DESCRIPTIVE NOTES

INTRODUCTION

The Committee Bay belt is a 600 km long belt of northeast-striking, Archean supracrustal rocks and granitoid plutons that form part of the Rae Province in central Nunavut (Fig. 1). The Archean supracrustal rocks of this belt belong to the Prince Albert group (PAg; Heywood, 1961), and are host to a number of gold and base metal occurrences. This map is a product of the 2000-2003 Targeted Geoscience Initiative that was instigated by the Geological Survey of Canada, in partnership with the Canada – Nunavut Geoscience Office and university researchers, as a stimulus for mineral exploration of this remote area. The project involved an aeromagnetic survey, helicopter-supported, 1:100,000 scale bedrock and surficial mapping of NTS map sheets 56K, 56J (north), 56-O (south) and 56P, supporting geoscience studies and a drift prospecting survey. The aeromagnetic survey covered 85,300 line km and was flown along 400 m spaced, northwest – southeast flight lines (perpendicular to strike) on a pre-calculated drape surface with a mean terrain clearance of 150 m (Kiss et al., 2002a-g). The results of the bedrock mapping and related petrological/structural studies are presented in the following: 1) Laughland Lake area (56K) – Johnstone (2002), Johnstone et al. (2002), MacHattie (2002) and Sandeman et al. (2001a-c); 2) Walker Lake and Arrowsmith River (56J (north) and 56O (south), respectively) – this map, Sanborn-Barrie et al. (2002) and Skulski et al. (2002); and 3) Ellice Hills (56P) – Sanborn-Barrie et al. (2003) and Skulski et al., 2003). Lithogeochemical prospecting results for the study area are presented in Deyell and Sherlock (2003), Hyde et al. (2002) and Sherlock and Deyell (2002; 2003), with the surficial mapping and drift prospecting results in Giangioppi et al. (2003), Little (2001), Little et al. (2002), McMartin et al. (2002; 2003), Ozyer and Hicock (2002) and Utting and Ward (2002).

REGIONAL GEOLOGICAL SETTING

The eastern part of the Rae Province contains a discontinuous, 2000 km long, northeast – trending zone of polydeformed and metamorphosed Archean supracrustal rocks (Fig. 1). These rocks have continental affinities, as reflected in localized evidence for their deposition on an older sialic basement (3.05 Ga, Hartlaub et al., 2001; 2.87 Ga, Zaleski et al., 2001) and the presence of older Meso- to Paleoarchean detrital zircons in widespread quartzite deposits (Ashton, 1988; Davis and Zaleski, 1998; Hartlaub et al., 2001; Skulski et al., 2003). Volcanic rocks within this zone include komatiite, basalt, andesite, and rhyolite, with the latter yielding U/Pb ages in the Woodburn Lake and Committee Bay area between 2.73 and 2.69 Ga (Zaleski et al., 2001; Skulski et al., 2003; T. Skulski, unpublished). Plutonic rocks in the eastern Rae Province are dominated by calc-alkaline granitoid plutons, which were emplaced between 2.64 and 2.58 Ga (LeCheminant and Roddick, 1991; Zaleski et al., 2001; Skulski et al., 2003).

Outliers of platformal to basinal facies Paleoproterozoic meta-sedimentary rocks are found throughout the Rae Province (Fig. 1). These include the > 1.85 Ga Amer Group (Tella, 1994) and the c. 1.88 Ga Penrhyn Group (Henderson et al., 1983), Chantrey Group (Frisch, 2000) and Folster Lake Formation (Frisch, 1982). In the Committee Bay area small outliers of Paleoproterozoic metasedimentary rocks include < 2.50 Ga quartzite in the Laughland Lake area and < 2.32 Ga arkose and calc-arenite in the Ellice Hills (SHRIMP U/Pb detrital zircon, T. Skulski, unpublished data: Fig. 2). These Paleoproterozoic sedimentary sequences have sustained deformation and are locally metamorphosed to amphibolite facies.

