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Results of bedrock mapping of the Darby Lake–Arrowsmith River north map areas, central Rae Domain, Nunavut

H.A. Sandeman[1], M. Schultz[2], and K. Rubingh[3]

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Abstract: The Darby Lake–Arrowsmith River area, southwest of Pelly Bay and southeast of Chantrey Inlet, is readily divided into three northeast-trending lithotectonic subdomains all of which are dominated by granitoid rocks, but contain uncommon, dispersed remnants of upper greenschist- to amphibolite-facies Archean supracrustal rocks dominated by psammite and semipelite with rare mafic and ultramafic units. Greenschist-facies supracrustal rocks are associated in the northwest and southeast by widespread tonalite, granodiorite, and monzogranite. Along the central axis of the map area, a wide range of moderately to strongly deformed, commonly L>S medium-grained to megacrystic granodiorite to dominant monzogranite tectonite bodies at amphibolite facies, grade into biotite±garnet and biotite-orthopyroxene±garnet-bearing granitoid rocks. These granitoid rocks all contain abundant screens, rafts, and schlieren of tonalite, biotite±garnet±hornblende±sillimanite-bearing metasedimentary rocks, and cospatial metasedimentary metatexite and diatexite. Small cupolas of massive biotite±magnetite monzogranite crosscut these rocks.

Résumé : La région couverte par les feuillets cartographiques Darby Lake et Arrowsmith River, qui est située au sud-ouest de la baie Pelly et au sud-est de l'inlet Chantrey, se divise aisément en trois sous-domaines lithotectoniques orientés nord-est–sud-ouest. Ces sous-domaines renferment en majorité des granitoïdes, mais aussi des vestiges occasionnels de roches archéennes supracrustales, métamorphisées du faciès des schistes verts supérieur au faciès des amphibolites, qui sont constituées surtout de psammite et de semipélite, ainsi que de rares unités mafiques et ultramafiques. Au nord-ouest et au sud-est, les roches supracrustales du faciès des schistes verts sont associées avec de la tonalite, de la granodiorite et du monzogranite, trois types de roches très répandus. Le long de l'axe central de la région étudiée, une grande diversité de tectonites (généralement L>S) modérément à fortement déformées, à grain moyen ou à mégacristaux, et de composition granodioritique à (surtout) monzogranitique, qui ont été métamorphisées au faciès des amphibolites, montrent un passage progressif à des roches granitoïdes à biotite±grenat et à biotite-orthopyroxène±grenat. Tous les granitoïdes contiennent en abondance des écrans, des blocs digérés et des schlieren de tonalite, de roches métasédimentaires à biotite±grenat±hornblende±sillimanite, ainsi que de métatexites et de diatexites métasédimentaires cospatiales. De petites coupoles de monzogranite massif à biotite±magnétite recoupent toutes ces roches.

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INTRODUCTION

Geological mapping of the Darby Lake and Arrowsmith River regions in central mainland Nunavut forms the first year of the multidisciplinary 'Boothia Peninsula Integrated Geoscience Project'. This region was selected as the target for a year of bridging mapping between the Committee Bay supracrustal belt to the south and the poorly documented Barclay supracrustal belt (Frisch, 2000) lying to the north of the map area. The current study establishes a strong geotectonic linkage and scientific continuity across the region, thus providing 'seamless' regional geological coverage between the southward-lying Committee Bay supracrustal belt (Committee Bay Integrated Geoscience Project: e.g. Skulski et al. (2003b)), northward through a region of granitoid rocks (NTS 56 N and -O) and finally, into the Barclay supracrustal belt exposed predominantly north of 68°N. During the summer of 2004, a collaboration between the Geological Survey of Canada and Indian and Northern Affairs Canada undertook a new regional aeromagnetic survey for regions lying north of 68°N. For the survey, 101 000 line kilometres were flown at a line spacing of 400 m and at 150 m elevation. This new aeromagnetic data set, the first publically available for the region, will facilitate the next two-year phase of bedrock mapping northwards from 68°N along the Boothia Peninsula. This following phase of bedrock mapping will be led by the Geological Survey of Canada in conjunction with the Canada-Nunavut Geoscience Office and university and industry partners (Fig. 1).

