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PRECAMBRIAN METAMORPHIC AND TECTONIC EVOLUTION OF NORTHERN BAFFIN ISLAND, NUNAVUT, CANADA*

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Abstract

The northern part of Baffin Island, in Nunavut, lies within the *ca.* 3.0–2.5 Ga Committee belt, characterized by episodic granitic plutonism and greenschist- to upper-amphibolite-facies belts of supracrustal rocks. Whereas the entire belt on Baffin Island was likely affected by *ca.* 2.7 Ga plutonism and associated metamorphism, there is also evidence of a high-grade event at *ca.* 2.55–2.5 Ga. Evolution of the Baffin orogen in south-central Baffin Island led to generation of the *ca.* 1.86 Ga Cumberland Batholith, *ca.* 1.85–1.83 Ga northwest-directed thrusting of the Foxe fold-and-thrust belt over the Dexterity granulite belt (DGB), and variable structural and metamorphic reworking of the Committee belt on northern Baffin Island. Thermobarometric data for granulite-facies rocks in the western DGB indicate ~8.7 kbar paleopressure, interpreted to have been achieved in continental crust thickened by thrust imbrication. Paleopressure decreases gradually northward from the western DGB to <4 kbar, but decreases sharply south of the Isortoq fault zone (IF), which approximates the southern boundary of the DGB. Combined thermobarometric and structural constraints suggest that the IF represents an important crustal-scale structure involved in both NW-directed thrusting and tectonic loading of the DGB, as well as subsequent extensional unroofing of the DGB. Southwest-directed thrusting in the *ca.* 1.825–1.81 Ga Northeast Baffin thrust belt (NBTB) is interpreted to have produced similar tectonic thickening and ~10.5 kbar pressures along most of the length of this belt on northern Baffin Island, including the eastern part of the DGB. The ~6–8 kbar Archean Bylot Batholith represents a higher structural level that may have contributed to tectonic loading of adjacent high-pressure rocks in the NBTB.

Keywords: Baffin Island, metamorphism, tectonics, P–T data, thermobarometry, Committee belt, Baffin orogen, Nunavut.

Sommaire

La partie nord de l’île de Baffin, au Nunavut, se trouve à l’intérieur de la ceinture Committee, dont l’âge serait d’environ 3.0–2.5 Ga; ce socle témoigne d’épisodes de plutonisme granitique et contient des ceintures métamorphiques de roches supracrustales recristallisées aux conditions allant des faciès schistes verts à amphibolite supérieur. Tandis que la ceinture en entier sur l’île de Baffin a subi un épisode de plutonisme et de métamorphisme associé à environ 2.7 Ga, il y a aussi des signes d’un métamorphisme de haut grade à environ 2.55–2.5 Ga. L’évolution de l’orogène de Baffin dans le secteur centre-sud de l’île a mené à la mise en place du batholite de Cumberland à environ 1.86 Ga, au chevauchement vers le nord-ouest à environ 1.85–1.83 Ga de la ceinture de Foxe, imbriquée par-dessus la ceinture granulitique de Dexterity, et au remaniement structural et métamorphique d’intensité variable de la ceinture Committee plus au nord. Les données thermobarométriques pour les roches du secteur ouest de la ceinture Dexterity indiquent environ ~8.7 kbar de pression, qui serait dû à un épaississement de la croûte continentale suite au chevauchement et à l’imbrication. Les pressions diminuent graduellement vers le nord à partir de la ceinture Dexterity (secteur ouest) jusqu’à moins de 4 kbar, mais elles diminuent abruptement au sud de la zone de faille Isortoq, qui marquerait la bordure sud de la ceinture Dexterity. D’après les données thermobarométriques et les contraintes structurales, la zone de faille Isortoq représenterait une structure importante à l’échelle de la croûte, impliquée à la fois dans le chevauchement vers le nord-ouest et l’empilement tectonique sur la ceinture Dexterity, de même que la remontée de ce socle en milieu d’extension par la suite. Un chevauchement vers le sud-ouest à environ 1.825–1.81 Ga le long de la ceinture du Nord-Est de Baffin aurait produit un épaississement semblable et des pressions d’environ 10.5 kbar tout le long de cette ceiture dans la partie nord de l’île, et en aurait affecté la partie orientale de la ceinture Dexterity. Le batholite archéen de Bylot, témoignant de pressions d’environ 6–8 kbar, représente un niveau structural supérieur qui pourrait avoir contribué à l’empilement tectonique par dessus les roches de pression élevée avoisinantes de la ceinture de chevauchement du Nord-Est de Baffin.

(Traduit par la Rédaction)

Mots-clés: île de Baffin, métamorphisme, évolution tectonique, données P–T, thermobarométrie, ceinture Committee, orogène de Baffin, Nunavut.

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Introduction

The geology of most of Precambrian Baffin Island is known only at reconnaissance scale, based in large part on four Geological Survey of Canada helicopter mapping projects with flight lines and landings at ~10 km intervals (*e.g.,* Blackadar 1967, 1970, Jackson & Taylor 1972, Jackson & Davidson 1975, Jackson *et al.* 1975, Jackson 2000). More detailed mapping and associated studies have largely been restricted to central and southern Baffin Island (*e.g.,* Morgan *et al.* 1976, Tippett 1980, Henderson *et al.* 1989, St-Onge *et al.* 1999, 2000), with the exception of the Eqe Bay area (Bethune & Scammell 1997) and the Mesoproterozoic sedimentary basins on northern Baffin Island (Jackson & Iannelli 1981, Chandler 1988, Iannelli 1992). Although the distribution of metamorphic facies and the main overprinting relationships have been described at reconnaissance scale for Baffin Island (Jackson & Morgan 1978a), more detailed studies with associated U/Pb geochronology have been restricted to portions of southern Baffin Island (St-Onge *et al.* 2000), a small area in central Baffin Island (Henderson *et al.* 1989, Henderson & Henderson 1994), and the Eqe Bay area (Bethune & Scammell 1997). Except for southernmost Baffin Island (St-Onge *et al.* 2000), quantitative constraints on metamorphic conditions are known only for one other small area of south-central Baffin (Cortemiglia *et al.* 1985).

In this paper, we address this gap in metamorphic knowledge base by presenting the first reconnaissance-scale thermobarometric constraints for northern Baffin Island. We first describe geological relationships, tectonic domains, and regional-scale metamorphic relationships on northern Baffin Island. We then summarize what can be inferred about its tectonometamorphic history, relating metamorphic features in Archean and Paleoproterozoic lithologies to major tectonic domains and domain boundaries. We begin with a brief overview of the geotectonic setting of Baffin Island.

Geotectonic Setting

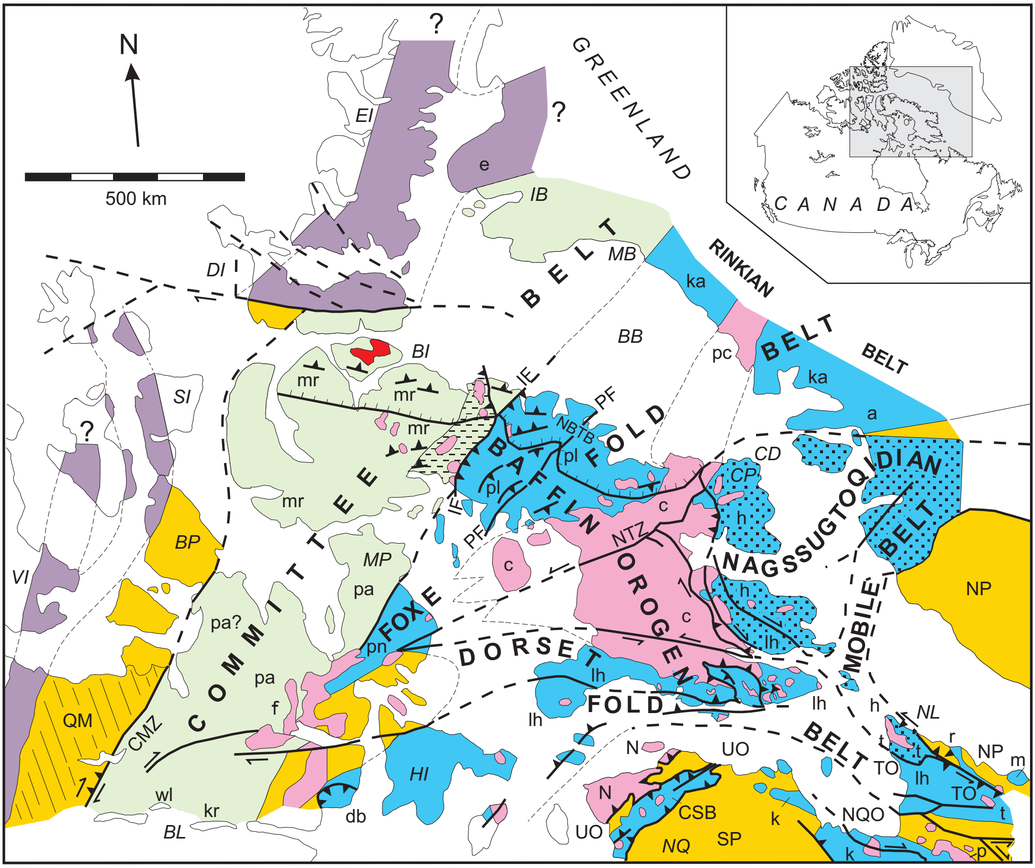
Baffin Island can be divided into two blocks with contrasting geological histories. The northern part consists of the *ca.* 3.0–2.5 Ga Committee belt (the Committee Fold Belt of Jackson & Taylor 1972), which lies within the northern Churchill Province (Stockwell 1982) or the northern Rae Province (Hoffman 1989). This belt extends northeast for at least 2000 km from southwest of Baker Lake to northwestern Greenland (Fig. 1). It is characterized by episodic felsic plutonism and greenschist- to upper-amphibolite-facies supracrustal belts. The *ca.* 1.9–1.8 Ga Baffin orogen comprises the rest of Baffin Island, extending into northern Baffin Island, where it overprints the Committee belt. The Baffin orogen forms part of the northeastern Trans-Hudson orogen, and extends into western Greenland, Melville Peninsula, and northern Quebec–Labrador (Fig. 1; Henderson *et al.* 1980, Hoffman 1990a, b, Jackson *et al.* 1990a, b, St-Onge *et al.* 1999, Jackson 2000).

In addition to these two main lithotectonic units, Baffin Island has been divided into eight tectonic domains on the basis of differences in aeromagnetic character, structural features, lithologies, faults and lineaments, and extant geochronology. In northern Baffin Island, there is general continuity in lithologies across these domain boundaries, with the exception of several basins that consist of younger sediments. For this reason, tectonic domains and important boundaries between domains are described after the geological relations within the Committee belt and Baffin orogen. Descriptions of geological relationships (Fig. 2) and tectonic domains (Fig. 3) are based largely on the work documented and referenced in detail by Jackson (2000), who also presents a comprehensive list of geological maps and geochronological results for the region. All reported ages are U–Pb zircon ages unless otherwise noted.

