DEVONO-MISSISSIPPIAN VMS PROJECT: CONTINUING STUDIES IN THE DORSEY TERRANE, NORTHERN BRITISH COLUMBIA

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INTRODUCTION

This project aims to trace out, within central northern B.C., stratigraphy favorable to the formation of Early Mississippian volcanogenic massive sulphide deposits similar to Kudz Ze Kayah, Wolverine, and Fyre Lake. Begun in 1997, the project has focussed on two areas, the eastern Dorsey Terrane near the headwaters of the Cottonwood River in central Jennings River map area (Figure 1; Nelson *et al*., 1998a), and the Big Salmon Complex (Mihalynuk *et al*., 1998). Mapping in the eastern part of the Dorsey Terrane continued in August 1998. The Big Salmon project, on hold for a year, will be completed in 1999.

The Dorsey Terrane has been divided into several assemblages (Harms and Stevens, 1996). The lower Dorsey Terrane in the southern Yukon comprises the Ram Creek and Dorsey assemblages. The structurally lowest Ram Creek Assemblage is a suite of mafic and intermediate to felsic metavolcanic rocks with lesser quartzite, marble and metaplutonic bodies. The overlying Dorsey Assemblage consists of quartzose, pelitic, mafic (to possibly felsic, muscovite-quartzite?) metavolcanic and intermediate metaplutonic rocks, which underwent high-temperature, high-pressure metamorphism (609-732oC, 7.7-14.1 kilobars) prior to emplacement of the mid-Permian Ram Stock (Stevens, 1996). The Dorsey Assemblage is overlain structurally by the Klinkit and Swift River assemblages, which show lower metamorphic grades and less penetrative deformation (Stevens and Harms, 1995, Harms and Stevens, 1996). Fossil ages in these upper assemblages of the Dorsey Terrane range from late Mississippian to Triassic (Harms and Stevens 1996). Limestones at different structural levels contain Pennsylvanian conodonts (Abbott, 1981): this may indicate fault and/or fold repetition.

Mapping in 1997 indicated that the Dorsey Terrane near the headwaters of the Cottonwood River contains elements assignable to the Ram Creek, Dorsey, and Swift River assemblages (Nelson *et al*., 1998a). Both the Ram Creek and Dorsey units contain felsic rocks of early Mississippian age (Nelson *et al*., 1998a), comparable with the age of the suite that hosts VMS deposits in the Yukon-Tanana Terrane near Finlayson Lake, Yukon (Mortensen and Jilson, 1985, Hunt, 1997).

LOCAL GEOLOGY

In the central Jennings River map area, the lower part of the Dorsey Terrane rests structurally on metamorphosed basinal strata that are assumed to be the outer fringes of the Cassiar Terrane, the western edge of the North American passive continental margin (Figure 2).

Field mapping in 1997 and 1998 has resulted in subdivision of the Dorsey Terrane into a number of units (Figure 2 and Table 1). As none of them can be traced across Parallel Creek, it is assumed that a major high-angle fault is concealed within its valley.

Units northeast of Parallel Creek include, from structurally lowest to highest:

Unit 1: "Greenstone-intrusive unit": Greenschist-grade intermediate to mafic metatuff, pyritic felsic metatuff, and tonalite/quartz diorite.

Unit 2: "Metasediment-amphibolite unit": This unit consists of a lower, amphibolite (metabasite)-bearing part (2L on Figure 3) and an upper metasedimentary part (2U on Figure 3). The contact between the two, albeit tectonised, appears to be gradational. The lower part consists of amphibolite and garnet amphibolite,