Archean and Paleoproterozoic strata in the eastern Rae Province have a prominent northeasterly striking tectonic fabric that is constrained in the Committee Bay and Woodburn Lake areas to have formed between 1.85 and 1.81 Ga (Zaleski et al., 2001; Sandeman et al., 2001c; Sanborn-Barrie et al., 2002; 2003). This prominent northeasterly fabric is interpreted to be the result of D_2 deformation in the hinterland of the Trans-Hudson orogen, and is locally superimposed on earlier D_1 fabrics that formed between 2.6 and 1.85 Ga (Fig. 1; Sanborn-Barrie et al., 2003). The D_2 deformation was accompanied by regional amphibolite grade metamorphism. Prominent dextral, and locally oblique-slip, east-striking shear zones (e.g., the Amer, Wager Bay, and Walker Lake shear zones) overprint D_2 fabrics in the northeastern Rae Province(Fig. 1).

Paleoproterozoic intrusive rocks in the Rae Province include late- to post-tectonic 1.825 Ga calc-alkaline granites and granodiorites of the Ford Lake batholith (LeCheminant et al., 1987) and similarly aged biotite – magnetite (± fluorite) monzogranites in the Committee Bay region (Skulski et al., 2003). Northwest trending, Mesoproterozoic MacKenzie diabase/gabbro dykes cut all lithological units and structures.

GEOLOGY OF THE COMMITTEE BAY AREA

The Committee Bay area contains three, northeast-trending crustal subdomains (Skulski et al., 2002; 2003: Fig. 2). The Prince Albert group subdomain (central subdomain of Skulski et al. 2002) contains abundant supracrustal rocks belonging to the lower and middle PAg (Table 1; Fig. 2). The lower PAg consists of basalt, 2732 Ma rhyolite and komatiite (Skulski et al., 2003), whereas the middle PAg contains an iron formation, semipelitic, psammitic and < 2722 Ma quartzite sedimentary sequence that is overlain by 2711 Ma dacite. These rocks are locally cut by 2718 Ma synvolcanic tonalite and extensively by post-volcanic 2610 to 2585 Ma tonalite, granodiorite and monzogranite plutons (Skulski et al., 2003; Table 1; Fig. 2). The Northern Migmatite subdomain (northern subdomain of Skulski et al. 2002) comprises high-grade metasedimentary rocks and less abundant mafic and ultramafic volcanic rocks of the < 2691 Ma upper PAg (Table 1; Fig. 2). These are cut by peraluminous monzogranite and intermediate, calc-alkaline 2580 Ma plutonic rocks (Table 1; Fig. 2). The Arrowsmith River shear zone separates the Northern Migmatite and Prince Albert group subdomains south of the Arrowsmith River (Sanborn-Barrie et al., 2002). The Walker Lake intrusive complex (southeastern subdomain of Skulski et al. 2002) contains 2610 Ma K-feldspar augen – magnetite granodiorite to monzogranite , which is cut by late- to post-tectonic, 1821 Ma biotite - magnetite ± fluorite monzogranite (Sandeman et al., 2001b; Skulski et al., 2003: Fig. 2). Plutonic rocks of the Walker Lake intrusive complex intrude the Prince Albert group subdomain or are in fault contact with it along the dextral Walker Lake shear zone (Fig. 2).

WALKER LAKE – ARROWSMITH RIVER REGION

The Walker Lake and Arrowsmith River map area has variable bedrock exposure (generally in the order of 30%), with excellent exposure in the northern Arrowsmith River area, but extensive cover east of Walker Lake (Ozyer and Hicock, 2002; Utting and Ward, 2002). Aeromagnetic data, in particular the second vertical derivative, was used to extrapolate geological contacts between traverses and beneath the cover. The geophysical data helped define the trace of the supracrustal belts, map-scale northeast-trending folds and the distribution of iron formation, komatiite, clastic metasedimentary and mafic volcanic rocks. The PAg in the Walker Lake – Arrowsmith River area includes the Committee Bay supracrustal belt (CBs), the Three Bluffs belt (TB) to the south and the Northern Hayes River belt (NHR) to the northwest (Fig. 2).

