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Bedrock geology of the Ellice Hills map area and new constraints on the regional geology of the Committee Bay area, Nunavut[1]

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Abstract: The Ellice Hills map area (NTS 56 P), southwest of Committee Bay, contains two belts of Archean supracrustal rocks intruded by younger, diverse plutonic rocks. The Ellice Hills supracrustal strand is a west-northwest–facing belt of interbedded psammite, semipelite, silicate iron-formation, komatiite, and basalt. To the south, the Committee Bay supracrustal belt contains komatiite, semipelite, psammite, and iron-formation, overlain by quartzite, rare intermediate volcanic rocks, and interbedded psammite and semipelite. Ultramafic sills intrude the supracrustal rocks. Folded with the Archean supracrustal rocks is a small outlier of younger meta-arkose and calc-arenite. A regionally extensive, northeast-striking, 2610 Ma intrusive complex of K-feldspar–magnetite granodiorite and monzogranite intrudes supracrustal rocks in the south. To the north, the supracrustal belts are cut by tonalite, granodiorite, monzogranite, and diorite plutons that are likely part of a widespread, 2610–2580 Ma plutonic suite. The northern part of the Ellice Hills area is intruded by a large biotite-muscovite monzogranite pluton.

Résumé : La région cartographique d'Ellice Hills (SNRC 56P), au sud-ouest de la baie Committee, renferme deux bandes de roches supracrustales de l'Archéen encaissées dans divers types de roches plutoniques plus récentes. L'étroite ceinture de roches supracrustales d'Ellice Hills est constituée d'une succession à regard ouest–nord-ouest formée d'une interstratification de psammite, de semipélite, de formation de fer à faciès silicaté, de komatiite et de basalte. Au sud, la ceinture de roches supracrustales de Committee Bay est formée d'une succession de komatiite, de semipélite, de psammite et de formation de fer, surmontée de quartzite et de rares roches volcaniques intermédiaires, ainsi que de psammite et de semipélite interstratifiées. Des filons-couches ultramafiques recoupent les roches supracrustales. Plissé au sein des roches supracrustales de l'Archéen se trouve un petit lambeau de méta-arkose et de calcarénite plus récentes. Dans le sud de la région, les roches supracrustales sont recoupées par un grand complexe batholitique de granodiorite à feldspath potassique et à magnétite et de monzogranite qui s'allonge vers le nord-est et remonte à 2 610 Ma. Au nord, les ceintures de roches supracrustales sont recoupées par des plutons de tonalite, de granodiorite, de monzogranite et de diorite appartenant probablement à une suite plutonique aux manifestations répandues qui remonte à 2 610-2 580 Ma. Le nord de la région d'Ellice Hills est recoupé par un vaste pluton de monzogranite à biotite-muscovite.

[1] Contribution to the Targeted Geoscience Initiative (TGI) 2000–2003

INTRODUCTION

The Committee Bay region, central mainland of Nunavut, has been the focus of a three-year (2000–2003) integrated geoscience study by the Geological Survey of Canada (TGI program), the Canada-Nunavut Geoscience Office, and university partners. The study aims to establish the geological framework of an area of high mineral-resource potential through a detailed aeromagnetic survey, bedrock and surficial mapping, drift prospecting, and process-related thematic studies. The project area, underlain by northeast-striking Archean supracrustal belts of the Prince Albert group and surrounding plutonic rocks, lies within the eastern part of the Rae domain in the western Churchill Province (Fig. 1). Helicopter-supported mapping of the Ellice Hills map area (NTS 56 P) near the Arctic coast in the 2002 field season, along with previous fieldwork to the southwest in the Walker Lake–Arrowsmith River area (Skulski et al., 2002, and references therein) and Laughland Lake area (Sandeman et al., 2001a), completes 1:100 000 scale geological mapping of the Committee Bay area (Fig. 2). Some of the major crustal domains (Skulski et al., 2002) and regional structural elements (Sandeman et al., 2001b; Sanborn-Barrie et al., 2002) identified to the southwest extend into the Ellice Hills region. This report, and companion papers on structural evolution (Sanborn-Barrie et al., 2003), economic geology (Deyell and Sherlock, 2003), and surficial geology (Giangioppi et al., 2003), provide an overview of the geology of the Ellice Hills region.

GEOLOGICAL SETTING

The eastern Rae domain of the western Churchill Province contains rare vestiges of Mesoarchean plutonic crust that have yielded ages of 3.05 Ga on the north shore of Lake Athabasca (Hartlaub et al., 2001) and 2.87 Ga in the Woodburn Lake area (Zaleski et al., 2001; Fig. 1). These Mesoarchean crystalline rocks locally represent stratigraphic basement to an unconformably overlying, discontinuous belt of Neoarchean supracrustal rocks that extends from Lake Athabasca to northern Baffin Island (Frisch, 1982; Hartlaub et al., 2001; Zaleski et al., 2001). Archean supracrustal rocks in the eastern Rae domain were deposited between 3.05 and 2.64 Ga in the Murmac Bay group (Hartlaub et al., 2001), between 2.74 and 2.63 Ga in the Woodburn Lake group (Zaleski et al., 2001), and between 2.73 and 2.69 Ga in the Prince Albert group (this study). Rare, thin, basal, craton-derived quartzite units occur on the shore of Lake Athabasca and in the Woodburn Lake area, but are absent in the Prince Albert group southwest of Committee Bay. A volcanic sequence occurring in all three areas overlies these units and

