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Abstract: The Committee Bay Belt (NTS 56 K) exhibits northeast-southwest-oriented, variably dipping foliations and shallow lineations that trend east-west near the Amer and Walker Lake shear zones. Supracrustal rocks preserve an early ((?)Archean) greenschist-amphibolite-grade metamorphic assemblage, overgrown by later ((?)Proterozoic), comparable metamorphic minerals. The earliest deformation phase (D_1) is recorded by rare isoclinal folds (F_1) of bedding. D_2 generated tight, northeast-southwest-trending, doubly plunging F_2 folds of a composite S_0–S_1 foliation. An S_2 transposition foliation developed preferentially in the limbs of kilometre-scale folds, whereas L_2 extension was widespread. D_3 generated warps, with north-northwest axial planes, of the composite S_1–S_2 fabric and of the Amer and Walker Lake shear zones. D_2 accompanied northwest-southeast shortening, motion along both above-mentioned shear zones, and the generation of a large, sigmoidal feature (about 70 km wide) wherein northeast-trending structures rotate into the bounding east-west-trending shear zones. This deformation was probably Paleoproterozoic.

Résumé : La zone de Committee Bay (SNRC 56 K) comporte des foliations à orientation nord-est–sud-ouest et à pendage varié et des linéations peu profondes de direction est-ouest près des zones de cisaillement d'Amer et de Walker Lake. Les roches supracrustales ont conservé un ancien (archéen?) assemblage métamorphique de faciès des schistes verts et des amphibolites qu'entourent des minéraux métamorphiques comparables plus récents (protérozoïques?). La phase de déformation la plus ancienne (D_1) se manifeste par la présence de rares plis isoclinaux (F_1) dans le litage. La déformation D_2 a produit des plis serrés F_2 à double plongements axiaux, de direction nord-est–sud-ouest, dans une foliation composite S_0–S_1. Une foliation de transposition S_2 s'est développée de façon préférentielle dans les flans de plis kilométriques, alors que l'extension L_2 est largement répandu. La déformation D_3 a provoqué le gauchissement, avec plans axiaux nnord-nord-ouest, de la fabrique composite S_1–S_2 et des zones de cisaillement d'Amer et de Walker Lake. La déformation D_2 a accompagné un raccourcissement nord-ouest–sud-est, un mouvement le long des deux zones de cisaillement mentionnées ci-dessus et la formation d'une grande structure sigmoïde (large d'environ 70 km) dans laquelle des structures de direction nord-est ont subi une rotation au sein de zones de cisaillement limitrophes de direction est-ouest. Cette déformation remonte probablement au Paléoprotérozoïque.

INTRODUCTION

In the Rae Domain of the Western Churchill Province (Fig. 1), Archean supracrustal sequences of the quartzite/komatiite association are exposed semi-continuously along a northeast-trending strike length in excess of 1100 km. These belts comprise, from southwest to northeast, the Whitehills–Tehek and Woodburn Lake belt (Henderson et al., 1991; Zaleski et al., 1997), the Committee Bay Belt (Schau, 1982; Chandler et al., 1993), and, to the extreme northeast, the Mary River Belt (Bethune and Scammell, 1993; Jackson, 2000) exposed on Baffin Island. Recent detailed mapping (Ashton, 2000) suggests that comparable rocks, at higher metamorphic grade, may continue to the southwest into Saskatchewan, thereby extending the strike length to about 1800 km.

The Committee Bay Belt incorporates a sequence of Archean supracrustal and plutonic associations termed the Prince Albert Group. Initial investigations of the rocks of the Committee Bay Belt southwest of Committee Bay include the reconnaissance mapping of Heywood (1961), who delineated the general extent of supracrustal versus granitoid units. Schau (1982) mapped parts of the Laughland Lake map area (NTS 56 K), and the northern half of the Walker Lake map area (NTS 56-O), further subdividing the supracrustal rocks of the Prince Albert Group and formulating names for the distinct granitoid units enclosing the supracrustal belts. Mineral resource assessments by the Geological Survey of Canada (Jefferson and Schau, 1992; Chandler et al., 1993), initiated as a consequence of the proposal to establish a new national park in the region, incorporated local, detailed geological mapping in well exposed areas, in conjunction with aerial reconnaissance and archival data compilation.

In this contribution we examine the regional structural geology of the southwest part of the Committee Bay Belt (Fig.1, 2). An overview of the bedrock geology of the map area is presented in a companion paper (Sandeman et al., 2001), to which the reader is referred.

