# EXTENSIONS AND AFFILIATES OF THE YUKON-TANANA TERRANE IN NORTHERN BRITISH COLUMBIA

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## INTRODUCTION

Kudz Ze Kayah (KZK) and Wolverine are volcanogenic massive sulphide deposits hosted by Early Mississippian meta-rhyolites, marine metasedimentary rocks and intermediate to mafic metatuffs of the Yukon Tanana Terrane in the Finlayson Lake area, southern Yukon (Figure 1). This area became a focus of intense exploration in late 1994, following Cominco's discovery of significant massive sulphides associated with metarhyolites in the ABM zone, at what later became their Kudz Ze Kayah project. Reserves at Kudz Ze Kayah now stand at 11.3 million tonnes of 6% Zn, 1% Cu, 1.3% Pb, 125 g/tonne Ag and 1.3 g Au. In 1996, reserves at Westmin-Atna Resources' Wolverine deposit were 5.3 million tonnes of 1.8 g/tonne Au, 360 g/tonne Ag, 13% Zn, 1.4% Cu and 1.5% Pb; new discoveries in 1997 will upgrade this figure. Columbia Gold's Fyre Lake deposit, located in the Finlayson Lake district 50 km south of Kudz Ze Kayah, contains a significant copper-cobalt-gold resource within a complex series of massive sulphide lenses enclosed by a mafic metavolcanic host (Blanchflower *et al*,. 1997).

This project aims to pinpoint, 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. In 1996, six widely scattered target areas were mapped and evaluated for this potential (Nelson, 1997). In 1997 the focus was narrowed to two areas and systematic, detailed geological mapping was begun (Figure 2). Most of the work was done on the Big Salmon Complex in northwestern Jennings River (104O) and northeastern Atlin (104N) map areas, the direct strike continuation of Yukon Tanana rocks from the Teslin map area of southern Yukon into northern B.C. It is the subject of a companion paper (Mihalynuk *et al.*, this volume). This paper describes the results of preliminary mapping in the structurally lower part of the Dorsey Terrane in central Jennings River map area (104O).

## REGIONAL CORRELATIONS AND CONTEXT

Besides the crucial Early Mississippian rocks that host the volcanogenic massive sulphide deposits, the Yukon Tanana terrane is characterised by pre-Mississippian continentally-derived siliciclastic meta-sediments, Early Mississippian intrusions that are coeval and probably cogenetic with the volcanic stratigraphy, Pennsylvanian and Permian limestone, Permian volcanic and plutonic rocks, and cross-cutting Early Jurassic plutons (Mortensen, 1992). This capsule geologic history provides a "thumbprint" of the terrane that can be used to help identify its correlatives.

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 (609-732°C, 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.

The lower part of the Dorsey Terrane shares a number of common elements with the Yukon Tanana Terrane (Stevens, 1996). Near the Little Rancheria River, pyrite-bearing, felsic metatuffs are interbedded with intermediate metatuffs and a limestone that contains early Mississippian conodonts (Nelson, 1996). A highly deformed porphyritic tonalite, collected in 1996 from near the base of the terrane west of the Cottonwood River (Figure 3), returned an early

