amphibolite which display internal compositional layering, and are interpreted as layered mafic sills. Layers and pods of metaperidotite and pyroxenite several metres in thickness are associated with the supracrustal units and are interpreted as dismembered ultramafic sills and dykes. The panels of supracrustal rocks (unit Ppm), which St-Onge et al. (1996, 1999) correlated with the Povungnituk Group in northern Quebec, separate the kilometre-scale imbricates of Archean orthogneiss within level 1 and also demarcate a fundamental tectonic contact (Map 1985A, Fig. 2) between the parautochthonous units of level 1 and the allochthonous tectonostratigraphic assemblages of level 2 (described below).

## TECTONOSTRATIGRAPHIC UNITS (level 2)

### Sugluk Group (unit Pss)

The Sugluk Group (unit Pss) comprises highly deformed semipelite, pelite, quartzite, and amphibolite which predominantly outcrop along the northern shore of Big Island and on islands in White Strait (Map 1985A, Fig. 2). Semipelite and pelite are the most abundant rock types, whereas quartzite and amphibolite are relatively rare. The supracrustal rocks occur in bands of relatively limited width (< 1 km) but significant strike lengths (up to 20 km). Some of the bands of Sugluk Group are intruded by adjacent plutonic units, and therefore are interpreted as large, map-scale screens between Narsajuaq arc plutons (*see* below). However most of the metaplutonic units are concordant with the well foliated bands of Sugluk Group rocks. This observation, coupled with evidence for local truncation of units (Map 1985A, Fig. 2), suggests that at least some of the contacts between sedimentary and plutonic rocks are tectonic. Hanmer et al. (1996) suggested that these tectonic contacts are thrust faults, although whether they are related to late intra-Narsajuaq deformation (ca. 1.82 Ga) and/or to collision with the Superior Province margin (1.82-1.79 Ga) remains unresolved.

### Narsajuaq arc (units Pnm-Pnd)

Several types of orthopyroxene-bearing, compositionally layered metaplutonic rocks (i.e. layered monzogranite-granodiorite-tonalite gneiss; monzogranite gneiss) occur at intermediate structural levels in the project area (level 2, Fig. 4). The metaplutonic rocks in the upper Soper River valley area (Map 1980A, Fig. 2), McKellar Bay, Shaftesbury Inlet, and Barrier Inlet areas (maps 1981A and 1982A, Fig. 2), and Canon Inlet area (Map 1984A, Fig. 2) are in physical continuity with and/or are lithologically similar to plutonic rocks in the Kimmirut area (Map 1981A, Fig. 2) and north shore of Big Island (Map 1985A, Fig. 2) 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 within the project area (Fig. 4) 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. Grey anorthosite layers (unit Pna), up to several tens of metres in thickness and over a kilometre in strike length, are part of the monzogranite-granodiorite-tonalite gneiss unit about 40 km northeast of McKellar Bay (Map 1981A, Fig. 2). Lenses, layers, and locally discordant dykes of dark, hornblende-biotite-clinopyroxene ± orthopyroxene quartz diorite (unit Pnd), up to several tens of metres in thickness, commonly form an integral component of the orthogneiss. The tonalitic, granodioritic, and quartz dioritic components are crosscut by concordant to discordant veins of medium-grained orthopyroxene-biotite ± hornblende monzogranite and by rare coarse-grained hornblende-biotite ± orthopyroxene syenogranite.

Large areas of Narsajuaq arc (Fig. 4) 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. Coarse-grained and locally megacrystic layers can be up to 100 m in thickness. Hornblende-clinopyroxene-orthopyroxene-biotite quartz diorite layers (unit Pnd) are common. The scale of mapping in the project area 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.

## TECTONOSTRATIGRAPHIC UNITS (level 3)

### Ramsay River orthogneiss (unit Prm)

Buff- to pink-weathering, layered orthopyroxene-biotite ± hornblende dominantly monzogranite-tonalite orthogneiss (unit Prm) occurs on both limbs of the northeast-trending McKellar Bay-Frobisher Bay cross-fold antiform (Fig. 4). The orthogneiss units in the eastern portion of the project area (maps 1981A and 1982A, Fig. 2) are along strike from orthogneiss units intruded by the Cumberland batholith in the Frobisher Bay area (Map 1979A, Fig. 2). These in turn are correlated with metaplutonic gneiss mapped on the northwestern limb of the antiform (Scott et al., 1997) and were 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 the project area (Fig. 4).