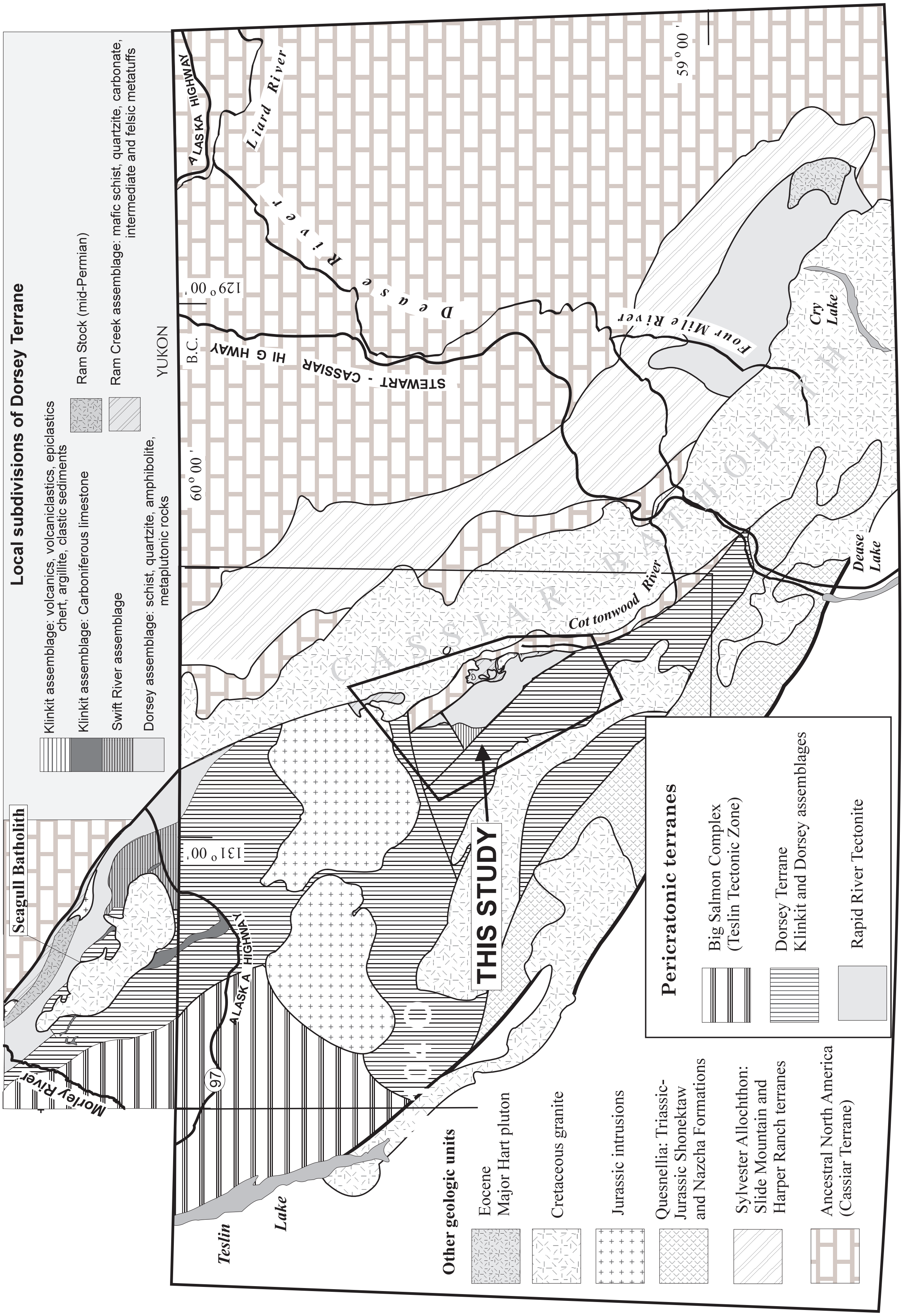

Figure 1. Location and tectonic setting of the Dorsey Terrane project. Regional Geology from Gabrielse (1963, 1969, 1994) and Steven and Harms.

Table 1. Lithostratigraphic units

Map Unit	Assemblage	Informal name
1	Ram Creek	greenstone-intrusive unit
2	Dorsey	metasediment-amphibolite unit
3	Swift River? Klinkit?	Quartzite-pelite unit
4	Swift River? Klinkit?	Metachert-metatuff-phyllite unit
5	Swift River	Dark phyllite-quartzite-marble unit
6	Swift River	Phyllitic metasedimentary unit
7	Klinkit	Limestone-chert-tuff unit

interlayered (interbedded?) with metatuffs, fine grained quartzite, biotite-muscovite+graphite schist, and quartzofeldspathic schist (metamorphosed chert, argillite and orthoquartzite, respectively), and marble. The upper part consists of thinly layered impure quartzite with biotite-muscovite partings (meta-argillite), thin bedded limestone, dark grey meta-chert; and interlayered chlorite+muscovite+garnet schist and quartz-muscovite schist that probably represent intermediate to felsic tuff protoliths. Both the upper and lower parts of this unit are intruded by pods of deformed tonalite, diorite and gabbro. Ultramafic pods are restricted to the lower, amphibolite-dominated unit.

Unit 3: "Quartzite-pelite unit": quartzite, pelitic schist and phyllite, and one layer of quartz-plagioclase grit.

Unit 4: "Metachert-metatuff-phyllite unit": thin bedded fine quartzite (metachert) interbedded with siliceous metatuff, dark grey meta-argillite, phyllite, chert-argillite-clast sedimentary breccia, and carbonate olistostromes.

Unit 1 is assigned to the Ram Creek Assemblage, unit 2 to the Dorsey Assemblage, and units 3 and 4 tentatively to the Swift River and/or Klinkit Assemblage.

Units southwest of Parallel Creek include:

Unit 5: "Dark phyllite-quartzite-marble unit": Dark grey phyllite, white quartzite (quartz arenite), and one thick, continuous marble band.

Unit 6: "Phyllitic metasedimentary unit": Siliceous green to grey phyllite, quartzite (quartz arenite), limestone, metatuff, and diorite.

Unit 7: "Limestone-tuff-chert unit": Thick pure limestone/marble, mafic metatuff, bedded chert.

Units, 5 and 6 are assigned tentatively to the Swift River and unit 7 to the Klinkit assemblage.

Many of these units have similar protoliths. The theme of basinal sedimentation accompanied by distal volcanism and persistent minor siliciclastic influx repeats from one to the other. For instance the contact betweeen the "Metasediment-amphibolite unit" and the overlying "Metachert-metatuff-phyllite unit" was defined by the disappearance of garnet, as the protoliths of these two units - cherts, tuffs and argillites - resemble one another.

North American marginal strata

These rocks, described in Nelson *et al*., 1998a, are dark grey to black slate, silty slate and argillite with minor quartzite and limestone, exposed in homoclinally southwest-dipping succession in the mountains north of the headwaters of the Cottonwood River (Figure 2).

Unit 1: Greenstone-intrusive unit

The "greenstone-intrusive unit" forms the lowest of the allochthons in the Cottonwood River area (Unit 1 on Figure 3), resting directly above inferred Earn Group-equivalent strata on a surface that is very gently dipping over tens of square kilometres and truncates steeper cleavage and bedding in the para-autochthonous rocks below. It consists of two lithologic suites: a supracrustal, metavolcanic suite, and a suite of