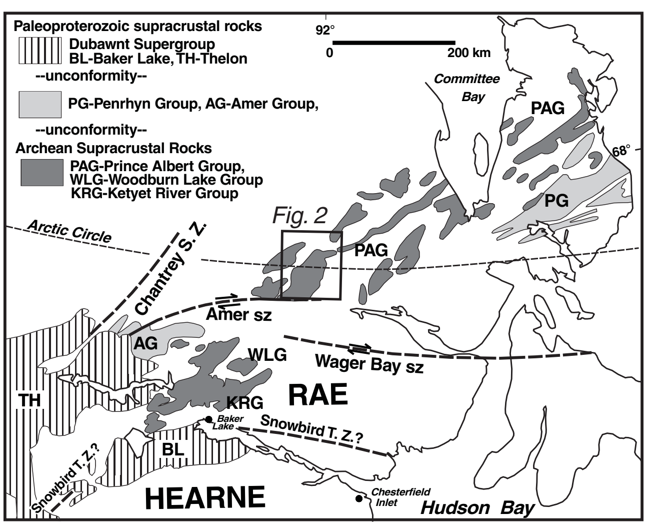
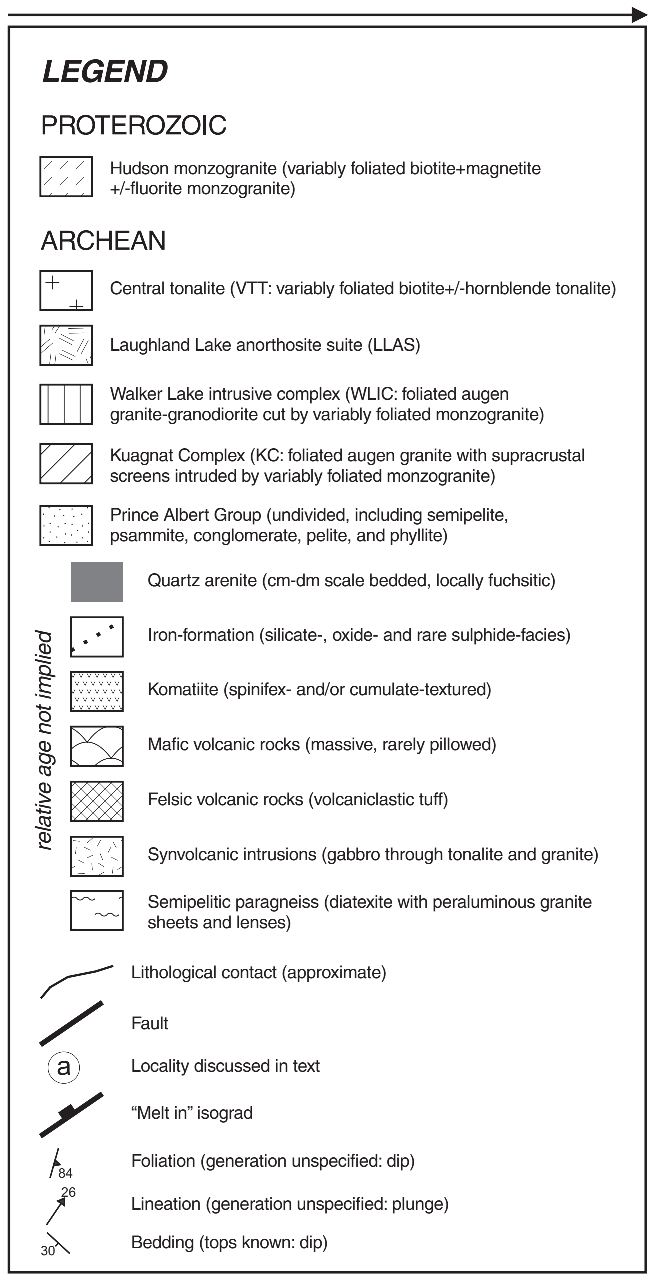


Figure 1. Regional geological setting of the study area northwest of Hudson Bay showing the distribution of Archean supracrustal rocks of the Prince Albert Group, the Woodburn Lake Group and the Ketyet River Group relative to the Paleoproterozoic supracrustal suites of the region. Adapted from Zaleski et al. (1997).

GENERAL GEOLOGY

The Committee Bay Belt extends from the northern margin of the Amer shear zone (Fig. 1, 2), northeastwards to Committee Bay. Exposed bedrock forms about 10 per cent of the total surface, and is limited to rare, glacially sculpted roches