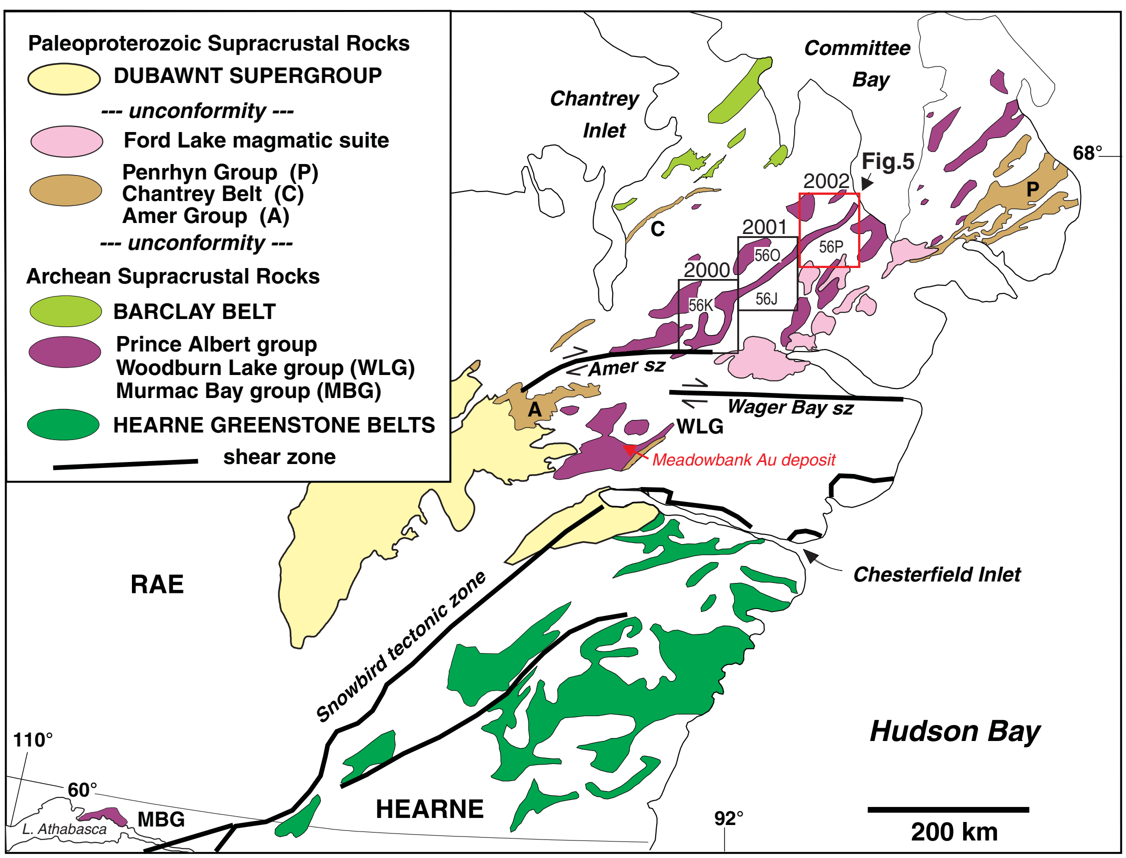

Figure 1. *Location of the Committee Bay study area relative to major lithotectonic units of the western Churchill Province.*