Bedrock mapping (1:100 000 scale) and surficial ice-flow direction studies along with drift prospecting were undertaken to upgrade the geoscience knowledge of the region in light of the strong interest in both precious-metal and diamond exploration in the area. The present helicopter-supported mapping along with previous fieldwork to the south in the Committee Bay belt (Sandeman et al., 2001a, b; Sanborn-Barrie et al., 2002, 2003; Skulski et al., 2002, 2003a, b and references therein) greatly enhances our understanding of the regional geological history of the region. This report, and forthcoming papers on the economic geology (K. Rubingh and H.A. Sandeman, unpub. manuscript, 2005), and surficial geology (C.A. Ozyer and S.R. Hicock, unpub. manuscript, 2005), provide an overview of the geology of the Darby Lake and Arrowsmith River area.

GEOLOGICAL SETTING

The western Churchill Province of the Canadian Shield comprises the Rae and Hearne domains (Fig. 1) and represents a vast tract (about 1.7 million km^2) of northeast- and locally east-trending Neoarchean granitoid and supracrustal rocks that have been variably tectonically reworked during the Paleoproterozoic (Relf and Hanmer, 2000; Hanmer et al., 2004). The Hearne Domain was recently subdivided into southern, central, and northwestern subdomains on the basis of lithological, metamorphic, structural, and petrochemical distinctions. The geology of the southern Hearne subdomain is poorly known, but it apparently contains crust of probable Mesoarchean age (van Breemen et al., 2005). The central Hearne supracrustal belt preserves greenschist-facies, volcanic-rock-dominated supracrustal belts and their contemporaneous, voluminous tonalitic to granodioritic plutonic rocks. The central Hearne subdomain lacks Paleoproterozoic granitoid rocks; yields concordant, simple U-Pb zircon ages ranging from 2711 Ma to 2659 Ma; and exhibits juvenile Neoarchean εNd compositions (Hanmer et al., 2004). In contrast, the northwestern Hearne subdomain preserves polydeformed amphibolite-facies assemblages, more abundant Archean metasedimentary rocks, common, ca. 2600 Ma granodioritic plutons, abundant Paleoproterozoic granitoid rocks and Paleoproterozoic U-Pb titanite ages (W.J. Davis, S. Hanmer, S. Tella, J.J. Ryan, and H.A. Sandeman, unpub. manuscript, 2005).

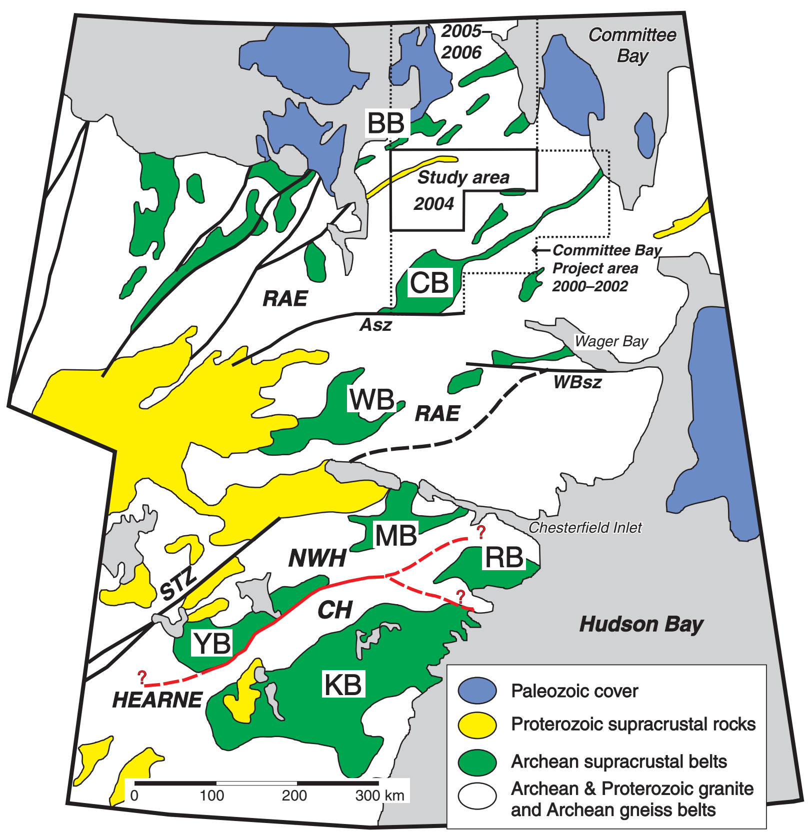

Figure 1. *Location of the Darby Lake and Arrowsmith River study area relative to major lithotectonic units of the western Churchill Province. Key: CB = Committee Bay belt; BB = Barclay belt; WB = Woodburn belt; MB = MacQuoid belt; RB = Rankin belt; KB = Kaminak belt; YB = Yathkyed belt; STZ = Snowbird tectonic zone; WBsz = Wager Bay shear zone; Asz = Amer shear zone; NWH = northwestern Hearne subdomain; CH = Central Hearne subdomain.*

