Chapter 4

Strongly Foliated Rocks

Foliated rocks of unknown age are grouped with either the Boundary Ranges Metamorphic suite or the Stuhini Group in Figure GM97-1 (as had been done previously by Mihalynuk and Rouse, 1988b). However, they are important because they locally preserve good protolith textures and, particularly in the case of the Boundary Ranges metamorphic suite, may hold key clues about genesis of the suite. Future advances in understanding these rocks may rely heavily upon such clues, so these uncommon rocks are highlighted here.

Subdivision of these foliated rocks into packages with similar lithologic character, structural position and preservation of similar relict textures produces several units. Relict textures occur mainly in volcanic facies, but at some localities sedimentary protoliths are dominant (e.g. Tutshi Lake). Metamorphic grade is dominantly greenschist, although amphibolite grade is attained where the rocks are hornfelsed.

These units occur sporadically along the eastern margin of the Boundary Ranges Suite. All are within 2 kilometres west of the Llewellyn fault, and occur sporadically from Fantail Lake to at least the British Columbia - Yukon border (Figure 4-1). They crop out at Bennett Lake, Tutshi Lake, Racine Lake and perhaps at Skelly Lake. Just south of the map area, at the head of Hobee Glacier, a package of phyllites and poorly developed schists with preserved protolith textures has well displayed contact relationships with pillow basalt that probably belongs to the Stuhini Group. Foliated rocks at these localities are described and possible correlations and age relationships are discussed below.

Bennett Lake

Foliated rocks of unknown affiliation occur on both sides of Bennett Lake. On the western shore, across from Guard Rail Point, is a poorly mapped area that is underlain by what appears to be moderately foliated, bleached and silicified intermediate lapilli tuffs and epiclastic strata. Rocks on the opposite shore, at Guard Rail Point, are similarly difficult to identify, although traced along strike, they can be linked with units IJL, muJv or DTB. Peak metamorphic grade at these localities can probably be attributed to the close proximity of Cretaceous and Tertiary intrusions of the Coast Belt.

On the ridges west of Bennett Lake and just north of the British Columbia - Yukon border is a package of chlorite-epidote-actinolite-altered pyroxene porphyries originally believed to be part of the Stuhini Group. However, new age data (Hart, 1995 and personal communication, 1993) indicate that a Permian age is more likely. Medium to coarse-grained pyroxene leucogabbro at the border is deformed by quasi-ductile fabrics to locally produce chlorite schist. Isolated parts of this intrusive unit display banding of probable magmatic origin. Identical rocks are reported from within the Tally Ho shear zone of Doherty and Hart (1988).

Tutshi Lake Southeast

Some of the best relict textures within foliated rocks are displayed east of Tutshi Lake and south of Moon Creek. At this locality, two southward converging prongs of metamorphic rocks form the limbs of a late syncline that is cored by younger, unfoliated sediments mapped as Laberge Group (Figure GM97-1). The younger strata contain abundant clasts derived from the underlying...
metamorphic terrain as well as fossil belemnites, coralites and carbonized plant debris. Deformation and metamorphic grade within both prongs appear to decrease toward the fold hinge where a discontinuous carbonate band marks the contact with younger, probable Laberge strata.

Less deformed parts of both ‘prongs’, but especially the northern one (shown on Figure 4-1) can be identified as foliated siltstone, wacke, tuffaceous sediment, finely bedded micrite and a fine-grained, cherty, white and black laminated unit. Cherty strata are continuous and dip 45° to 65° degrees east for more than 1.5 kilometres along strike. Graded bedding can be distinguished locally. The units generally have an early foliation which is contorted into disharmonic, although generally coaxial folds.

A weakly foliated, pyrrhotitic and silicified sharpstone conglomerate crops out along the contact between rocks with protolith textures and rocks in which such textures have been obliterated by a foliation. This unit may not be a true conglomerate, but could instead represent a milled fault breccia, perhaps at a detachment surface. Distinction between these two possibilities is of pivotal importance in unraveling the early tectonic history of the area.