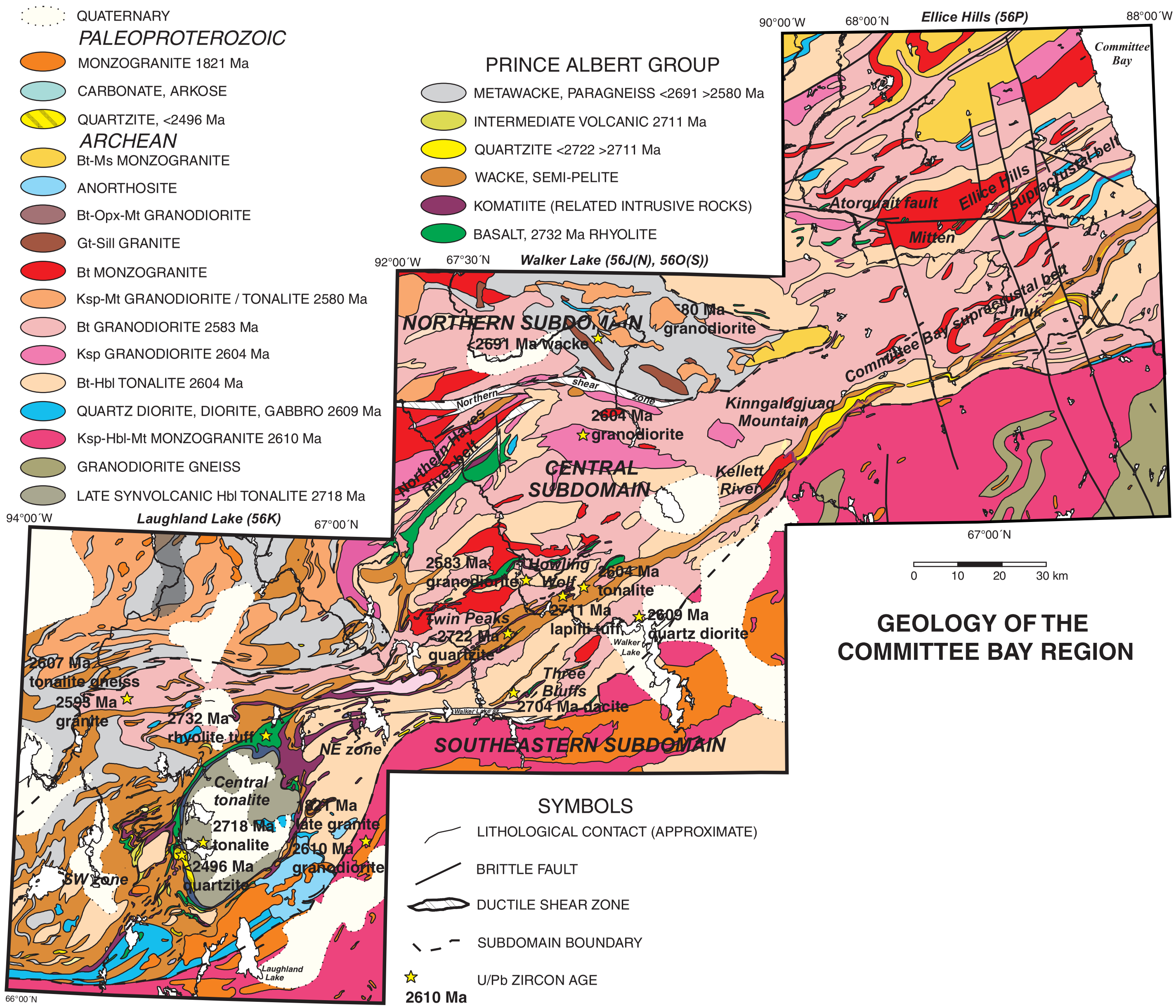

Figure 2. *Compiled geology of the Committee Bay region showing major geological units and map sheets located in Figure 1. Simplified from geological maps of the Laughland Lake area (Sandeman et al., 2002), Walker Lake area (Skulski et al., 2002), and Ellice Hills area (this study). Also shown are recently acquired U-Pb zircon ages from the Walker Lake and Laughland Lake areas (T. Skulski and N. Rayner, unpub. data, 2002; M. Sanborn-Barrie and W.J. Davis, unpub. data, 2002).*

contains basalt, komatiite (including its intrusive equivalents), and felsic volcanic rocks. These are in turn overlain by mixed sedimentary-volcanic sequences including wacke, pelite, iron-formation, and quartzite, intercalated with intermediate to felsic tuff units (Hartlaub et al., 2001; Zaleski et al., 2001). Both Hartlaub et al. (2001) and Zaleski et al. (2001) recognized continental affinities in the Neoarchean volcano-sedimentary sequences of the eastern Rae domain, and interpreted komatiitic and basaltic volcanic units in these sequences as melting products of a mantle plume (or more than one) in a continental rift setting.

Calc-alkaline, I-type, granitoid plutons emplaced between 2.64 and 2.60 Ga are voluminous and widespread across the eastern Rae domain (LeCheminant and Roddick, 1991; Zaleski et al., 2001; this study). In the Committee Bay area, plutons of similar age (this study) intrude the Prince Albert group and contain dispersed rafts and xenoliths of supracrustal rocks (Sandeman et al., 2001a; Skulski et al., 2002).

Outliers of Paleoproterozoic metasedimentary rocks are found throughout the Rae domain (Fig. 1). They include quartzite, carbonate rocks, and sulphidic mudstone of the >1.85 Ga Amer Group (Tella, 1994); lower clastic and carbonate sequence and upper carbonaceous shale and arkosic wacke sequence of the ca. 1.88 Ga Penrhyn Group (Henderson et al., 1983); quartzite, marble and pelite of the Chantrey Group (Frisch 2000); and arkose and carbonate rocks of the Folster Lake Group (Frisch 1982). These Paleoproterozoic sedimentary sequences have sustained complex deformation and are locally metamorphosed to amphibolite facies.

A northeasterly structural grain characterizes the eastern part of the Rae domain (Fig. 1). In the Woodburn Lake area, Zaleski et al. (2001) attributed the dominant northeasterly structural trend to D_2 deformation that affected supracrustal rocks deposited after 2 Ga, but was cut by 1.84 Ga post-tectonic dykes. D_2 deformation in the Woodburn Lake area involved transposition of post–2.6 Ga S_1 ductile fabric into S_2 foliation associated with northwest-verging, tight to isoclinal F_2 folds and associated reverse faults (Zaleski et al., 2001). D_2 folds and fabrics in the Committee Bay area have comparable geometry and timing (Sanborn-Barrie et al., 2003). A number of major east-striking shear zones cut the eastern part of the Rae domain and rework D_2 structures (Fig. 1 and 2). In the Committee Bay area, these include the dextral, oblique-slip Amer shear zone in the southwestern part of the area, and the dextral strike-slip Walker Lake shear zone through its centre.

Paleoproterozoic intrusive rocks in the Rae domain include 1.825 Ga calc-alkaline granite and granodiorite plutons of the Ford Lake batholith (LeCheminant et al., 1987) and biotite-magnetite±fluorite monzogranite of similar age in the Committee Bay region (this study). Northwest-trending, Mesoproterozoic Mackenzie diabase gabbro dykes cut all lithological units and structures in the Rae domain.

GEOLOGY OF THE COMMITTEE BAY AREA

The Committee Bay area comprises three northeast-trending crustal subdomains (Skulski et al., 2002; Fig. 2). The central subdomain includes a main northeast-trending belt of supracrustal rocks belonging to the Prince Albert group, here called the Committee Bay supracrustal belt, that extends from the Laughland Lake area in the southwest to the Ellice Hills. The lower part of the Prince Albert group is exposed in the Laughland Lake area, where it comprises basalt, komatiite, and rare rhyolite lapilli tuff (Fig. 2 and 3). The latter has a U-Pb zircon age of 2732 +8/-3 Ma (T. Skulski, unpub. data, 2001; Fig. 2). Synvolcanic tonalite dated at 2718 ± 2 Ma (T. Skulski, unpub. data, 2001) intrudes these komatiitic and basaltic rocks (Fig. 2) and provides a minimum age for deposition of the lower Prince Albert group. The middle part of the Prince Albert group is well exposed in the Committee Bay supracrustal belt in the Walker Lake area (Skulski et al., 2002; Fig. 2 and 3). It includes a lower sequence of komatiite, semipelite, psammite, and iron-formation, which is overlain by quartzite, intermediate volcanic rocks, komatiite, and interbedded semipelite and psammite. Dating of detrital zircon in quartzite using the GSC SHRIMP yielded a maximum deposition age of 2722 ± 11 Ma (T. Skulski and N. Rayner, unpub. data, 2002; Fig. 2). Intermediate lapilli tuff overlying the quartzite gave a zircon U-Pb age of 2711 ± 3 Ma (M. Sanborn-Barrie and W.J. Davis, unpub. data, 2002; Fig. 2), thus bracketing quartzite deposition between 2722 and 2711 Ma.