The orthogneiss may represent the stratigraphic basement to the Lake Harbour Group (1.93-1.86 Ga; Table 1) described below. However, this is difficult to evaluate in the field as all observed contacts between orthogneiss and supracrustal units are tectonic. The age of the orthogneiss and its spatial association with the younger Lake Harbour Group, both restricted to level 3 (Fig. 4), suggest that a primary stratigraphic link is possible.

### Lake Harbour Group (units Plhs-Plhw)

The marble, psammite, and semipelite units in the eastern portion of the project area (maps 1980A, 1981A, and 1982A, Fig. 2) are along strike from, or are lithologically similar to rocks of the Lake Harbour Group examined in the Soper Lake, Crooks Inlet, and Markham Bay areas (maps 1981A, 1983A, 1984A, and 1985A, Fig. 2). Within these supracrustal rocks, two lithologically and geographically distinct successions are recognized. Along the southern coastal inlets and river valleys between Wight Inlet and Wharton Harbour (maps 1981A, 1982A, 1984A, and 1985A, Fig. 2), the Lake Harbour Group comprises interlayered semipelite (unit Plhs), garnetiferous psammite, orthoquartzite, 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 (maps 1979A, 1980A, 1983A, 1984A, and 1985A, Fig. 2), 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).

Semipelite (unit Plhs) is generally rusty, thinly layered at the centimetre scale, and characterized by abundant graphite. Garnet ± cordierite ± sillimanite pelite typically occurs as thin layers within garnet-biotite semipelite although dark pelitic bands predominate south of Beaumont Harbour (Map 1985A, Fig. 2). Compositional layers in the psammite (unit Plhp) 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 is generally subordinate within the psammite and both are generally rusty weathering and characterized by trace amounts of disseminated graphite, pyrite, chalcopyrite, and pyrrhotite. The 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 Plhw) are large enough to show on maps (e.g. maps 1984A and 1985A, Fig. 2).

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, and wollastonite. 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 generally associated with marble. Thicknesses of individual calcareous rock sequences range typically between about 2000 m north of Kimmirut (Map 1981A, Fig. 2) and in the Crooks Inlet area (Map 1984A, Fig. 2) to about 200 m in the Wight Inlet area (Map 1982A). 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 (maps 1980A, 1981A, 1982A, 1984A, and 1985A, Fig. 2). 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. In one locality 12 km east of Shaftesbury Inlet (Map 1981A, Fig. 2), a metadunite sill several hundred metres in strike length is characterized by chromite seams several millimetres in thickness. Metaleucodiorite sills and metatonalite bodies (unit Plhd) are abundant in the siliciclastic rocks of the Lake Harbour Group east of the Soper River (maps 1980A and 1981A, Fig. 2).

### Blandford Bay assemblage (units Pbbq-Pbbm)

Light- to dark-grey-weathering feldspathic quartzite (unit Pbbq), typically medium to coarse grained, constitutes the dominant siliciclastic component of the Blandford Bay assemblage (maps 1983A and 1984A, Fig. 2). Homogeneous sections up to 500 m thick are common and form prominent ridges in the area. Individual beds are generally 10-20 cm thick, but range up to 2 m in thickness. In contrast to clastic units of the Lake Harbour Group, aluminous minerals such as garnet and sillimanite are generally absent in the feldspathic quartzite (unit Pbbq). Rusty-weathering pelite is thinly bedded and commonly forms sections several hundred of metres thick below the feldspathic quartzite. Garnet and sillimanite, as well as disseminated pyrite and minor chalcopyrite, are found throughout the pelite.

Sheets of homogeneous coarse-grained metaperidotite, layered metaperidotite-metagabbro, and homogeneous metagabbro (unit Pbbm) are widespread in the siliciclastic rocks of the Blandford Bay assemblage (maps 1983A and 1984A, Fig. 2). The sheets are typically 50-100 m thick, and commonly have strike lengths of up to several kilometres. Relict compositional layering, defined by variations in modal composition, has been observed in both ultramafic and mafic rocks. The contacts of these bodies with the host siliciclastic rocks are conformable, and the igneous rocks locally preserve chilled margins. These observations suggest that these bodies are best interpreted as sills. Disseminated pyrite and minor chalcopyrite have been observed in both mafic and ultramafic sills. Finally, the presence of distinctive mafic and ultramafic sills in rocks of both the Lake Harbour Group and Blandford Bay assemblage suggests that they were in close proximity to one another at the time of sill emplacement.