Racine Lake Southwest

Between the southern bend of Racine Creek and Brownlee Lake is a relatively continuous belt of foliated volcanic and sedimentary strata. Unique to this belt of rocks are rhyolitic lapilli tuffs which serve to distinguish them from the Stuhini Group. These light green weathering tuffs contain up to 80% angular, white rhyolite lapilli in a reddish or green, chloritic matrix. Rhyolite fragments are poorly to strongly strained within a foliated matrix (Photo 4-1). They are intercalated with strongly foliated chlorite schist containing rare feldspar fragments and 4-millimetre chlorite patches which may be altered mafic minerals. A thin but continuous carbonate unit is moderately to strongly foliated and generally less than 5 metres thick. Little-strained portions were sampled for microfossils, but no samples were productive.

Hoboe Glacier Southeast

Contact relationships between pillow basalt of probable Stuhini Group and schistose carbonate and phyllite are well displayed in an uninterrupted section just south of the map area at the head of Hoboe Glacier. At this locality, well developed pillows of pyroxene-phyric basalt are exposed on the western side of a steeply dipping, continuous section of Stuhini Group tuffs, flows and sediments. The pillows become increasingly more strained (Photo 4-2) to the west until they are reduced to a chloritic schist adjacent a thin, foliated carbonate band. On the western side of the carbonate is a thick package of weakly schistose, fine-grained sediments in which no primary structures have been preserved.

Foliated sediments west of the Stuhini pillow basalt are believed to be part of the Stuhini stratigraphy. Pervasive foliation and disharmonic mesoscopic folding reflect proximity to the Llewellyn fault zone. Strain is concentrated in incompetent horizons such as the fine-grained sediment. However, highly strained zones are common within the main panel of Stuhini rocks as mapped by Mihalynuk et al. (unpublished data, 1991) and Werner (unpublished UBC map, 1978) where they may affect both volcanic and sedimentary strata.
Skelly Lake

South of the eastern end of Skelly Lake a half a square kilometre or more is underlain by pyritic rhyolite tuff and clastic strata. Rhyolite appears to grade from massive, indurated breccia and flows to chlorite-quartz-feldspar semischist. Protoliths for the schist appears to be medium to coarse-grained clastic strata derived from the rhyolite tuff. Unfortunately, contact relationships are obscured by thermal metamorphism related to the emplacement of abundant felsic dikes and nearby granodiorite bodies of the Coast Belt.

Regional Correlations, Age & Tectonic Significance

Inclusion of foliated rocks with recognizable protolith textures with either the Stuhini Group (as unit uTSf on Figure GM97-1) or with the Boundary Ranges suite may mask important relationships. Foliated rock packages along strike both north and south of the map area that were originally thought to be Stuhini Group, are now known to be of Permain age in southern Yukon (C.J.R. Hart personal communication, 1993) or of Pennsylvanian age in the Tulesequah area (Mihalynuk et al., 1995). These rocks may be structurally juxtaposed with unfoliated Stuhini Group strata perhaps through protracted shuffling along the Llewellyn fault. Alternatively, differences in fabric may be due to a deformational event that predates Stuhini Group deposition.

Occurrence of a crustal sliver of ammonite-bearing Lower Jurassic sediment that is enclosed by foliated volcanic strata clearly shows that tectonic admixing along the Llewellyn Fault does occur. This is further emphasized by an isotopically dated 58.5Ma rhyolite from within variably foliated volcanic strata near Skelly Lake (Tables AA1, AA2, albeit the sample may have been collected from a late dike). On the other hand, foliation of presumed Stuhini Group at Hoboe Glacier apparently predates intrusion of the Willison Bay pluton at circa 217 Ma (see Chapter 12). Because of this, Mihalynuk et al. (1996) included the foliated basalts in a unit of Carboniferous to Triassic age. The rocks with very well preserved relict protolith textures at Tutshi Lake, including a probable banded chert unit, could be included in this same unit. Both are believed to be correlative with the Paleozoic Stikine assemblage (as, it is suspected, is the Boundary Ranges Metamorphic Suite, see Chapter 3). Foliated rocks west of Bennett Lake extend into the Yukon where they have yielded a Permian age and, on this basis, are also believed correlative with the Stikine assemblage. Foliated rhyolite tuffs south of Racine Lake and southwest of Skelly Lake are more enigmatic.