Although the Rae Domain shares many lithological, structural, and metamorphic similarities with the northwestern Hearne subdomain, it is characterized by lithologically distinct Archean supracrustal belts that contain notable komatiite-quartzite sequences. The Rae Domain exhibits a polymetamorphic history involving both Archean and Paleoproterozoic orogenic events and is widely intruded by voluminous ca. 2600 Ma plutons of granitic (*sensu lato*) composition. Rocks of the Rae Domain and those of the northwestern Hearne Domain have locally been observed to contain both U-Pb zircon and Nd isotopic evidence for interaction with older, Mesoarchean basement. Moreover, the Rae Domain contains rare vestiges of Mesoarchean plutonic crust that have yielded ages of ca. 2870 Ma in the Woodburn Lake area (Zaleski et al. (2001); Fig. 1) and 2880–2750 Ma in the Eqe Bay region of north Baffin Island (Bethune and Scammell, 2003). These Mesoarchean metaplutonic rocks are inferred to represent stratigraphic basement to the Woodburn Lake, Prince Albert, and Mary River groups, a series of generally discontinuously exposed, Neoarchean supracrustal rocks extending from Woodburn Lake to northern Baffin Island (Fig. 1 (Baffin Island not shown); Frisch, 1982; Zaleski et al., 2001; Bethune and Scammell, 2003; Skulski et al., 2003b).

Archean supracrustal rocks of the Woodburn Lake group were deposited between 2740 Ma and 2630 Ma (Zaleski et al., 2001) whereas the Prince Albert group was formed during the interval 2730–2690 Ma (Skulski et al., 2003b). Local, thin basal cratonic-derived quartzite and quartz-cobble conglomerate (Woodburn only) are overlain by a lower volcanic sequence containing basalt, komatiite (including its intrusive equivalents), and felsic volcanic rocks. These are in turn overlain by mixed sedimentary-volcanic sequences including psammite, semipelite, pelite, iron-formation, and quartzite intercalated with intermediate to felsic tuffs (Zaleski et al., 2001; Skulski et al., 2003b). Zaleski et al. (2001) and Skulski et al. (2003a) suggested a continental affinity for the Neoarchean volcano-sedimentary sequences of the Woodburn Lake and Prince Albert groups and interpreted komatiitic and basaltic volcanism in these sequences as the mantle-derived products of a mantle plume(s) in a continental rift setting.

Widespread, metaluminous, and weakly peralkaline I-type granitoid plutons including charnockite and greatly dominated by granodiorite were emplaced throughout the Rae Domain between 2640 Ma and 2580 Ma (LeCheminant and Roddick, 1991; Frisch and Parrish, 1992; Zaleski et al., 2001; Skulski et al., 2003b). These are locally cospatial with peraluminous intrusions comprising both two-mica- and garnet-biotite±sillimanite-bearing variants that, although not precisely dated, are inferred to be contemporaneous with the metaluminous plutonic rocks. Plutonic rocks of this general age appear to underlie a large proportion of the present study area.

Outliers of Paleoproterozoic metasedimentary rocks are found throughout the Rae Domain (Fig. 1). These include quartzite, carbonate, and sulphidic mudstone of the greater than 1850 Ma Amer Group (Patterson, 1986; Tella, 1994); lower clastic and carbonate, and upper carbonaceous shale and arkosic wacke sequences of the ca. 1880 Ma Penrhyn Group (Henderson, 1983); quartzite, marble, and pelite of the undated Chantrey Group (Frisch, 2000); and arkose and carbonate of the 2321 Ma and younger Folster Lake Group (Frisch, 1982; Skulski et al., 2003b). These Paleoproterozoic sedimentary sequences have sustained two episodes of deformation and although locally metamorphosed to amphibolite facies, are typically of greenschist facies.

Paleoproterozoic intrusive rocks include the ca. 1825 Ma granite and granodiorite plutons of the Ford Lake batholith (LeCheminant et al., 1987) and similar-age biotite-magnetite ±fluorite monzogranite in the Amer Lake (Tella et al., 1985; Tella, 1994) and Committee Bay (Skulski et al., 2003a, b) regions. Northwest-trending, Mesoproterozoic (ca. 1267 Ma) Mackenzie diabase dykes cut all major lithological units in the Rae Domain.