High-grade paragneiss and rare metawacke in the northern subdomain (Skulski et al., 2002) are believed to represent metamorphosed upper Prince Albert group (Fig. 2 and 3). A metawacke inferred to be the protolith of the high-grade paragneiss yielded a maximum deposition age of 2691 ± 16 Ma from SHRIMP U-Pb detrital zircon dating (T. Skulski and N. Rayner, unpub. data, 2002; Fig. 2). Granodiorite that intrudes paragneiss in the northern subdomain gave a SHRIMP U-Pb zircon age of ca. 2580 Ma (C. Carson, unpub. data, 2002), thus bracketing upper Prince Albert group wacke deposition between 2691 Ma and 2580 Ma.

The Prince Albert group is intruded by widespread and voluminous granodiorite, tonalite, and monzogranite, and by lesser amounts of quartz diorite and diorite (Sandeman et al., 2001a; Skulski et al., 2002). A diverse suite of quartz diorite, tonalite, granodiorite, K-feldspar–megacrystic granodiorite, and monzogranite from the Laughland Lake and Walker Lake areas (Fig. 2) yielded SHRIMP U-Pb zircon ages ranging from 2610 to 2593 Ma (T. Skulski and N. Rayner, unpub. data, 2002), attesting to widespread and voluminous intermediate to felsic magmatism in a narrow time interval in the Committee Bay region.

High-grade paragneiss and diatexite in the northern subdomain are intruded by small plutons of garnet-sillimanite-biotite granite, and by younger, larger plutons of biotite-magnetite granodiorite and tonalite, dated at 2580 Ma (C. Carson, unpub. data, 2002). Garnet diatexite in the northeastern Walker Lake area is intruded by a small pluton of foliated (S_2), partly

COMPOSITE STRATIGRAPHIC SECTION, PRINCE ALBERT GROUP, COMMITTEE BAY AREA

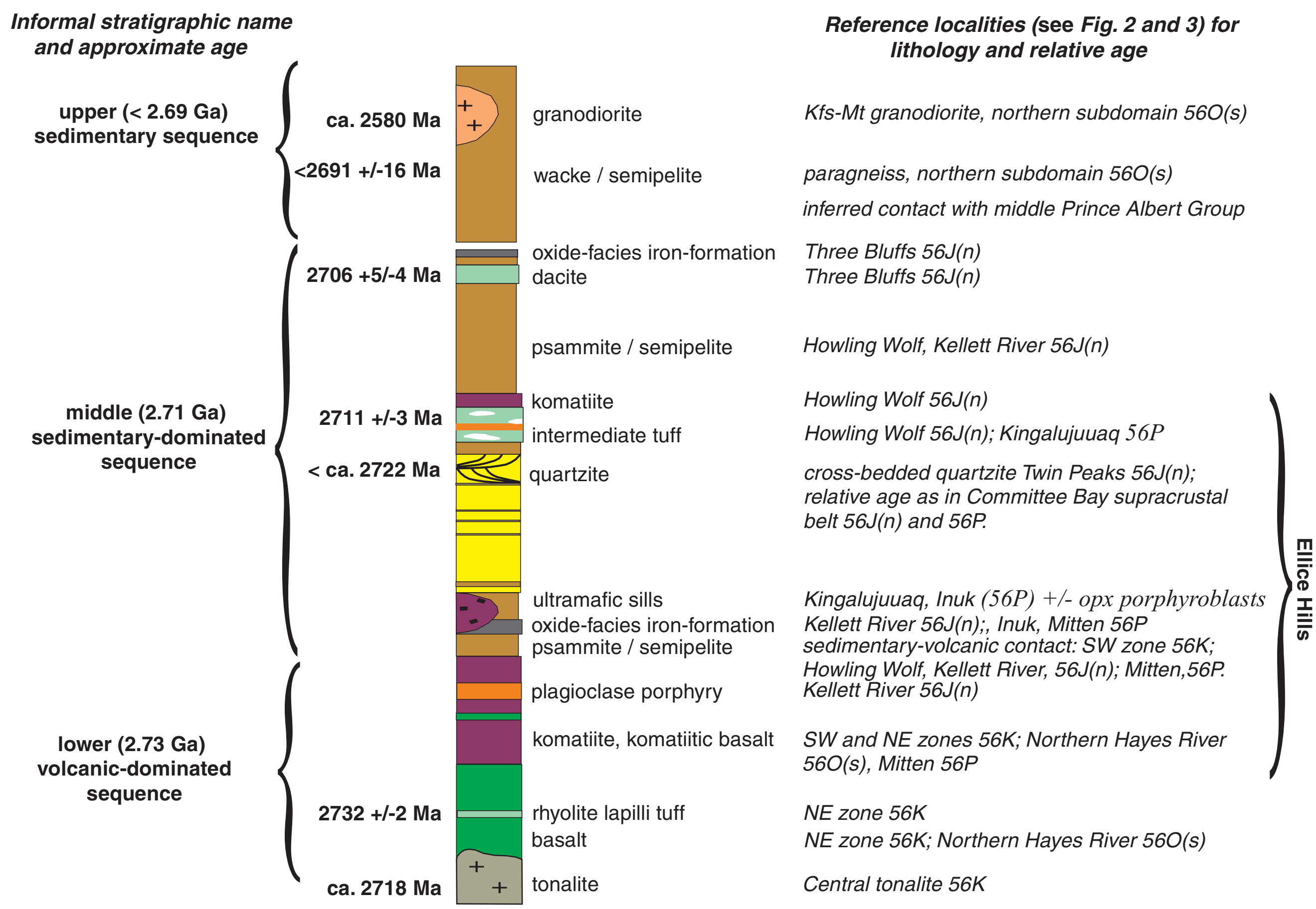

Figure 3. *Composite stratigraphic section of the Prince Albert group, Committee Bay area, showing major lithological units in sketch form (relative thickness and stratigraphic positions of units). Place names are shown in Figure 2. Shown for reference are recently acquired U-Pb zircon ages from the Walker Lake and Laughland Lake areas (T. Skulski and N. Rayner, unpub. data, 2002; M. Sanborn-Barrie and W.J. Davis, unpub. data, 2002).*