Rhyolite tuffs at Racine Lake

Rhyolite tuffs within foliated, mainly volcanic strata south of Racine Lake are unlike any unit found within Stuhini Group elsewhere in the map area. However, close association with lithologies typical of the Stuhini Group, such as thin carbonate layers, turbidite wacke and coarse pyroxene-phyric basaltic breccia, suggest a correlation between the two. An unfoliated rhyolite lens 2 kilometres south of Racine Lake may be coeval with the foliated rhyolite tuff. In general these foliated rocks display a single foliation which does not appear to be overprinted by later fabrics. In contrast, two or three fabrics are commonly displayed by rocks of the Boundary Ranges Metamorphic Suite. Thus, they are probably younger than the Boundary Ranges protoliths.

A minimum age limit is difficult to interpret, particularly as variably foliated rhyolitic tuffs above the southwest shore of Skelly Lake, originally thought to belong to this package, could be of Early Tertiary age based upon a preliminary isotopic date (see discussion in preceding section). Lack of age data and similarities of lithology permit correlation with an array of different lithologic packages. Also, as these rocks crop out within the zone disrupted by the long-lived Llewellyn fault, they could be tectonic slivers with no ties to immediately adjacent units. These uncertainties aside, two correlations appear most probable: Devonian-Mississippian Stikine assemblage, in which felsic volcanic strata are common, or a felsic facies of the Stuhini Group, such as is seen in the Iskut area (Logan, 1997). Rhyolites have been mapped in foliated rocks of the Tulesequah map area by Souther (1971) and Mihalynuk et al. (unpublished data). However, there are also ambiguities in the Tulesequah area. Rhyolite originally mapped as Upper Triassic Stuhini Group is now known to be Early Mississippian (Sherlock...
Doherty and Hart (1988) also point out similarities between foliated rhyolitic rocks in the Yukon, and either the western facies of the Stuhini Group in the Iskut area or felsic volcanic strata in the Permian Stikine assemblage. The age and correlation of these rocks is still open to speculation.

**Tutshi Lake foliated sedimentary and volcanic strata**

Contacts of foliated strata with adjacent units at Tutshi Lake are generally poorly exposed and virtually no independent age data exist. One possible age constraint is imposed where chlorite - actinolite - quartz ± biotite schist of this unit is cut by a plagioclase and pyroxene - phryic dike. The dike margins have been modified by a younger deformation, but the interior remains unfoliated. Compositionally, this dike is most similar to volcanic units within the Stuhini Group, and it may be a feeder. If this is true then the foliated rocks are older than Late Triassic (Carnian) Stuhini feldspar-pyroxene porphyries. Analogous lithologies and contact relationships occur in areas of good exposure southwest of Sloko Lake (BCGS, unpublished field data) and are described by Bultman (1979) on southern Llewellyn Inlet.

**Mineral Potential**

Foliated rocks of Stikinia affinity occur primarily within and immediately adjacent to the Llewellyn fault zone. As a result, they are a potential hosts for shear related gold deposits. Several gold showings occur along the Llewellyn fault with some of the most significant prospects being within these foliated rocks. Examples include the Gridiron (MINFILE 104M 001) and the Nasty Cirque (Mihalynuk and Rouse, 1988a; near Moon Lake). Assays from the Gridiron showing returned 3.2 grams gold per tonne and 315 grams silver per tonne, and the Nasty Cirque (Big Thing, 104M071) returned 27 grams gold per tonne and 48 grams silver per tonne (Table DD). However, both of these showings are small, reflecting the discontinuous nature of structural and lithologic units within this foliated package. Yet some units within this foliated unit display significant continuity along-strike; such as the carbonate unit (Photo 4-3) which can be traced for 6 kilometres south of Racine Lake, and the banded silicic sediments east of Tutshi Lake probably extend for more than 1.5 km. Thus, mineralized zones with along-strike persistence might also exist.

Correlation of felsic volcanic units is particularly important. If an early Mississippian age can be demonstrated, then they may correlate with the felsic volcanic facies at the Tulsequah Chief and Big Bull Deposits in the Tulsequah map area, making these felsic units an exploration target for volcanogenic massive sulphide deposits.