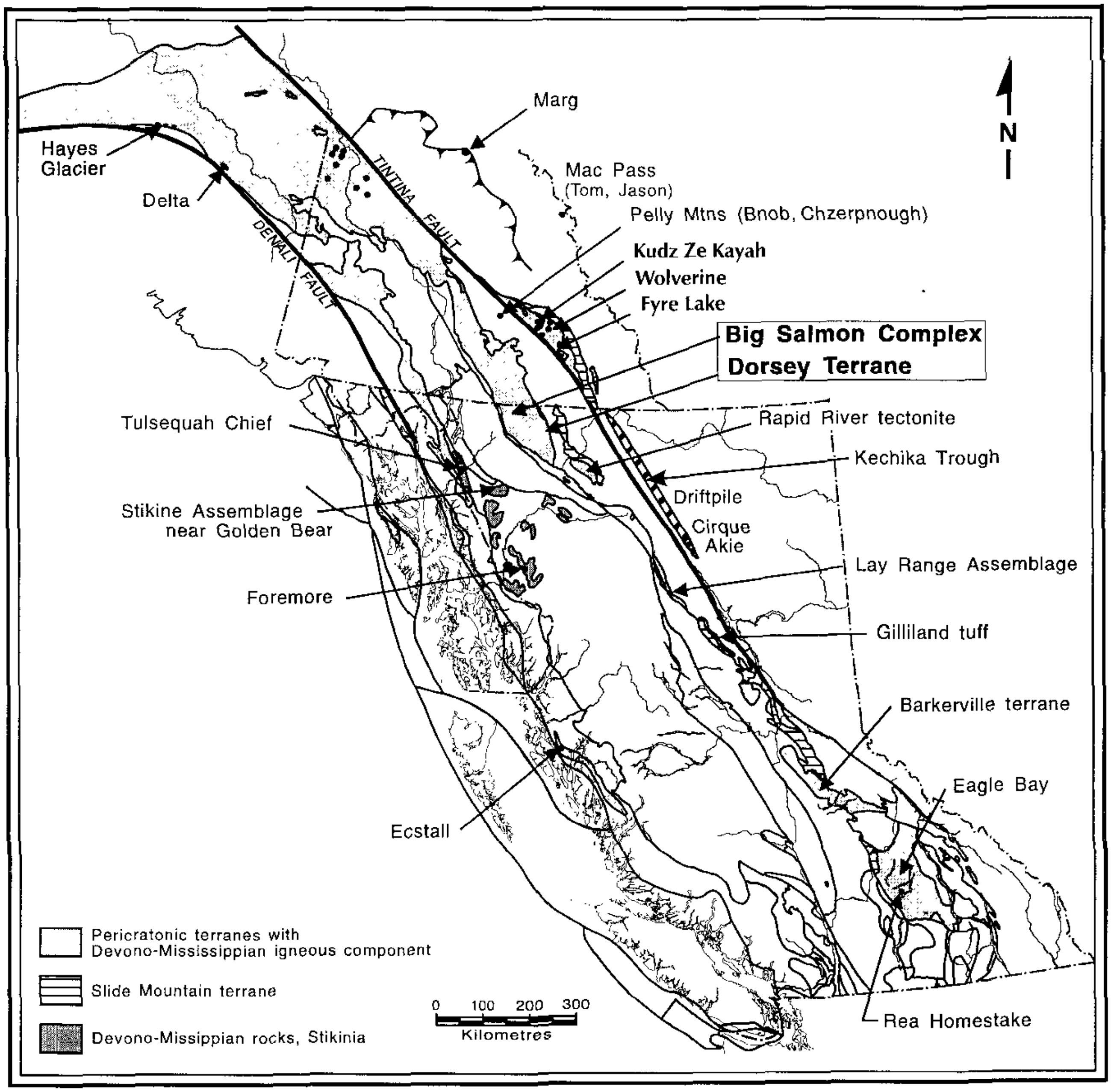


Figure 1. Location of this project (Dorsey Terrane) and Big Salmon Complex in the context of Devonian-Mississippian tectonics and metallogeny of the Canadian Cordillera Terrane outlines modified from Wheeler *et al.*(1991)

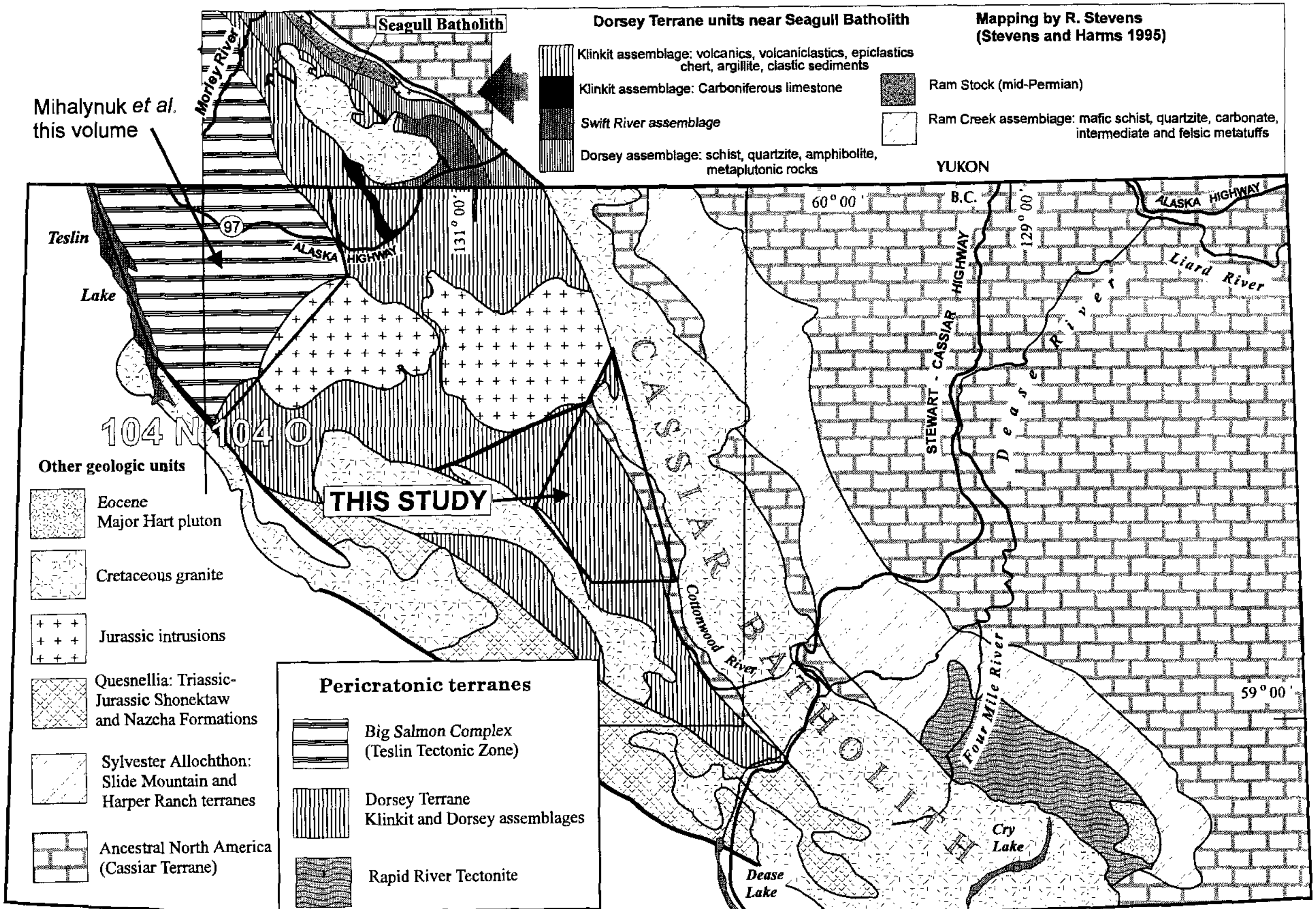


Figure 2. Tectonic location map for this project in the Dorsey Terrane and Mihalynuk *et al.* project in the Big Salmon Complex. Geology from Gabrielse (1963, 1969, 1994); Stevens and Harms (1995)

Mississippian U-Pb zircon age (Table 1, Figure 4 and discussion below). This age and the lack of Precambrian inheritance compare closely with the Simpson Range plutonic suite in the Finlayson Lake area (Mortensen and Jilson, 1985; Mortensen, 1992). Mid-Permian and Early Jurassic(?) intrusions cut the lower Dorsey Terrane near the Seagull Batholith in southern Yukon (Stevens, 1995).