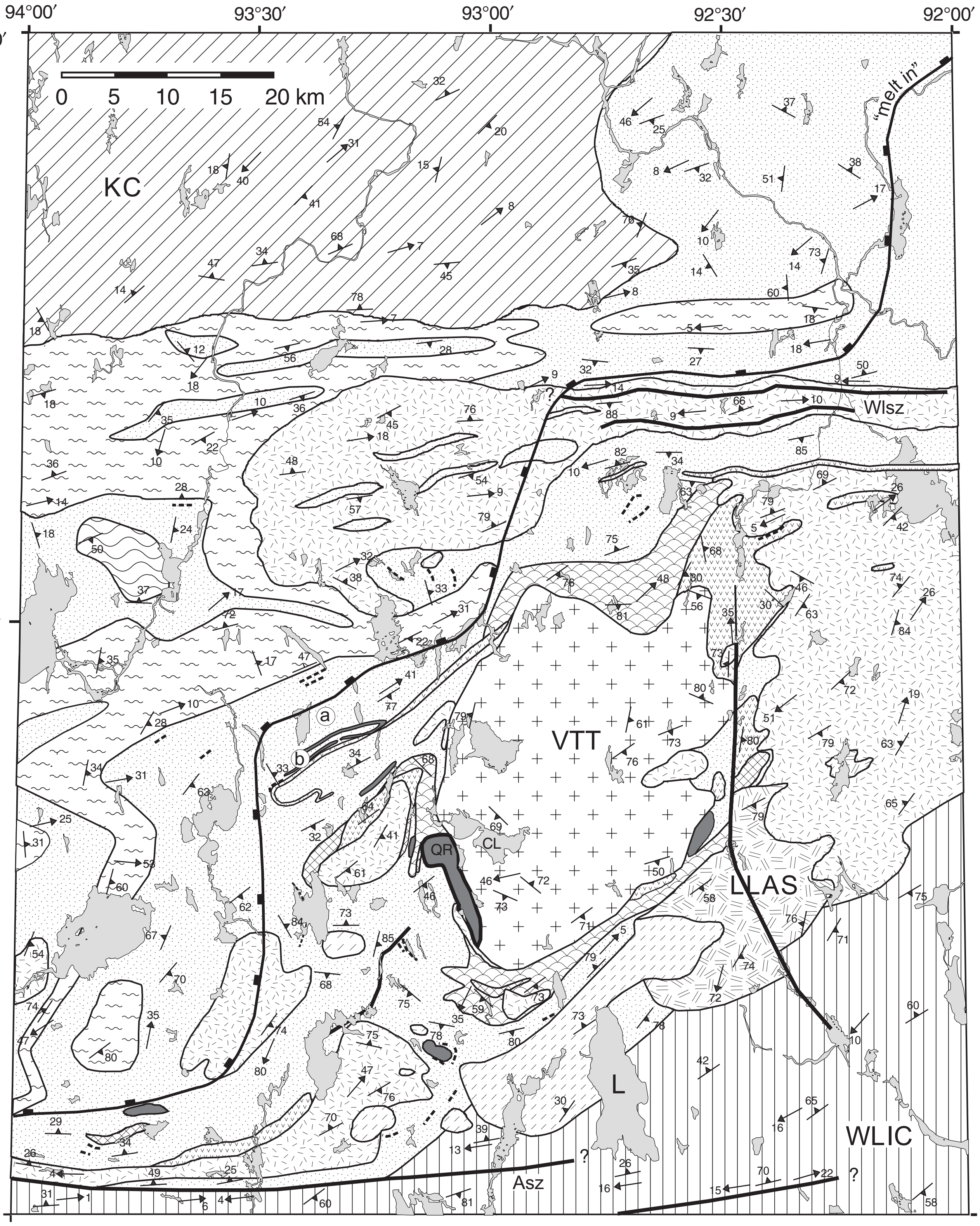


Figure 2. Generalized geology of the laughland Lake map area. Letters and locations discussed in the text.

moutonnées and to glacial meltwater channels with sparse glacial-boulder coverage. The map area is extensively covered by thick packages of glacial till and fluvioglacial sediments (*see* Little, 2001).

The map pattern is centred on a variably foliated, approximately oval tonalite to granodiorite body (central tonalite: VTT on Fig. 2), about which the foliations in the main supracrustal belts are wrapped (Fig. 2). Primary stratigraphic and structural relationships in the supracrustal units are best preserved in rocks exposed immediately west and southwest of the central tonalite, wherein interlayered volcanic and sedimentary units exhibit greenschist- and lower-amphibolite-facies metamorphic mineral assemblages, and preserve many of the earliest structural elements in the belt, including critical relationships linking fabric development and metamorphic mineral paragenesis.

To the southwest of the central tonalite, compositionally variable, thinly layered greenschist- to amphibolite-grade metasedimentary rocks lie to the north of, and are in structural contact with, foliated and lineated granitoid bodies. These all strike west and dip shallowly to the north, and are characterized by well developed, subhorizontal, doubly plunging, extension lineations. Both the sedimentary package and the underlying granitoid bodies contain a number of east-west-trending, cataclastic and protomylonitic strands of the Amer shear zone (Tella and Heywood, 1978; Tella et al., 1998). The mylonitic strands appear to splay to the east and appear to gradually die out in the eastern part of the map area (Fig. 2).

North and northeast of the central tonalite, predominant map-scale northeast-southwest structural trends are deflected east-west and are accompanied by development of an intense stretching lineation. Therein, east-west-trending, strongly lineated, interlayered supracrustal and tonalitic granitoid rocks are cut by a series of steeply dipping mylonitic strands of the Walker Lake shear zone trending 080°. Both the Amer and Walker Lake shear zones are manifest as prominent, east-west-trending magnetic highs on the Geological Survey of Canada's regional aeromagnetic database (Teskey et al., 1982).

The western and northern parts of the map area (Fig. 2), previously mapped as granitic gneiss (Schau, 1982; Chandler et al., 1993), are underlain by sequences of northeast-trending, shallowly southeast-dipping, alternating, coarsely recrystallized psammite, semipelite, and pelite with rare amphibolite, quartzite, and ultramafic rock. These are widely intruded by foliated lenses, veins, and sheets of biotite±muscovite±garnet granite, yielding centimetre to kilometre-scale, discontinuously layered paragneissic, diatexitic, and schlieren-laden plutonic rocks. Locally, however, compositionally layered and foliated, grey, biotite±hornblende tonalite to granodiorite is predominant, and is commonly intruded by strongly lineated, pink biotite+magnetite granodiorite.

To the south and southeast of the central tonalite (VTT on Fig. 2) and supracrustal belt, metasedimentary rocks are rare, and that region is underlain by a series of intrusive rocks including potassium-feldspar-augen monzogranite of the Walker Lake intrusive complex (Fig. 2), anorthosite and gabbroic anorthosite of the Laughland Lake anorthosite suite, and less abundant diorite and tonalite. All of these units are crosscut by abundant salmon-pink, unfoliated equigranular or weakly foliated, biotite±magnetite±fluorite monzogranite interpreted to be Paleoproterozoic (Sandeman et al., 2001). These rocks are characterized by northeast-southwest-trending, moderate to steeply dipping foliations and moderately plunging lineations.

The map area can be subdivided into 13 structural domains on the basis of distinct structural and lithological characteristics. These are represented schematically in Figure 3 in order to facilitate further discussion of the structural evolution of the region.

STRUCTURAL GEOLOGY

Rocks exposed throughout the map area are characterized by high states of strain and complex overprinting relationships implying multiple deformation events. Strong linear and L>S fabrics are prominent structural features of the entire map area, as are the two, approximately east-west-trending high-strain zones, the Amer shear zone (Tella and Heywood, 1978; Tella et al., 1998), and the Walker Lake shear zone. In general, however, fabric geometry in regions between the high-strain zones is characterized by tight, northeast-trending folds and foliations, possibly indicative of northwest-southeast-directed shortening. Proximal to the bounding high-strain zones, fabric orientations have been broadly rotated into east-west orientations.

Further discussion of the fabrics and other structural aspects of the belt is undertaken here with reference to the structural domains outlined earlier. We focus particularly on six of the domains by way of lower-hemisphere, equal-area stereographic projections that help discern the regional structural history. Structural data from these six domains provide, from the southwest to the northeast, a series of images (Fig. 4 to 8) that highlight the contrasting structural elements developed throughout the belt. Although structures are briefly discussed for the remaining domains, space requirements predicate that equal-area stereographic projections are not presented.