retrogressed, biotite-orthopyroxene-magnetite granodiorite (Fig. 2 and 4). A larger pluton of orthopyroxene–K-feldspar–megacrystic granodiorite lies 40 km north of the Walker Lake map area. This pluton lies near the centre of a subcircular, positive Bouguer gravity anomaly, measuring 170 km in diameter, that extends beneath the northern subdomain. This gravity anomaly may reflect, in part, the presence of dense transitional-granulite-facies paragneiss (see below, this section) and charnockite in this area. Frisch and Parrish (1991) reported an age of 2587 +9/-7 Ma for comparable, retrograded orthopyroxene–K-feldspar–megacrystic granite associated with garnet paragneiss in a granulite belt in the Chantrey Inlet area, 170 km to the west-southwest.

The southeastern subdomain is dominated by K-feldspar–megacrystic, biotite-hornblende-magnetite granodiorite-monzogranite of the 300 km long, northeast-trending, Walker Lake intrusive complex (Sandeman et al., 2001a; Skulski et al., 2002). Granodiorite from this complex yielded a SHRIMP U-Pb zircon age of 2610 ± 4 Ma (T. Skulski and N. Rayner, unpub. data, 2002).

Figure 4. *Plan view of orthopyroxene with biotite in foliated (S_2), medium-grained orthopyroxene-biotite-magnetite granodiorite, northern subdomain (Fig. 2).*

A large ridge of thick-bedded, massive quartzite in the Laughland Lake area is in tectonic contact with underlying rocks of the Prince Albert group (Sandeman et al., 2001b; Fig. 2). Detrital zircons in the quartzite yielded a maximum SHRIMP U-Pb age of sediment deposition of 2496 ± 13 Ma (T. Skulski and N. Rayner, unpub. data, 2002), indicating that this quartzite unit is notably younger than quartzite of the Prince Albert group. The minimum age of sediment deposition is constrained by the presence of S_2 fabrics in this rock, which are known to have formed prior to 1821 Ma (*see* below, this section).

Three phases of regional deformation are recognized in the Committee Bay area (Sanborn-Barrie et al., 2003). D_1 deformation is younger than 2600 Ma and is characterized by a commonly shallowly to moderately dipping, northwest-striking, bedding-parallel foliation, and by north-northwest–trending folds. D_2 is characterized by northeast-striking, northwest-vergent, steeply to shallowly dipping fabrics, and by northeast-trending, shallowly plunging folds. East-striking dextral shear zones, such as the Walker Lake shear zone, rotate and transpose D_2 structures (Johnstone et al., 2002; Sanborn-Barrie et al., 2002). D_3 deformation involves variably developed, northwest-trending open cross folds (NTS 56 K; Sandeman et al., 2001b) as well as kink-style folds and brittle conjugate faults (Sanborn-Barrie et al., 2003).

D_2 deformation coincides with greenschist- to amphibolite-facies metamorphism in the southwest, and with amphibolite-facies metamorphism in the Walker Lake area (Sandeman et al., 2001b; Sanborn-Barrie et al., 2002). Garnet porphyroblasts wrapped by S_2 fabrics in metasedimentary rocks and paragneiss have monazite inclusions with SHRIMP U-Pb ages of ca. 1850 Ma (C. Carson, unpub. data, 2002), providing a maximum age for S_2. Unstrained, biotite-magnetite-fluorite monzogranite that cuts S_2 in the Walker Lake intrusive complex has a SHRIMP U-Pb crystallization age of 1821 ± 5 Ma (T. Skulski and N. Rayner, unpub. data, 2002; Fig. 2). These constraints bracket the age of regional penetrative S_2 fabrics formed under amphibolite-facies conditions to between 1850 and 1821 Ma. However, the onset of D_2 crustal thickening leading to metamorphism and garnet growth may be older than 1850 Ma (Sanborn-Barrie et al., 2003).

Subsequent metamorphism was characterized by post-tectonic garnet growth in parts of the central subdomain, and by transitional granulite facies in northern subdomain paragneiss, with the mineral assemblage garnet±K-feldspar+sillimanite+cordierite+biotite (Sanborn-Barrie et al., 2002). This assemblage overgrows the S_2 fabric, and is therefore post-tectonic. These late garnets contain monazite inclusions with SHRIMP $^{207}Pb/^{206}Pb$ ages as young as ca. 1780 Ma, providing a maximum age constraint on late metamorphism (C. Carson, unpub. data, 2002). Hornblende crystals from across the Walker Lake area yielded ^{40}Ar-^{39}Ar age spectra with flat to locally disturbed (excess Ar) profiles, and plateau ages of ca. 1780 to 1765 Ma (H. Sandeman, unpub. data, 2002). The absence of a pre–1780 Ma history in the ^{40}Ar-^{39}Ar age spectra for hornblende indicates regional-scale, complete isotopic resetting of Ar during metamorphism at ca. 1780 Ma.

GEOLOGY OF THE ELLICE HILLS MAP AREA

The central and southeastern subdomains are represented in the Ellice Hills map area (Fig. 5). The central subdomain comprises diverse granitoid plutonic rocks, including biotite-muscovite granodiorite and monzogranite, that intrude and engulf the northeastward extension of the Committee Bay supracrustal belt; and narrow, northeast-trending supracrustal strands to the north, designated as the Ellice Hills supracrustal strand (Fig. 5). The southeastern subdomain in the Ellice Hills map area is dominated by K-feldspar–megacrystic granodiorite and monzogranite of the ca. 2610 Ma Walker Lake intrusive complex, and also contains lesser, diverse, older granodiorite gneiss and rare, younger 1821 Ma Hudsonian monzogranite.