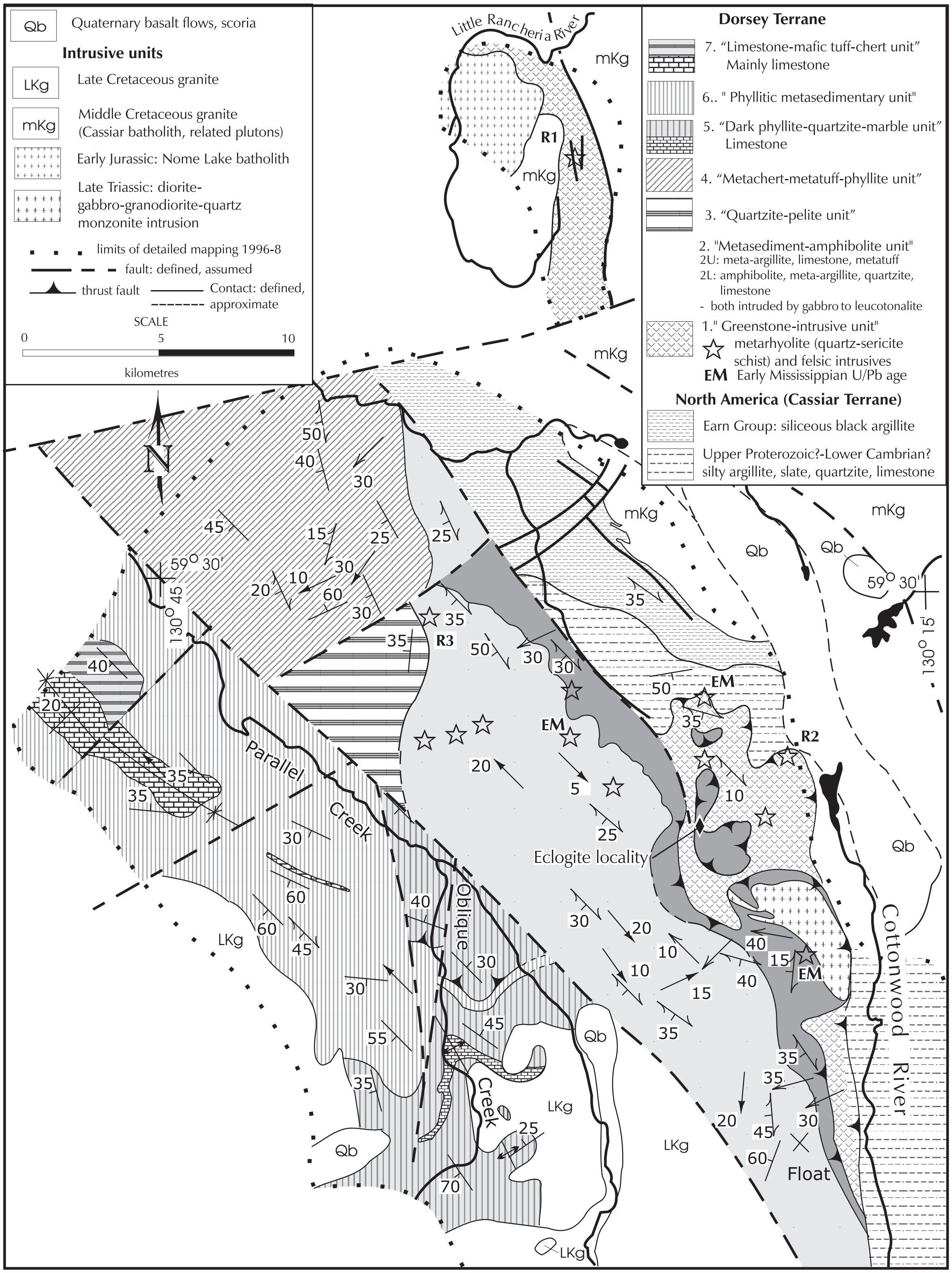

Figure 2. Geology of the area near the headwaters of the Cottonwood River and Parallel Creek (104O/7, 8, 9, 10). Based on 1998 mapping by J. Nelson, W. Zantvoort, T. Gleeson and K. Wahl; 1997 mapping by T. Harms, J. Nelson, and M. Mihalynuk; 1996 mapping by J. Nelson; and Gabrielse (1963).

heterogeneous intrusions. The metavolcanic suite consists primarily of metatuffs, mostly mafic to intermediate, but with pyritic quartz-sericite schist (meta-rhyolite tuff) in places. Some of the felsic metatuffs contain recognizable primary quartz and/or plagioclase phenocrysts. Quartz-sericite schist localities are shown on Figure 2 by stars. Sedimentary components of the "greenstone-intrusive unit" include volumetrically minor grey argillite and grey to sea-green chert. The metavolcanic-metasedimentary suite is intruded by deformed plutonic bodies. They range from gabbro and diorite to tonalite and quartz diorite. Foliation in them is variably developed. It ranges from weak to protomylonitic, particularily near the base of the allochthon. The thin southern extension of this unit is a polydeformed coarse-grained gabbro.

The "greenstone-intrusive unit" also includes a sequence of quartz-sericite schist-intermediate metatuff-limestone-chert near the headwaters of the Little Rancheria River, which contains a limestone that yielded early Mississippian conodonts (Nelson, 1997).

Three quartz-eye-bearing quartz-sericite and quartz-chlorite-sericite schists in the "greenstone-intrusive unit" were sampled in 1998 for U-Pb zircon analysis. One of the deformed tonalite bodies in it has returned a preliminary early Mississippian U-Pb age (R. Friedman, personal communication 1998).

Unit 2: Metasediment-amphibolite unit

This unit overlies the "greenstone-intrusive unit" above a sharp, nearly flat contact (Figure 2), and is distinguished from it by strong contrasts in metamorphic grade and lithologic components. The "metasediment-amphibolite unit" is divided into a lower part and an upper part (Units 2L and 2U on Figure 2). The lower part contains thick, dark green tabular amphibolite bodies and small pods of ultramafic rock, both of which are absent in the upper part. Both upper and lower parts contain very siliceous metasedimentary rocks and marble interbeds. Chlorite phyllite and quartz-sericite schist commonly occur together in the upper part. Based on their composition, they are interpreted as intervals of intermediate to felsic metatuff, although remnant primary textures are lacking to substantiate this. The contact between the upper and lower parts is gradational, and is mapped at the top of the highest amphibolite body.