Geology of the Committee Belt

The geology of much of the Committee belt (Fig. 1) is known at a reconnaissance scale only. Extant geochronology indicates that it is characterized by three Archean crust-building episodes. The oldest (*ca.* 3.0–2.8 Ga) is represented by a *ca.* 2.85 Ga felsic pluton on northwestern Baffin Island (Jackson *et al.* 1990b) and *ca.* 2.9 Ga felsic volcanic rocks on Melville Peninsula (Frisch 1982, Henderson 1983). In addition, the presence of old crust is indicated by *ca.* 3.0 Ga zircon

FIG. 1. Major Archean and Paleoproterozoic lithological and tectonic terranes and zones, vicinity of Baffin Island, Nunavut. Greenland's fit is after Le Pichon *et al.* (1977). Figure is modified from Jackson (2000). **Topographic features, political regions:** *BI*: Bylot Island, *BB*: Baffin Bay, *BL*: Baker Lake, *BP*: Boothia Peninsula, *CD*: Cape Dyer, *CP*: Cumberland Peninsula, *DI*: Devon Island, *EI*: Ellesmere Island, *HI*: Southampton Island, *IB*: Inglefield Bredning, *MB*: Melville Bugt, *MP*: Melville Peninsula, *NL*: Northern Labrador, *NQ*: Northern Quebec, *SI*: Somerset Island, *VI*: Victoria Island. **Tectonic features:** CSB: Cape Smith Belt, CMZ: Chantrey mylonite zone; IF: Isortoq fault zone, N: Narsajuak arc, NBTB: Northeast Baffin thrust belt, NP: Nain Province, NQO: New Quebec orogen, NTZ: Nettilling shear zone, PF: Piling fault zone, QM: Queen Maude block, SP: Superior Province, TO: Torngat orogen, UO: Ungava orogen. **Rock assemblages**: a: Anâp Nuna Group, c: Cumberland Batholith, db: Daly Bay Complex, e: Etah Group, f: Ford Lake plutons, h: Hoare Bay Group, k: Kaniapiskau Supergroup, ka: Karrat Group, kr: Ketyet River Group, lh: Lake Harbour Group, m: Mugford Group, mr: Mary River Group, p: De Pas Batholith, pa: Prince Albert Group, pc: Prøven Charnockite, pl: Piling Group, pn: Penhryn Group, r: Ramah Group, t: Tasiuak Gneiss, wl: Woodburn Lake Group.



PALEOPROTEROZOIC

Dexterity Granulite Belt (1.825 Ga); reworked Archean and some Paleoproterozoic rocks

Granite-tonalite, charnockite-enderbite plutons (1.87- 1.81 Ga, c= Cumberland Batholith)

Thelon Tectonic Zone; reworked Archean, 2.0 - 1.9 Ga granitic, and charnockitic intrusions, supracrustal rocks of uncertain age

Supracrustal rocks and derived gneisses (2.2 - 1.8 Ga); includes some small Paleoproterozoic granitic plutons, and reworked Archean rocks; Nagssugtoqidian Mobile Belt is shown by stippling

ARCHEAN

Granite - tonalite, charnockite - enderbite (~2.54 Ga)

Committee Belt; 2.9-2.5 Ga granite-greenstone terranes with some older and younger rocks, and Paleoproterozoic reworking

QM Undifferentiated Archean (3.8-2.5 Ga); local Paleoproterozoic reworking NP = Nain Province, SP = Superior Province, and QM = Queen Maud Block

MAJOR PALEOPROTEROZOIC STRUCTURES:

thrust

western limit of Northeast Baffin Thrust Belt (1.825-1.81 Ga)

fault or shear zone (defined, assumed)

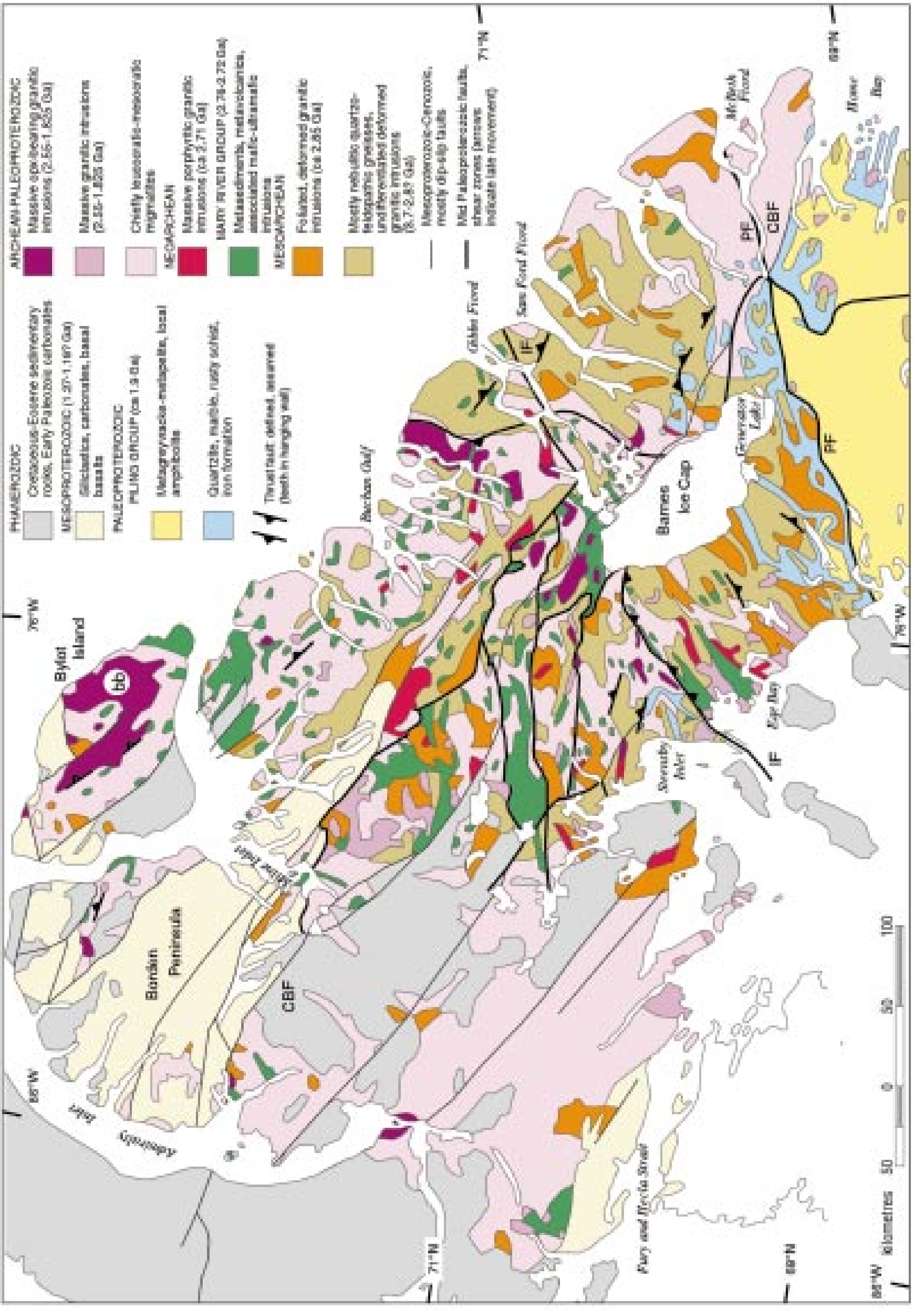


FIG. 2. Geology of northern Baffin Island; bb: Bylot Batholith, CBF: Central Borden fault zone, IF: Isortoq fault zone, PF: Piling fault zone.

xenocrysts in syenite (Ashton 1988), *ca.* 3.0–2.81 Ga detrital zircon in quartzite near Woodburn Lake (Davis & Zaleski 1998), and by *ca.* 2.84 zircon in conglomerate on northwestern Baffin Island at Eqe Bay (Bethune & Scammell 1997).

The middle episode, at *ca*. 2.76–2.71 Ga, is represented by widespread felsic plutonism and by metavolcanic and paragneiss sequences, such as the Woodburn Lake, Ketyet River, Prince Albert and Mary River groups (Fig. 1) that occur in NE–SW-trending belts that are complexly deformed with large-scale fold hinges tens of km across (*e.g.,* Fig. 114 in Jackson 2000, and references therein). Younger granitic plutons and orthogneisses, most in the range *ca.* 2.6–2.5 Ga, have been reported, mostly from the southwestern part of the belt from Boothia Peninsula to south of Baker Lake (Fig. 1; Dudás *et al.* 1991, LeCheminant & Roddick 1991, Frisch & Parrish 1992, Davis & Zaleski 1998), but they also are present on southern Devon Island, Bylot Island, and in northwestern Greenland.

A *ca.* 2.55–2.50 Ga tectonothermal event may have affected much of the Committee belt. Evidence for this event comes from *ca.* 2.54 Ga SHRIMP analyses of zircon (likely igneous) of the charnockitic Bylot Batholith on northwestern Baffin Island (D.J. Scott & G.D Jackson, unpubl. data), *ca.* 2.52–2.43 Ga orthogneisses on southern Devon Island (Frisch 1988), and *ca.* 2.56–2.5 Ga zircon and monazite inclusions in garnet from middle- to upper-amphibolite-facies metapelites just south of Baker Lake (Stern & Berman 2000).

The extent and boundaries of the Committee belt are uncertain, given the reconnaissance nature of geological information within the belt. Although the Isortoq fault zone (IF) and its southwestward extension are taken as the southern boundary of the Committee belt with the Baffin orogen, the occurrence of reworked Archean rocks south of the IF indicates that the Committee belt was more extensive than shown in Figure 1. Its northwestern border has been taken tentatively as the Chantrey mylonite zone and its northeastward extension (Fig. 1). Partially overlapping Nd-depleted mantle model ages ($T_{DM;}$ DePaolo 1981) between the southern Queen Maude Block (3.6–3.1 Ga; Thériault *et al.* 1994) and the southwestern (2.9–2.4 Ga; Dudás *et al.* 1991) and northwestern Committee belt (3.7–2.8 Ga; Hegner & Jackson 1990, Jackson *et al.* 1990a) suggest, however, that the Queen Maud block could be considered part of the Committee belt. On the other hand, too little is known about the geology in and north of the Queen Maud Block to include it in the Committee belt at this time. Extension of the Committee belt into the Inglefield Bredning – Melville Bugt (IB) region of northwestern Greenland (Fig. 1) is based on the lithological, geochronological, and metamorphic similarities between supracrustal rocks there (Dawes & Frisch 1981, Nutman 1984, Dawes *et al.* 1988, Dawes 1991) and the Mary River Group on Baffin Island (Fig 1). An extension of the Thelon Tectonic Zone may truncate the Committee belt west of northeastern Greenland (*e.g.,* Condie & Rosen 1994, Kalsbeek *et al.* 1993).

Within the Committee belt on northern Baffin Island, four major assemblages of rocks have been identified (Fig. 2) and are described below. The Mesoarchean (< 2.9–2.8 Ga) is represented by felsic orthogneisses and by foliated, strongly deformed felsic plutonic rocks. Neoarchean (2.76–2.71 Ga) rocks include the supracrustal Mary River Group and post-Mary River Group, syn- to late-tectonic felsic intrusions. Because of Paleoproterozoic deformation, metamorphism, and plutonism, two map units are of uncertain age (Archean or Paleoproterozoic or both): layered gneissic migmatite, and granite – charnockite. The Paleoproterozoic Piling Group (see Baffin orogen below) was deposited on the exhumed Archean complex. A subsequent exhumation after Paleoproterozoic orogenesis was followed by deposition of the Mesoproterozoic Bylot Supergroup in the Borden Rift Basin (Fig. 3).