LOWER AND MIDDLE PRINCE ALBERT GROUP

The lower PAg is dominated by basalt- and komatiite-bearing volcanic successions that show local northward younging in the NHR in the northern Prince Albert group subdomain. The stratigraphy of this narrow (< 5 km wide) belt comprises amphibolite facies, massive to pillowed, non-vesicular basalt (unit Am) that is overlain by komatiite, sulphidic pelitic sedimentary rocks and a thin upper basalt unit. The komatiite sequence (unit Ak) includes 50 cm to 1 m thick flows that display distinctive colour banding with brown-weathered cumulate zones and dark green-weathered spinifex zones, which contain pseudomorphs of bladed olivine up to 10 cm long. Sulphidic pelitic rocks (pyrite and pyrrhotite bearing) are locally interbedded with this komatiite. The mafic volcanic sequence is cut by late synvolcanic, fine to medium grained gabbro sills (unit Agb) up to 100 m wide, very fine grained quartz diorite dykes and 0.5 to 20 m wide felsic quartz and plagioclase porphyritic sills (unit Afp).

The middle PAg is well exposed in the CBs, with well-defined younging in the Kellett River, Howling Wolf and Twin Peaks areas (Fig. 2). The stratigraphy of the CBs comprises lower komatiite and basalt from the upper part of lower PAg, overlain by mainly southward-younging, middle PAg rocks that include semipelites and psammites that are interbedded with thin basalt flows, iron formation and quartzite, which is in turn overlain by intermediate volcaniclastic rocks, komatiite and an upper pelite/psammite sedimentary unit.

The base of the middle PAg consists of poorly bedded, ungraded, rusty weathered metawacke and semipelitic rocks (unit Aps) with local tabular cross bedding (2 cm foresets). A prominent iron formation (unit Ai) underlies this quartzite in the Kellett River (chert-magnetite facies) and Howling Wolf areas (silicate facies) and is traced discontinuously by aeromagnetic data along the length of the belt (Fig. 2). The main quartzite unit (unit Aq) is up to 85 m wide and weathers white, with 5 to 20 cm thick beds that locally (e.g., the Howling Wolf area) grade from grit to coarse sand, contain fuchsite and at Twin Peaks display moderate (50 cm thick) tabular cross bedding. Quartzite at Twin Peaks contains detrital zircon at least as young as 2722 ± 11 Ma (map number 2; Table 1). This quartzite is overlain by lenticular, buff weathered, 2711 ± 3 Ma dacite tuff and lapilli tuff (unit Aiv: map number 3; Table 1; Fig. 2). Massive dacite in the Three Bluffs area has an age of 2706 +5/-4 Ma (map number 4; Table 1). In the Howling Wolf area, the dacite volcaniclastic is overlain by rusty weathered, thickly bedded semi-pelitic and psammitic sedimentary rocks with an interbedded 20 m thick ultramafic (possibly komatiite) unit (unit Aku).

NORTHERN MIGMATITE SUBDOMAIN AND THE UPPER PRINCE ALBERT GROUP

The Northern Migmatite subdomain is dominated by high-grade metasedimentary rocks (unit Adm) including metatexite (metasedimentary migmatite with 10 to 40% interbanded granitoid mobilizate), heterogeneous- and homogeneous-diatexite (70 to 95% medium grained to pegmatitic granitoid mobilizate, typically garnet bearing with inclusions of metatexite) that are rust coloured, muscovite-free, quartz – biotite ± garnet ± sillimanite ± K-feldspar ± cordierite ± melt rocks that have either a migmatitic texture and reflect in situ partial melting and extraction, or contain granitic dykes and pods of likely proximal derivation. The migmatites contain lenticular, foliated leucosome of quartz-plagioclase ± garnet ± K-feldspar ± cordierite enveloped in a melanosome comprising garnet – sillimanite – biotite. Within the metasedimentary domain are rare wacke enclaves (paleosomes) that locally preserve bedding. One such metawacke south of the Arrowsmith River contains detrital zircons that constrain the maximum age of sedimentation to be < 2691 ± 16 Ma (map number 5; Table 1; Fig. 2). In northeastern portion of map sheet 56-O (south), tonalite contains screens of relatively intact, upper amphibolite metabasalt, iron formation and komatiite believed to be part of the upper PAg. These rocks may be correlative with komatiite and basalt in the northern Ellice Hills that are interbedded with psammite deposited between 2687 ± 10 Ma (youngest detrital zircon) and 2577 ± 18 Ma (cross-cutting peraluminous granite; SHRIMP U/Pb zircon; Skulski et al., 2003; T. Skulski, unpublished; Fig. 2).