### Cumberland batholith (units Pcmo-Pcd)

Coarse- to medium-grained, massive to foliated metaplutonic rocks northeast of Markham Bay (Map 1983A, Fig. 2), around Frobisher Bay (Map 1979A, Fig. 2), and in the eastern portions of the McKellar Bay (Map 1981A, Fig. 2) and Wight Inlet (Map 1982A, Fig. 2) map areas 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. 4; Blackadar, 1967; Jackson and Taylor, 1972).

The principal rock type mapped in the Cumberland batholith in the northern part of the project area (Fig. 4) is a tan- to pink-weathering orthopyroxene-biotite monzogranite (unit Pcmo) that is massive to weakly foliated. Minor biotite-garnet- (unit Pcmg), biotite ± orthopyroxene-garnet ± cordierite- (unit Pcmb), and epidote-bearing (unit Pcme) phases are present. Panels of garnetiferous psammite and forsterite-bearing marble that physically resemble Plhp and Plhc units can be traced along strike for several kilometres. Sheets of hornblende-orthopyroxene-clinopyroxene diorite (unit Pcd), 10-500 m wide and up to several kilometres long, are broadly coplanar with the dominant foliation in the host monzogranite 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 (maps 1979A and 1983A, Fig. 2).

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 supracrustal units (*see* below). Isolated, kilometre-scale plutons of pink orthopyroxene-biotite monzogranite northeast of Crooks Inlet (Map 1984A, Fig. 2), north and east of Soper Lake (maps 1981A and 1985A, Fig. 2), one of which has been dated at 1.85 Ga (Wodicka and Scott, 1997), are interpreted as part of the Cumberland magmatic system.

## DEFORMATION AND METAMORPHISM

Completion of systematic regional mapping, re-examination of key outcrops in previously mapped areas, and new geochronological data (Wodicka and Scott, 1997; Scott and Wodicka, 1998) have facilitated the development of a comprehensive structural and metamorphic framework for the entire project area within the greater Trans-Hudson Orogen (Quebec-Baffin Island segment) context (Table 1; St-Onge et al., 1999). Deformation and metamorphism are polyphase, with at least three regional episodes of compression and one thermal event common to all tectonostratigraphic units (Table 1; Scott et al., 1997. The tectonothermal evolution is described in the following paragraphs, utilizing the deformation-metamorphism framework outlined in Table 1. References for age dates are given in Table 1.

### Pre-$D_1$ and $D_1$ deformation and metamorphism (level 1)

The oldest deformation structures and mineral assemblages recognized in the project area are found in the level 1 Archean orthogneiss and granite (units Ast - Asg) bodies on Big Island (Map 1985A, Fig. 2), which are correlated with the Superior Province basement in northern Quebec (St-Onge et al., 1996). In northern Quebec, plutonism, concomitant granulite-facies metamorphism, and deformation range in age from 3.22 to 2.74 Ga (Table 1). Accumulation of the (Table 1) Povungnituk Group (Ppm; > 2.04-1.96 Ga) on the orthogneiss is interpreted to record Paleoproterozoic rifting of the northern Superior Province (St-Onge et al., 1992; and references therein). Lucas and St-Onge (1992) defined $D_1$ (regular sequence) thrusting deformation and associated $M_1$ prograde metamorphism of the Povungnituk Group rocks in the Cape Smith Belt (Quebec) as a pre-Narsajuaq arc event that may have been initiated by ca. 1.87 Ga. $D_1$-$M_1$ deformation structures and assemblages have not been recognized on Big Island.

### $D_1$ deformation and $M_1$ metamorphism (level 2)

Arc plutonism, $M_1$ granulite-facies metamorphism, $D_1$ deformation, and the development of compositional layering in the metaplutonic rocks (units Pnm - Pnd) of the Narsajuaq arc (Lucas and St-Onge, 1995) are bracketed on southern Baffin Island (maps 1980A, 1981A, and 1982A) between 1.84-1.82 Ga (Table 1). In northern Quebec, plutonism and $D_1$-$M_1$ deformation structures and assemblages are bracketed between 1.86-1.82 Ga (Lucas and St-Onge, 1992).