On the eastern side of the Dorsey Terrane, the Klinkit and Swift River assemblages lie structurally above the Dorsey Assemblage in a southwesterly dipping structural stack (Stevens and Harms, 1995; Stevens, 1996). There is regional dip reversal within the Klinkit Assemblage, such that northeast-dipping low-grade chert, quartz sand-stone, slate and tuff in its western extent lie structurally above metamorphic rocks of the Big Salmon Complex (unpublished data, this project; see also structural data of Gabrielse, 1969 and Abbott, 1981). The Big Salmon Complex of Gabrielse (1969) was the subject of a detailed study during this project (Mihalynuk *et al.*, this volume). It consists of a sequence of stratified rocks cut by a highly deformed pluton, the Hazel orthogneiss. All of the units, including the Hazel orthogneiss, have been metamorphosed at grades ranging from greenschist to amphibolite, and all have undergone several episodes of folding. From lowest to highest, the stratified units in it are: siliciclastic rocks and interbedded felsic tuffs, limestone, chert that is locally highly manganiferous, a thick greenstone unit that includes both flows and pyroclastic material, and chert-quartz greywacke. The Big Salmon Complex was assigned to the Slide Mountain Terrane by Wheeler *et al.* (1991); Harms and Stevens (1996) termed it the Hazel assemblage and suggested a correlation with the Yukon-Tanana Terrane, with which it lies .directly along strike. Mihalynuk *et al.* (this volume) document this correlation. Although no age is yet available for the Hazel orthogneiss, it may be equivalent to Early Mississippian tonalites that intrude the Yukon Tanana Terrane (Kootenay Terrane) in Teslin map-area (Gordey and Stevens, 1994).

The actual contact between the Klinkit Assemblage and the underlying Big Salmon Complex has not been observed; however near this contact north of the Alaska Highway and east of Logjam Creek, the westernmost Klinkit rocks are deformed into major recumbent, southwest-verging folds, like the D3 folds that have affected the rocks of the Big Salmon Complex to the west (Mihalynuk *et al.*, this volume). This suggests that the Klinkit Assemblage and Big Salmon Complex were deformed together, and thus were adjacent to each other at least by the time of this deformation. The Early Jurassic Simpson Peak and Nome Lake batholiths intrude the Dorsey Assemblage near the Little Rancheria River (Nelson, 1997), the Klinkit Assemblage in the headwaters of Hook Creek and elsewhere (Gabrielse, 1969), and the Big Salmon Complex southeast of Mt. Francis (Mihalynuk *et al.*, this volume); therefore all three were contiguous by Early Jurassic time at the latest.

The possibility of an early connection between the Dorsey assemblage and the Big Salmon Complex raises interesting questions. Although the well-developed stratigraphy of the Big Salmon Complex is not seen in the Dorsey Assemblage, they do share a number of common elements, such as orthoquartzites, mafic metavolcanics, highly deformed Early Mississippian intrusive bodies, metamorphism up to amphibolite grade and recumbent folding. Do they represent originally adjacent but strongly contrasting facies belts? What are the ages of the units involved, and what timelines are present to constrain correlations? These will only be answered in further geological and geochronological studies.

## LOCAL GEOLOGY

In the central Jennings River map area, the structurally lower part of the Dorsey Terrane is represented by four distinct lithologic packages in two or more separate thrust panels. They rest structurally on metamorphosed basinal strata that resemble rocks of the Kechika Trough and are assumed to represent the outer fringes of the Cassiar Terrane, the western edge of the North American passive continental margin. Near the headwaters of the Cottonwood River the basal contact of the allochthons over presumed continental margin strata is a dramatic juxtaposition of green rocks above black rocks, exposed in cirque walls and mountainsides over tens of kilometres.

Field mapping in 199.76 identified three separate units in the lower Dorsey Terrane (Figure 3). From structurally lowest to highest they are the following:

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

2. "Metasediment-amphibolite unit": This unit consists of a lower, amphibolite-dominated 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, 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.