PLUTONIC ROCKS

Intermediate to felsic plutonic rocks in the Prince Albert group subdomain include (from oldest to youngest): biotite tonalite, hornblende – biotite quartz diorite/tonalite, biotite – K-feldspar megacrystic granodiorite, biotite granodiorite, monzogranite, and syn- to posttectonic pink syenogranite. Tonalite and granodiorite in the southern part of the Prince Albert group subdomain contain schlieren, screens and enclaves of the PAg, discernable as variably folded supracrustal screens in the field and as folded, linear aeromagnetic anomalies.

Recrystallized, typically fine- to medium-grained, foliated biotite ± epidote ± magnetite tonalite (unit Abt) form voluminous, lenticular, northeast-trending plutons, which cut and engulf supracrustal belts, dominate the southern half of the Prince Albert group subdomain. These include the tonalite south of Walker Lake that has a U/Pb SHRIMP zircon maximum crystallization age of 2720 Ma (map number 1; Table 1), and biotite tonalite in the Howling Wolf area (Fig. 2) that intrudes komatiite and has a zircon U/Pb SHRIMP age of 2606 ± 4 Ma (map number 6; Table 1). Medium grained, foliated hornblende-biotite ± epidote quartz diorite and tonalite (unit Aht) occurs as small, lenticular plutons that cut biotite tonalite south of the CBs. A SHRIMP U/Pb zircon age on hornblende quartz diorite from the northern shore of Walker Lake (Fig. 2) yielded an age of 2609 ± 5 Ma, which is coeval with the Howling Wolf biotite tonalite (map number 7; Table 1). Small plugs and sills (up to 8 km long) of hornblende – biotite ± clinopyroxene diorite and monzodiorite (unit Adt) occur throughout the map area and may be genetically related to the hornblende – diorite/tonalite unit. K-feldspar megacrystic (up to 50% by volume and 5 cm in length) granodiorite (unit Akg) forms large lenticular sheets in the northern half of the Prince Albert group subdomain and within the Arrowsmith River shear zone. A K-feldspar augen granodiorite, which occurs in southern portion of map sheet 56-O, has yielded a SHRIMP U/Pb zircon age of 2604 ± 6 Ma (sample 7, Table 1), whereas a deformed, K-feldspar megacrystic, leuco granodiorite dyke that occurs within the Walker Lake shear zone has a SHRIMP U/Pb zircon minimum age of 2608 Ma (sample 8, Table 1). The northern half of the Prince Albert group subdomain is dominated by voluminous medium- to coarse-grained, foliated, equigranular biotite (± magnetite ± allanite) granodiorite (unit Abg). North of the CBs, these biotite granodiorites frequently contain metasedimentary screens and enclaves. A sample of biotite granodiorite from the Howling Wolf area (Fig. 2) has yielded a SHRIMP U/Pb zircon age of 2583 ± 4 Ma (sample 9, Table 1). Coarse-grained biotite monzogranite (Agr) occurs as centimetre to decimetre thick sheets throughout the Prince Albert group subdomain and as larger plutons in the Arrowsmith River shear zone. The granites have a weak to moderate foliation and are locally folded into kilometre wide sheets south of the CBs. Relatively rare, small, < 1 km long plugs of massive to weakly foliated, coarse grained phlogopite gabbro and diorite, and phlogopite ± olivine ± clinopyroxene lamprophyre dikes (unit Apgb) occur throughout the map area.

In the Northern Migmatite subdomain, small (< 1 km long) serpentinized peridotite (unit Apr) bodies with local magmatic layering, are engulfed within tonalite or cut high grade metasedimentary rocks, and may be late intrusive equivalents of the upper komatiite unit. Elsewhere, peraluminous plutons cut the metasedimentary rocks and are composed of white to buff-coloured, blocky K-feldspar, biotite, garnet ± sillimanite granite (unit Agg). These granitic bodies likely represent pooled partial melts derived from within or near the Northern Migmatite subdomain and were emplaced after 2691 Ma (maximum age of the upper sedimentary – volcanic sequence), but before 1849 Ma, which is the age of metamorphic zircon in the granite (C. Carson, personal communication, 2002). Also cutting the paragneisses are foliated biotite – magnetite – K-feldspar megacrystic granodiorite and biotite – magnetite tonalite (unit Amt), similar to those in the Prince Albert group subdomain. The tonalite/granodiorite of this suite has an age of 2580 ± 8 Ma (sample 10; Table 1). A light grey-green, foliated, magnetite ± biotite ± orthopyroxene (retrogressed to biotite) granodiorite pluton (unit Ack) intrudes high-grade metasedimentary rocks east of the Arrowsmith River.