Mesoarchean rocks

The oldest rocks occur in a basement complex that consists predominantly of nebulitic and migmatitic granitic–tonalitic orthogneiss, together with undifferentiated, relatively small, less deformed, younger felsic plutons, and variable gneisses of uncertain origin. Foliated and deformed monzogranite–tonalite plutons also form part of the basement complex (Fig. 2), and are closely associated with the more highly deformed nebulitic gneisses. Field relationships indicate that the foliated plutons intrude nebulites, a relation that is compatible with Nd model ages: model ages of nebulite attain 3.7 Ga and are all older (mean 3.3 Ga: Hegner & Jackson 1990, Jackson & Hegner 1991) than those for foliated felsic intrusions (mean 2.8 Ga). Although these ages may reflect different amounts of incorporated protolith (>2.8 Ga) in the two units, similar U–Pb zircon and Nd model ages of 2.85 and 2.84 Ga for samples of foliated granite (Hegner & Jackson 1990, Jackson *et al.* 1990b, Bethune & Scammell 1997) indicate that at least some foliated granitic rocks are composed mostly of juvenile material. Two *ca.* 2.78 Ga ages of crystallization of felsic gneisses at Eqe Bay, based on zircon (Bethune & Scammell 1997), suggest early Neoarchean reworking. The younger Mary River Group (see Neoarchean below) unconformably overlies the complex in several places, and is also locally in fault contact with scattered remnants of metasedimentary and metavolcanic rocks within the complex (Jackson 2000). Differences in composition between Mary River amphibolites and some of these metavolcanic rocks (*e.g.,* areas A and B, Fig. 3; Jackson 1978b, 2000) are consistent with the interpretation that some of these supracrustal remnants within the basement complex predate the Mary River Group.

Neoarchean

Rocks assigned to the Mary River Group (MRG) are generally a minor bedrock component that forms lenticular bodies as much as 65 km long, generally preserved throughout the Committee belt as infolds and isolated remnants within older gneiss and within migmatite derived from the MRG (Figs. 2, 3). The Mary River Group most commonly consists of a lower sequence of metamorphosed, bimodal (calc-alkaline and felsic to tholeiitic mafic and ultramafic, including spinifex-bearing komatiite) metavolcanic rocks and an upper sequence of pelite–greywacke of turbiditic affinity. The stratigraphic positions of chromian-muscovite-bearing quartzite, conglomerate, volcanic breccia, Algoma-type iron formation (containing some of the highest-grade primary and secondary iron deposits in the world), and minor marble vary on a regional scale (Jackson 1966, 2000, Morgan *et al.* 1975, Bethune & Scammell 1997). Mafic and ultramafic intrusions are abundant; anorthosite occurs locally. U–Pb zircon ages for felsic metavolcanic rocks (Morgan 1982, Jackson *et al.* 1990b, Bethune and Scammell 1997) indicate extrusion ages of 2.76–2.72 Ga. Mafic metavolcanic rocks are likely of similar age, given that they both underlie and overlie felsic volcanic rocks at different localities. Similar *ca.* 2.85 Ga Nd model ages have been obtained for two mafic metavolcanic samples and a 2.85 Ga (zircon) basement tonalite sample (Hegner & Jackson 1990, Jackson *et al.* 1990a). Deposition of the group is interpreted to be related to rifting in a large, unstable, volcanically active basin. The chemical composition of Archean granitic rocks (G.D. Jackson, unpubl. data) favors emplacement in a volcanic arc environment of an active continental margin (Jackson 2000), although field and Sm–Nd data suggest that some Neoarchean chemical signatures may have been inherited from a remelted Mesoarchean protolith.

A large number of syn- to late-tectonic, massive to weakly foliated, near-minimum-melt-granite intrusions appear to truncate Mesoarchean rocks and the Mary River Group. Regionally, most of these intrusions are K-feldspar-phyric monzogranite–granodiorite (Fig. 2), but at Mary River (Jackson 1966) and Eqe Bay (Bethune & Scammell 1997), felsic intrusive rocks are equigranular and have a wider compositional range. Ages of crystallization based on zircon are 2.73–2.70 Ga, as little as 9 Ma younger than Mary River metavolcanic rocks they intrude. A Nd model age for one sample suggests that these intrusive rocks may contain a component at least as old as 2.90 Ga (Hegner & Jackson 1990, Jackson *et al.* 1990a, b).

Archean – Paleoproterozoic

Layered migmatite and gneiss comprise a complex of variously intermixed and assimilated remnants of all Archean to middle Paleoproterozoic map units, including the Piling Group. Zircon ages for granitic components may range from 2.85 to 1.82 Ga. Most Nd model ages are 2.9–2.5 Ga (Hegner & Jackson 1990, Jackson *et al.* 1990a). The presence of low-grade strata of the Mary River Group unconformably overlying migmatite and other high-grade gneisses in a few localities indicates at least one episode of pre-MRG formation of migmatite.

Another melting event considered to be related to reworking of the southern part of the Committee belt during the Baffin orogeny is indicated by the Proterozoic lower intercept of the U–Pb zircon data from an anatectic granite in migmatite southwest of Buchan Gulf. These data have been interpreted to indicate Proterozoic melt formed from an Archean protolith considered in part to be *ca.* 2.73 Ga amphibolite of the Mary River Group engulfed in this melt (Jackson *et al.* 1990b). The 2.522 ± 0.01 Ga upper intercept for this granite may represent an additional high-grade event recognized elsewhere in the Committee belt (see above).

Massive to weakly foliated felsic intrusions, commonly of near-minimum-melt monzogranite composition, occur throughout the Committee belt as locally abundant dykes, sills, stocks and as numerous batholiths (Fig. 2). The larger bodies are concentrated in two discontinuous belts that are discordant with regional structural and supracrustal trends in the Committee belt, although contacts of most individual plutons parallel local structures. Pink, equigranular granitic intrusions occur in a belt from Milne Inlet south past the western end of the Dexterity granulite belt (DGB). Equigranular to feldspar-phyric charnockite intrusions occur mostly within the Dexterity granulite belt (Figs. 1–3) and sporadically in the Northeast Baffin thrust belt. Pluton contacts are normally sharp at grades lower than granulite, but are commonly less distinct at granulite-facies conditions owing to metamorphic recrystallization.

With the following exceptions, the ages of most felsic intrusive bodies are constrained only to be younger than the Mary River Group and older than middle Paleoproterozoic. U–Pb data for a pluton of pink monzogranite west of Bylot Island suggest Paleoproterozoic melting and recrystallization of Archean protolith (Jackson *et al.* 1990b), and some felsic plutons interpreted as Archean adjacent to the Dexterity granulite belt appear to grade into charnockite within the Dexterity granulite belt. However, most charnockite within the Dexterity granulite belt is considered to be *ca.* 1.82 Ga, the age of granulite-facies metamorphism and deformation in the southwestern end of the Dexterity granulite belt (Bethune & Scammell 1997). Several syn- to late-kinematic granites in the Eqe Bay area also have *ca.* 1.82 Ga ages of crystallization (Bethune & Scammell 1995, 1997, Scammell & Bethune 1995). Mesoarchean, Neoarchean and Paleoproterozoic felsic plutons have similar Nd-depleted mantle model ages of 2.91–2.82 Ga (Hegner & Jackson 1990, Jackson *et al.* 1990a, Jackson & Hegner 1991), suggesting derivation from a common Archean crustal source.

Geology of the Baffin Orogen

The southern part of northern Baffin Island was strongly affected by the Middle Paleoproterozoic (*ca.* 1.87–1.81 Ga) tectonism and magmatism that forged the Baffin orogen (Fig. 1). The core of the orogen is the huge, triangular Cumberland Batholith, composed chiefly of anastomosing, variously deformed, orthopyroxene-bearing, mostly 1.87–1.85 Ga, monzocharnockite plutons (Pidgeon & Howie 1975, Henderson 1985b, Jackson *et al.* 1990b, Scott & Wodicka 1998, Scott 1999), with large areas of hornblende monzogranite in the western part. Supracrustal inclusions are common, and anatectic granite, paragneiss and orthogneiss dominate locally. Preliminary chemical data indicate that the Cumberland Batholith consists of calc-alkaline, I- to S-type granite interpreted to have formed in a volcanic arc of an active continental margin (Hegner & Jackson 1990, Jackson & Hegner 1991, Jackson 2000). A large majority of Nd model ages for the Cumberland Batholith and surrounding supracrustal belts (see below) range from 2.6 to 2.2 Ga (maximum 3.3, minimum 2.1 Ga; Hegner & Jackson 1990, Thériault 1998), indicating a mixed crustal source.

The Cumberland Batholith is surrounded by three coeval fold-and-thrust belts: the Dorset fold-and-thrust belt to the southwest, the Nagsuggtoqidian mobile belt to the southeast and the Foxe fold-and-thrust belt to the north (Fig. 1). The latter extends from a strikingly complex fan fold (Henderson 1984) in southern Melville Peninsula eastward across central Baffin Island to its apparent termination in northwestern Greenland in another large-scale fold closure several tens of kilometers across (Escher 1985). The belts contain correlative, *ca.* 1.9 Ga supracrustal sequences (Hegner & Jackson 1990, Henderson & Parrish 1992, Scott & Gauthier 1996, Scott 1997, 1999), an uncertain amount of tectonically intermixed Archean rocks, and satellite intrusions of the batholith. Granite emplacement youngs outward toward the margins of the orogen. On the north side of the batholith, plutonism and granulite metamorphism seem to have progressed outward from the batholith into the more distal part of the Foxe fold-and-thrust belt between *ca.* 1.83 and 1.81 Ga (Henderson *et al.* 1986, LeCheminant *et al.* 1987, Machado *et al.* 1988, Parrish 1989, Perrault & Hynes 1990, Van der Leeden *et al.* 1990, Bertrand *et al.* 1993, Henderson & Henderson 1994, Kalsbeek & Nutman 1996, Bethune & Scammell 1997, Scott 1997, Scott & Wodicka 1998). The isotopic signatures of mafic and ultramafic rocks in the Piling Group on Baffin Island and the corrrelative Karrat Group in western Greenland are chemically comparable (E. Anderson, pers. commun., 1997). Tholeiitic basalts and ultramafic rocks in the latter region are enriched in Fe, Ti, and incompatible trace elements and depleted in heavy rare-earth elements. The ultramafic rocks closely resemble meimechites in northern Siberia, which have been proposed to be genetically related to a late Permian plume (Anderson 1997). We thus infer a similar early history for the Baffin orogen, as suggested by E. Anderson (pers. commun. 1997), in accord with suggestions of Francis *et al.* (1983) and Scott *et al.* (1991) for the origin of the Chukotat Group and the Purtuniq Ophiolite in northern Quebec.