Thick bands of garnet and epidote amphibolite form prominent exposures in the lower part of the unit. They are interlayered and interfolded with quartz-rich to pelitic metasediments, some of which display protolith textures that identify them as meta-argillites, metacherts, and quartz sandstones. Microscopically, the amphibolites consist of aggregates of forest green, prismatic hornblende with interstitial albite and in some cases large splotchy garnet poikiloblasts; trains of rutile and ilmenite-magnetite are heavily overgrown by retrograde sphene.

The high metamorphic grade of the lower part of the unit is indicated by hornblende +garnet+epidote-sodic plagioclase-quartz-rutile in meta-basites. Assemblages of coarse biotite-muscovite-quartz-feldspar are developed in impure pelitic rocks, and garnet-clinozoisite-biotite-muscovite-plagioclase in intermediate to felsic orthogneisses. One of the garnet amphibolites contains relict sodic clinopyroxenes, and is interpreted as a heavily retrograded eclogite (P. Erdmer, personal communication 1998). Structural relationships show that some of the least deformed garnet amphibolites are garnetiferous gabbros that intrude the metasedimentary section. These bodies were folded and foliated prior to intrusion of the sill-like intermediate to felsic bodies. The intermediate to felsic intrusions themselves are highly foliated and affected by garnet-grade metamorphism. One of them has yielded early Mississippian zircons (349.9 + 4.2 Ma) (Nelson *et al*., 1998a).

The contact between units 2L and 2U is a strongly sheared but lithologically gradational: it may be a structurally remobilized depositional contact. Above it, siliceous schists are the most abundant rock type, and amphibolite and ultramafites are rare. Three interlayered lithologic suites dominate the upper part of the unit: siliceous, platey-layered phyllites and fine grained quartzites, which are probably meta-argillites and metacherts; thin-bedded limestone; and interlayered chlorite, chlorite-sericite and quartz-sericite schist, which reflect a metamorphosed intermediate to felsic tuffaceous protolith. New mapping of the southern continuation of the upper unit shows an increase in the proportion of metatuff.

The metamorphic grade in 2U is somewhat lower than that in 2L: chlorite-muscovite +actinolite assemblages predominate in metamorphosed intermediate tuffs, although this appears to be mainly due to strong retrograde metamorphism. Although large garnet porphyroblasts are common, both garnet and biotite are texturally unstable and both have partly reverted to chlorite. Cordierite occurs in a few metatuffs.

Both the upper and lower parts of the unit are intruded by small mafic to tonalitic pods and sills, typically coarse grained diorites, gabbros, and white leucotonalite and granite (leucosome?), which themselves are strongly foliated, folded and refolded. Their abundance decreases markedly upwards. One of these tonalite bodies contains some of the phases of deformation but not others, which are inferred to predate it (see Structure, below). U-Pb dating of this body is in progress, and if successful will help to constrain timing some of the tectonic events in the lower Dorsey Assemblage.

Unit 3: Quartzite-pelite unit

This unit underlies the western part of one ridge in the central part of the map area (Figure 2). It was previously included in unit 5, the ”phyllitic metasedimentary unit”; however it is distinct from that unit, and geographically separated from it by the broad, overburden-covered valley of Parallel Creek. The lower 25 metres are dominated by quartzite with interlayered pelitic schist. This sequence contains one layer of quartz-plagioclase grit and monomictic, plutonic-clast conglomerate in a limey matrix. It appears to have been derived as an immature sediment from a coarse grained plutonic source. Towards the southwest in continuous exposure, the quartzite-pelite section passes gradationally upward into finer metasedimentary strata including grey, tan, greenish and white pelites, grey phyllite and metachert.

Relict garnet porphyroblasts enveloped by chlorite occur in the lower part of this unit, a feature that allies it with the underlying upper part of the “metasediment-amphibolite unit”. However no garnet occurs in its upper part; therefore it is tentatively grouped with the units of Klinkit Assemblage affinity. Its contact with the “metasediment-amphibolite unit” is unexposed and structurally somewhat discordant (strikes change from approximately northwest, to north-northeast across the covered interval). Preliminary detrital zircon data from the quartz-plagioclase grit indicates that the source pluton was Late Devonian (R. Friedman, personal communication 1998); this restricts the base of the unit to no older than Late Devonian.

Unit 4: Metachert-metatuff-phyllite unit

This unit underlies the broad highland in the north-central part of the map area. It consists of thin-bedded fine-grained quartzite (metachert) interbedded with green siliceous chlorite-muscovite phyllite, interpreted as metatuff, dark grey meta-argillite, phyllite, chert-argillite-clast sedimentary breccia, and carbonate olistostromes. The unit is characteristically highly variable on a small scale, but homogeneous on the scale of a regional map. Packages of ribbon-bedded cherts, including black-stained manganiferous chert, are common, and aquamarine “sea-green” cherts occur locally. In places, individual chert beds form white ribbons in green metatuff. There is a repeated association between dark grey meta-argillite, chert-argillite clast sedimentary breccia, and carbonate olistostromes with carbonate-breccia aprons.

The thin-bedded cherts are characteristically folded at outcrop-scale both into recumbent isoclines with M-folded cores, and upright chevron-style folds.

The lower contact of this unit above the “metasedimentary-amphibolite unit” is drawn above the highest occurrence of garnet in metamorphosed tuffaceous rocks, now chlorite-muscovite phyllites. Both it and the upper part of Unit 2 have similar protoliths, although some differences are seen. It lacks the thin-bedded limestones that typify parts of Unit 2. Metacherts are much more abundant in it, and the sedimentary breccias do not occur in Unit 2.

Unit 5: Dark phyllite-quartzite-marble unit

This unit is mainly exposed in the ridges surrounding the Oblique Creek valley. West of Oblique Creek, it overlies unit 6 across a strongly sheared zone shown as a thrust fault on Figure 2. It consists of dark grey phyllite and silty (?), siliceous phyllite, white quartzite (quartz arenite) and minor grit. One thick, continuous marble subunit outlines the limbs of a northwesterly plunging antiform.