Central subdomain, Committee Bay supracrustal belt

The Committee Bay supracrustal belt (Fig. 5) consists of a continuous, 1 to 4 km wide, folded panel of Prince Albert group rocks, intruded by sheets of granodiorite (*see* below, this section). The southwestern and central parts of the belt are dominated by quartzite-capped ridges that are flanked or cored by clastic and chemical metasedimentary rocks. Small ridges of ultramafic rock are also present. The margins of the belt are intrusive where exposed, or show local shearing against younger plutonic phases. These flanking plutons contain numerous, narrow metasedimentary and minor ultramafic screens and rafts that vary in size from 15 km long belts to metre-scale and smaller xenoliths.

The map-scale geometry of the Committee Bay supracrustal belt is controlled primarily by F_2 folding (Sanborn-Barrie et al., 2003; Fig. 5). The Kinngalugjuaq Mountain anticline, located in the southwestern portion of the Ellice Hills map area, is a 25 km long F_2 anticline cored by shallow-dipping quartzite and minor komatiite, with interbedded semipelite, psammite and iron-formation on its limbs. Immediately to the northeast, an en échelon F_2 syncline is cored by semipelite and psammite, with quartzite on its limbs over a 5 km strike length. Further to the northeast, the belt outlines an F_2 syncline (Sanborn-Barrie et al., 2003), with quartzite intruded by granodiorite and tonalite on its limbs, and semipelite and psammite in its core.

Stratigraphic younging was determined at nine localities along the length of the belt in graded beds of quartzite and psammite, and in quartzite beds with scours and crossbedding (Fig. 5). The lowest stratigraphic unit contains biotite±garnet±sillimanite±muscovite psammite with local centimetre-thick to 0.5 m thick interbeds of impure quartzite (Fig. 3). These are interbedded with thin- and medium-bedded semipelite, locally containing garnet±sillimanite±andalusite. Iron-formation occurs as a 3 to 10 m thick oxide- and sulphide-facies unit, and as thin silicate iron-formation beds within the clastic sedimentary rocks. Oxide-facies iron-formation includes laminated and thin-bedded recrystallized chert and magnetite that are locally cut by veins and stringers