Domain 1 (southwestern, clastic supracrustal and plutonic rocks: Amer shear zone)

In domain 1 (Fig. 3), a generally west-striking, shallowly north- to northwest-dipping package of sedimentary rocks structurally overlies well foliated to protomylonitic granodiorite bodies that are intruded by large volumes of weakly foliated, but generally well lineated pink, equigranular, biotite monzogranite. Static recrystallization obscures the highly strained nature of these sedimentary units and resulted in severely annealed mylonitic fabrics, a feature that is inferred from the development of an intense subhorizontal stretching lineation, boudinage of more competent rock types, and the high degree of attenuation of compositional layering ((?)beds), giving the package a thinly layered appearance. Linear elements (mineral and extension lineations and fold axes) are shallowly plunging and east-northeast-trending, although some steeply plunging lineations were noted (Fig. 4a). Layering and layering-parallel foliations are shallowly north-dipping and west-southwest- to west-trending and steepen northwards away from the Amer shear zone (Fig. 2, 4b). Folds are more easily recognized at structurally higher levels (northward) in the section, and where fabrics rotate from east-west to both north-northwest and east-northeast trends. Although the Amer shear zone is easily noted on the Geological Survey of Canada's regional aeromagnetic database (Teskey et al., 1982), it is not easily delineated on the ground. It consists of a series of strands of protomylonitic and locally cataclastic, mixed foliated granitoid rocks ranging from diorite through granite. These are all cut by lineated, late ((?)Paleoproterozoic) biotite granite.

Domains 2 and 3 (west-central, mixed volcanic and clastic rocks)

The supracrustal package exposed immediately to the west of the central tonalite (VTT on Fig. 2, 3) is characterized by highly deformed rocks that preserve bedding, but rarely stratigraphic younging indicators. Bedding can be recognized by compositional layering in semipelite and psammite, igneous flow textures and internal stratigraphy in komatiite, banding in iron-formation, and heavy-mineral laminae in quartzite. Stratigraphic younging indicators are only reliably observed in komatiite flows, but these can only locally be used to infer stratigraphic order given the structural complexity and high degree of strain. These two domains, along with domain 8 (Fig. 3), comprise sequences of layered rocks with highly contrasting competencies (eg. semipelitic and sericitic

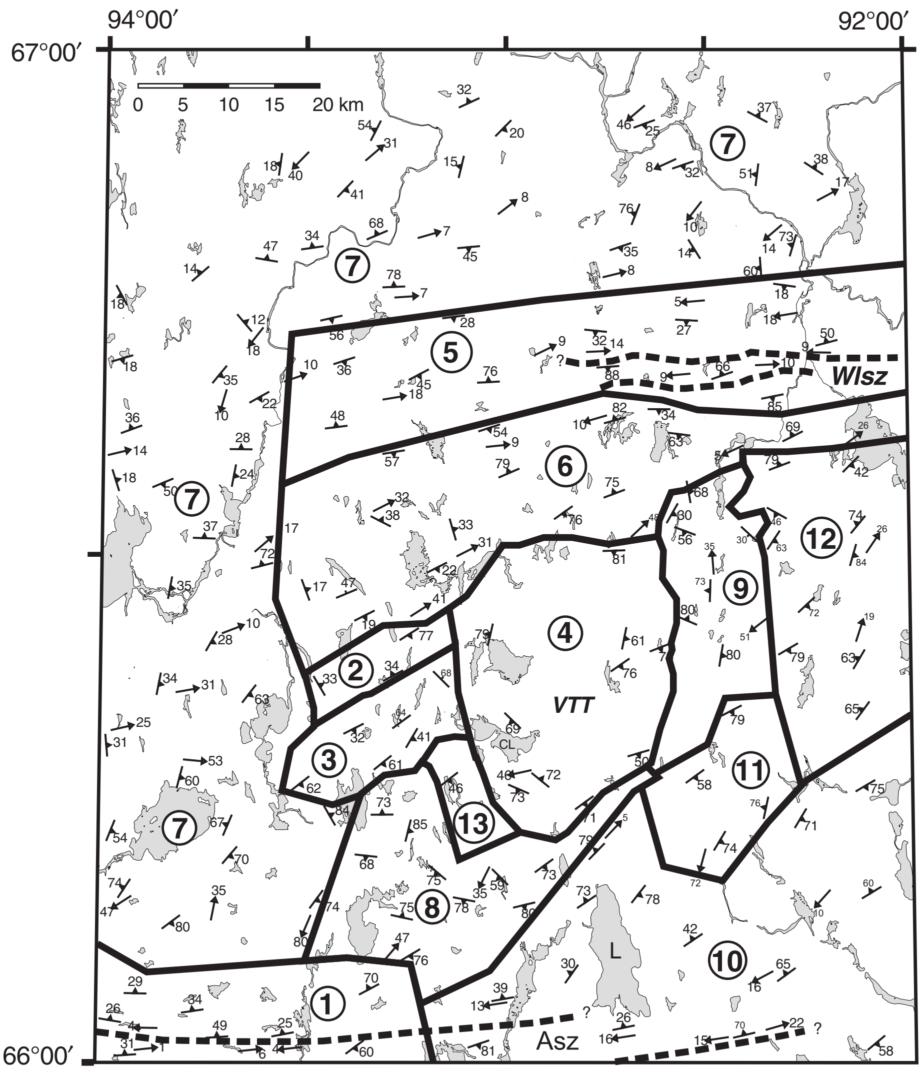


__Figure 3.__ Simplified structural map of the Laughland Lake map sheet showing the distribution of structural domains discussed in the text. VTT = central tonalite, Asz = Amer shear zone, Wlsz = Walker Lake shear zone.

schist versus quartzite and komatiite); a feature that has strongly controlled the development of structural elements in the supracrustal belt.