The southern part of the Walker Lake sheet is dominated by foliated, K-feldspar – biotite – magnetite granodiorite to monzogranite of the Walker Lake intrusive complex (WLIC), and younger, massive to weakly foliated, Hudson biotite granite (Fig. 2). Foliated, K-feldspar megacrystic – biotite – magnetite ± hornblende granodiorite to monzogranite (unit Akm) are coarse-grained rocks that contain 2 to 3 mm magnetite and are characterized by a regional high (total field) aeromagnetic signature. In the Laughland Lake area, these rocks yielded a zircon U/Pb age of 2610 ± 4 Ma (Skulski et al., 2003; Sandeman et al., 2001a). The WLIC plutonic rocks contain abundant supracrustal screens of amphibolitic basalt, psammite and semipelite. The younger, massive to weakly foliated, Hudson biotite monzogranites (unit Pgr) are fine to medium grained, and were emplaced as metre to decimetre thick sills, dykes and sheets. In comparison to the WLIC, the Hudson suite has a subdued and mottled aeromagnetic signature (total field). Miarolithic cavities and secondary fluorite, common in Hudson monzogranites in the Laughland Lake area (Sandeman et al., 2001a), are absent in the map area. Massive biotitie – magnetite – fluorite monzogranite that cuts foliated 2610 Ma K-feldspar augen granodiorite near Laughland Lake has an U/Pb zircon age of 1821 ± 5 Ma (Skulski et al., 2003). A similar, salmon coloured monzogranite dyke, that cuts S_2 fabric in the Northern subdomain (map sheet 56-O (south)), has a preliminary U/Pb zircon age of 1815 (map number 12; Table 1). Northeast striking, up to 100m wide, MacKenzie diabase dykes (map unit Pmd) cut the map area. The extent and geometry of individual dykes are in part defined by positive linear aeromagnetic anomalies, with individual dykes characterized by overlapping to en echelon dyke tips.

STRUCTURAL GEOLOGY

The Walker Lake – Arrowsmith River area structural geology as presented in Sanborn-Barrie et al. (2002) is summarized below.

D1 STRUCTURES

In the supracrustal rocks, the planar tectonic fabrics that predate the regional northeast-striking foliation are interpreted as S_1 and occur predominantly in komatiitic and plutonic rocks. In komatiite, the northwestward striking, bedding parallel S_1 is defined by aligned to schistose tremolite, serpentine and talc, which dips shallowly northeast or moderately southwest. In plutonic rocks, S_1 is recognizable in the hinge zones of F_2 folds where it is defined by aligned biotite and quartz at a high angle to S_2. In the Northern Migmatite subdomain, S_1 is represented by a migmatite layering defined by millimetre to centimetre scale leucocratic veinlets, and aligned biotite ± garnet layers. F_1 folds, to which S_1 is axial planar, occur at the western end of the NHR and trend north to northwest.

D2 STRUCTURES

The dominant fabric throughout the Committee Bay region is a moderate to strong, northeast-striking foliation. This fabric is axial planar to regional, northeast-trending F_2 folds. In general, this regional foliation appears to represent a composite $S_2 \pm S_1$ fabric, since F_2 hinges commonly display two moderately to weakly developed oblique foliations, S_1 and S_2, whereas F_2 limbs generally contain a single foliation of higher strain.

The $S_2 \pm S_1$ composite foliation typically has a southeastward dip, but shows variations in both dip direction and inclination. Within the supracrustal belts, S_2 planes dip moderately to steeply (65 to 85°) to the southeast. Intervening plutonic panels have planar fabrics with more variable attitudes. In the south, the $S_2 \pm S_1$ fabric varies from steeply southeast to steeply northwest dipping, whereas in the northern part of the Prince Albert group subdomain, the $S_2 \pm S_1$ fabric generally maintains a shallow (14 to 25°) to moderate (55 to 70°) southeastward dip. The $S_2 \pm S_1$ fabric locally contains an elongate quartz lineation that is uniformly characterized by a moderate (15 to 40°) east to northeast plunge. The shallower dip of the $S_2 \pm S_1$ foliation in the northern part of the Prince Albert group subdomain results in generally shallower (5 to 15°) eastward plunging lineations.