Although a number of generations of structural elements are widely observed in the Rae Domain, and indeed in the western Churchill Province as a whole, it is only in rocks unequivocally documented as Paleoproterozoic in age that the timing of the generation of these structural elements is relatively straightforward. Where dated Paleoproterozoic rocks are absent, the intensity and extent of Paleoproterozoic deformation proves difficult to determine when mapping Archean sequences. Recent mapping by Skulski et al. (2003b and references therein) has demonstrated that across the north-central Rae Domain, extending from the Woodburn Lake area in the southwest, northeastwards towards Committee Bay, two of the three regional fabrics and structural elements can be attributed to Paleoproterozoic orogenic events (Carson et al., 2004). Moreover, the observed regional airborne magnetic structural trend of both Archean and Paleoproterozoic supracrustal and granitoid rocks (*see* Skulski et al., 2003b) is the result of inclined, tight, southeast-dipping, 20–30 km wavelength folding and possibly thrusting of all of these rocks at ca. 1880–1850 Ma (Berman et al., 2002; Sanborn-Barrie et al., 2003; Carson et al., 2004). These were subsequently cross folded by north-northeast- and north-northwest-trending regional and mesoscopic open folds and local conjugate crenulations. The timing of the latter is not known, but is inferred to be cogenetic with a regional, apparently static metamorphic event at ca. 1780 Ma (Carson et al., 2004).

GEOLOGY OF THE DARBY LAKE–ARROWSMITH RIVER AREA

The map area is dominated by plutonic rocks and can be subdivided into three major, generally northeast-trending lithotectonic subdomains (Fig. 2): the southern, central, and northern subdomains. Overall, granitoid rocks are greatly predominant and supracrustal rocks occur only as isolated rafts and inclusions in the granitoid rocks.

Geochronological constraints on the age of rocks in the Darby Lake and Arrowsmith River areas are limited to the historical data of Frisch and Parrish (1992) and Frisch (2000), but much may be inferred from the recent work by