Bedding and at least two later generations of planar structures are subparallel, strike northeast (approximately 045°), and have generally intermediate, but variable dip angles (Fig. 5). Bedding is generally transposed, and is only oblique to foliation in the hinge zones of F_1 folds. F_1 mesoscale folds are rarely observed, and typically comprise isolated intrafolial isoclines. Map-scale geometry is controlled by a second generation of folds (F_2), that are tight, with up to 5 km wavelengths and variable amplitudes ranging from metres to tens of kilometres. These F_2 folds, arising from northwest-southeast-directed shortening, resulted in moderately northeast-plunging, tight folds of the composite S_0–S_1 fabric and development of pervasive mineral and extension lineations (L_2) parallel to the fold axes. Planar fabrics (S_2) were apparently not penetratively formed in the hinge zones of these F_2 folds, but were developed in the limbs, particularly in fissile, incompetent supracrustal rocks. Presumably, strain partitioning at that stage resulted in formation of an S_2 transposition foliation, apparently localized along the limbs of the F_2 folds and accompanied by boudinage of competent rock types and development of northeast-southwest-trending zones of higher strain. A strong, generally shallow northeast-plunging stretching lineation, defined by quartz rods, mullions, and mineral aggregates is ubiquitous and is parallel to F_2 fold axes and L_2 mineral lineations (Fig. 5).

The latest deformation features observed in domains 2 and 3 include local, north-south-trending, steeply dipping crenulation cleavage ((?)S_3) developed in fine-grained schistose units, and rare, metre-scale open warps ((?)F_3)of earlier planar fabrics. These F_3 folds have north-northwest- to south-southeast-trending axial planes.

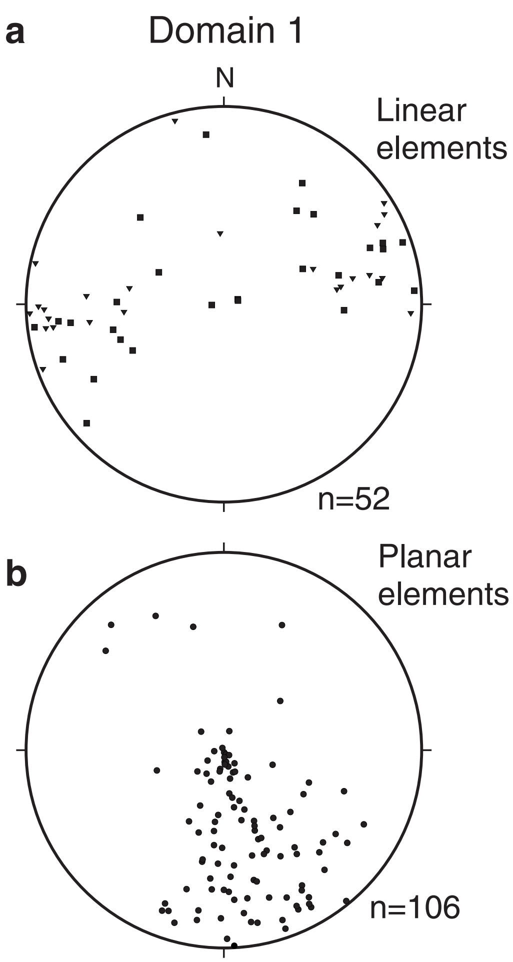


Figure 4. Lower-hemisphere, equal-area stereographic projections for structural data from domain 1. ***a****) linear structural data (squares are fold axes, triangles are lineations);* ***b****) planar structural elements. Planar elements are plotted as poles, and include all measured foliations (generation was commonly not interpretable in the field).*

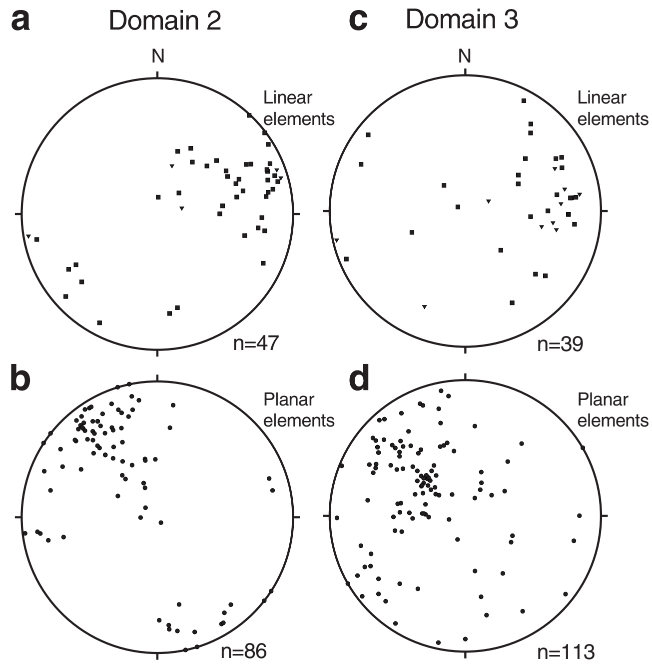


Figure 5. *Lower-hemisphere, equal-area stereographic projections for structural data from domains 2 and 3.* ***a****) linear structural for domain 2;* ***b****) planar structural data for domain 2;* ***c****) linear structural data for domain 3;* ***d****) planar structural data for domain 3. Squares are fold axes, triangles are lineations.*

Domain 4 (central tonalite)

The central tonalite (VTT on Fig. 2) comprises a homogeneous, central pluton consisting of weakly foliated to unfoliated biotite±hornblende±titanite±allanite-bearing tonalite to granodiorite and rare quartz diorite that intrudes the supracrustal belt. Foliations are rarely developed, and are typically only found near the margins of the pluton. They are steeply dipping with no systematic trend (Fig. 6). Folds are absent and lineations are rare.