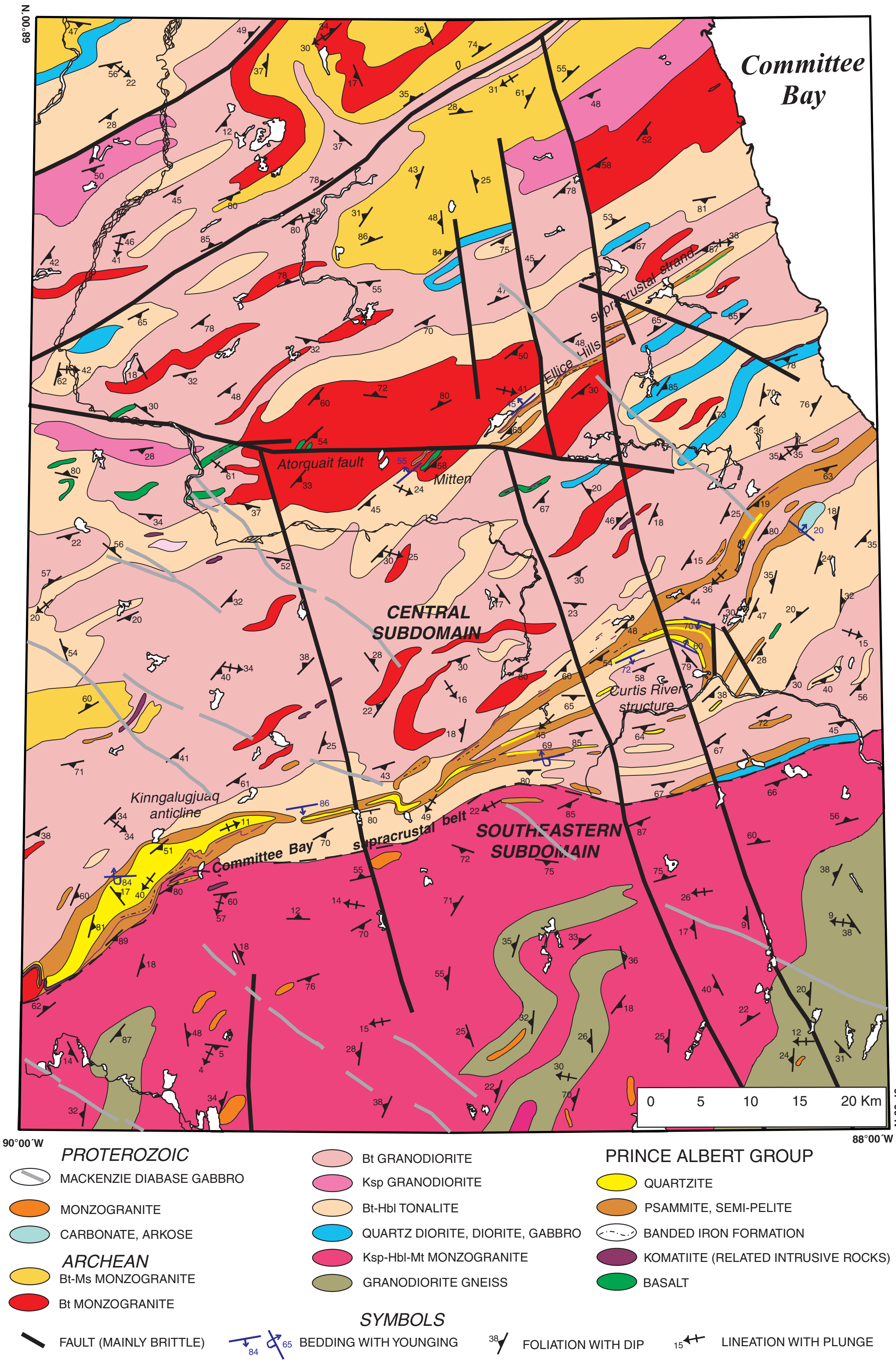

Figure 5. *Simplified geological map of the Ellice Hills map area (NTS 56 P).*

of pyrite and pyrrhotite (cf. Deyell and Sherlock, 2003). Silicate-facies iron-formation is medium- to thin-bedded and is composed of garnet, amphibole, magnetite, and pyrite (Fig. 6).

Overlying the lower sedimentary rocks is the main quartzite ridge, which is 20 to 30 m thick and contains beds varying in thickness from 5 to 20 cm and rarely reaching 1 m (Fig. 3). In the southwest, the main quartzite is locally in contact with a 14 m wide komatiite unit with 2 m thick alternating brown and green layers, interpreted to represent lower cumulate and upper parts of individual flows, respectively. The quartzite may contain variable amounts of muscovite±garnet±sillimanite±fuchsite±pyrite±magnetite. Bedding, graded bedding in particular, is defined by coarse to fine grain size variations within beds, an increase in muscovite content toward the top of beds, and fuchsite seams along the bases of beds. Trough-type crossbedding was observed at one locality, occurring in foresets 15 cm wide. Impure quartzite contains circular quartz-sillimanite-muscovite knots that may have formed by retrogression of sillimanite–K-feldspar knots (Fig. 7). These knots are typically flattened in S_1 foliation, locally stretched, and define an L_2 extension lineation. The main quartzite is overlain by interbedded psammite, semipelite, and thin iron-formation, and in the southwest by thin intermediate volcanic rocks (Fig. 3). Oxide- and silicate-facies iron-formation occurs in 10 to 40 cm thick units, interbedded with 1 to 2 cm thick semipelite layers. Intermediate tuff is found in layers <5 m thick.

Figure 6. F_2 folds developed in silicate-facies iron-formation, southwest coast of Committee Bay.

Figure 7. Quartz sillimanite muscovite knots in impure quartzite, Kinngalugjuaq Mountain area.

Central subdomain, Ellice Hills supracrustal strand

The Ellice Hills supracrustal strand is a narrow, northeasterly striking belt which is intruded by granitoid rocks and segmented and cut by the Atorquait fault and by north-northwesterly brittle faults and fracture zones (Fig. 5). At the Mitten showing (Fig. 3 and 5), supracrustal rocks form a west-northwest–younging package including: 2 to 3 m thick komatiite flows with 1 to 2 m thick, brown-weathering cumulate zones and 20 cm to 1 m thick, green-weathering spinifex upper zones; overlain by 20 to 60 m thick units of interbedded garnet-biotite semipelite, psammite, and rare, thin quartzite beds; overlain by 2 to 5 m thick silicate-facies iron-formation, komatiitic basalt (Fig. 8), and an upper komatiite unit. To the southwest, supracrustal rocks occur as isolated kilometre-scale pods within younger plutonic rocks.

Figure 8. Bedding-plane view of polygonal jointing in upper part of a komatiitic basalt flow near the Mitten showing.

Figure 9. *Sectional view of bedding contact between calc-arenite and arkose, with overprinting S_2 foliation, in (?)Paleoproterozoic metasedimentary rocks near southwest coast of Committee Bay.*

Figure 10. *Orthopyroxene porphyroblasts (1–1.5 cm in length) in a peridotite sill that intrudes semipelite, psammite, and iron-formation below quartzite, Kinngalugjuaq Mountain area.*

Central subdomain, (?)Paleoproterozoic metasedimentary rocks

An open syncline of shallowly dipping (5–20°), approximately 80 m thick, pink to buff subarkose and grey, recessive, calcareous arenite structurally overlies Prince Albert group metasedimentary rocks and younger plutonic rocks near the northeastern end of the Committee Bay supracrustal belt. These possibly Paleoproterozoic sedimentary rocks consist of massive subarkose with at least two calc-arenite sequences, each approximately 5 m thick (Fig. 9). Bedding in the subarkose is 10 to 30 cm thick. At one locality, low-angle planar crossbedding was observed to indicate normal younging. The contact with the underlying Archean rocks is obscured by a medium-grained, well foliated monzogranite that intrudes the Archean rocks. The contact between this granite and overlying Proterozoic sedimentary rocks is covered. The sedimentary rocks are strongly recrystallized, and the calc-silicate rocks contain metamorphic epidote and diopside. The sedimentary rocks have a shallow-dipping foliation that is locally bedding-parallel and generally parallel to the regional S_2 (Sanborn-Barrie et al., 2003; Fig. 9). These rocks occur in the core of an open, southwest-plunging F_2 synform. The minimum age of this sedimentary succession is interpreted to be 1.85 Ga (maximum age of S_2). The association of arkose with calc-arenite is common to a number of Paleoproterozoic sedimentary successions in the Rae domain, including the Folster Lake formation on Melville Peninsula (Frisch, 1982).

Central subdomain plutonic rocks

Serpentinized peridotite sills occur within the Committee Bay supracrustal belt, in contact with psammite, semipelite and iron-formation beneath, and with the main quartzite above (Fig. 3). Individual tabular bodies occur as discontinuous ridges up to 50 m wide. These locally contain metamorphic orthopyroxene porphyroblasts up to 1.5 cm in length, in a matrix of tremolite, pyroxene, and magnetite (Fig. 10). At one locality, an ultramafic sill contains modal layering on a scale of 3 to 4 m that likely reflects changes in the proportions of olivine and pyroxene. Some of these bodies occur as large screens within granodiorite and tonalite. They are interpreted to be late synvolcanic, and may be related to late-stage komatiitic volcanism in the interval from 2711 to 2691 Ma.