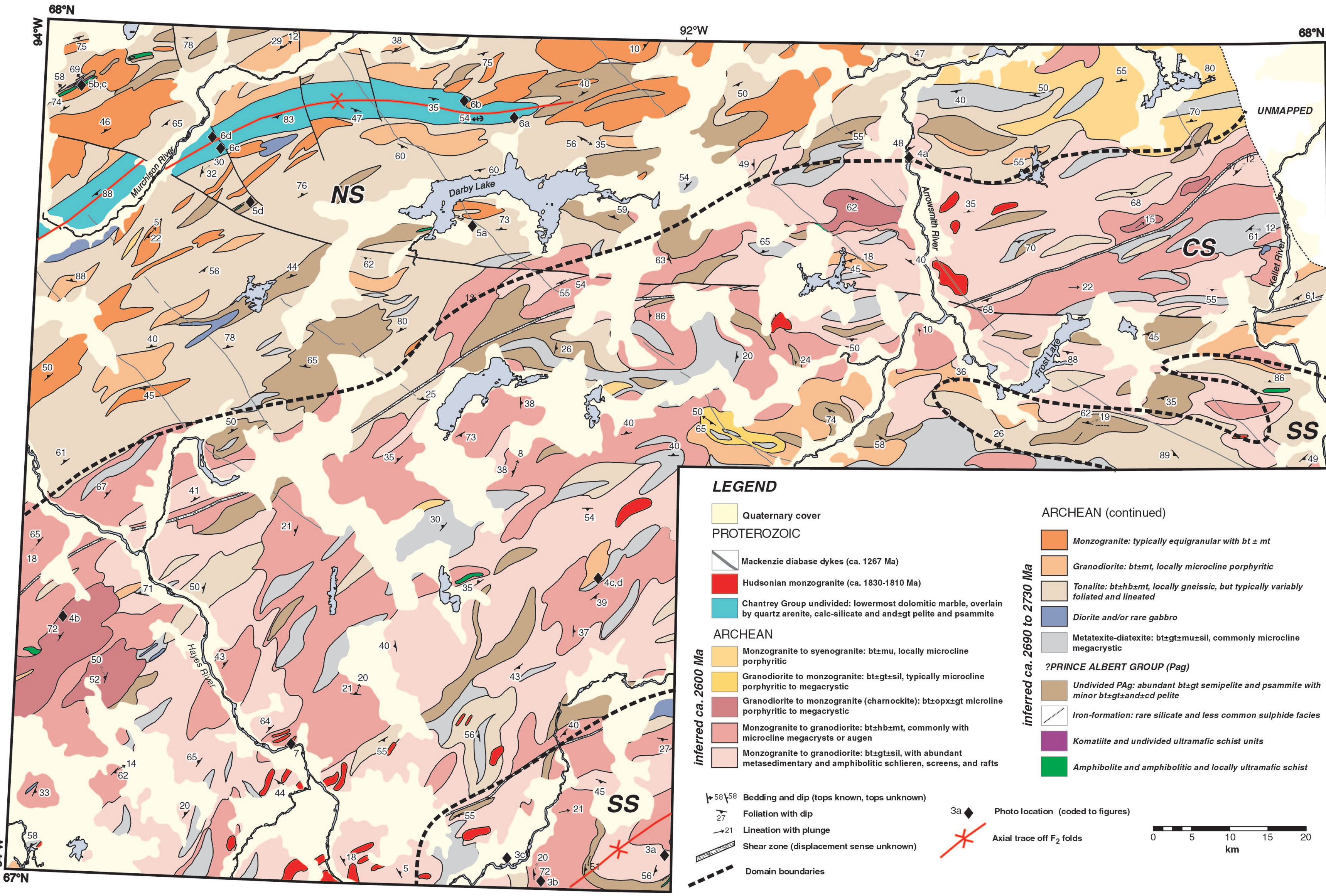

Figure 2. *Simplified geological map of the Darby Lake and Arrowsmith River study area with major geological units and simplified structural geology. Locations of following figures are also given. Heavy dashed lines are subdomain boundaries. SS = southern subdomain, CS = central subdomain, NS = northern subdomain, and = andalucite, gt = garnet, bt = biotite, mu = muscovite, sil = sillimanite, opx = orthopyroxene, hb = hornblende, mt = magnetite, cd = cordierite.*

Skulski et al. (2003a, b) and Carson et al. (2004) in the Committee Bay belt immediately to the south and east. Frisch and Parrish (1992) reported a bulk grain, U-Pb TIMS zircon age of 2587 +9/-8 Ma for a retrograde metamorphosed microcline megacrystic biotite-orthopyroxene granodiorite associated with garnet paragneiss exposed about 20 km to the west of the southwestern part of the Darby Lake area. This is comparable to ages of ca. 2604–2580 Ma for a range of microcline megacrystic to medium-grained granodiorite and monzogranite from NTS 56-O south, immediately east of the Darby Lake area (T. Skulski, pers. comm., 2004). The present authors consider, therefore, that the majority of the microcline megacrystic to medium-grained monzogranite and granodiorite of the central and southern subdomains of the present map area are likely of comparable age.

Southern subdomain

The southern subdomain is dominantly underlain by granodiorite and monzogranite. Moderately foliated to gneissic, generally medium-grained biotite±garnet monzogranite is most abundant and varies gradationally to a coarse-grained, L>S microcline megacrystic biotite granodiorite to monzogranite tectonite (Fig. 3a). Both varieties contain abundant rafts, screens, and schlieren of biotite±garnet±andalusite semipelite, psammite, and gneissic tonalite. Moderately south- and east-dipping, sporadically preserved exposures of gneissic biotite±hornblende tonalite contain abundant metasedimentary and metavolcanic rafts, screens, and schlieren (Fig. 3b) all of which are crosscut by a range of variably-textured monzogranite to granodiorite described above. One small (<50 m^2) exposure of recrystallized hematitic quartzite was observed in the extreme southeast of the map area (Fig. 3c). Similarly, thin (tens of metres) units of mafic volcanic rocks were observed along with rusty biotite semipelite in the same part of the Darby Lake map area and were also previously noted in the adjacent NTS 56-O south map area. This domain is continuous along strike to the east-northeast with the central Prince Albert group subdomain of Skulski et al. (2003a, b).

Central subdomain

The broad, areally expansive central subdomain (Fig. 2), comprises a northeast- to east-northeast-trending swath of moderately to shallowly northwest- and southeast-dipping, predominantly monzogranitic rocks with tonalite and metatexitic metasedimentary rafts and less common diatexite. This subdomain is generally continuous along strike to the northeast with the northern migmatite subdomain of Skulski et al. (2003b), although the present map area contains more abundant granitoid rocks and less common metatexite and diatexite. The central and northeastern parts of the central subdomain are dominated by the central monzogranite.

Figure 3.