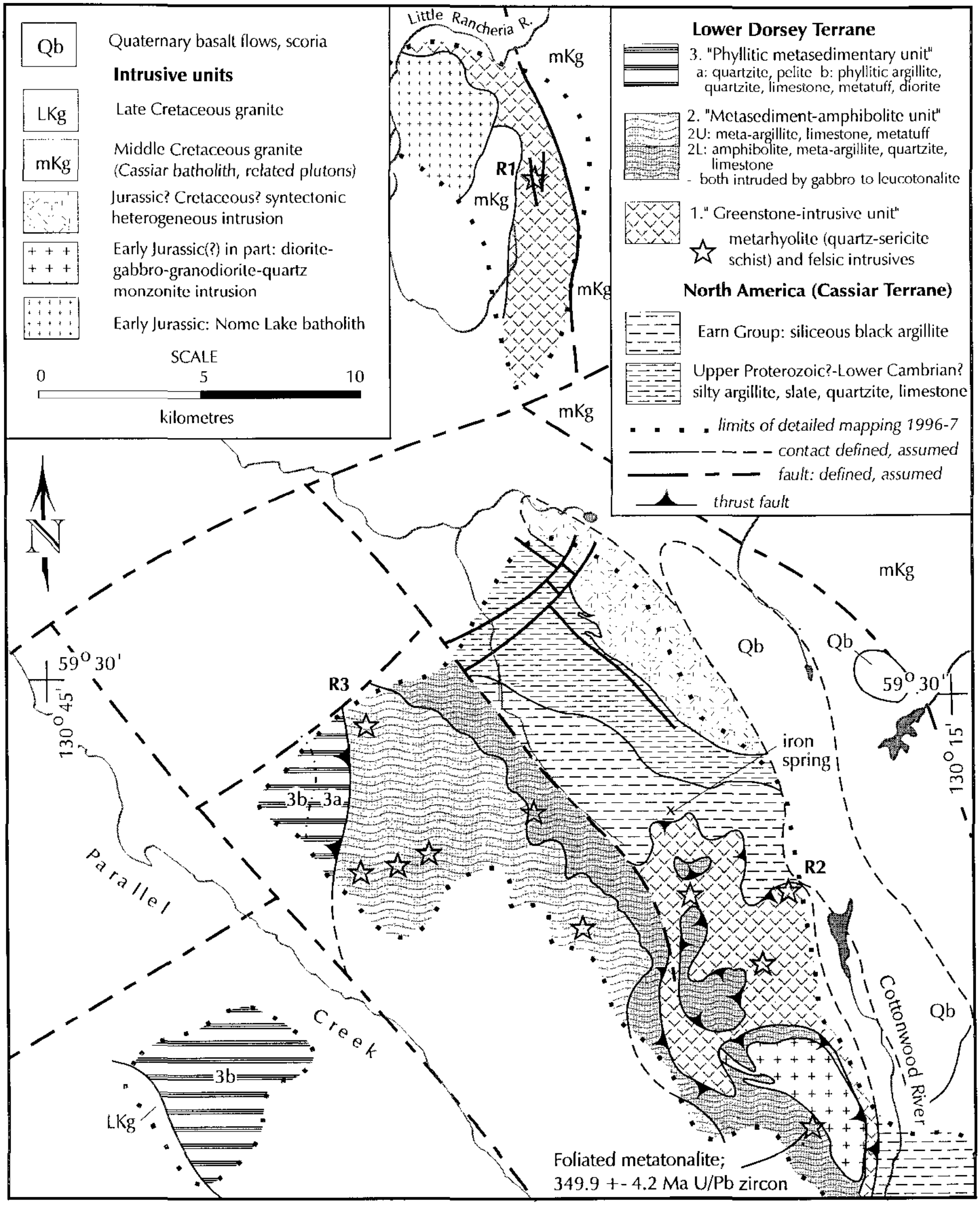


Figure 3. Geology of the area between headwaters of the Cottonwood River and Parallel Creek. Based on 1997 mapping by T. Harms, J. Nelson and M. Mihalynuk, 1996 mapping by J. Nelson and regional mapping by Gabrielse (1969)

3. "Phyllitic metasedimentary unit": Phyllitic argillite, metaquartzite, limestone, metatuff, and diorite.

## North American marginal strata

Dark grey to black slate to argillite are exposed extensively in the mountains north of the headwaters of the Cottonwood River (Figure 3). These rocks form a homoclinally southwest-dipping succession. At the base, a thick section of blocky to slabby-weathering slate and silty slate contains sparse beds of buff quartzite and white limestone. The siliciclastic rocks in this sequence are dark grey to black. They form rugged cliff outcrops and slabby to platey talus. Dark iron stains coat weathered surfaces. Muscovite is present on some bedding planes. In a few localities, large-scale current ripples are preserved on the bedding surfaces of thick-bedded silty slates. These features suggest correlation with the upper Proterozoic-Cambrian basinal rocks of the central Kechika Trough (for description see Ferri *et al.*, 1996). This unit is overlain by a few metres of black calcareous argillite, and then by a thick, monotonous unit of black, rusty-weathering, platey, carbonaceous, siliceous slatey argillite, black porcellanite, and at one locality, siltstone with graded beds. These two upper units closely resemble, respectively, the Ordovician-Lower Devonian Road River Group and the Devono-Mississippian Earn Group of the central Kechika Trough. More locally, they are probably correlative with exposures of siliceous, pyritic black argillite, pyritic and baritic chert, and limestone on the COT claims 15 kilometres to the south (Nelson, 1997).

A strongly foliated and lineated, highly heterogeneous pluton intrudes the base of the sequence, roughly following bedding and cleavage. It ranges from diorite to tourmaline-bearing granitic pegmatite. Fairly homogeneous granodiorite with plagioclase and/or orthoclase phenocrysts is interspersed with areas of gneissic, compositionally banded intrusive. The margins of the pluton are extensive sill complexes.