In the Northern Migmatite subdomain, S_2 is readily identified as axial planar to folds that modify the orientation of S_1, and is typically a northeast- to east-striking schistosity that is defined by biotite, sillimanite and garnet, and possibly cordierite and/or melt. In contrast to S_1, S_2 is typically steeply dipping (> 70°) with northward dips dominating.

Numerous regional northeast-trending F_2 folds within the plutonic rocks of the Prince Albert group subdomain are defined by dip variations in their foliations and by the recognition of fold closures outlined by S_1. These F_2 folds are upright to overturned (northwest vergent), noncylindrical, antiforms and synforms that tend to die out over a strike length of 4 to 12 km. On the basis of closure configuration, regional F_2 folds appear to plunge westward in the western half of the map area, and eastward in the eastern half. Macroscopic folds typically show Z-asymmetry or are symmetrical, and show a general plunge reversal about a north-northwest trending (330°) axis.

A reversal in younging has been determined along the length of the CBs, from southward younging at Kellett River and the Howling Wolf area (Fig. 2), to northward younging at the main quartzite ridge in the Twin Peaks area. The belt may represent a south-facing homoclinal sequence that, through pervasive asymmetric Z-folding, has short-limb segments (i.e., Twin Peaks quartzite ridge) of north-younging strata. Pervasive development of structures with dextral vorticity in the Twin Peaks, Howling Wolf and Kellett River areas is consistent with this interpretation, and would implicate imposition of significant east-directed transpressional strain during, or subsequent to, D_2 folding. Northward younging at one locality in the TB and NHR may be a manifestation of regional-scale fold linkages between the belts.

ARROWSMITH RIVER SHEAR ZONE

An arcuate corridor of annealed porphyroclastic mylonitic rocks, designated the Arrowsmith River shear zone , separates the Prince Albert group- and Northern Migmatite subdomains. This structure encompasses two major arcuate strands of very strongly foliated to mylonitic plutonic rocks. A 1 to 3 km wide east-striking high-strain corridor extends for c. 40 km across the northern part of the map area. Within this corridor, shallow (< 15°) south-dipping mylonitic rocks are characterized by very strong quartz and feldspar rodding lineations that are generally oblique to the shear plane. In the west, lineations generally plunge shallowly westward (< 10°), whereas east of the Arrowsmith River they generally plunge eastward. Asymmetrical structures (mainly sigma-type winged porphyroclasts) indicate a dextral shear sense for the tectonites with shallow west-plunging mineral lineations, and sinistral shear for those with east-plunging mineral lineations. The general displacement vector for the northern strand may therefore be one of oblique-normal displacement (hanging-wall down-to-the-south).

An adjacent northeast-striking high strain zone is similar in strain intensity, fabric development and protolith to that of the northern strand. This strand is a moderately shallow, southeast-dipping (15 to 35°) structure with strong rodding lineations that plunge to the east to southeast (20 to 25°). Shear sense indicators (winged porphyroclasts and asymmetrical extensional shear bands) are widespread in planes parallel to the lineation and perpendicular to foliation and show top down to the southeast, extensional motion.

D3 STRUCTURES AND THE WALKER LAKE SHEAR ZONE

The moderately to strongly developed regional northeast-striking $S_2 \pm S_1$ composite foliation typical of the Prince Albert group subdomain progressively changes its character and intensity in the southwest portion of the map area (cf., Johnstone, 2002; Johnstone et al., 2002). Here, a progressive change in planar fabric orientation from northeast striking and moderately northwest dipping (60 to 80°) to west striking and steeply north dipping occurs. Mineral lineations progressively decrease in pitch with proximity to the west striking zone, which contains nearly horizontally lineated rocks. Accompanying this change in attitude is a change in strain state from moderate L'S fabrics to high strain L < S tectonites. In plutonic rocks, high strain is reflected by strong biotite and possibly amphibole alignment, quartzo-feldspathic segregation, quartz ribbon structure and grain-size reduction of groundmass minerals resulting in a high proportion of porphyroclastic units. The high strain metasedimentary rocks are schistose and contain pervasive microfolds. Collectively, these changes are interpreted to define a steeply north dipping, west striking high strain zone along the east segment of the Walker Lake shear zone. Dextral strike – slip displacement on the Walker Lake shear zone is supported by the deflection of regional strain fabrics and aeromagnetic anomalies, the presence of asymmetrical structures consistent with dextral shear sense and lineation attitudes interpreted to reflect nearly horizontal maximum finite extension. An estimate of the magnitude of displacement is provided by right lateral offset of c. 20 km on a potentially correlative quartzite unit exposed north and south of the shear zone.