*Characteristic rock types of the southern subdomain. **a)** Coarse-grained, microcline megacrystic biotite monzogranite. Two dollar coin (2.8 cm in diameter) for scale. **b)** Gneissic biotite tonalite with abundant gneissosity-parallel, medium-grained monzogranite bands and less common inclusions of biotite+hornblende amphibolite. Hammer handle is 34 cm long. **c)** Recystallized, fine-grained orthoquartzite occurs as a tens of metre-scale raft in medium-grained biotite monzogranite in the southeast corner of the Darby Lake map area. Two dollar coin for scale.*

This characteristically comprises medium-grained, moderately foliated to locally gneissic, metasedimentary schlieren and xenolith charged, biotite±garnet monzogranite to granodiorite (Fig. 4a). It is easily recognized in the field, and is observed to grade laterally into both medium-grained, microcline-porphyritic, megacrystic, or more intensely deformed augen biotite±hornblende±garnet monzogranite and locally, charnockitic, microcline megacrystic biotite±orthopyroxene±garnet monzogranite to granodiorite (Fig. 4b). The latter unit is of regional significance and occurs proximal to the metasedimentary rocks exhibiting the highest metamorphic grade assemblages.

The central schlieren-laden, gneissic monzogranite apparently intruded a voluminous package of predominantly metasedimentary rocks and thus contains abundant foliation parallel rafts, xenoliths, and schlieren of typically amphibolite, to locally transitional granulite facies paragneiss, metatexite, and diatexite (Fig. 4c, d). In the northern migmatite subdomain of Skulski et al. (2003a, b) these are intruded by small, generally ovoid plutons of garnet-sillimanite-biotite granite, and younger, larger plutons of 2580 Ma (Skulski et al., 2003b) biotite±magnetite granodiorite and tonalite. Only one pluton of the former variety was observed (NTS 56-O north) whereas the latter were not observed in the present map area.

Northern subdomain

The northern Barclay Belt subomain is most similar to the central Prince Albert group subdomain of Skulski et al. (2003b) and is underlain by northeast- and east-trending tonalite with metasedimentary, and less common metavolcanic supracrustal rocks. Overlying the Archean rocks in the northwest part of the map area is an elongate, synformal structure comprising the Chantrey Group (Heywood, 1961; Frisch et al., 1985). The northern Barclay Belt subomain is underlain by dominant, medium-grained, biotite±hornblende±magnetite tonalite (Fig. 5a) that varies locally to granodiorite and monzogranite.

Figure 4. Characteristic rock types of the central subdomain. ***a)*** *Medium-grained, L>S, gneissic biotite monzogranite with abundant metre-scale inclusions and centimetre-scale schlieren of both hornblende-biotite±garnet amphibolite and biotite±garnet semipelite. Hammer handle is 48 cm long.* ***b)*** *Retrograde metamorphosed microcline megacrystic biotite+orthopyroxene+garnet charnockite. Marker is 13.5 cm long.* ***c)*** *Brownish-white-weathering, biotite±garnet±muscovite metatexite with a sinuous gneissosity. Note that this rock contains about 60% medium-grained, white syenogranite pods and foliation-parallel veins. Hammer handle is 48 cm long.* ***d)*** *Close-up of the metatexite in Figure 4c with abundant, disrupted, white-weathering monzogranitic lenses and layers. Marker is 13.5 cm long.*

Figure 5. *Characteristic rock types from the northern Barclay Belt subdomain.* ***a)*** *Medium-grained, moderately to strongly foliated biotite±hornblende±magnetite tonalite. Pencil is 14.5 cm long.* ***b)*** *Metre-scale features interpreted as pillows with schistose selvages in fine-grained amphibolite. Hammer handle is 34 cm long.* ***c)*** *Alternating green (spinifex) and orange-brown (cumulate) zones in 1.5 m scale komatiite flows that preserve rare spinifex textures. Hammer handle is 48 cm long.* ***d)*** *Fine- to medium-grained muscovite-biotite-andalusite±cordierite pelite. Pen magnet is 14 cm long.*

These plutonic rocks contain uncommon metasedimentary inclusions, but host the largest intact volcanic-rock-bearing supracrustal rafts in the map area (Fig. 2). In the best preserved rocks exposed in the extreme northwest of the region, metamorphic grade is greenschist facies and stratigraphic younging was determined at two localities. Therein, common actinolitic to hornblende-bearing metavolcanic rocks (Fig. 5b) are in close proximity to spinifex-textured komatiite (Fig. 5c) having unambiguous A, B1, and B2 horizons that indicate northward younging. This observation is identical to a northwestward younging direction determined from crossbedding in finely interlayered psammite and semipelite exposed nearby. Pelite is rare, but where observed contains the mineral assemblage biotite±muscovite±andalusite ±cordierite (Fig. 5d). As one progressively moves south-southeast towards the central subdomain, the metamorphic grade gradually increases through the amphibolite facies and the intensity of recrystallization and migmatization of contained metasedimentary rafts also increases.