The abundance of metamorphosed quartz sandstone and the presence of grit in this unit suggest a similarity to the "quartzite-pelite" of unit 3; however there is no structural continuity or age data to support a direct correlation, and the "look" of these two units is somewhat different: unit 3 lacks the overall dark coloring and flagginess of unit 5.

Unit 6: Phyllitic metasedimentary unit

This unit only occurs southwest of Parallel Creek. Although it is locally, and to a certain extent regionally, heterogeneous, no consistently mappable subdivisions of it could be made. It is dominated by grey, black and light green siliceous phyllite to phyllitic argillite with subordinate buff, dark grey, or white quartz grit and sandstone, and less abundant thin-bedded pale green to grey chert. A few prominent bands of recrystallized limestone are present. Meta-diorite, amphibolite and metatuff outcrop in one continuous layer, and appear to grade into one another. One dacite crystal tuff, a light green, comparatively uncleaved unit interfolded with green phyllite, was confirmed in thin section. Generally, however, igneous rocks are rare.

The "phyllitic metasedimentary unit" shows less development of metamorphic minerals and textures than the "metasediment-amphibolite unit". Garnet is not seen, except where related to contact metamorphism.

Unit 7: Limestone-mafic tuff-chert unit

This unit, exposed on the subdued upland in the northwest corner of the map area, overlies unit 6, the "phyllitic metasedimentary unit", across a well-exposed, concordant contact with no evidence of shearing or structural discontinuity. It consists of interbedded thick pure limestone/marble, mafic metatuff, and bedded chert. The limestone is partly replaced by pure white, coarse grained quartzite. The mafic metatuffs contrast strongly with other tuffs and metatuffs in the Dorsey Terrane. They range from large lapilli to laminated dust tuffs, all a rich, dark green color. They are interbedded with the limestone: mafic clasts occur in carbonate matrix, and dolomitized carbonate clasts occur in mafic tuff matrix; green tuff and orange-weathering carbonate are interlaminated in dust tuffs. Ribbon-bedded chert lies both above and below the limestone. Colors range from grey to green to white; some cherts are manganiferous, with black Mn-oxide coatings. Some cherts contain 3 to 10% disseminated pyrite.

Structural style of the allochthonous units

The following structural domains are recognized:

Domain A: Cassiar Terrane

Domain B: Unit 1, "greenstone-intrusive unit"

Domain C: Unit 2, "metasedimentary-amphibolite unit"; unit 3 "quartzite-pelite unit"

Domain D: Unit 4, "metachert-metatuff-phyllite unit"

Domain E: Units 5, 6 and 7 southwest of Parallel Creek

No new data is presented for the Domains A or B (see Nelson et al., 1998a). Structures from these domains are shown in Figure 3a.

Domain C: the metasedimentary-amphibolite unit

The "metasediment-amphibolite unit" was affected by several episodes of deformation over a protracted period of time. Near its base, early Mississippian sill-like intrusions follow and also cross-cut a pre-existing metamorphic foliation into which bedding was already transposed. The intrusions themselves were metamorphosed at garnet grade, carry a strong foliation subparallel to the earlier one, and are isoclinally folded. Well foliated to protomylonitic leucogranites cut foliations but are themselves folded. One of these has returned an Early Permian age (R. Friedman, pers. comm., 1998). Other nearby pegmatites, assumed to be part of the Permian suite, are very weakly foliated, and crosscut the ductile structures. Finally, the pluton near the base of the allochthon is discordant and only partly foliated, but some of its apophyses are folded. A preliminary U-Pb zircon age for this body is 211 Ma (R. Friedman, pers. comm., 1998).