In the Northern Migmatite subdomain, penetrative D_3 strain is locally observed to overprint D_2 structures but, in general, is interpreted by variations in the orientation of D_2 structures consistent with widely spaced, northeast trending F_3 folds. Observed D_3 structures include northeast trending F_3 folds and S_3 fabrics that overprint and tightly fold S_2 at one locality in the north-central region. In addition, a set of metre scale conjugate shear zones deflect and rework D_2 structures. Anomalous orientations of S_2 and S_1 structures at the southward bend in the Arrowsmith River may be due to an open northeast-trending F_3 folding.

METAMORPHISM

Metamorphic grade varies from lower amphibolite facies in the southeast to middle amphibolite facies in the eastern and northern portions of the Prince Albert group subdomain. Subassemblages at lower grade include staurolite – muscovite – garnet, cordierite – andalusite – muscovite and cordierite –garnet – biotite in metapelitic rocks, andalusite – sillimanite in impure quartzites and hornblende – plagioclase in metavolcanic rocks. Most porphyroblasts appear to be pre- to synkinematic with respect to the dominant ($S_2 \pm S_1$) foliation, with the exception of some postkinematic garnet. Higher grade semipelitic rocks contain sillimanite – garnet – muscovite – biotite, with pre- to synkinematic sillimanite porphyroblasts retrograded to fibrolitic mats rimmed by coarse muscovite. Metamorphic overgrowths on zircon extracted from plutonic rocks in the Prince Albert group subdomain yielded SHRIMP U/Pb ages of around 2580 Ma (map numbers 6, 7 and 9; Table 1). It is not clear how this metamorphic event is related to structural fabric development.

The Northern Migmatite subdomain consists dominantly of upper amphibolite facies rocks, with migmatitic paragneiss exhibiting the assemblages garnet – sillimanite – biotite – quartz ± K-feldspar and garnet – sillimanite – biotite – quartz ± K-feldspar ± cordierite ± melt, respectively. Two generations of garnet are apparent: inclusion rich subhedral, partially embayed, M_1 porphyroblasts that are enveloped by the main biotite-sillimanite defined foliation ($S_1 \pm S_2$); and smaller, subhedral to euhedral, M_2 garnet porphyroblasts that overgrow the main foliation and commonly contain inclusions of aligned sillimanite. Whereas M_1 garnet may be rimmed by cordierite, the M_2 garnet appears to be in textural equilibrium with cordierite. These relations suggest that M_2 probably formed at a higher grade due to the breakdown of biotite, sillimanite and quartz to form garnet and fluid/melt ± cordierite ± K-feldspar, with heat outlasting strain. Carson et al. (personal communication, 2003) have obtained three ages of metamorphism (2.35, 1.85 and 1.78 Ga) for Northern Migmatite subdomain high-grade rocks using in situ monazite and conventional zircon SHRIMP U/Pb methodology. From this, they conclude that the M_1 garnet formed at around 1.85 Ga, whereas the post-tectonic M_2 garnet formed at 1.78 Ga. Thus, M_1 garnet growth would be broadly coeval with D_2 deformation, which is constrained between 1.85 and 1.82 Ga.

ECONOMIC GEOLOGY

Several mineral occurrences are known in the PAg in the Walker Lake area (NTS 56J(north); Sherlock and Deyell, 2002; Hyde et al., 2002). Whole rock geochemical data from ten of the most significant of these occurrences are listed in Table 2. In addition, McMartin et al. (2002; 2003) report drift prospecting results across the map area, including five sample sites with both high gold grain counts (0.18 to 0.27 grains of gold per gram of heavy mineral concentrate in the < 2 mm fraction of till) and gold values (high values in the range 200-500 ppb gold in non ferromagnetic heavy mineral concentrate in < 2mm fraction of till) from a previously unreported potentially gold-rich domain in the northwestern part of 56-O (south). A brief description of the major mineral occurrences in the map area is presented below (adapted from Sherlock and Deyell, 2002 and references therein). The B claim, Goose, A claim and Heb occurrences are hosted in the lower PAg, whereas occurrences in the Hayes River area and at the Wrench showing are hosted by the middle PAg.