Chantrey Group

The Chantrey Group was initially described by Heywood (1961) and was mapped in greater detail in 1985 by Frisch and others (Frisch et al., 1985; Frisch, 1992; Frisch, 2000). The Chantrey Group forms a regional syncline over 70 km long that is in apparent unconformable and structural contact with underlying units consisting mainly of Archean biotite±hornblende±magnetite tonalite to monzogranite. The group is a shallow-water, clastic-dominated sequence consisting of four distinct units in the map area. The basal unit is a sporadically preserved, about 10 m thick, variably foliated, siliceous marble unit that exhibits well formed tremolite rosettes (Fig. 6a). Along the northern margin of the belt at locality 6B (Fig. 2), the unit has been thrust imbricated with strongly foliated, locally mylonitic microcline augen chloritic granodiorite and tonalite yielding a downsequence tectono-stratigraphy comprising brown biotite psammite to quartz arenite (50 m), tremolite marble (10 m), mylonitic Archean granodiorite (20 m), dolomitic marble (10 m), and then moderately deformed granodiorite of the Archean

Figure 6. *Photographs of characteristic rock types of the Chantrey Group.* ***a)*** *Lowermost (oldest) dolomitic carbonate of the Chantrey Group with well preserved tremolite rosettes. Two dollar coin for scale (2.8 cm in diameter).* ***b)*** *Ripple marks in massive to locally foliated micaceous (muscovite) orthoquartzite of the Chantrey Group. Hammer handle is 34 cm long.* ***c)*** *Calc-silicate rock of the Chantrey Group showing bedding defined by medium-grained, orange-grey carbonate-rich matrix with thin, tan-green arenitic lenses and bands. Two dollar coin for scale (2.8 cm in diameter).* ***d)*** *Fine-grained, well laminated (east (left)-west (right) in photograph) grey pelite interbedded with lenses of tan quartz arenite of the Chantrey Group. Two dollar coin for scale (2.8 cm in diameter).*

basement. The lowermost marble is typically overlain by micaceous quartz arenite that grades upsequence into clean, white to pink quartzite that exhibits rare crosstrough stratification (Fig. 6b). The quartzite is the most common and thickest unit exposed in the eastern parts of the Chantrey Group.

The quartzite is overlain by a typically thin (<15 m) unit of siliceous marble or calc-silicate that is dominated by porous, fine-grained, granular, orange-grey calcite, but contains centimetre- to millimetre-scale lenses and continuous to discontinuous layers of pink, green, and tan, fine-grained arenite (Fig. 6c). This forms a distinctive marker horizon throughout the Chantrey syncline and separates the underlying micaceous quartzite from an overlying unit of finely interlayered black and grey to tan arenite and pelite (Fig. 6d). The pelite unit forms the uppermost exposures of the Chantrey Group in the map area, and thickens substantially to the west and southwest (Fig. 2).

The Chantrey Group is inferred to be correlative with an open syncline of shallowly dipping (5–20°), approximately 80 m thick, pink-buff subarkose and grey, recessive, calcareous arenite that overlies Prince Albert Group rocks near the northeastern end of the Committee Bay supracrustal belt (Fig. 1) and with a thick sequence of quartzite exposed in the central parts of the Laughland Lake area to the south (NTS 56 K). These two clastic sequences exhibit tectonic contacts with underlying metasedimentary and intrusive rocks and are constrained to be younger than 2321 Ma and younger than 2490 Ma, respectively.

Paleoproterozoic intrusive rocks

The central and southern subdomains contain abundant, small intrusions of variably textured massive, locally microcline-porphyritic and commonly pegmatitic, biotite±magnetite monzogranite that intrude all of the Archean rocks described above (Fig. 7). On the basis of comparison with rocks exposed

Figure 7.

Photograph of moderately foliated, L>S, augen textured, medium- to coarse-grained biotite monzogranite of the central subdomain crosscut by massive, fine- to medium-grained biotite monzogranite of the ca. 1830 Ma Hudsonian suite. Rock hammer for scale is 34 cm long.

in the Committee Bay belt to the southeast, these are inferred to be Hudsonian (ca. 1830 Ma) (Skulski et al., 2003b; M. Sanborn-Barrie, pers. comm., 2004). They comprise irregular networks of veins, sheets, and stocks that likely represent high-level cupolas that are underlain by more substantial plutons at depth. These rocks are typically magnetite-bearing and underlie magnetic highs on the regional aeromagnetic database. Thus, the elongate, moderate regional aeromagnetic highs with 'bright' extremely high bulletshaped areas observed in the central subdomain likely represent complex cumulative magnetic highs reflecting both regionally extensive magnetic Archean domains with superimposed bullet highs resulting from later, present erosional surface breaching Hudsonian granitoid rocks.