Structurally, the metasedimentary sequence is characterised by a ubiquitous, moderately southwest-dipping cleavage. Bedding parallels this cleavage, as shown in their general parallel attitudes in outcrop and in Figure 5, and microscopically by the limbs of isoclinal folds. An earlier crinkled cleavage, not parallel to the dominant cleavage, is seen only in thin section, preserved in the cores of andalusite porphyroblasts. Minor to mesoscopic, northeasterly-verging folds (F2) fold earlier tight to isoclinal folds in a few outcrops. These folds and also crenulations parallel the west-northwesterly regional strike (Figure 5). The youngest (F3) chevron-style folds, which refold F2 at a few localities, have southwesterly plunging axes with northwesterly vergence. Perhaps related to these, top-to-the-northwest shear, determined from C and S fabrics and asymmetrical pressure shadows around relict plagioclase phenocrysts, was noted at in granite at one locality along the margin of the pluton. Sills and dikes related to the pluton are involved in F2 and F3 folds, and foliation in the pluton is parallel to that in the surrounding rocks (Figure 5), indicating that it had been emplaced prior to much of the deformation.

Metamorphic andalusite and cordierite are widespread throughout the metasedimentary sequence. Their distribution bears no spatial relationship to the pluton. In some cases elongate andalusite porphyroblasts up to several centimetres in length show very little or no preferred orientiation. Andalusite cores, however, contain a crinkled cleavage that is not parallel to the dominant rock fabric. Their later growth follows crenulations, and the crenulations themselves are deflected around the porphyroblasts. These textural relationships indicate that andalusite growth occurred throughout a sequence of progressive deformation, and even outlasted it in some localities.

A set of multielement stream sediment anomalies was determined in this area by the Regional Geochemical Survey (Geological Survey of Canada, 1978). During follow-up geochemical work, several strong northwest-trending soil anomalies were defined (Smith and Gillan, 1980). An iron spring occurs in the Earn Group a few hundred metres below the base of the allochthons (Figure 3). Our prospecting work did not locate any specific sedimentary-exhalative occurrences, although wispy pyrite and/or pyrrhotite laminae are very common in the metamorphosed black shales. In some samples, the stringers form tiny rootless isoclines, and follow the earliest recognized cleavage. For the most part this cleavage is parallel to bedding; however in one petrographic section, both the cleavage and the sulphide stringers clearly cut across bedding in isoclinal fold hinges, indicating that the sulphide stringers are not bedding-parallel laminae, but rather the result of sulphide migration into a solution cleavage.

## "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 autochthonous rocks below. It consists of two lithologic suites: a supracrustal, metavolcanic suite, and a suite of heterogeneous intrusions. The metavolcanic suite consists prima-rily 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 compo-nents 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 "greenstone-intrusive unit" resembles the quartz-sericite schist-intermediate metatuff-limestone-chert sequence mapped near the headwaters of the Little Rancheria River (Nelson 1997). They are correlated on Figure 3, although the Little Rancheria sequence is isolated by Quaternary cover and Mesozoic plutons, and may be separated from the Cottonwood River allochthons by a major normal(?) fault. Similarities include: predominance of metatuffs and cogenetic high-level pre-tectonic intrusions, presence of pyritic quartz-sericite schist with plagioclase and less abundant quartz phenocrysts, and greenschist grade metamorphism with widespread biotite, chlorite, epidote and sericite. The Little Rancheria sequence contains a Mississippian limestone (Nelson, 1997).

## "Metasediment-amphibolite unit"

This unit overlies the "greenstone-intrusive unit" above a sharp, nearly flat contact (Figure 3), 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 3). 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 (metamorphosed inter-mediate tuff?) and quartz-sericite schist (felsic metatuff?) commly occur together in the upper part. The contact between the upper and lower parts is gradational, and is mapped at the top of the highest amphibolite body.

Thick bands of amphibolite and garnet amphibolite form prominent cliffside and knob exposures in the lower part of the unit (unit 2L). In petrographic section, the amphibolites consist of lepidoblastic aggregates of forest green 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 amphibolites are interlayered with quartz-rich to pelitic metasediments, some of which display protolith textures that identify them as meta-argillites, metacherts, and quartz sandstones. Small amounts of thin-bedded marble are also present, interlayered with either meta-argillite or mafic (tuffaceous) rocks. A few thin units of quartz-muscovite schist within the amphibolite are may be meta-rhyolite tuffs, although there are no relict primary textures to support this assertion. Pods and slivers of ultramafic rock occur in the lower part of unit 2. Except for one fairly intact serpentinized harzburgite tectonite near its base, these have been metamorphosed along with their enclosing rocks. Original textures are generally obliterated and they appear as coarse aggregates of actinolite/tremolite and talc.

The relatively high metamorphic grade of the lower part of the unit is indicated by hornblende ($\pm$garnet$\pm$epidote)-plagioclase-quartz-rutile in meta-basites, and assemblages of coarse biotite-muscovite-quartz-feldspar in pelitic rocks. In thin sections of the mafic rocks, trains of rutile and (?)ilmenite of the peak metamorphic assemblage are heavily mantled by retrograde sphene.

The upper part of the "metasedimentary-amphibolite unit" overlies the amphibolite-bearing lower part along a lithologically gradational contact that is also a zone of comparatively strong deformation. This may be due to remobilization of an original depositional contact. Above the contact, siliceous schists are the most abundant rock type, and amphibolite and ultramafites are rare. Three rock types dominate the upper part of the unit: siliceous, platey-layered semipelites, which are probably meta-argillites and metacherts; thin-bedded limestone; and chlorite schist with quartz-sericite schist, which reflect a metamorphosed intermediate to felsic tuffaceous protolith. These components repeat across strike, probably because of fold and/or fault repetition; however without "way up" indicators and spotty exposure the exact mechanism of the thickening is not clear.