Piling Group

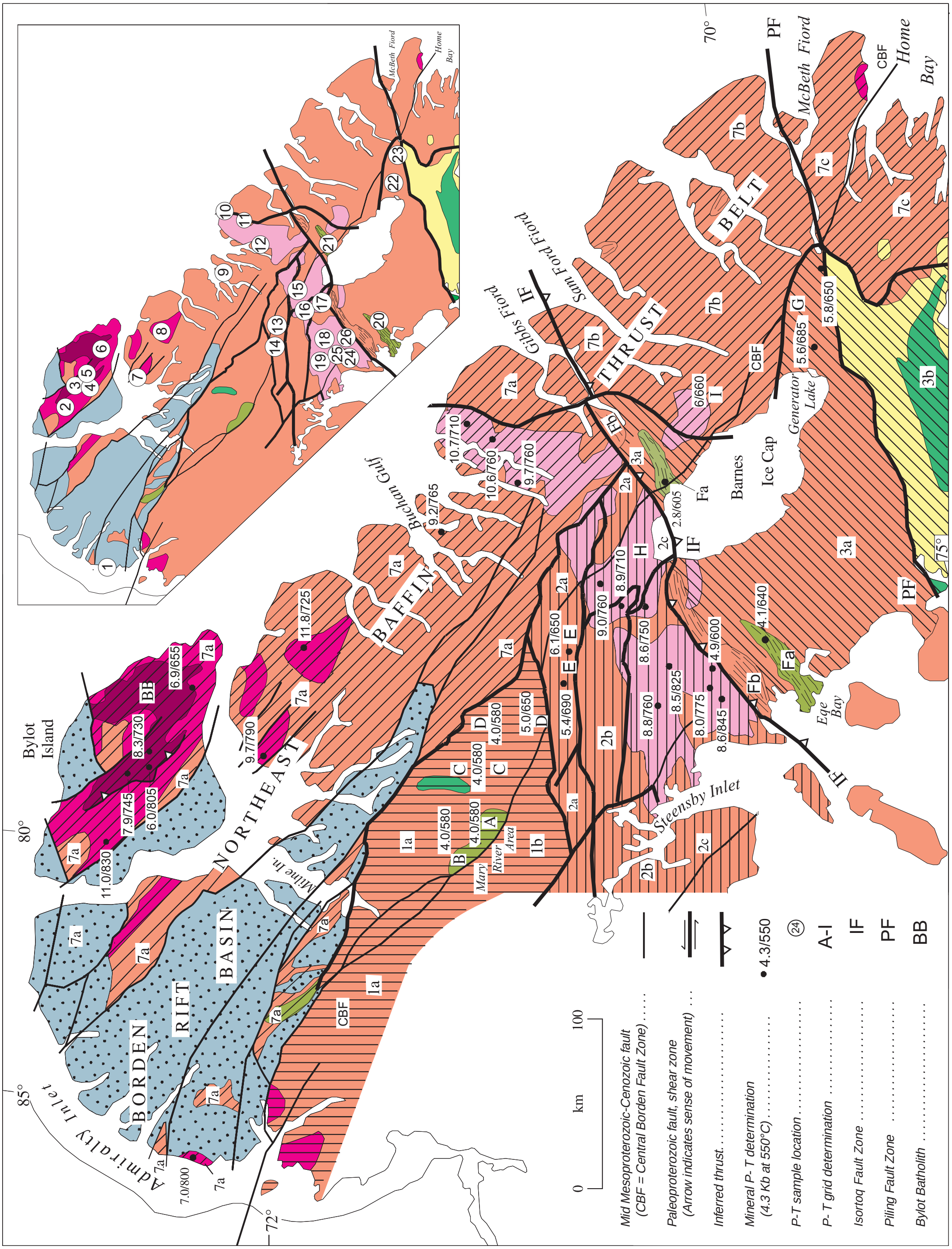
Archean rocks of the Committee belt predominate throughout the northern third of, and represent the basement of the Piling Group in the foreland of the Foxe fold-and-thrust belt on Baffin Island and on Melville Peninsula (Figs. 1–3; Jackson and Taylor 1972, Henderson 1983). Horizontal and shallowly dipping thrust slices of Archean gneiss and Piling Group are interleaved with one another in several places (*e.g.*, Figs. 1, 2). The southern two thirds of the belt is underlain almost entirely by the Piling Group containing scattered Archean windows and satellite plutons of the Cumberland Batholith.

The Piling Group comprises a lower, thin shelf sequence of quartzite and marble conformably overlain by a thick, flysch-like turbidite sequence of greywacke, shale and metamorphosed equivalents that compositionally mature upward. Sulfide-bearing schist with iron formation and a discontinuous basalt – gabbro – ultramafic rock – iron formation unit occurs in the basal turbidites (*e.g.*, Jackson & Taylor 1972, Morgan *et al.* 1975, 1976). The group has been traced southward well into the northern part of the Cumberland Batholith, and northward into the reworked southern part of the Committee belt north of the Isortoq fault zone (Figs. 1, 2; Jackson & Taylor 1972, Tippett 1980, Jackson 1998).

Ages of detrital zircon from the basal quartzite indicates that the Piling Group is younger than 2.16 Ga; rocks of the group are intruded by the 1.87–1.85 Ga Cumberland Batholith (Jackson *et al.* 1990b, Scott & Wodicka 1998). An age of 1883^{+4}_{-3} Ma for a penecontemporaneous diorite sill in the mafic volcanic – ultramafic unit has been interpreted as an approximate age for the unit and the overlying turbidites (Henderson & Parrish 1992). A 1.93 Ga Nd model age for Piling metabasalt suggests that the mafic–ultramafic unit of the group represents Middle Paleoproterozoic juvenile crust (Hegner & Jackson 1990) that may be related to a mantle plume (E. Anderson, pers. commun., 1997). A 2.43 Ga Nd model age for upper Piling metasiltstone is interpreted to represent a mixture of detritus from Archean crust and Paleoproterozoic juvenile crust, which may have included a source for the 2.16 Ga detrital zircon.

Tectonic Domains and Domain Boundaries

The Precambrian rocks of Baffin Island have been divided into eight tectonic domains, with additional subdomains, on the basis of differences between structural trends, aeromagnetic patterns, location of major


Bylot Island
Admiralty Inlet
Milne In.
Mary River Area
Buchan Gulf
Gibbs Fiord
Sam Ford Fiord
McBeth Fiord
Home Bay
Steensby Inlet
Barnes Ice Cap
Generator Lake
Eqe Bay
BORDEN RIFT BASIN
NORTHEAST BAFFIN THRUST BELT
85°
80°
75°
70°
72°
0 km 100
Mid Mesoproterozoic-Cenozoic fault (CBF = Central Borden Fault Zone)
Paleoproterozoic fault, shear zone (Arrow indicates sense of movement)
Inferred thrust
Mineral P- T determination (4.3 Kb at 550°C) • 4.3/550
P-T sample location (24)
P- T grid determination A-I
Isortoq Fault Zone IF
Piling Fault Zone PF
Bylot Batholith BB

LEGEND

MID-MESOPROTEROZOIC

BORDEN RIFT BASIN (Tectonic domain 8 ,1.27 Ga); Bylot Supergroup*; sedimentary and mafic volcanic rocks.*

ARCHEAN-PALEOPROTEROZOIC

NORTHEAST BAFFIN THRUST BELT (Tectonic Domain 7, ~ 1.825-1.81 Ga);
Three subdivisions: 7a, 7b, 7c.

BAFFIN OROGEN (1.9-1.8 Ga): chiefly amphibolite to granulite grade

FOXE FOLD AND THRUST BELT (Tectonic Domain 3); Archean gneisses, ~1.9 Ga Piling Group; Three subdivisions: 3a, 3b, 3c (not shown).

COMMITTEE BELT (2.9-2.5 Ga?)

Chiefly Archean rocks (2.9-2.5 Ga?) and structures with varied Paleoproterozoic structural and metamorphic overprinting.

TECTONIC DOMAIN 2 (Steensby Domain); Archean and ~ 1.9-1.825 Ga structures, metamorphism present. Three subdivisions: 2a, 2b, 2c.

TECTONIC DOMAIN 1 *(Mary River Domain); Mostly Archean structures; Archean and Paleoproterozoic metamorphism. Two subdivisions: 1a, 1b.*

MARY RIVER GROUP (2.76-2.72 Ga); supracrustal belts (Fa, Fb) south of Isortoq Fault (IF).

METAMORPHIC ZONES

Subgreenschist stratigraphically up to unmetamorphosed

Greenschist

Greenschist- lower amphibolite

Lower amphibolite

Chiefly upper amphibolite

Granulite: Paleoproterozoic (may include Archean); Dexterity Granulite Belt (1.825 Ga)

Granulite: Bylot Batholith (ca. 2.54 Ga)

FIG. 3. Tectonic domains, regional distribution of metamorphic zones and thermobarometry results for the Precambrian of northern Baffin Island.

TABLE 1. MAIN STRUCTURAL AND AEROMAGNETIC CHARACTERISTICS OF TECTONIC DOMAINS, NORTHERN BAFFIN ISLAND, NUNAVUT

1a^C	Variable Archean structures and RME; early structures refolded about E–SE axes (some Paleoproterozoic?); concentrated SE-trending RME related to Mesoproterozoic–Recent faulting
1b^C	Consistent SE Archean structures, straightening supersedes 1a trends and may include Paleoproterozoic deformation; most of boundary between 1a and 1b is Mesoproterozoic–Recent Central Borden fault zone
2^C	N-dipping, dominantly E-trending foliation, with NE-plunging lineation, suggesting stacked, S-directed thrusts and fold vergence
2a^C	High RME. Boundary with 1b taken at northern extent of E–W, convex southward trends; increased straightening and dismemberment of Mary River Group toward south suggest sinistral kinematics and possible thrusting; boundary with 2b taken at sharp decrease in RME to south, considered to mark a structural break with sinistral movement
2b^C	Low RME (owing to paucity of Mary River Group); slight discordance in magnetic and structural trends with subdomain 2c suggests fault boundary
2c^C	High RME. Mary River Group highly dismembered; thin elongate granitic bodies; deformed Piling Group suggests E–W structures in at least southern part are ≤1.9 Ga; shape of Piling Group fold interpreted to be related to oblique dextral thrusting in the Isortoq fault zone
3^B	Mostly low RME. Two phases of Archean and four phases of Paleoproterozoic (mostly 2.16–1.825 Ga, based on deformed Piling Group) deformation recognized; Archean deformation and metamorphism in low-grade Eqe Bay area (Bethune & Scammell 1997)
3a^B	The foreland of the Foxe fold-and-thrust belt; mostly Archean rocks; complex Isortoq fault zone separates 3a from 2c; convex northward RME and structural trends and abrupt changes in metamorphic grade related to NW–N-directed Paleoproterozoic thrusting and younger high-angle faults; domal structures along S side adjacent to 3b
3b^B	E–W upright, near-isoclinal folds in low-grade Piling Group separated from higher-grade rocks of subdomain 3a by Piling fault zone; Archean-cored domal structure
3c^B	Not shown on Figure 3; boundary with 3b is gradational into upper-amphibolite-facies rocks; common domal structures cored by Archean basement and high-grade Piling Group; southern boundary is Cumberland Batholith
7^BC	1.825–1.81 Ga, Northeast Baffin Thrust Belt; SE foliation and structural trends truncate and overprint structures in tectonic domains to the west (Fig. 3)
7a^C	Pronounced SE straightening in the west suggests fault boundary that was likely reactivated during formation of Mesoproterozoic Borden Rift Basin (Fig. 3); stacks of gently dipping thrust slices and nappes in eastern fjord region (Figs. 4–7)
7b^B	Separated from 7a by Isortoq fault zone and from 7c by Piling fault zone; contains mixed structural trends, fewer supracrustal rocks, more granitic plutons than subdomain 7a and northern 7c
7c^B	Gradational western contact with increase in overprinted structures toward the NE; upright, NW-trending (F4) folds (Henderson & Tippett 1980, Henderson & Loveridge 1981) may mark the SW extent of SW-directed thrusting, obstructed by the Cumberland Batholith to the south
8	*Ca.* 1.27 Ga Borden Rift Basin and Fury and Hecla Basin; the former is probably an aulacogen (Olson 1977) that developed horsts and grabens along part of the W boundary of the Northeast Baffin Thrust Belt

RME: regional magnetic expression; ^C : Committee Belt; ^B : Baffin Orogen.

faults, proportions of major rock-types and available geochronology (Jackson 2000). Most boundaries between domains and subdomains are either known or interpreted faults (Fig. 3). Table 1 summarizes the main characteristics of, and differences between, tectonic domains and subdomains within northern Baffin Island. Domains 1, 2, and subdomain 7a occur within the Archean Committee belt; domains 3–6 and subdomains 7b and 7c are within the Paleoproterozoic Baffin orogen, but domains 4–6 and most of subdomain 7c are further south than the area shown in Figure 3. The Northeast Baffin thrust belt overprints domains 1–3 and subdomains 5a and 6a, and thus comprises a part of both the Committee belt and Baffin orogen. Tectonic domain 8, the Mesoproterozoic Borden Rift Basin, consists mostly of sedimentary rocks (Jackson & Iannelli 1981, Iannelli 1992).