All rocks of the region are crosscut by a number of north-northwest-trending diabase dykes interpreted as part of the ca. 1267 Ma Mackenzie swarm.

Deformation and metamorphism

On the basis of mapping and in situ SHRIMP U-Pb monazite geochronology three phases of regional deformation were recognized in the Committee Bay area (Carson et al., 2004; Sanborn-Barrie et al., 2003). D_1 deformation is younger than 2600 Ma and is characterized, particularly notable in the hinge zones of the large-scale F_2 folds, by a commonly shallow to moderate-dipping, northwest-striking bedding-parallel foliation, and north-northwest-trending folds. D_2, dated by U-Pb SHRIMP geochronology on monazite (Carson et al., 2004), is ca. 1850 Ma and is characterized by macroscopic to megascopic northwest-vergent and northeast-trending, shallowly northeast- and less commonly south west-plunging folds. S_2 fabrics are typically difficult to recognize outside of the supracrustal rocks and comprise both northeast- and southwest-striking and moderate-dipping foliations. West-striking dextral shear zones, such as the Walker Lake and Amer shear zones, rotate and transpose D_2 structures typically into north-dipping, east-west orientations (Johnstone et al., 2002; Sanborn-Barrie et al., 2002, 2003). D_3 deformation involved variably developed, north-west-trending, open cross folds (56 K; Sandeman et al., 2001b) and kink-style folds and brittle conjugate faults (Sanborn-Barrie et al., 2003) and is inferred to correlate with apparent static metamorphism at ca. 1780 Ma (Carson et al., 2004).

The map-scale geometry of the region is controlled primarily by upright, east-northeast-trending F_2 folds (Frisch et al., 1985; Frisch, 2000; Sanborn-Barrie et al., 2003). In the northwest, the Chantrey Group forms a regional F_2 syncline more than 70 km long that is in apparent structural contact with underlying units consisting mainly of Archean biotite±hornblende±magnetite tonalite to monzogranite. D_2 deformation coincides with greenschist- to amphibolite-facies metamorphism in the southwest, and amphibolite-facies metamorphism in the central and northern parts of the Committee Bay belt (Sandeman et al. 2001b; Sanborn-Barrie et al., 2002). Unstrained, biotite-magnetite-fluorite monzogranite that cuts S_2 in the Walker Lake intrusive complex of the Committee Bay belt and has a SHRIMP U/Pb crystallization age of 1821 ± 5 Ma (Skulski et al., 2003b; Fig. 2) places a minimum age on D_2. These constraints bracket the age of regional penetrative S_2 generally formed under amphibolite-facies conditions to between 1850 Ma and 1821 Ma. The onset of D_2 crustal thickening leading to metamorphism and garnet growth may, however, be older than 1850 Ma (Berman et al., 2002; Sanborn-Barrie et al., 2003).

ECONOMIC IMPLICATIONS

Because only a few, thin and discontinuous volcanic-rock-bearing supracrustal belts were observed in the Darby Lake and Arrowsmith River map areas, the prospectivity of the study area for precious- and base-metal mineralization is inferred to be low. Diamond potential is currently poorly known, but recent staking activity by exploration companies and the recognition of diamondiferous kimberlite in the region (cf. Stornoway Diamond Corporation, December 14, 2004 press release) indicate that kimberlite may be more widespread than previously recognized.

Utilizing the bedrock mapping and the proposed stratigraphic model for the Prince Albert Group as developed by Skulski et al. (2002, 2003b) and co-workers, the present authors infer, in light of a lack of geochronological data, that the thin supracrustal strands preserved throughout the study area likely represent remnants of the upper Prince Albert Group (≤2691 Ma: Skulski et al. (2003b). This will be tested through U-Pb geochronology. In total, 33 samples of sulphitic metasedimentary and metavolcanic rocks were collected during the field season for assay analysis, and these yielded only rare anomalous values for Au, Cu, and Ni (H.A. Sandeman and M. Schultz, unpub. map manuscript, 2005). In particular, identification of the greenschist-facies metavolcanic rocks in the northwestern Darby Lake map area, inferred to represent the southernmost extension of the Barclay supracrustal belt (*see* Fig. 1) and perhaps contemporaneous with the Prince Albert group, suggests that the prospectivity of the area for base- and precious-metal mineralization likely increases to the north. Further mapping of these rocks, along with geochemical and geochronological investigations in the 2005–2006 field seasons, will delineate and define their stratigraphic position relative to the stratigraphy of the Prince Albert Group (Skulski et al., 2003b) and will assist in future precious-metal exploration initiatives.

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