The metamorphic grade in the upper part of the unit is somewhat lower than in the lower part: chlorite-biotite$\pm$garnet$\pm$actinolite assemblages pre-dominate in metamorphosed intermediate tuffs, although this appears to be in part due to strong retrograde metamorphism in which garnet and biotite have partly reverted to chlorite.

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. A highly foliated and deformed tonalite to diorite pluton, mapped in 1996 (Nelson, 1997), intrudes rocks that are considered to be within the lower part of the unit (Figure 3). This body returned a U/Pb zircon age of $349.9 \pm 4.2$ Ma (Table 1, Figure 4).

The base of unit 2 exhibits widespread crystalloblastic textures and fabrics typical of metamorphic rocks, including coarse-grained, schistose, mica-rich rocks; compositionally banded orthogneiss; and foliated and lineated amphibolite. The rest of the unit, including rocks of both the lower amphibolite-rich and the upper siliceous parts, is characterized by very fine grain size and a fabric of paper-thin, laterally continuous compositional bands and rodding typical of a zone of high shear strain.

## TABLE 1

### 96JN-32-6- Dorsey Assemblage metatonalite

Three fractions of clear colourless zircon define an array characteristic of Pb loss with no evidence for inheritance. The best age estimate for this rock is **349.9 ± 4.2 Ma**, based on the weighted average of the three $^{207}Pb/^{206}Pb$ ages.

### U-Pb ANALYTICAL DATA

| Fraction[1] | Wt | U[2] | Pb*[3] | $^{206}Pb$[4] | Pb[5] | $^{208}Pb$[6] | Isotopic ratios (1σ,%)[7] | | | Apparent ages (2σ,Ma)[7] | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | mg | ppm | ppm | $^{204}Pb$ | pg | % | $^{206}Pb/^{238}U$ | $^{207}Pb/^{235}U$ | $^{207}Pb/^{206}Pb$ | $^{206}Pb/^{238}U$ | $^{207}Pb/^{206}Pb$ |
| **Dorsey Assemblage metatonalite** | | | | | | | | | | | |
| A c,N5,p,s | 0.036 | 284 | 16 | 1161 | 30 | 14.1 | 0.05492 (0.11) | 0.4052 (0.25) | 0.05351 (0.18) | 344.6 (0.7) | 350.7 (8.1) |
| B c,N5,p,s | 0.032 | 333 | 19 | 1117 | 33 | 14.1 | 0.05466 (0.13) | 0.4032 (0.29) | 0.05350 (0.22) | 343.1 (0.9) | 350.2 (9.9) |
| E m, N5,p,s | 0.144 | 279 | 16 | 1553 | 87 | 14.1 | 0.05321 (0.36) | 0.3924 (0.42) | 0.05348 (0.13) | 334.2 (2.3) | 349.4 (5.9) |

Notes: Analytical techniques are listed in Mortensen et al. (1995).

[1] Upper case letter = fraction identifier; All zircon fractions air abraded; Grain size, intermediate dimension: c= < 149μm and > 105μm and m= < 105μm and > 74μm; Magnetic codes:Franz magnetic separator sideslope at which grains are nonmagnetic (N) or Magnetic (M); e.g., N1 =nonmagnetic at 1°; Field strength for all fractions =1.8A; Front slope for all fractions=20°; Grain character codes: b= broken fragments, e=elongate, eq=equant, p=prismatic, s=stubby, t=tabular, ti=tips.

[2] U blank correction of 1pg ± 20%; U fractionation corrections were measured for each run with a double $^{233}U$-$^{235}U$ spike (about 0.005/amu).

[3] Radiogenic Pb

[4] Measured ratio corrected for spike and Pb fractionation of 0.0035/amu ± 20% (Daly collector) and 0.001/amu ± 7% and laboratory blank Pb of 10pg ± 20%. Laboratory blank Pb concentrations and isotopic compositions based on total procedural blanks analysed throughout the duration of this study.

[5] Total common Pb in analysis based on blank isotopic composition

[6] Radiogenic Pb

[7] Corrected for blank Pb, U and common Pb. Common Pb corrections based on Stacey Kramers model (Stacey and Kramers, 1975) at the age of the rock or the $^{207}Pb/^{206}Pb$ age of the fraction.

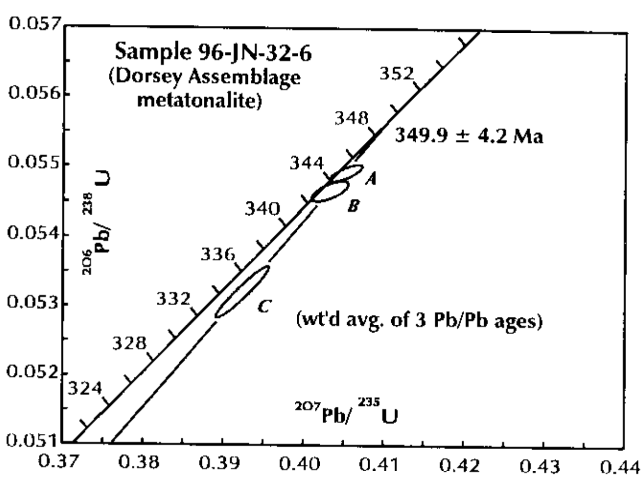


Figure 4. $^{206}Pb/^{238}U$ v. $^{207}Pb/^{235}U$ concordia diagram for sample 96-JN-32-6. Fractions as in Table 1.

Large, mountainside-scale recumbent folds occur within this unit, particularily in cliff exposures of the lower part, where compositional layering in amphibolite bodies outlines the noses of recumbent isoclines. Mesoscopic northeasterly-verging chevron folds with gently northwest-plunging axes also occur (Figure 5). On Figure 5, the axes of small-scale isoclinal, intrafolial folds and also mineral lineations form a diffuse girdle ranging from gently northwest-plunging to steeply southwest-plunging.