The B claim (Fig. 2; Table 2) is a zone of strongly oxidized outcrops identified by King Resources (1970) that occurs in a 4 km long belt of lower PAg 10 km northeast of the Howling Wolf area. Mineralization occurs as disseminations, stringers and locally irregular masses of pyrite and pyrrhotite, with trace chalcopyrite; assay samples containing up to 7950 ppb Au (map number 1, Table 2: Sherlock and Deyell, 2002). Sulphides are hosted in iron-rich, amphibole – garnet – chlorite metasedimentary schist associated with mafic volcanic rocks. The metasedimentary rocks are strongly foliated, folded and crosscut by boudinaged quartz – pyrite –pyrrhotite veinlets.

The Goose occurrence is hosted by narrow rafts of rusty metasedimentary rocks within lower sequence mafic and ultramafic volcanic rocks, 10 km northwest of the Howling Wolf area (Fig. 2). Stringers and disseminations of pyrrhotite, arsenopyrite and pyrite are associated with iron-rich, garnet-bearing metasedimentary units containing minor bands of oxide iron formation and enveloped in mafic and ultramafic volcanic rocks. Cyprus Canada Inc. (1995) report assay values up to 1620 ppb Au (map numbers 2 and 3; Table 2).

The A claim comprises sulphide-bearing metasedimentary rocks interlayered with komatiite flows on the southwestern edge of the NHR (Fig. 2). Fine disseminations and stringers of pyrite, pyrrhotite and arsenopyrite, with traces of bornite and chalcopyrite occur in well-defined rusty zones over a distance of two kilometres. The metasedimentary rocks are strongly lineated, locally folded and contain thin, sulphide-bearing quartz veinlets. King Resources (1970) report values of up to 0.8% Cu and 0.11% Ni in trench samples (map number 4; Table 2).
The Heb Cu showing in the CBs of the southwest part of the map area (Fig. 2) comprises massive sulphide (pyrrhotite-rich) pockets in an ultramafic body. Hauseux and Surmacz (1986) report assays up to 3.7% Cu, whereas chip samples collected by Sherlock and Deyell (2002) yielded modest assay values of 500-4210 ppm Cu (map number 5; Table 2).

The middle sequence of the PAg hosts the Wrench showing (Committee Bay Resources Ltd.), which is located 10 km south of the Howling Wolf area (Fig. 2). Mineralization occurs within isolated outcrops of oxidized iron formation that occur along 5 km of strike. Disseminated pyrite and pyrrhotite are hosted in thin units of oxide-facies iron formation and interbedded iron-rich metasedimentary rocks. The metasedimentary rocks are crosscut locally by irregular, white quartz veins containing minor sulphide and up to 9730 ppb Au (Sherlock and Deyell, 2002: map number 6; Table 2).

The Hayes River area in the southwestern part of the map area (Fig. 2) contains three separate occurrences (Three Bluffs, Ledge and Antler) all currently held by Committee Bay Resources Ltd.. Strongly oxidized outcrops that occur within a northeast-striking zone north of the Hayes River identified these occurrences. Subsequent sampling, detailed mapping and drilling by Apex Geoscience Ltd. indicate gold concentrations up to 120.82 g/t at the Antler occurrence (Committee Bay Joint Venture, 1993: map numbers 7 to 10; Table 2). Mineralization is hosted in strongly folded, silicate- and oxide-facies iron formation interbedded with pelite. The metasedimentary rocks are all strongly foliated and strike to the northeast. Mineralization occurs as disseminations and stringers of pyrite and pyrrhotite, with lesser amounts of arsenopyrite and chalcopyrite. Boudinaged black quartz veins are common. Rare visible gold is associated with silicified and chloritic oxide iron formation (Apex Geoscience, 1994). On the basis of deformation fabrics, sulphidation reactions and associated gold mineralization predate or are early within the development of the main composite transposition fabric ($S_2 + S_1$) (Hyde et al., 2002). Deformation that affects gold occurrences in the TB may reflect strain partitioning into the supracrustal sequence, possibly during development of the Walker Lake shear zone (Hyde et al., 2002).

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