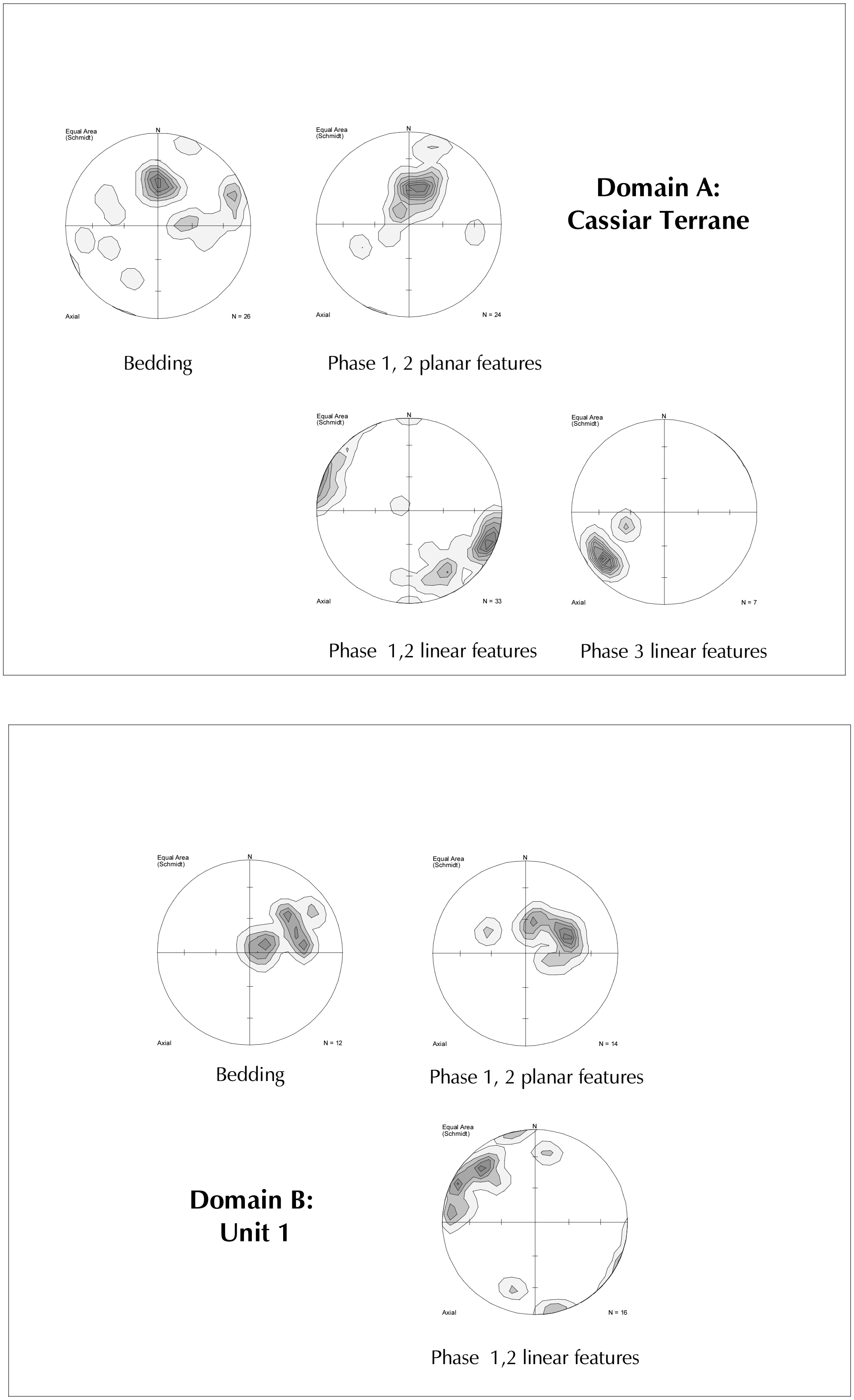

Figure 3a. Structural data from Cassiar Terrane and unit 1.

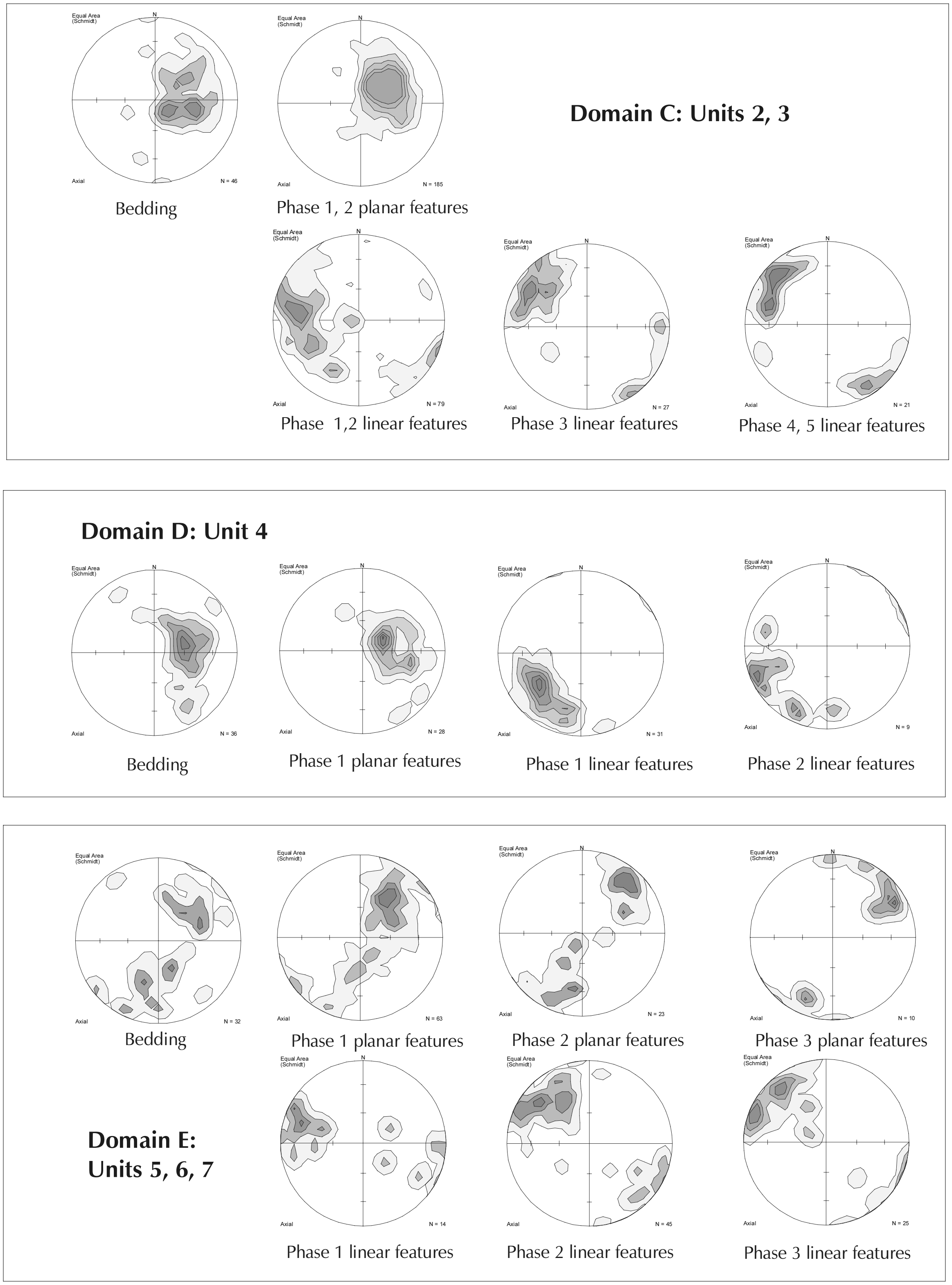

Figure 3b. Structural data from units 2 - 7.