## "Phyllitic metasedimentary unit"

This structurally highest unit overlies the upper part of the "metasediment-amphibolite unit" across a covered contact. In the northern part of the mapped area, where the two units are seen in closest proximity, bedding attitudes above and below the contact show some angular discordance: possibly they lie in faulted contact. The base of the "phyllitic metasedimentary unit" there (subunit "3a" on Figure 3) consists of medium to thick bedded buff-coloured micaceous orthoquartzites with interbedded grey slate and silty slate, a section typical of Early Cambrian siliciclastics of the miogeocline. A

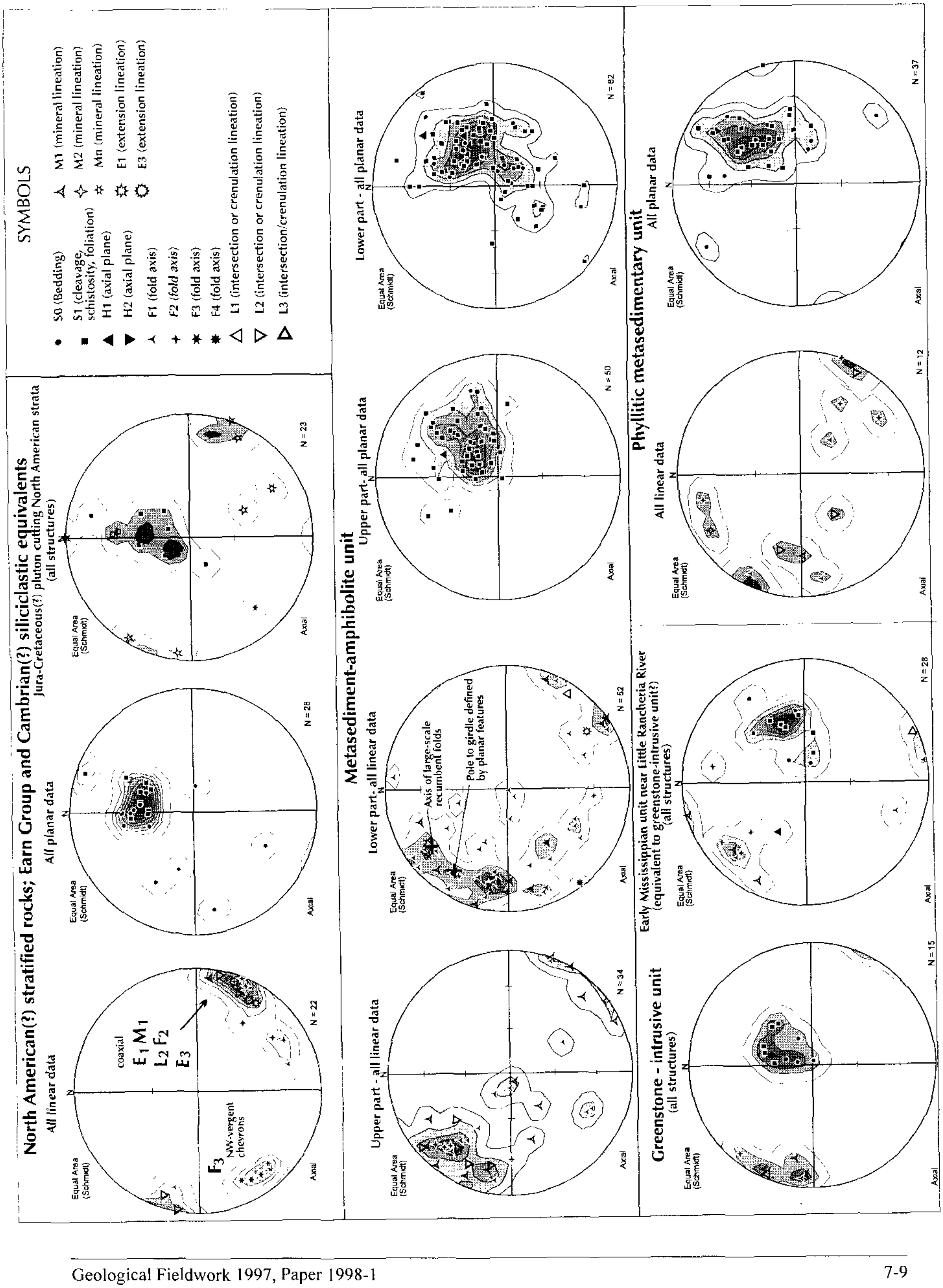


Figure 5. Structural data for the area shown on Figure 3.

minor but notable feature of this section is one dismembered bed, 0.5 to 1 metre thick, of coarse quartz-feldspar grit that forms slump blocks in impure carbonate. Towards the southwest in continuous ridge exposure, the quartzite-pelite section passes gradationally upward into finer metasedimentary strata including grey phyllite and chert (subunit "b" on Figure 3).

The main exposures of the "phyllitic metasedimentary unit" are southwest of Parallel Creek. There, the unit is dominated by grey, black and light green phyllitic argillite with subordinate buff, dark grey, or white quartz grit and sandstone, and thin-bedded pale green to grey chert. A few prominent bands of recrystallized limestone are present. In one continuous layer, meta-diorite grades into amphibolite and metatuff.