Within the Committee belt, the main difference between domains 1 and 2 is the degree to which Archean structures are preserved. Domain 1 has variable structural trends, considered to be Archean in age, with early structures refolded about east- and southeast-trending axes. Southeast-trending structural and aeromagnetic fabrics become dominant in subdomain 1b and may include a Paleoproterozoic straightening component. North-dipping, dominantly east-trending foliations, and northeast-plunging lineations are dominant in the western part of domain 2, and are interpreted as south-verging thrusts (Jackson 2000). Involvement of the Piling Group in these structures in southern subdomain 2c, and overprinting by *ca.* 1.82 Ga granulite-facies metamorphism in the Dexterity granulite belt, constrain these structures to have formed between *ca.* 1.9 and 1.82 Ga during the evolution of the Baffin orogen. Trends are more varied in the eastern part of domain 2, likely reflecting later deformation in adjacent domains 3 and 7. Subdomain 2b, with low magnetic expression, separates subdomains 2a and 2c, with higher magnetic expression. This difference appears to be related to the relative dearth of Mary River Group and mafic rocks in subdomain 2b, which may have been uplifted (late horst?) relative to the adjacent subdomains.

The boundary between tectonic domains 2 and 3, and between the Committee belt and Baffin orogen, is the Isortoq fault zone (IF), which continues southwest to Melville Peninsula (Fig. 1), where it is cut off by the *ca.* 1826 Ma Ford Lake plutons (LeCheminant *et al.* 1987). On Baffin Island, the Isortoq fault zone separates the Dexterity granulite belt to the north from amphibolite-facies rocks to the south. Northeast of the Barnes Ice Cap, foliations are variable, and the diffuse aeromagnetic change across the fault zone suggests a moderate dip (P. McGrath, pers. commun., 1990). At one locality, near Eqe Bay, the Isortoq fault zone includes a ~50-meter-wide mylonite zone that dips 50°SE, which is consistent with inferences based on the sharp change in aeromagnetic pattern across the fault southwest of the Barnes Ice Cap. Sinistral kinematics, together with a 35° east-plunging extension lineation, indicate that latest movement involved uplift of the high-grade northwest block obliquely toward the west.

Observations summarized below suggest that the early history of the Isortoq fault zone involved northwesterly directed thrusting of the Foxe Fold Belt over tectonic domain 2 (Bethune *et al.* 1996, Bethune & Scammell 1997, Jackson 2000). Just east of Steensby Inlet, on the northwestern side of the Isortoq fault zone within tectonic domain 2c, a complex antiformal, ENE-plunging fold is outlined by partially dismembered strata of the Piling Group, and its south limb is truncated by the Isortoq fault zone at a low angle (Fig. 2; see also Jackson *et al.* 1978). We interpret this fold to have originated during early northwest-directed, oblique dextral thrusting along the Isortoq fault zone, in which E–W structures were truncated and dragged southwestward. Bethune & Scammell (1995, 1997) also interpreted the fault zone to have an early history of northwest-directed thrusting, partly on the basis of increased flattening and northwestward overturning of northeast-trending folds (Morgan 1982) as the fault zone is approached from the south. Further east within tectonic domain 3a, northeast of the Barnes Ice Cap and near the head of Gibbs Fiord, northeast-trending, southeast-dipping planar structures adjacent to the Isortoq fault zone also are interpreted as northwest-directed thrusts (Jackson & Morgan 1978b, Jackson 2000).

On a regional scale, structural trends are northeastly within tectonic domain 3, the Foxe fold-and-thrust belt. Although two phases of Archean deformation have been recognized, most deformation (four phases) is Paleoproterozoic (Morgan *et al.* 1976, Tippett 1980, Henderson *et al.* 1989). The most northerly subdomain (3a) consists mostly of Archean rocks with more variable trends than other subdomains, and some Archean-cored domes. Subdomain 3b is characterized by upright to variably inclined, near-isoclinal folding of the low-grade Piling Group. The latter grades southward into subdomain 3c, which consists of upper-amphibolite-facies Piling strata, satellite plutons of the Cumberland Batholith, and some Archean-cored structural domes.

The Piling fault zone (PF, Fig. 3) separates subdomains 3a and 7b to the north, with variable structural trends, from subdomains 3b and 7c to the south, in which structural trends parallel the fault. Faults and lineaments mapped along the fault zone are parallel to it and coincide with aeromagnetic anomalies, suggesting that the western end of the fault zone may be a broad (up to 5 km wide) shear zone, whereas the eastern part may be a relatively narrow fault-zone (Morgan 1983, Henderson 1985a, G.D. Jackson, unpubl. data). Nappes, which are subhorizontal, apparently north-verging thrust slices of Paleoproterozoic Piling Group and domes cored by Archean basement, occur mostly north of the Piling fault zone (Fig. 2; Jackson 1978a). In contrast, the south side of the Piling fault zone is characterized by steeply dipping limbs of gently to steeply plunging parallel folds of Piling meta-turbidite with few basement gneiss domes. Like the Isortoq fault zone to the north, the latest movement was south side down.

The Northeast Baffin thrust belt (NBTB, domain 7) contains the same lithologies as western domains, including the Mary River Group and the Paleoproterozoic Piling Group. Southeasterly structural trends predominate in most of this domain, but are less evident in the middle subdomain (7b). Subdomain 7a is also characterized by stacks of southwest-directed, gently northeast-dipping, ductile thrust-slices and isoclinal nappes with attenuated fold limbs more than 10 km long (Figs. 4–7). Pronounced straightening is especially evident along the western side of subdomain 7a, where the Northeast Baffin thrust belt truncates domains 1 and 2, and overprints the Foxe fold-and-thrust belt (domain 3). The orientation of small felsic plutons and Mary River Group remnants parallel to the axis of the Northeast Baffin thrust belt, an apparent truncation of northeast-trending Piling Group fold keels east of the Barnes Ice Cap by southwest-directed thrusts (*e.g.,* Kranck 1955, Jackson 2000), and interference folds (Figs. 1–3) indicate that late deformation in the Northeast Baffin thrust belt is younger than that in adjacent tectonic domains. A little-deformed, 1.806 ± 0.01 Ga tonalite pegmatite in the Home Bay region in northern subdomain 7c has been interpreted to postdate this deformation (Henderson & Loveridge 1981). The maximum age of the thrust belt is considered to be no older than the 1.825 Ga granulite-facies metamorphism in the east end of the Dexterity granulite belt, which is interpreted to be overprinted, mostly at upper-amphibolite-facies conditions, by southwesterly, and locally southeasterly, verging structures of the thrust belt. Similarities in the age, abundance of subhorizontal shearing, the general westerly to southwesterly direction of ductile thrusting and nappe movement and their likely pre-Cretaceous drift proximity, suggest that the Northeast Baffin thrust belt may represent the southwestern extension of the latest Paleoproterozoic deformation in the Rinkian belt on west Greenland (Fig. 1; Kalsbeek 1986, Grocott & Pulvertaft 1990).

Two middle to late Mesoproterozoic supracrustal basins (domain 8) include the Borden Rift Basin (Fig. 3) and the Fury and Hecla Basin (Fig. 2). The Borden Rift Basin contains rocks of the Bylot Supergroup, with a maximum preserved thickness of ~6 km, and represents an aulacogen (Olson 1977) that developed from about 1.27 to 1.19 Ga during the opening, and possible subsequent closing, of the Poseidon Ocean to the northwest. Using aeromagnetic data, faults can be traced another 150 km southeast from the last exposures of strata of the Bylot Supergroup (Fig. 3). Some of the main Mesoproterozoic faults, such as the Central Borden fault zone (Fig. 3), have been active intermittently up to Recent time along a distance of 1200 km from Cornwallis Island southeast to the east coast of central Baffin Island (Jackson & Iannelli 1981, Knight & Jackson 1994).

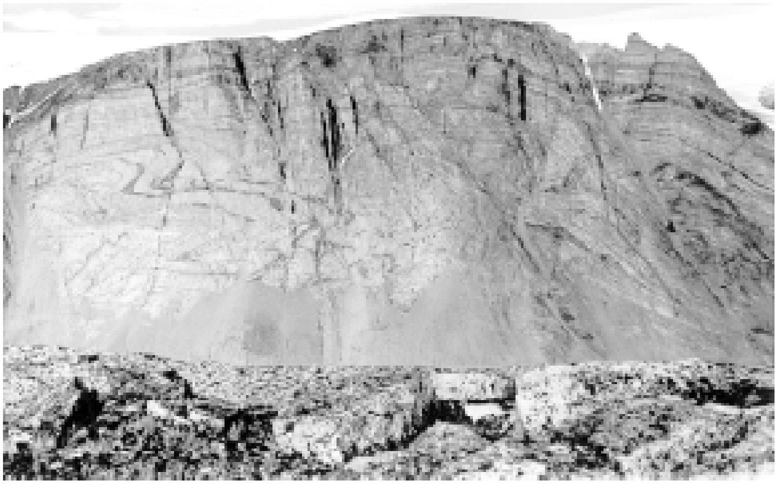


FIG. 4. View looking northwest at recumbent folds in Archean–Paleoproterozoic migmatite ~60 km northwest of Buchan Gulf. Rocks contain deformed mafic bands (dykes?) and near-vertical mafic dykes which are locally beaded (e.g., left of snow in crevice). The folds are truncated by a horizontal zone of "straight gneiss" interpreted as a ductile thrust zone. The shear zone dips northward under an antiformal fold overturned to the south at the right of the photo. Relief ~900 m. GSC photograph 186330, by W.J. Crawford.

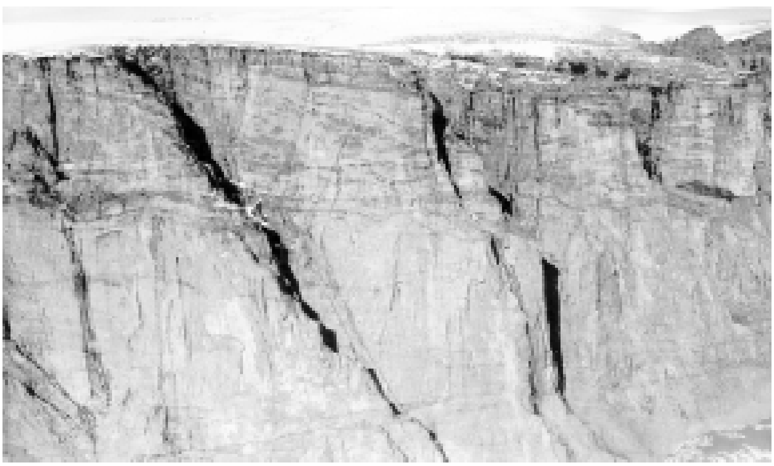


FIG. 5. View looking northwest at sinistrally sheared, southwest-verging ductile nappe of Archean–Paleoproterozoic migmatite, overlying Archean nebulitic gneiss (southeast side of Scott Island north of Buchan Gulf). Elevation ~460 m. GSC photo 158677, by S.L. Blusson.