Domains 5 and 6 (northern high-strain zone: Walker Lake shear zone)

Domain 5 comprises a series of strongly foliated and lineated, interlayered tonalitic to granodioritic intrusions with screens of metre-scale layered psammite, semipelite, pelite, and less common quartzite, with local ultramafic and mafic volcanic rocks and rare gabbro, diorite, and intermediate tuff (Fig. 2). These rocks exhibit shallow to moderate, south- and north-dipping orientations with well developed, shallow, doubly plunging mineral and stretching lineations (Fig. 7). Developed in this domain are a number of discontinuous, east-west-trending, anastomosing strands of steeply dipping, mylonitic supracrustal and granodioritic to tonalitic intrusive rocks. The mylonites are characterized by near-vertical foliation surfaces and very strong, subhorizontal to shallowly plunging (≤10 degrees) stretching lineations with approximately 080° or 260° trends. Mesoscopic folds and kinematic indicators are uncommon, but imply dextral rotation of the southern wall versus rocks of the northern wall. These fabrics are overprinted by a series of open, north-northwest-trending, steeply plunging folds (F_3) of the composite S_1/S_2 fabrics. These are characterized by variable-scale wavelengths and low amplitudes. The structural and geochronological evolution of rocks in the Walker Lake shear zone forms the topic of the M.Sc. thesis of S. Johnstone.

The rocks of domain 6, exposed immediately north of the central tonalite comprise poorly exposed supracrustal rocks that are intruded by well lineated biotite±muscovite granite. Overall, these rocks exhibit structural features very similar to rocks exposed in domain 5. They are characterized by a generally steeply southeast-dipping, east-northeast-trending penetrative foliation, and north-northeast-trending, shallowly plunging fold axes and lineations. South-southwest-trending linear features occur, but are less common.

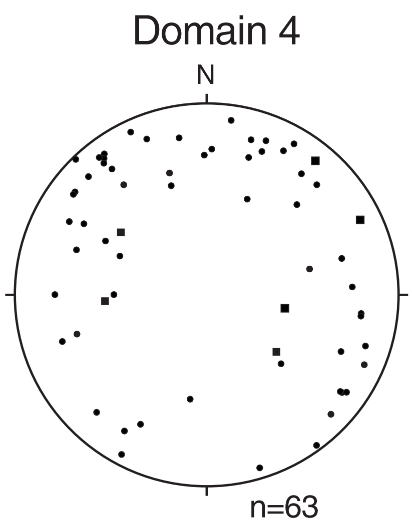


Figure 6. *Lower-hemisphere, equal-area stereographic projections for structural data from domain 4 (central tonalite). Squares are lineations, dots are foliations.*

Domain 7 (north and western diatexite and granitoid)

To the north and west of the central tonalite (VTT on Fig. 2), rocks of the main supracrustal belt (domains 2 and 3) grade transitionally into a diatexitic metasedimentary and a foliated peraluminous granite package that is of higher metamorphic grade, and characterized by more shallowly south-dipping planar structural features. Centimetre- to metre-scale layering in the granitoid and diatexite units are typically 'ghost foliations' inherited from their metasedimentary protoliths. However, good deformational fabrics, including shallowly south-dipping, northeast-striking foliations, and shallow (≤20°), doubly plunging lineations and open to tight folds of layering and gneissosity (Fig. 8a), are commonly observed. Layering ((?)bedding) and the layering-parallel S_1 foliation are northeast-trending with variable, but most commonly shallow to moderate dips (Fig. 8b). The subsequent S_2 foliation surfaces are also northeast-striking and have variable dip angles (Fig. 8c). These surfaces contain the ubiquitous, subhorizontal, doubly plunging, northeast-trending L_2

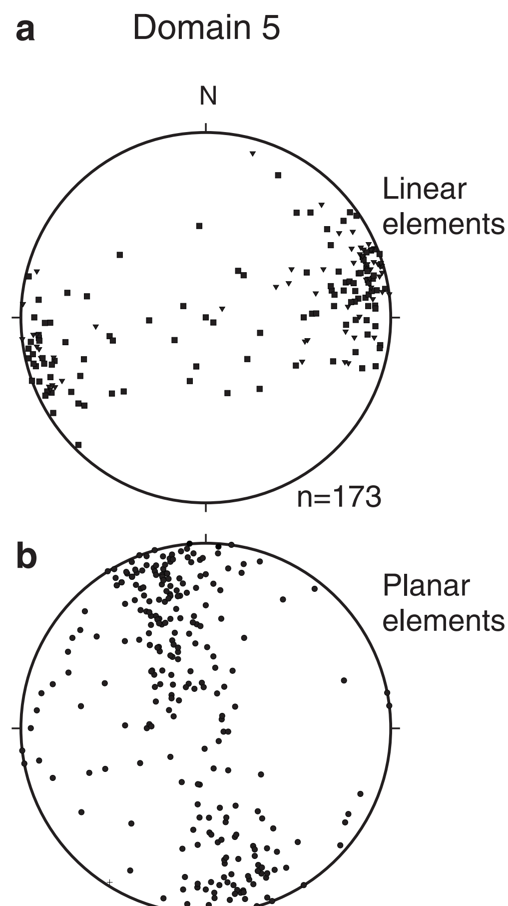


Figure 7. *Lower-hemisphere, equal-area stereographic projections for structural data from domain 5.* ***a****) linear structural data (squares are fold axes, traingles are lineations);* ***b****) planar structural elements.*

extension lineation. S_3 spaced cleavage surfaces are weakly developed and are northwest-southeast-trending, steeply dipping features (Fig. 8c).

Domain 8 (south central supracrustal belt)

Supracrustal rocks that dominate domain 8 exhibit lithological variations comparable to those described above for domains 2 and 3. These rocks are characterized by typically steeply dipping and variably trending foliation surfaces (Fig. 2), wherein northeast trends are most common. Lineations and fold axes exhibit variable orientations, however, moderate northeast and southwest plunges predominate.