Overall, foliation in Unit 2 tends to dip moderately southwest (Figure 3b). This attitude is discordant with its basal contact, which is nearly horizontal in exposures near the headwaters of the Cottonwood River.

Most minor folds are intrafolial isoclines. They plunge gently in west-northwesterly or east-southeasterly directions (Figure 3b). Their attitudes are subparallel to the axes of kilometre-scale recumbent isoclines, which fold the garnet amphibolite bodies. There is a small but significant population of minor folds, particularily in the lower part of the unit, that plunge 50^{o} to 80^{o} "downdip" to the west and southwest. This geometry is also seen in elongation and mineral lineations. Many of the "downdip"-plunging folds are rootless isoclines outlined by quartzite layers, in a matrix of chlorite-muscovite phyllite. Within the same outcrop, folds of this type a few metres apart may have plunges that diverge by tens of degrees.

Timing and development of these "downdip" linear features is constrained by the structures in two small intrusive bodies. A sill-like muscovite-garnet-bearing felsic pluton, which outcrops fifty metres above the base of the unit, is strongly mylonitized and displays a well-developed, southwesterly-plunging quartz stretching lineation. A variety of strain indicators - assymetric plagioclase porphyroclasts, displaced muscovite plates, mica fish, shear bands, and micro-thrust faults, indicate that shear sense was top-to-the-northeast. This mylonitization accompanied retrograde metamorphism in which chlorite-clinozoisite developed at the expense of biotite-garnet: it probably occurred during exhumation and cooling of the metamorphic complex.

Two hundred metres above the base of the "metasediment-amphbolite unit", a well-foliated, intermediate sill-like body intrudes chlorite-muscovite-garnet schist and quartzite, locally cross-cutting an earlier foliation. The minor recumbent isoclines in this body trend between 310 and 315 degrees; it lacks southwesterly-plunging minor structures. Both of these intrusive units are similar, in terms of composition and style of deformation, to the dated early Mississippian pluton that occurs 3 kilometres along strike to the north. A sample from the upper pluton is currently being processed for U-Pb dating.

During shearing, sheath folds can develop in which fold axes rotate towards the direction of tectonic transport (the extensional direction of the finite strain ellipse). The lower pluton underwent top-to-the-northeast shear after it was emplaced. The upper pluton, by contrast, was emplaced subsequent to rotation of local structures, since it only contains northwesterly, transport-normal folds. If they are indeed the same age, then these differences can be explained by strain gradients and progressive deformation: the stratified rocks were undergoing northeasterly transport and accompanying northwesterly folding during emplacement of the early Mississippian plutons, which continued after they cooled. Downdip structures formed in the lower pluton but not the upper one because shear strain increased with depth in the pile.

Later folds in unit 2, such as those that fold foliations, open folds and chevrons, also trend west-northwest to northwest. Northeasterly vergences are most common. It is notable that folds in unit 1, the Mississippian "greenstone-intrusive unit", also trend west-northwesterly and verge to the northeast (Figure 3a). No downdip structures occur in unit 1, perhaps because it was too young (Mississippian) and too high structurally for them to develop.

Domain D: Unit 4, the metachert-metatuff-phyllite unit

This unit shows evidence for a unique structural history compared with the others. Foliations in it are variable, ranging in a continuum from northwesterly with southwesterly dips to southwesterly with northwesterly dips (Figure 3b). Linear features in this unit tend to southwesterly trends, in contrast to the other units. This orientation prevails, not only among quartz stretching lineations and rootless isoclines, but also with respect to bedding-cleavage intersections, axes of outcrop-scale recumbent folds, and later upright fold axes. Northwesterly-trending fold axes are extremely rare. The structural history of this unit is anomalous; however, as noted in its description, it grades downwards into rocks indistinguishable from those in the "metasediment-amphibolite unit". It represents an outstanding puzzle in the interpretation of the Dorsey Terrane.

Domain E: Units 5, 6 and 7 southwest of Parallel Creek

The structural style of the upper units 5, 6 and 7 reflects deformation at a higher crustal level than the units northeast of Parallel Creek. Mesoscopic recumbent and intrafolial folds are less common. Although bedding and cleavage are commonly parallel, axial planar cleavages that are steeper than bedding are also present, associated with concentric, open to tight upright folds. Phyllites are typically crenulated, and many outcrops display multiple sets of crenulations. Major fold axial surfaces strike west-northwest to northwest. Unit 7 occurs in the core of an open synform. Along the valley of Oblique Creek, a northwest-plunging antiform is disrupted by a steep, northerly-striking fault; limb attitudes of this structure outline the girdles in first and second phase planar features on Figure 3b. As in the other domains, early recumbent folds and later upright folds are coaxial, with northwesterly-plunging fold axes.

Two outcrops within unit 6 of this domain show southwesterly quartz stretching lineations, refolded by northwesterly crenulations and minor chevron folds. This temporal relationship, in which early "downdip" lineations are succeeded by northwesterly folding, constitutes a possible structural link between the rocks southwest of Parallel Creek and those of Domain C, the deeper, higher-grade "metasediment-amphibolite unit".

Correlations and relationships between units

The Ram Creek Assemblage in the map area is represented by unit 1, the "greenstone-intrusive unit". It is now known to be at least in part of early Mississippian age, on the basis of a U/Pb age on a deformed tonalite and conodonts from a limestone near the headwaters of the Little Rancheria River. It is interpreted as an early Mississippian arc edifice, with a varied volcanic to epiclastic suite ranging from andesite to dacite and rhyolite, accompanied by limestone banks and basinal chert/tuff sequences, all intruded by coeval intermediate plutons.