REGIONAL METAMORPHISM

Age constraints

Current gechronological data for igneous and metamorphic rocks of northern Baffin Island indicate four main tectonometamorphic episodes at *ca.* 2.9–2.84, 2.76–2.71, 2.6–2.5 and 1.9–1.8 Ga. Subgreenschist-facies metamorphism also affected at least parts of the region between *ca.* 1.3 and 0.7 Ga. At present, the scant geochronological database does not allow the areal extent of the various Archean events to be delineated within the Committee belt. Whereas the available data suggest that the entire belt was likely affected by *ca.* 2.7 Ga metamorphism, further work is needed to identify the extent of the *ca.* 2.85 and 2.55 Ga events. Data

FIG. 6. View looking southeast at isoclinal recumbent folds in Archean–Paleoproterozoic migmatite with amphibolite layers in the western Buchan Gulf region. Elevation several hundred m. GSC photo 204194–H, by A. Davidson.

FIG. 7. View looking southwest at isoclinal recumbent fold with an east–west-trending axis in Archean–Paleoproterozoic migmatite, south side of lower McBeth Fiord. The migmatite includes plastically deformed paragneiss, amphibolite and granitic layers, and locally boudined amphibolite. Height of cliff ~450–600 m. GSC photo 185945, by S.L. Blusson.

summarized below suggest that metamorphism associated with formation of the Baffin orogen affected most parts of northern Baffin Island.

Available geochronological data for the Foxe fold-and-thrust belt indicate metamorphism between *ca.* 1.85 and 1.81 Ga. In one area in southern tectonic subdomain 3c, *ca.* 1.81 Ga monazite has been interpreted to date the deformation (Henderson & Henderson 1994). In another area, *ca.* 1.85 Ga charnockite that intrudes middle- to upper-amphibolite-facies rocks of the Piling Group contains *ca.* 1.83 Ga monazite grains (Jackson *et al.* 1990b). Further north, in the Eqe Bay region of tectonic domain 3a, metamorphism is dated by *ca.* 1.845 Ga zircon in amphibolite of the Mary River Group, as well as 1.83–1.82 Ga zircon, monazite and titanite in charnockite, MRG amphibolite and MRG and Piling

Group metapelites (Bethune & Scammell 1997). Similar ages of peak metamorphism have been obtained both north of the Isortoq fault zone in tectonic domain 2c, within the Dexterity granulite belt (*ca.* 1.83–1.82 Ga zircon and monazite; Bethune & Scammell 1997), and in southern Baffin Island (*ca.* 1.85–1.84 Ga; Scott 1997), indicating that metamorphism was broadly synchronous throughout much of the Baffin orogen. Cooling ages compatible with this age of peak metamorphism have been obtained for charnockite in subdomain 3c (1.73 Ga Rb–Sr isochron; 1.73–1.69 Ga biotite K–Ar) and Archean granitic basement in subdomain 3c (1.64–1.59 Ga Rb–Sr and muscovite K–Ar; Henderson 1985b, Jackson *et al.* 1990b).

Given the widespread evidence for Paleoproterozoic metamorphism, an important question that remains is the degree to which Archean mineral assemblages are preserved in northern Baffin Island. The best documentation of preserved Archean assemblages of metamorphic minerals is provided by Bethune & Scammell (1997) for rocks of the Mary River Group with *ca.* 2.76–2.72 Ga ages of igneous crystallization in the Eqe Bay region (Figs. 2, 3). Their data suggest that rocks in the Eqe Bay belt (Fa, Fig. 3) and southeastern part of the Isortoq belt (Fb) were metamorphosed to greenschist to middle amphibolite facies at *ca.* 2.72 Ga before being reworked at greenschist-facies conditions at *ca.* 1.82 Ga. Titanite in some dated lithologies retains *ca.* 2.7 Ga ages, in marked contrast to *ca.* 1.82 Ga metamorphic titanite in felsic gneiss and pegmatite just north of the Isortoq fault zone. A Rb–Sr errorchron age of *ca.* 2.2 Ga for metavolcanic rocks in the Eqe Bay Belt (Morgan 1982) likely represents an Archean age that was partially reset during *ca.* 1.82 Ga low-grade metamorphism.

North of the Isortoq fault zone, available geochronological data are not conclusive, but suggest decreasing Paleoproteroic reworking northward from the Dexterity granulite belt, a pattern that is consistent with the inferred tectonometamophic evolution discussed below. In the Mary River area of tectonic subdomain 1a (Figs. 2, 3), the Mary River Group yields a *ca.* 1.97 Ga Rb–Sr isochron. These data, together with metamorphic overprinting textures described below, are interpreted to indicate moderate resetting of Archean metamorphic assemblages during Paleoproterozoic lower- to middle-amphibolite-facies metamorphism. Further north in the westernmost part of tectonic subdomain 7a, Archean gneisses east of Admiralty Inlet give a *ca.* 2.3 Ga Rb–Sr errorchron (Jackson *et al.* 1990b). We tentatively relate these ages to minor resetting during *ca.* 1.83 Ga subgreenschist- to greenschist-facies metamorphism, an interpretation supported by the otherwise anomalously high P–T conditions recorded by one sample in this area (see below). A 1.1 Ga Rb–Sr age for amphibolite-facies mafic–ultramafic dykes within the above gneiss may have resulted from fluid-enhanced resetting during Mesoproterozoic low-grade metamorphism. The overall interpretation of the Admiralty Inlet area needs to be further tested, as other locations north and south of the Isortoq fault zone (basement gneisses to the Mary River Group at Mary River, and upper-amphibolite-facies granitic gneiss and plutons north of the Piling fault zone) preserve Archean (2.7–2.5 Ga) and middle Paleotproterozoic (*ca.* 2.1) Ga whole-rock Rb–Sr isochrons (Jackson 1978a, b, 2000), whereas supracrustal rocks yield Proterozoic (2.0–1.9 Ga) Rb–Sr isochrons. These differences in Rb–Sr ages in felsic gneiss and plutons and supracrustal rocks may be explained by contrasting permeability of the rocks and associated fluid-enhanced recrystallization, which exerted a major control on isotopic resetting.

Most metamorphic assemblages in the Northeast Baffin thrust belt are considered to be Paleoproterozoic because the belt transects tectonic domains to the west and deforms rocks in the eastern part of the belt, the Foxe fold-and-thrust belt, and the Cumberland Batholith (Figs. 1, 3; Jackson 1998, 2000). In addition, the belt has yielded several K–Ar ages, most between 1.70 and 1.63 Ga. The preliminary age of *ca.* 2.54 Ga obtained for zircon in sheared enderbite in the western arm of the Bylot Batholith (Figs. 2, 3) is interpreted as the time of igneous crystallization. Although emplacement of the batholith was likely associated with granulite-facies metamorphism in surrounding rocks, similarity in structural fabric with more southerly portions of the Northeast Baffin thrust belt suggests that this part of the belt was also involved in the same Proterozoic tectonometamorphic event. Zircon samples from two other samples in the thrust belt, one from south of Buchan Gulf and the other west of Bylot Island, yield upper intercept ages of *ca.* 2.52 and 2.50 Ga and poorly constrained lower intercept ages of *ca.* 1.53 and 1.52 Ga. These data have been interpreted to result from mixed populations of Archean and Proterozoic zircon formed during *ca.* 1.8 Ga melting of Archean crust (Jackson *et al.* 1990b).

Regional distribution of metamorphic zones

Assemblages of metamorphic minerals are listed in Jackson & Morgan (1978a), Bethune & Scammell (1997), and Jackson (2000) and, for the most part, are not repeated here. The general distribution of metamorphic facies is shown in Figure 3 (for more details, see Fraser *et al.* 1978, R.G. Berman, in prep.). With the exception of lower- to middle-amphibolite-facies rocks in the southern greenstone belt at Eqe Bay (Fa, Fig. 3) and greenschist-facies rocks at Mary River, all facies boundaries are considered to be Proterozoic in age, as discussed above.

Granulite-facies rocks are most abundant in the Paleoproterozoic Dexterity granulite belt and in the northwestern part of the Northeast Baffin thrust belt. The Dexterity granulite belt extends about 280 km southwest–northeast across Baffin Island, past the north end of Barnes Ice Cap (Figs. 1, 2). The granulite belt contains three segments, separated by irregular, southeast-striking, lower-grade Middle Paleoproterozoic tectonic zones, Mesoproterozoic–Recent faults, and Neoproterozoic dyke swarms. Metamorphic contrasts within the belt and between the belt and rocks to the northwest seem to be gradational. Field data and geochronology indicate that charnockite bodies within the belt include both older Archean granites metamorphosed to granulite facies as well as synmetamorphic intrusions (Jackson & Morgan 1978a, Bethune & Scammell 1997, Jackson 2000).

The second largest region of granulites occupies a huge, complex, synformal structure cored by the U-shaped, *ca*. 2.54 Ga monzocharnockitic Bylot Batholith (BB on Fig. 3), which is most strongly deformed along its western arm. An area of upper-amphibolite-facies rocks lies along the synformal axis northwest of the nose of the structure. Lineations plunge ~20°NW in the core and east limb of the batholith, but are more variable west of the fold axis, plunging shallowly northwest parallel to the western contact.

The Opx-in isograd that bounds granulite-facies rocks in the larger regions commonly transgresses, but in some places is parallel to map units and structural trends, indicating that at least some granulite-facies metamorphism postdates the main episode of deformation. Some plutons, such as the Bylot and Dexterity batholiths (Fig. 2) and a small granite–charnockite pluton east of the Barnes Ice Cap, are partially to completely rimmed by relatively narrow bands of granulite-facies country rocks, suggesting that the plutons were a significant source of heat for high-grade metamorphism. In other places, the Opx-in isograd cuts across granitic plutons, indicating metamorphism after pluton emplacement. Bethune & Scammell (1997) documented a steep Proterozoic metamorphic gradient going southward from the Dexterity granulite belt to greenschist-facies assemblages in the Eqe Bay region (Fig. 3). The gradient northward from the Dexterity granulite belt to greenschist-facies assemblages at Mary River is much more gradual. The lack of evidence of significant retrogression across this metamorphic transition suggests that it is a prograde, Proterozoic, feature.

The most common granulite-facies assemblages include quartz, plagioclase, biotite, orthopyroxene, clinopyroxene, brown-green hornblende and pyrope-rich garnet. Although compatible on an outcrop scale, orthopyroxene and sillimanite have not been found to coexist within the same thin section. Minor development of retrograde minerals is widespread and not systematically distributed, suggesting that it is a local result during the waning stages of metamorphism, rather than a consquence of later regional amphibolite-facies retrogression. Partial retrogression due to fluid ingress is common along faults, shear zones, and lineaments.

Most of northern Baffin Island consists of upper-amphibolite-facies quartzofeldspathic gneissic rocks without diagnostic mineral assemblages, but they and associated supracrustal rocks show a variety of textures indicative of extensive partial melting. Some migmatite, including some derived from Mary River Group strata, formed during at least two epsisodes of partial melting. Retrogression from granulite facies has only been observed locally.

The largest area of greenschist- to middle-amphibolite-facies rocks occurs in the Paleoproterozoic Piling Group in the central part of the Foxe fold-and-thrust belt (Fig. 3). The other main areas of greenschist-facies rocks are in the vicinity of Eqe Bay and in the Mary River area, both of which are commonly surrounded by thin lower- to middle-amphibolite-facies zones. As discussed above, mostly greenschist-facies assemblages of Archean age at both locations are considered to be overprinted by Proterozoic, greenschist- to lower-amphibolite-facies metamorphism.