Domain 9 (northeastern volcanic package)

East and northeast of the central tonalite (domain 9), supracrustal rocks are dominated by volcanic rocks, in particular komatiitic and basaltic flows, with less common biotite semipelite and rare silicic tuffaceous units. These are intruded by a series of porphyritic to equigranular, foliated biotite+hornblende granodiorite bodies that are interpreted as synvolcanic intrusions (Sandeman et al., 2001). Komatiite flows appear to have behaved as rigid bodies during deformation and are extensively boudinaged. Internally, the boudins are moderately to extensively dismembered by small- to moderate-scale brittle fractures and faults but the lozenges are bounded by well-foliated talc-schist. The main structural features of this domain consist of a strong north-south-trending, steeply east-dipping foliation, and north-northeast-trending, moderately plunging mineral lineations and fold axes (Fig. 2, 3).

Contact relationships between the northeast volcanic belt and the surrounding plutonic rocks have locally been obscured by postintrusion shearing. On the western margin of domain 9, the contact with the central tonalite is sheeted and has been transposed in an approximately 15 m wide series of north-south-trending protomylonitic strands derived from metasedimentary and tonalitic protoliths. Much of this domain, therefore, is characterized by a series of north-south-trending, probably anastomosing shear zones and brittle faults, a feature recognized by previous investigators in the region (Schau, 1982; Chandler et al., 1993).

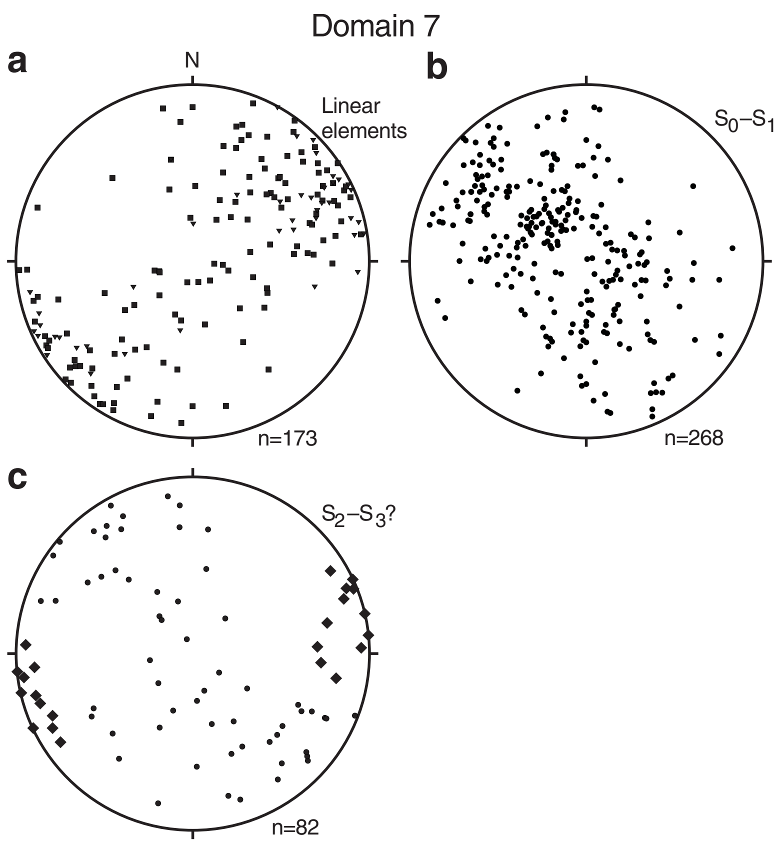


Figure 8. *Lower-hemisphere, equal-area stereographic projections for structural data from domain 7.* ***a****) linear structural data;* ***b****) layering ((?)S_0) and S_1 foliations;* ***c****) S_2 (dots) and S_3 (diamonds) foliations. Squares are fold axes, traingles are lineations.*

Domain 10 (southeast: Walker Lake intrusive complex)

Bedrock exposure in the southeast is very poor and consists of widely spaced rubbly outcrops comprising primarily well foliated and locally lineated potassium-feldspar-augen biotite granodiorite to granite. Locally, in areas of good outcrop, variations in strain can be observed, characterized by thin (≤30 m) discontinuous strands of west-southwest-trending, moderately to steeply dipping augen-granite protomylonite. These probably represent the expression of deformation along the northeast extension of the Amer shear zone (Tella and Heywood, 1978). Structural features of this domain consist of northeast-trending, steeply southeast-dipping, and steeply to moderately northwest-dipping foliations. Fold axes and lineations are typically northeast- and southwest-trending with variable plunges.

Domain 11 (Laughland Lake anorthosite suite)

Deformation in the anorthosite complex is strongly partitioned. Coarse-grained, cumulate-textured anorthosite is mostly undeformed, with very localized, centimetre-scale, northeast-trending shear zones. The relationship between these shear fabrics and regional deformation is unclear. Strong, penetrative deformation is typically associated with mafic phases of the complex (gabbroic anorthosite, pyroxenite and layered gabbro-pyroxenite), locally comprises mylonite and cataclasite, and is characterized by variable, but generally northeast-trending, subvertical planar fabrics and an intense vertical stretching lineation.

Domain 12 (east central synvolcanic tonalite)

Rocks of domain 12 mainly comprise foliated and gneissic intrusive rocks varying from rare diorite through abundant tonalite, granodiorite, and rare granite. These are characterized by consistently northeast- or southwest-striking, steeply dipping foliation and gneissosity surfaces. Linear elements are generally poorly developed, but typically comprise moderately to shallowly, northeast- and southwest-plunging mineral lineations.

Domain 13 (quartzite ridges)

The bodies of quartzite preserve good decimetre-scale bedding and F_1 cylindrical folds, but second-generation fabrics are generally poorly developed. The margins of the quartzite bodies are only rarely exposed, and these are typically characterized by very penetrative foliations that parallel the contact zones.