The "phyllitic metasedimentary unit" shows less development of metamorphic minerals and textures than the underlying "metasediment-amphibolite unit". Garnet is not seen, except in the lowermost exposures of unit 3a northeast of Parallel Creek. The structural style of this upper unit reflects deformation at a higher crustal level than the lower units. Outcrop-scale concentric folds with axial planar cleavage are common, and multiple tiny crenulations typify the phyllitic argillites.

## Structural style of the allochthonous units

Prevailing dips of bedding, compositional layering, cleavage and schistosity throughout the allochthonous units are moderately to the southwest (Figure 5). Ridge- and outcrop-scale isoclinal folds, common within the "metasediment-amphibolite unit", suggest that this uniformity results, at least in part, from isoclinal folding and accompanying axial planar fabric development. Axes of outcrop-scale isoclinal, intrafolial F1 folds and mineral elongation lineations throughout all of the allochthonous units have dominantly shallow west-northwest plunges but are variably dispersed about that trend within the plane of foliation (Figure 5). This pattern is consistent with the observed isoclinal folding. More open to chevron-type, in many cases northeasterly-verging minor folds refold the earlier cleavage and mineral lineations: they are designated F2. Their axes, which plunge gently to the northwest, do not coincide with the second-phase, northeasterly vergent minor folds in the North American sequence, which plunge gently to the southeast (Figure 5). On the other hand, the consistency of orientation of fabric elements throughout the allochthons in the study area suggests that all of them underwent a uniform oriention, if not degree, of deformation.

## Correlations and relationships between units

Each of the three units of the lower Dorsey Terrane described here differs from the others in lithologic makeup and metamorphic grade. One possible common element is the early Mississippian age of the tuff-limestone sequence near the Little Rancheria River and of the felsic pluton that cuts the "amphibolite-quartzite unit" west of the Cottonwood River. Perhaps the "metasediment-amphibolite unit" was originally basement to the "greenstone-intrusive unit", but now lies structurally above it. Another "common theme" between different thrust slices is the presence of metamorphosed tuffs, including quartz-sericite schists, in both the "greenstone-intrusive" unit and in the upper part of the "metasediment-amphibolite" unit. Planned U/Pb dating will hopefully clarify inter-allochthon relationships.

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

The "greenstone-intrusive unit", the lowest of the allochthons in central Jennings River area, occupies an equivalent structural position to the Ram Creek Assemblage, which lies immediately above the Earn Group along the Swift River in southern Yukon (Stevens and Harms, 1995; Harms and Stevens, 1996). They are lithologically similar as well: both are dominated by mafic to intermediate metatuffs and intrusive rocks. Quartz-sericite schist, exposed a few metres west of the Lucy prospect on the Swift River property of Birch Mountain Resources, may be a metamorphosed felsic tuff like those in the "greenstone-intrusive unit".

The "metasediment-amphibolite unit" resembles the Dorsey Assemblage in metamorphic grade. They share a lithologic suite of pelitic schist, quartzite and metaplutonic rocks, amphibolites and garnet amphibolite. The gross distribution of rock types in it, with mafic protoliths more abundant in its lower part, is a further point of similarity with the Dorsey Assemblage (Stevens and Harms, 1995). Stevens (1996) reports high temperatures and pressures for pre-Permian metamorphism of the Dorsey Assemblage in the southern Yukon. Garnet-bearing amphibolites texturally and mineralogically very similar to those in unit 2L occur within the "Anvil allochthon" of the St. Cyr klippe (Fallas, 1997) and within the Rapid River Tectonite in the Sylvester Allochthon (Figure 2; Nelson, 1997). Contact relationships both here and in the Rapid River Tectonite show clearly that the metabasites are interbedded with metamorphosed siliciclastic rocks and very aluminous, mica-rich pelites as well as argillite, chert and limestone. This overall protolith differs very markedly from the Slide Mountain Terrane in its classic exposures. The oldest rocks known in the Slide Mountain Terrane are latest Devonian-Early Mississippian basalts interbedded with cherts and argillites, and the bulk of the microfossil ages in the terrane are Early Mississippian to Late Triassic (Nelson and Bradford, 1993). The "metasediment-amphibolite unit" is intruded by an Early Mississippian pluton: thus it is reasonably Devonian or older, and predates the Slide Mountain Terrane. Its age and tectonic setting are problematic. The timing of the metamorphic event that this sequence experienced is also so far unknown. Is it indeed correlative with pre-mid Permian metamorphism and major deformation in the Dorsey Assemblage, or is it younger, for instance, Jurassic? Future work will address these questions.

The "phyllitic metasedimentary unit" west of Parallel Creek, correlates in lithologies and style and degree of deformation and metamorphism with the Swift River Assemblage as defined by Harms and Stevens (1996).

## Mineral potential

Quartz-sericite schists, considered 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 3; Nelson, 1997) and a new discovery 2 kilometres northwest of the lake that forms the headwaters of the Cottonwood River (R2, Figure 3). Quartz-sericite schists also occur at scattered localities in the upper part of the "metasediment-amphibolite unit". The most extensive exposure in this unit consists of a set of small outcrops and subcrops spread over a 400 by 150 metre area on a hillside 5 kilometres northeast of Parallel Creek (R3 on Figure 3). The exposures consist of white, rusty-weathering finely laminated siliceous exhalite(?) with pyrite stringers. So far the age of the presumed felsic metatuffs is constrained by a single early Mississippian conodont collection near R1 (Nelson 1997). Those in the "metasediment-amphibolite unit" are not dated, and their relationship to those in the "greenstone-intrusive" allochthon is not known.


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