The Nauyat volcanic suite (*ca.* 1.27 Ga) in the basal part of the Mesoproterozoic Bylot Supergroup strata in northwestern Baffin Island contains prehnite–pumpellyite assemblages indicative of subgreenschist-facies burial metamorphism. This assemblage has been observed in only one Franklin dyke (*ca.* 720 Ma; Pehrsson & Buchan 1999) in Borden Basin. The general absence of this assemblage in Franklin dykes throughout northwestern Baffin Island, and the relative paucity of alteration in them, compared with the older Nauyat volcanic rocks, bracket the age of subgreenschist metamorphism between 1.27 and 0.72 Ga (Fahrig *et al.* 1981, Jackson & Iannelli 1981, Pehrsson & Buchan 1999). Prehnite–pumpellyite assemblages that occur locally in metasedimentary rocks of the Mary River Group near Mary River (area A in Fig. 3) are assumed to be of the same age.

Regional Pressure – Temperature Conditions

Methods

Metamorphic pressures and temperatures have been determined for 26 samples from northern Baffin Island, mostly from pelitic metasedimentary rocks, amphibolite and orthopyroxene-bearing rocks in tectonic domains 1–3, and 7. All results were calculated with the TWQ computer program (Berman 1991) using the version 1.02 database that provides P–T estimates based on amphibole compositions (Mäder *et al.* 1994). For samples lacking garnet, temperatures were calculated with the hornblende–plagioclase thermometer of Holland & Blundy (1994) and the two-feldspar thermometer of Furhman & Lindsley (1988). For orthopyroxene-bearing assemblages, temperatures estimates were based on the Al content of orthopyroxene in equilibrium with garnet (Aranovich & Berman 1997; TWQ version 2.02). An important advantage of this Al-in-Opx thermometer is that it has been shown to be less prone to retrograde re-equilibration than typical

Fe–Mg exchange thermometers (Pattison & Bégin 1994, Berman & Bostock 1997).

Mineral analyses were performed on standard polished thin sections with a Cameca SX–50 electron microprobe equipped with four wavelength-dispersion spectrometers. The microprobe was operated at 15 kV with beam current of 10 or 30 nA depending on the element, sample stability and size. The raw counts were corrected to elemental concentrations using the Cameca "PAP" program (Pouchou & Pichoir 1985).

Thermobarometric data are complemented by P–T estimates for nine areas of metasedimentary rocks of the Mary River and Piling groups (Fig. 3: A–I) using constraints from a petrogenetic grid for pelitic rocks constructed by D.M. Carmichael (Davidson *et al.* 1990), with superimposed reactions involving calcic minerals from Froese (1997).

TABLE 2. PRESSURE – TEMPERATURE RESULTS, NORTHERN BAFFIN ISLAND, NUNAVUT

#	Sample	Rock Type	Tectonic Domain	Rock Assemblage	P–T Assemblage	P (kbar)	T (°C)
1	DA3	paragneiss	1a	GOBPKs	GOBPs	7.0	800
2	C96	syenocharnockite	7a	GOCHBPKs	GHPs	11.0	830
3	J161	pyribolite	7a	GOCHBPKs	GCPs	7.9	745
4	B196	enderbite	7a	GOBPKs	GOPs	6.0	805
5	J159	enderbite	7a	GOCHPKs	GCHPs	8.3	730
6	M125	MRG pyribolite	7a	GOHBPK	GOPs	6.9	655
7	J186	MRG metabasalt	7a	GOCHBPs	GOCHPs	9.7	790
8	C120	enderbite	7a	OCHBPKS	CHPs	11.8	725
9	M188	MRG paragneiss	7a	GBSPs	GBSPs	9.2	765
10	D236	monzocharnockite	7a	OCHBPKs	CHPs	10.7	710
11	D268	syenocharnockite	7a	CHBPKs	CHPs	10.6	760
12	J254	felsic nebulite	7a	OCHBPKs	CHPs	9.7	760
13	B127	MRG paragneiss	2a	GBcSPs	GBcSPs	6.1	650
14	J018	MRG pyribolite	2a	GHBPs	GHPs	5.4	690
15	J007	MRG pyribolite	2c	OCHPs	CHPs	9.0	760
16	J009	pyribolite	2b	OCHPs	CHPs	8.9	710
17	J012	MRG paragneiss	2c	GBSPs	GBSPs	8.6	750
18	J015	pyribolite	2c	GOHBPs	GOPs	8.5	825
19	M65	pyribolite	2c	OCHBPKs	CHPs	8.8	760
20	C25	MRG paragneiss	3a	GBcSPs	GBcSPs	4.1	640
21	C176	MRG paragneiss	3a	GBSPKs	GBSPs	2.8	605
22	B444	Piling Gp paragneiss	3a	GHBMSPs	GBSPs	5.6	685
23	B487	Piling Gp paragneiss	3a	GBMSPs	GBSPs	5.8	650
24	J024	Piling Gp paragneiss	2c	GOBPs	GOPs	8.6	845
25	J029	Piling Gp paragneiss	2c	GOBPs	GOPs	8.0	775
26	J062	Piling Gp paragneiss	2c	GcSPs	GSPs	4.9	600

Mineral abbreviations: B: biotite, c: cordierite, C: clinopyroxene, G: garnet, H: hornblende, K: K-feldspar, M: muscovite, O: orthopyroxene, P: plagioclase, s: quartz, S: sillimanite. Other abbreviations: MRG: Mary River Group.

Results

The regional distribution of P–T data is shown in Figure 3. Computed pressures and temperatures, along with mineral assemblages for each sample, are presented in Table 2. Mineral compositions used to calculate P–T values are given in Tables 3–6, which are available from the Depository of Unpublished Data, CISTI, National Research Council, Ottawa, Ontario K1A 0S2, Canada. The minerals in most samples show limited compositional variation: <5 mol% An in plagioclase, <0.05 Fe/(Fe + Mg) in biotite, garnet, and orthopyroxene. Almost all of the variation in Fe/(Fe + Mg) is related to retrograde re-equilibration, with the highest values in garnet and the lowest values in orthopyroxene and biotite occurring at mutual grain-boundaries, and intermediate values occurring at rims not in contact with another ferromagnesian phase.

Tectonic subdomain 1a

No thermobarometric data were obtained for subdomain 1a, and available constraints come from consideration of the petrogenetic grid. Mary River Group (MRG) metapelitic rocks in a ~40 km^2 area (A in Fig. 3) contain muscovite, staurolite, and rutile, in addition to all three aluminosilicate "polymorphs". An early (assumed to be Archean), higher-pressure event is suggested by texturally early porphyroblasts of kyanite up to 1 cm long. In places, the kyanite is almost entirely surrounded by cordierite, which is itself intergrown with andalusite. In other places, small porphyroblasts of staurolite partially rim kyanite, and aligned laths of sillimanite overgrow kyanite and andalusite. Given the Rb–Sr evidence cited above for Paleoproterozoic reworking in this area, these later-formed minerals are interpreted to have grown during the *ca.* 1.82 Ga low-pressure metamorphic event, culminating at roughly 4.0 kbar and 580°C. Although textural relations are not as clear, the occurrence of anthophyllite + sillimanite in MRG semi-pelite within other ~20–40 km^2 areas (B, C, Fig. 3) is also consistent with an early high-pressure event, followed by a lower-pressure event in which staurolite + muscovite ± andalusite grew. In areas labeled D (Fig. 3), similar low-pressure conditions, ~ 4.0 kbar and 580°C, are indicated by the assemblage Bt–Ms–Crd–And, with late needles of sillimanite marginal to the andalusite. In the southern area D, evidence of partial melting in pelitic metasedimentary rocks indicates that temperatures locally exceeded ~650°C.

Tectonic subdomain 2a

Pelitic mineral assemblages of the Mary River group, considered to have recrystallized during the Paleoproterozoic, occupy ~25 km^2 areas in central subdomain 2a (E, Fig. 3). The presence of muscovite, sillimanite, and anatectic melt indicate P–T conditions of ~4–7 kbar and 650°C, in agreement with two thermobarometric determinations, 6.1 kbar – 650°C and 5.4 kbar – 690°C (13, 14, Fig. 3).

Dexterity granulite belt (tectonic subdomains 2a–c)

Although the assemblage orthopyroxene + sillimanite + quartz has been observed in outcrop, its absence in thin sections of pelitic rocks suggests that the *ca.* 1.825 Ga Dexterity granulite belt formed at pressures below ~9.0 kbar (at 850°C; Aranovich & Berman 1996). Three samples (15–17, Fig. 3, Table 2) from within the central block of the Dexterity granulite belt yield P–T values just about at this upper limit, between 8.6 and 9.0 kbar, and between 710 and 760°C. The occurrence of magnesian spinel with quartz at locality H near the northwestern end of the Barnes Ice Cap (Fig. 3) suggests a somewhat higher grade of peak metamorphism in this region.

P–T determinations for four samples from the southwestern block of the Dexterity granulite belt (18–19, 24–25 in domain 2c) cluster between 8.0 and 8.8 kbar and between 760 and 845°C.

The Isortoq fault zone (IF)

The Isortoq fault zone separates the Dexterity granulite belt to the north from the lower-grade Eqe Bay block to the south (Fig. 3), several kilometers southeast of the location of sample 26 (Fig. 3). Upper-amphibolite-facies rocks border the mylonite in the fault zone at this locality, with granulite-facies rocks slightly farther to the northwest. Within the mylonite, porphyroclasts of garnet + clinopyroxene in a blastomylonitic matrix indicate a high-grade history, but most of the preserved assemblages equilibrated in the greenschist to lower amphibolite facies. P–T results for a cordierite–garnet-bearing sample of Piling Group paragneiss (#26) yield 4.9 kbar – 600°C, interpreted to represent a late stage of mylonite movement during uplift and cooling.

Northern tectonic subdomain 3a

The Eqe Bay area contains two main belts of Mary River Group rocks, the Eqe Bay belt (Fa) and the Isortoq belt (Fb; Fig 3), with discontinuous extensions to the northeast and east of the northern end of the Barnes Ice Cap. A steep thermal gradient, accentuated by northeast-trending faults (Bethune & Scammell 1997), is indicated by a progression northwestward from *ca.* 2.72 Ga greenschist- to lower-amphibolite-facies assemblages in the southern part of belt Fb to *ca.* 1.83 Ga upper-amphibolite- and granulite-facies assemblages in the northern part of this belt. Within the southern belt (Fa), *ca.* 2.72 Ga metamorphic grade increases southeastward from greenschist to amphibolite facies, with a greenschist-facies overprint at *ca.* 1.83 (Morgan *et al.* 1975, Morgan 1982, Jackson & Morgan 1978a, Bethune & Scammell 1997). The presence of subgreenschist- to greenschist-facies, Meso–Neoproterozoic strata at Eqe Bay (Morgan *et al.* 1975) suggests that some of the late low-grade metamorphism is Meso- to Neoproterozoic.

The lack of observed kyanite in the Isortoq belt (Fb) provides a maximum pressure of ~6 kbar for muscovite-bearing rocks, and the presence of the assemblage Grt–Crd–Kfs–Sil in transitional granulite-facies rocks in the northern part of the belt (Bethune & Scammell 1997) also indicates relatively low-pressure conditions. Within the Eqe Bay belt (Fa), P–T results for sample #20 indicate 4.1 kbar – 640°C for what we assume (see above) are *ca.* 2.72 metamorphic conditions (Fig. 3), consistent with the commonly observed assemblage Crd + Grt + Sil. P–T results for another sample of Mary River Group paragneiss (#21), in the northeastern extension of Fa east of the Barnes Ice Cap, yield lower-grade conditions, 2.8 kbar – 605°C, which we tentatively assume to correspond to *ca.* 1.83 Ga metamorphic conditions. The presence of texturally early kyanite in this sample offers additional evidence for an earlier (assumed to be Archean), higher-pressure metamorphic event (see tectonic subdomain 1a above).