### $D_1$ deformation and $M_1$ metamorphism (level 3)

Crosscutting field relations (maps 1983A, 1984A, and 1985A, Fig. 2) require that early map-scale $D_1$ imbrication of the Ramsay River orthogneiss (unit Prm), Lake Harbour Group (units Plhs - Plhw), and Blandford Bay (units Pbbq - Pbbm) assemblage within level 3 (Scott et al., 1997) predate emplacement of the 1.86-1.85 Ga Cumberland batholith (units Pcmo - Pcd) (Table 1). Prograde metamorphism $M_1$ of the Lake Harbour Group and Blandford Bay assemblage, and retrogression of granulite-facies assemblages in the Ramsay River orthogneiss, is constrained at ca. 1.85 - 1.84 Ga (Table 1).

### $D_2$ deformation and $M_2$ metamorphism

The $D_2$ deformation event is defined as the oldest compressional deformation event which affects all tectonostratigraphic elements in the project area (Table 1). It involves 1) accretion of the imbricated Lake Harbour Group (units Plhs - Plhw), Blandford Bay assemblage (units Pbbq - Pbbm) and Ramsay River orthogneiss (unit Prm) package (level 3) to the metaplutonic rocks (units Pnm - Pnd) of Narsajuaq arc (level 2), 2) accretion of Narsajuaq arc (level 2) to the northern margin of the Superior Province (level 1); and 3) imbrication of Povungnituk Group (unit Ppm) and Archean basement (units Ast - Asg) units (level 1). The $D_2$ event is bracketed (Table 1) between the youngest dated unit in the Narsajuaq arc (1.82 Ga) and the age of emplacement of a postaccretion syenogranite dyke (1.79 Ga). The presence of numerous repetitions and truncations of distinct tectonostratigraphic units, and the overall ramp-flat fault geometry of the $D_2$ structures (Scott et al., 1997; St-Onge et al., 1999) suggest that juxtaposition of the units occurred along a system of southwest-verging thrust faults. These thrusts are commonly associated with development of mylonitic fabrics over thicknesses of metres to tens of metres. In addition, $D_2$ thrust faulting was accompanied by outcrop- to map-scale recumbent folding (maps 1980A and 1981A, Fig. 2). In detail the recumbent folds deform $D_2$ thrust faults and the principal foliation and/or gneissosity but are themselves cut by younger $D_2$ faults. The recumbent folds deform $D_1$-$M_1$ fabrics in both level 2 and level 3 rocks.

$D_2$ deformation is characterized by a distinct $M_2$ metamorphic event involving retrogression of granulite-facies assemblages in the Archean basement, Narsajuaq arc, and Lake Harbour Group (Wodicka and Scott, 1997; St-Onge et al., 1999), and growth of prograde amphibolite-facies mineral assemblages in the Povungnituk Group (cf. Lucas and St-Onge, 1992). Within the hinge zone of the $D_2$ recumbent folds (e.g. Map 1980A, Fig. 2), growth of retrograde $M_2$ sillimanite-biotite-quartz at the expense of $M_1$ garnet ± cordierite in psammite units (unit Plhp) of the Lake Harbour Group led to the progressive development of a new schistose $D_2$ axial planar fabric.

Massive syenogranite dykes and syenite plugs, which are discordant to the principal deformation fabrics in host rocks of all three structural levels, were emplaced between ca. 1.79-1.78 Ga (Table 1). This age range provides a lower bracket for the age of the $D_2$ accretion event on southern Baffin Island. In addition, the documentation of 2.84 Ga zircon inheritance in a 1.78 Ga syenite north of Kimmirut (Fig. 4; Scott, 1997) suggests that the Superior Province basement extended at least that far north beneath level 2 and 3 rocks (Scott, 1997; St-Onge et al., 1999) or that metasedimentary rocks with an Archean component underlie these levels.

### $D_3$ deformation

Both $D_1$ and $D_2$ fault and fold structures are reoriented by southeast- to south-trending $D_3$ folds. The $D_3$ folds range from metre to map scale (Fig. 4; all project area maps) and display a consistent southwest- to west-verging asymmetry. The $D_3$ folding is manifest at map scale by the large synform cored by level 3 units northwest of Kimmirut and the northwest-striking antiform cored by level 2 units southwest of Frobisher Bay (Fig. 4). The numerous klippen of Lake Harbour Group rocks north and east of Kimmirut (maps 1980A, 1981A, and 1982A, Fig. 2) are second-order refolded $D_3$ synforms. $D_3$ folding in northern Quebec occurred at ca. 1.76 Ga (Table 1; Lucas and St-Onge, 1992).