The large, northern quartzite ridge (QR on Fig. 2) is characterized by a weakly deformed and folded interior wherein decimetre-scale beds have been openly folded around moderately southwest-plunging axes. Within 10 m of the margins of this body, the amount of strain increases, manifest as a contact-parallel, intense foliation in highly cleaved quartz sericite and chlorite schist. On its western margin, the quartzite passes abruptly into a well-foliated chlorite schist derived from mafic volcanic rocks. These schist units exhibit northeast-southwest-trending, intense foliations that rotate into parallelism with the quartzite/schist contacts. The intense foliation is crenulated by roughly north-south-trending, steeply plunging folds ((?)F_3). On its eastern margin, the quartzite overlies, along an approximately 30° dipping surface, weakly deformed biotite tonalite of the central tonalite (VT on Fig. 2). At least two generations of folds and associated fabrics are developed in the quartzite immediately above this contact. The quartzite ridges appear to represent large (kilometre-scale), openly folded ((?)F_2) synformal structures as suggested by Chandler et al. (1993).

METAMORPHISM

Biotite-muscovite-garnet-staurolite-plagioclase-quartz±cordierite mineral assemblages are common within the thick and well exposed package of metasedimentary rocks in domains 2, 3, and 8, and are consistent with upper-greenschist- to amphibolite-facies metamorphism. Below we briefly describe field relationships from the most continuously exposed locations immediately west of the central tonalite, in order to elucidate the nature of the metamorphism and its relationship with fabric development.

Mineral assemblages in schistose, metasedimentary rocks of domains 2 and 3 are dominated by biotite+plagioclase±muscovite, with rare garnet. The appearance of cordierite in semipelite, and sillimanite in quartz-rich sedimentary rocks indicates a sharp increase in metamorphic grade northwards across approximately 2 km of strike width (locality A on Fig. 2). North of locality A, metasedimentary rocks become more coarsely recrystallized and leucosome-bearing, diatexite units are widespread, and veins and lenses of biotite±muscovite±garnet granitoid become increasingly common and voluminous. This diatexis probably occurred at moderate temperatures and pressures consistent with amphibolite-facies metamorphism (Spear, 1990) and supports the hypothesis of Schau (1982) that the partial melting of pelite (probably at somewhat deeper crustal levels) produced many of the granitic plutons in the region.

A well exposed package of metasedimentary rocks (locality B on Fig. 2) contains mineral assemblages and textures that imply at least two, and possibly three, distinct episodes of metamorphism. Therein, a thick package of continuously exposed pelitic, semipelitic, and quartz-rich metasedimentary rocks suggests a complex metamorphic history, and provides a framework for linking relationships observed in patchy outcrop throughout the belt. Abundant coarse (≤2.5 cm), almost entirely retrograde-metamorphosed and broken cordierite is largely overgrown by large (≤2 cm), typically cospatial garnet and brown opaque staurolite. This first (M_1) generation of garnet and staurolite is commonly partially retrograde-metamorphosed to plagioclase, and has experienced subsequent deformation. This deformation is manifest either as an early, internally preserved mineral-shape fabric that is oblique to the main enclosing foliation (typically only visible in garnet), or as extension-related brecciation of the grains. Small (<4 mm) red garnet and translucent orange staurolite crystals have overgrown deformed and retrograde-metamorphosed M_1 cordierite, garnet, and staurolite and suggest a subsequent (M_2) metamorphic episode. The relationship between the M_2 metamorphic minerals and the regional fabrics is unclear. Pink andalusite with grey core zones appears to have overgrown all previously mentioned assemblages and related fabric elements and may represent a final, third metamorphic event or possibly, the culmination of M_2 metamorphism.

SUMMARY

The principal structural elements of the map area include dominant northeast-southwest structural trends developed between two east-west-striking high-strain zones. The regional foliation in the map area appears to be a complex S_2 transposition fabric derived largely from S_0 and S_1. The first deformation event (D_1) generated a bedding-parallel foliation (S_1), presumably developed axial-planar to a set of rarely preserved, macroscopic isoclinal folds (F_1) of bedding. Linear fabrics associated with D_1 were not identified. The second deformation (D_2) resulted in moderately northeast-plunging, tight F_2 folds of the composite S_0–S_1 fabric likely arising from northwest-southeast-directed shortening. Accompanying F_2 folding was the development of a pervasive mineral and extension lineation (L_2) parallel to the fold axes. Planar fabrics (S_2) were apparently not penetratively formed in the hinge zones of these folds, but a more intense foliation was developed preferentially in the limbs of F_2 folds. The intense foliation is either a new S_2 foliation, or represents further transposition of the composite S_0–S_1 foliation. These F_2, limb-parallel, intense foliations are interpreted to have developed as a transposition fabric generated in part because of the predisposed, northeast trends of all of the planar features, but also because of the large competency contrasts between the layered lithological units. We interpret that the D_2 structures may have developed during northwest-southeast-directed, dextral transpression that occurred synchronously with predominantly dextral strike-slip movement along the Amer and Walker Lake shear zones. Hence, the map pattern is controlled by a large, sigmoidal, crustal-scale structure (approximately 70 km wide) that resembles a C-S type configuration. Therein, structural elements are accentuated, and rotate into, the bounding, east-west-trending shear zones.

The final phase of regional deformation in the map area is represented by outcrop- to kilometre-scale open warps of the main regional foliations, and the mylonitic fabrics developed in the Walker Lake shear zone. These folds (F_3) have north-northwest- to south-southeast-trending axial surfaces, were probably generated through east-west-directed shortening, and were accompanied by sporadic, but generally weak development of an axial planar (S_3) cleavage.

Field relationships imply a complex metamorphic and deformation history that can be explained in part by Proterozoic overprinting of Archean events. Relatively late ((?)Proterozoic) reworking of the region, related to movement along the Amer and Walker Lake shear zones, is suspected to be responsible for much of the present geometry of the supracrustal belt, and therefore tends to obscure earlier ((?)Archean) internal relationships. Further examination of the timing relationships between fabric development and metamorphic mineral growth will form an integral part of future supporting scientific investigations.

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