The Dorsey Assemblage is represented by unit 2, the "metasediment-amphibolite unit". This unit, like the Ram Creek Assemblage, is intruded by early Missisippian intermediate (to felsic) plutons, which also display strong flattening fabrics. The presence of garnet grade metamorphic assemblages in them suggests that they either intruded at or were buried to mid-crustal levels, in contrast to Ram Creek plutons, which contain only greenschist-facies assemblages. The Dorsey Assemblage, unlike the Ram Creek, clearly records protoliths and metamorphic/tectonic events older than early Mississippian. Penetrative ductile fabrics in quartzite and metatuff are cut by the intermediate to felsic intrusions, and eclogite facies metamorphism predated garnet amphibolite conditions in at least one of the metabasites. One reasonable interpretation of the similarities and differences between the Ram Creek and Dorsey assemblages in this area is that the Dorsey Assemblage was basement to the Ram Creek Assemblage, but, through imbrication, now lies structurally above it. The comparative lack of volcanic rocks in the upper part of unit 2 may mean that unit 1 represents the core of the early Mississippian arc edifice, and unit 2 its flank. Reversal of top-to-the-northeast motion suggests that unit 2 once lay to the west of unit 1. If the presence of eclogite in unit 2 can be construed to indicate a subduction environment, then this western flank was the forearc, and the arc faced west.

Units 3 and 4, the "quartzite-pelite" and "metachert-metatuff-phyllite" units, are assigned to the Swift River or lower part of the Klinkit assemblage. Unit 4 overlies unit 2 across an apparently transitional contact. The principal differences between them, other than minor lithologic ones, are 1) unit 4 does not contain garnet grade assemblages, and 2) protolith textures in it are generally well-preserved. On the ridge immediately south of unit 4, unit 3 also overlies unit 2. The lowermost part of unit 3 is garnet grade, like the underlying unit 2. This part contains distinctive quartzose clastics and a pluton-derived grit with late Devonian zircons, which hint at an erosional interval. In southern Yukon near the Seagull Batholith, sequences of lower metamorphic grade that rest structurally above the Dorsey Assemblage are assigned to the Swift River and Klinkit assemblages (Figure 1); their basal contact is inferred to be a fault (Harms and Stevens, 1996). Here, however, the contact between units 2 and 4 appears to be gradational.

Units 5 and 6 southwest of Parallel Creek are similar to each other in metamorphic grade (greenschist facies chlorite-muscovite), in the dominance of siliceous phyllite and in the presence of quartzose clastics as thick, discrete beds. These features ally them with the Swift River Assemblage, as noted by T. Harms (Nelson *et al*., 1998a). Unit 6 is overlain concordantly by unit 7, the "limestone-mafic tuff-chert unit". This unit resembles a lithostratigraphic triplet in the Big Salmon Complex, which consists of limestone, chert (locally highly manganiferous and piedmontite-bearing), and a thick, generally mafic greenstone unit that includes both flows and pyroclastic material (Mihalynuk *et al*. 1998). It also resembles limestones and associated volcanic rocks in the upper part of the Klinkit Assemblage of Stevens and Harms, 1995 and Harms and Stevens, 1996. In both of these cases, the carbonate is of mid- to late Carboniferous age (Stevens and Harms, 1995; Mihalynuk *et al*., 1998).

Correlations with other allochthonous assemblages in southern Yukon and far northern B.C.

Unit 1, the Ram Creek Assemblage, contains an early Mississippian suite of arc affinity, like the host sequence for syngenetic deposits in the Finlayson Lake belt. Particularly noteworthy are the occurrences of metamorphosed pyritic felsic tuffs within it.

Unit 2, the "metasediment-amphibolite unit", resembles not only the Dorsey Assemblage near the Seagull Batholith, but also the "Anvil allochthon" of the St. Cyr klippe (Fallas, 1997) and the Rapid River Tectonite in the Sylvester Allochthon (Gabrielse and Harms, 1989). All of these contain garnet-bearing amphibolites and interlayered metasedimentary rocks. Eclogite remnants in the St. Cyr klippe have yielded mid-Permian K-Ar muscovite ages (Fallas, 1997). Both the "metasediment-amphibolite unit" and the Rapid River Tectonite are intruded by Early Mississippian plutons, which cross-cut early ductile fabrics but are in part protomylonites (Nelson *et al*., 1998b and unpublished data; Gabrielse *et al*., 1993). This group of lithotectonic slivers that underwent late Paleozoic high-pressure metamorphism forms a distinct subset within terranes of general "Yukon-Tanana Terrane" affinity (Nelson *et al*., 1998b): together with the set of Mississippian and Permian eclogite occurrences (Erdmer *et al*., 1998), it may serve to outline shifting mid- to late Paleozoic subduction zones that bordered or even segmented a composite pericratonic superterrane.

Mineral potential

Quartz-sericite schists, interpreted to be metamorphosed rhyolite tuffs, have been identified at numerous localities within the allochthons in the central Jennings River area. Several examples are found in the "greenstone-intrusive" unit, as shown by the Little Rancheria locality (R1 on Figure 2), and 2 kilometres northwest of the lake that forms the headwaters of the Cottonwood River (R2, Figure 2). Both occurrences are rusty and pyritic; and at R2, traces of chalcopyrite occur with pyrite in siliceous quartz-sericite schist. Quartz-sericite schists also occur at scattered localities associated with chlorite-muscovite phyllites (metatuffs) in the upper part of the "metasediment-amphibolite unit" (stars on Figure 2).

Interesting sulphide-bearing float was also discovered in a creek bed draining the lower part of Unit 1 (labelled "Float" on Figure 2). Pyrite and minor galena wisps occur in laminated metachert. Other float samples at the same locality contain laminated magnetite in a matrix of feathery actinolite and quartz. Although the feathery actinolite is clearly post-kinematic, the magnetite grains appear to be earlier: they are strongly aligned in the ductile fabric, and rimmed and penetrated by later titanite. Thus the origin of these rocks is equivocal: they may be either skarns, or banded magnetite such as is seen in the hanging wall at Wolverine. No bedrock exposure corresponding to them has yet been found.

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