### $D_4$ deformation

Upright refolding of all structural elements about north-northeast-trending axes generated the large $D_4$ cross-fold antiform that dominates the map pattern between McKellar Bay and Frobisher Bay (Fig. 4). $D_4$ refolding of $D_3$ synformal keels created the series of klippen of level 3 units (Fig. 4) along the $D_4$ antiformal hinge zone. It is the interference of $D_3$ and $D_4$ folds that has generated sufficient structural relief in the area to allow the study of the architecture of the South Baffin orogenic belt and its three principal structural levels at the present erosion surface. $D_4$ folding in northern Quebec occurred between 1.76 and 1.74 Ga (Table 1; Lucas and St-Onge, 1992).

## ECONOMIC POTENTIAL

The presence of mafic and ultramafic sills in siliciclastic rocks of the Lake Harbour Group (units Plhs, Plhp) and Blandford Bay assemblage (unit Pbbq) may present conditions favourable for the formation of magmatic Ni-Cu sulphide mineralization. The largest sills (units Plhu, Plhm, Pbbm) are indicated on all seven 1:100 000-scale maps in this set. Serpentinized ultramafic rocks have been identified in a number of localities in the map area, some of which may provide material suitable for stone carving.

## NEOPROTEROZOIC DIABASE DYKES

Several undeformed northwest-trending Neoproterozoic diabase dykes (unit Nd) intrude the supracrustal and metaplutonic rocks of levels 2 and 3 in the project area. The largest and most continuous group of dykes are found just north of Markham Bay (Map 1983A, Fig. 2) and west of the Soper River (Map 1980A, Fig. 2). The dykes vary in width from tens of metres to approximately 200 m and are near vertical. Locally they anastomose. Dykelets a few metres in width are locally observed branching from the larger intrusions. The dykes generally exhibit a brown weathered surface and the larger ones, a rectangular joint pattern.

## ORDOVICIAN LIMESTONE

Shallowly dipping (less than 10°) middle Ordovician limestone (Blackadar, 1967) occurs as a series of northwest-trending erosional outliers to the northwest of Frobisher Bay (Map 1979A, Fig. 2). The limestone outliers in the map area (unit Ol) are juxtaposed against Cumberland batholith monzogranite (units Pcmo, Pcme) by a northwest-striking normal fault with hundreds of metres of throw. The limestone is composed of medium grey lime mud, grading to siltier, light brown lime mud. Extensive fossil assemblages are preserved in the outliers. The fossils preferentially weather out and can be found in the rubble at the bases of cliffs. Fauna identified in the field include hemispherical colonial corals, high conispiral and pseudoplanispiral gastropods (*Maclurites* sp.), and orthocone nautiloids up to 1.5 m in length. Brachiopods, bivalves, and crinoids are also present. Sanford and Grant (1988, and references within) have assigned these rocks to the Amadjuak and Frobisher Bay formations correlative with similar units in Hudson Strait, Ungava Bay, and northwestward into the Foxe Basin.

## QUATERNARY

Quaternary deposits (unit Q) comprise till, except for outwash along south-flowing river valleys (e.g. Soper River, maps 1980A and 1981A, Fig. 2). Till is a clast-supported silty sand; clasts are granule to large boulder size, entirely of Precambrian lithologies except for rare Paleozoic carbonate below the marine limit (100 m elevation) on Hudson Strait shores. The till forms a blanket more than 2 m thick, locally much thicker in end moraines marking readvances during overall deglaciation. No exposures of till fabric were observed. Till was deposited by a strong southwesterly ice flow during the last (late Foxe) glaciation. The ice sheet divide lay north of the present Meta Incognita Peninsula watershed. Late deglacial events included a readvance over the present watershed, and reversals of flow over the Frobisher Bay-Amadjuak Lake lowland. Outwash is sand and minor silt and gravel, derived from till during late stages of deglaciation. Kettle fluvial terraces are 2-10 m thick, locally thicker where coalesced with a few eskers.