Southeastern tectonic subdomain 3a

Within area G at the southeastern corner of tectonic subdomain 3a (Fig. 3), Piling Group paragneiss with anthophyllite + sillimanite + muscovite and anatectic migmatite without staurolite constrain P–T conditions to approximately 6 kbar at 660°C. P–T results (#22, Table 2, Fig. 3) are 5.6 kbar – 685°C, in good agreement with constraints from the petrogenetic grid and with two-feldspar temperatures between 630 and 710°C. P–T results from Piling paragneiss further to the southeast (#23, Table 2, Fig. 3) are 5.8 kbar – 650°C, consistent with the presence of muscovite and the absence of migmatite.

Tectonic subdomains 7a, b: Northeast Baffin thrust belt

West of the southern end of Sam Ford Fiord, Piling Group paragneiss at location I (subdomain 7b, Fig. 3) contains the same assemblage as at location G, constraining P–T conditions to ~6 kbar – 660°C. Two-feldspar temperatures between 800 and 820°C suggest that conditions of peak metamorphism were higher and that muscovite in these rocks may be retrograde in origin.

Nearly all of the samples from the Dexterity granulite belt and to the north are either granulite-facies granitic plutons or metamorphosed mafic volcanic rocks. As discussed above, this northeastern block of the Dexterity granulite belt (Fig. 3) is considered to have been overprinted by the younger (1.825–1.81 Ga) Northeast Baffin thrust belt. Results obtained from this part of the Dexterity granulite belt yield consistently high pressures, between 9.7 and 10.7 kbar, and temperatures between 710 and 760°C for monzocharnockite (#10), syenocharnockite (#11), and felsic nebulitic gneiss (#12; older basement?). A similar high-pressure regime is indicated north of the Dexterity granulite belt from results for an upper-amphibolite-facies paragneiss sample (#9; 9.2 kbar – 765°C) from the Buchan Gulf area, an enderbite (# 8; 11.8 – 725°C), and a Mary River Group metabasalt (#7; 9.7 kbar – 790°C).

On Bylot Island, near the northeastern end of the Northeast Baffin thrust belt, a sample (#2) of a syenocharnockite pluton west of the Bylot Batholith also yields high P–T conditions, 11.0 kbar – 830°C. Two samples of enderbite from the sheared western side of the Bylot Batholith (#4, 5) give distinctly lower pressures, between 6.0 kbar – 805°C and 8.3 kbar – 730°C; sample #5 contains *ca.* 2.54 Ga zircon, interpreted as the age of batholith emplacement. Pyribolite, both within the western part of the Bylot Batholith (#3) and southeast of it (#6), also yield lower pressures, between 7.9 and 6.9 kbar, respectively (Fig. 3, Table 2).

Mixed gneisses on the east side of Admiralty Inlet at the location of sample #1 (Fig. 3, Table 2) are considered to lie on the southern side of tectonic subdomain 7a, rather than in northern subdomain 1a, because the dominant west–northwest structural trend in these gneisses parallels that in the Northeast Baffin thrust belt further east. In contrast, north–south trends are common in the gneisses to the south in subdomain 1a. The 2.3 Ga Rb–Sr isochron obtained in this area (see above) has been taken to indicate only minor Proterozoic reworking. Accordingly, we infer that thermobarometric results for this granulite-facies paragneiss (7.0 kbar – 800°C) correspond to Archean metamorphic conditions.

Discussion

Previous studies (Cortemiglia *et al.* 1985, Berman *et al.* 1993) of granulite-facies rocks within the Baffin orogen in south-central Baffin Island revealed a classic low P – high T metamorphic region (4.9 – 7.6 kbar; T up to 900°C), consistent with their evolution within the domain of the huge *ca.* 1.87–1.85 Ga charnockitic Cumberland Batholith. Similar pressures have been obtained within the Committee belt, mostly at upper-amphibolite-facies conditions, with the exception of granulite-facies rocks in the Bylot Batholith region (sample #3–6, Fig. 3), just east of Admiralty Inlet (sample #1, Fig. 3), and also on southern Devon Island (Frisch 1988). Extant geochronology suggests that the latter two samples reflect Archean (*ca.* 2.55 Ga?) metamorphic conditions, a possibility that cannot be ruled out for the Bylot Batholith region. All other granulite-facies rocks, both in the Dexterity granulite belt and in the eastern part of the Northeast Baffin thrust belt, record pressures above ~8.5 kbar. The geological setting of these samples suggests that Paleoproterozoic thermal evolution was controlled primarily by crustal thickening associated with northwest-directed overthrusting of tectonic domain 3a over 2c, and subsequent southwest-directed thrusting within the Northeast Baffin thrust belt.

The architecture of the southwestern part of this region appears to be a mirror image of that described for the southern portion of the Baffin orogen, in which a lower, northern Quebec plate has been underthrust by at least 160 km below an upper, Baffin Island plate containing the Cumberland Batholith (St-Onge *et al.* 1999, 2000). In northern Baffin Island, structural observations summarized above indicate that the Isortoq fault represents the most northerly major thrust-zone along which the Foxe fold-and-thrust belt was thrust northwestward over tectonic domain 2. Subsequent thermal relaxation in this intracratonic environment (Jackson *et al.* 1997) produced granulite-facies metamorphism within the tectonically thickened Dexterity granulite belt. P–T results within tectonic domains 1 and 2 offer strong support for this interpretation. Tectonic subdomain 1a, which extends to the west coast of northern Baffin Island, includes kyanite-bearing Archean rocks interpreted to have been increasingly reworked from north to south during the Baffin orogeny. Gneisses east of Admiralty Inlet that are inferred to retain Archean paleopressure (~7 kbar) represent the highest Paleoproterozoic crustal level (less than ~4 kbar recorded near Mary River). Southward toward the Isortoq fault, paleopressure and paleotemperature increase, from ~4–5 kbar in the southernmost part of tectonic subdomain 1a, ~5.5–6 kbar in subdomain 2a, to ~8.5–9.0 kbar over a broad region in tectonic domain 2c within the western portion of the Dexterity granulite belt. The discordance of the Opx-in isograd with lithological and structural trends indicates a late thermal event superimposed on earlier-formed structures, consistent with thermal relaxation in tectonically thickened crust.

Whereas the northern boundary of the western Dexterity granulite belt seems gradational into upper-amphibolite-facies rocks, the southern boundary is defined by the Isortoq fault zone, a major crustal-scale structure that extends across Baffin Island to Melville Peninsula. Comparison with P–T results and petrogenetic grid constraints south of the Isortoq suggest a vertical structural offset of at least ~8 km. Compared to the higher crustal levels exposed in subdomains 1a and 2a, the broad area of 8.5–9.0 kbar granulite-facies rocks north of the fault suggests that gravitational forces likely induced differential uplift of the most overthickened region (Dexterity granulite belt). Late sinistral kinematics within the Isortoq fault zone are consistent with this uplift occurring during the extensional phase of the Baffin orogenic cycle, the maximum age of which is given by the youngest titanite (1.818 Ga) in the footwall of the fault zone (Bethune & Scammell 1997). Thus the Isortoq fault zone acted as an important structure not only during tectonic thickening, but also during extension and at least partial exhumation of the Dexterity granulite belt. Additional study of cooling ages on both sides of the Isortoq fault zone are needed in order to further constrain the complete history of uplift.

Differences in structural trends between the central and eastern parts of the Dexterity granulite belt are taken as evidence that the eastern end of that belt has been reworked within the Northeast Baffin thrust belt (see Tectonic Domains above). Approximately 2 kbar higher pressure recorded at the eastern end of the granulite belt suggests that deformation associated with the Northeast Baffin thrust belt may have involved additional tectonic thickening. It should be noted, however, that about 0.6 kbar of the pressure contrast between the eastern and western ends of the Dexterity granulite belt (at sea level) may be accounted for by the Cenozoic uplift that has produced ~2 km of relief along the northeastern side of Baffin Island.

The Northeast Baffin thrust belt north of the Dexterity granulite belt (Fig. 3) also records high paleopressures (9.2–11.8 kbar) that are considered to be related to Paleoproterozoic crustal thickening. These pressures contrast markedly with the ~6–8 kbar pressures within and in the vicinity of the *ca.* 2.54 Ga Bylot Batholith. Southwest-verging nappes west of the batholith lie within a large arcuate, structurally complex region that rims the batholith to the south (Fig. 3). We suggest that the batholith is part of a thrust panel of Neoarchean rocks that was emplaced during the southwest-directed thrust imbrication characteristic of the Northeast Baffin thrust belt, and that contributed to tectonic loading of adjacent high-pressure rocks. Preservation of the Archean age of crystallization of the Bylot Batholith may be the result of protection of the internal part of the thrust panel from Paleoproterozoic deformation and recrystallization.

Summary and Conclusions

The data presented in this paper document regional pressure–temperature conditions and metamorphic relationships in different tectonic domains defined within the Archean Committee belt and the Paleoproterozoic Baffin orogen of northern Baffin Island. In conjunction with our interpretation of structural characteristics and geochronological constraints within each tectonic domain, these data provide insight into the tectonometamorphic evolution of northern Baffin Island and its relationship with events in southern Baffin Island. We offer the following summary of the main sequence of events, which require testing by more detailed mapping and geochronology:

1. Protracted, but as yet cryptic, formation of Archean granite – supracrustal belts within the Committee belt, followed by a widespread *ca.* 2.55 Ga tectonothermal event (Stern & Berman 2000).

2. Extensional thinning of the crust accompanied by widespread *ca.* 1.9 Ga shelf sedimentation (*e.g.,* Penrhyn, Lower Piling, Karrat, Lake Harbour groups, Tasiuyak gneiss, some supracrustal rocks in the Nagssugtoqidian Mobile Belt).

3. Rifting and volcanism related to plume activity; termination of shelf deposition and initiation of turbidite deposition in a rapidly subsiding basin (Upper Piling Group: Jackson & Taylor 1972, Morgan *et al.* 1975).

4. Formation of south-verging thrusts and nappes in tectonic subdomain 2c, likely related to convergence and north-dipping subduction in the Baffin orogen; crustal thickening, melting of isotopically heterogeneous lower crust, and generation of the *ca.* 1.87–1.85 Ga Cumberland Batholith in a volcanic arc environment; associated low-pressure granulite-facies metamorphism at *ca.* 1.85–1.83 Ga.

5. Continued convergence, producing thrusting outward from the Cumberland Batholith on all sides, but chiefly in the Dorset and Foxe fold-and-thrust belts (Henderson *et al.* 1989, Jackson *et al.* 1990b, Henderson & Henderson 1994, Hanmer *et al.* 1996, St-Onge *et al.* 1999); truncation of south-verging structures in subdomain 2c by the Isortoq fault zone.

6. Relatively high pressure, *ca.* 1.83–1.82 Ga granulite-facies metamorphism formed in the tectonically thickened, intracratonic Dexterity granulite belt, adjacent to the Isortoq fault zone.

7. Southwest-directed thrusting within the Northeast Baffin thrust belt (Jackson 2000) and the Rinkian belt in western Greenland (Grocott & Pulvertaft 1990), possibly related to a collision on the eastern side of Greenland; further tectonic thickening and higher pressure granulite-facies metamorphism in the Northeast Baffin thrust belt.

8. Exhumation and cooling, in part assisted by extensional movements along the Isortoq fault zone.

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