There are multiple generations of gabbro, diorite, and quartz diorite in the central subdomain. The oldest are cut by granitoid rocks and occur as screens and rafts, or as larger, kilometre-scale sheets (Fig. 5). They include fine- to medium-grained, foliated and variably lineated, hornblende±biotite diorite and rare hornblende gabbro. Some smaller bodies of gabbro, diorite, and quartz diorite have transitional contacts with biotite tonalite and granodiorite, and are likely contemporaneous.

Lenticular bodies of tonalite are found throughout the central subdomain (Fig. 5). These foliated plutons intrude the Prince Albert group and locally contain screens and rafts of supracrustal rocks. Biotite tonalite is common as inclusions in younger granodiorite and monzogranite. Hornblende-biotite tonalite is more common near the Committee Bay supracrustal belt. At a number of localities, primary hornblende is partially replaced by biotite. There is a southward increase in regional magnetic susceptibility in plutonic rocks in the central subdomain. Near the Committee Bay supracrustal belt, this is reflected in tonalite by the presence of 1 to 3 mm magnetite crystals.

Biotite granodiorite is the most common rock type in the central subdomain (Fig. 5). It occurs as large, medium- to coarse-grained, variably foliated bodies that intrude supracrustal rocks and contain abundant rafts and screens of supracrustal rocks. The granodiorite contains biotite and may also contain hornblende, magnetite, epidote, titanite, and allanite. K-feldspar can occur as phenocrysts or as megacrysts up to 3 cm in length. Thin dykes and larger sheets of monzogranite commonly cut granodiorite. Locally, contacts between biotite monzogranite and granodiorite are transitional on a decimetre scale. Large bodies of biotite monzogranite occur as lenticular sheets and as a single large intrusion in the central part of the map area. A large body of weakly foliated, medium-grained to K-feldspar–megacrystic, biotite+muscovite±sillimanite granodiorite to monzogranite occurs in the northern Ellice Hills area. Muscovite is typically a minor phase (1–2%) relative to biotite (5–10%), and forms isolated books up to 1–2 cm wide. Massive biotite monzogranite and syenogranite pegmatite dykes cut the biotite-muscovite granodiorite-monzogranite.

Southeastern subdomain

The southeastern subdomain is dominated by foliated, coarse-grained, K-feldspar–megacrystic, biotite±hornblende+magnetite granodiorite and monzogranite (Fig. 5), and represents the northeastern extension of the ca. 2610 Ma Walker Lake intrusive complex (Sandeman et al., 2001a; Skulski et al., 2002). K-feldspar megacrysts are up to 6 cm long and locally define a tectonic foliation. Magnetite occurs locally as euhedral crystals up to 8 mm across. Rafts and xenoliths of metasedimentary rocks occur locally.

The Walker Lake intrusive complex intrudes heterogeneous panels of strongly foliated and gneissic granodiorite (Fig. 5). This unit consists of biotite and hornblende tonalite with centimetre- to decimetre-scale injections of biotite-magnetite granodiorite, resulting in an injection-gneiss texture. The tonalite contains screens and rafts of metasedimentary rocks, amphibolite, diorite, and quartz diorite. Foliated and massive granite dykes crosscut the host tonalite and granodiorite.

Crosscutting granitoid rocks in the southeastern subdomain are dykes and small plugs of orange-pink, massive to weakly foliated Hudsonian biotite-magnetite monzogranite (Fig. 5). Hudsonian granite is more abundant to the southwest in the Walker Lake and Laughland Lake areas, and has been recently dated at 1821 ± 5 Ma (T. Skulski and N. Rayner, unpub. data, 2002).

ECONOMIC IMPLICATIONS

Bedrock mapping and the development of a stratigraphic model for the Prince Albert group have important economic implications for mineral exploration models in the Committee Bay area. In particular, identification of the stratigraphic position and distribution of iron-formation, with which all major gold showings are associated (Deyell and Sherlock, 2003), will assist in future gold-exploration initiatives. The stratigraphy of the Prince Albert group (Fig. 3) includes a lower volcanic-dominated sequence of basalt and ca. 2732 Ma rhyolitic lapilli tuff, overlain by komatiite which is locally interbedded with clastic sedimentary rocks and iron-formation. Only the younger komatiite, clastic sedimentary rocks, and iron-formation units are present in the Ellice Hills supracrustal strand. These are overlain by a middle sequence of semipelite, psammite, banded iron-formation, 2722 to 2711 Ma quartzite, 2711 Ma intermediate volcanic rocks, semipelite, psammite, and local iron-formation and komatiite, all of which are represented in the Committee Bay supracrustal belt in the Ellice Hills map area. The upper Prince Albert group comprises the high-grade equivalents of semipelite and psammite, deposited between 2691 and 2580 Ma. Silicate-, oxide-, and sulphide-facies iron-formation are recognized in the lower and middle Prince Albert group. Widespread D_2 deformation is Paleoproterozoic in age, and S_2 formation is bracketed between ca. 1.85 and 1.82 Ga. Deformation at this time was responsible for local, tight folding of iron-formation units, and these folds and associated axial-planar zones are the locus of gold mineralization in parts of the Committee Bay area (Deyell and Sherlock, 2003; Sanborn-Barrie et al., 2003).

The presence of relatively thick (>50 m) late-stage ultramafic sills, intrusive into clastic sedimentary rocks and locally into iron-formation, in the middle part of the Prince Albert group has important implications for nickel and platinum-group-element exploration. Further work is warranted to assess whether these magmatic rocks have assimilated sulphur from sedimentary sources and precipitated nickel or platinum-group elements.

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