Bedrock geology of western 'Mendocina Creek' (NTS 105F/5) and eastern Livingstone Creek (NTS 105E/8) areas, south-central Yukon

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ABSTRACT

Metasedimentary and meta-igneous rocks in 'Mendocina Creek' (NTS 105F/5) and eastern Livingstone Creek (NTS 105E/8) areas are part of three distinct stratigraphic sequences: from east to west, the Sheep Creek, Scurvy Creek and Dycer Creek successions. The Sheep Creek succession contains extensive carbonate horizons and is likely part of the Cassiar terrane. To the west, metaclastic rocks of the Scurvy Creek succession are extensively intruded by sills and dykes composed of augen meta-granite of Early Mississippian age; they are correlated with the Snowcap assemblage of Yukon-Tanana terrane. The overlying Dycer Creek succession in the southwest comprises marble, carbonaceous rocks, greenstone and quartzite of Lower Mississippian (and younger?) age that probably correlate with the Finlayson assemblage of Yukon-Tanana terrane. The 'Mendocina Creek' area experienced at least four phases of deformation and greenschist- to amphibolite-facies metamorphism. An east-verging thrust locally imbricates the Scurvy Creek succession and the boundary between the Yukon-Tanana and Cassiar terranes corresponds with a west-verging, brittle-ductile thrust fault in the eastern part of the area. Re-interpretation of the geology in western Quiet Lake map-area indicates that this boundary is located 20 km east of the d'Abbadie fault, the previously inferred terrane boundary.

RÉSUMÉ

Les roches métasédimentaires et méta-ignées des régions cartographiques de 'Mendocina Creek' et Livingstone Creek forment trois séquences stratigraphiques distinctes: d'est en ouest, les successions de Sheep Creek, Scurvy Creek et Dycer Creek. La succession de Sheep Creek comprend d'importants horizons de carbonate et forme probablement une partie du terrane de Cassiar. A l'ouest, les roches métaclastiques de la succession de Scurvy Creek sont recoupées par de nombreux dikes et sills de méta-granite "oeillé" d'âge Mississippien précoce; ces roches sont corrélées avec l'assemblage de Snowcap du terrane de Yukon-Tanana. La succession susjacente de Dycer Creek, dans le sud-ouest, se compose de marbre, de roches carbonées, de roches vertes et de quartzite d'âge Mississippien inférieur (ou plus jeune?) qui correspondent probablement à l'assemblage de Finlayson du terrane de Yukon-Tanana. La région de 'Mendocina Creek' fût affectée par au moins quatre phases de déformation et un métamorphisme des faciès des schistes verts et des amphibolites. Un chevauchement vers l'est répète localemment la succession de Scurvy Creek, et la limite entre les terranes de Yukon-Tanana et de Cassiar correspond à un chevauchement vers l'ouest dans la partie est de notre étude. Cette nouvelle interprétation de la géologie de la partie ouest de la région de Quiet Lake suggère que la limite entre les terranes de Yukon-Tanana et de Cassiar se situe environ 20 kilomètres plus à l'est de la faille de d'Abbadie, qui fût préalablement interprétée comme la limite entre ces terranes.

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INTRODUCTION

Bedrock mapping of a 625 km^2 area straddling the 'Mendocina Creek' (NTS 105F/5) and Livingstone Creek (NTS 105E/8) 1:50 000-scale map sheets in south-central Yukon was completed during the 2008 summer field season. The area is located approximately 80 km northeast of Whitehorse and 25 km east of the Livingstone town site (Fig. 1). The map area straddles the boundary between the Quiet Lake (NTS 105F) and Laberge (NTS 105E) 1:250 000-scale quadrangles. It is primarily underlain by Paleozoic (and possibly older) polydeformed, amphibolite-facies metasedimentary, meta-plutonic and metavolcanic rocks that are intruded by post-tectonic Cretaceous plutons (Fig. 2). Previous knowledge of the bedrock geology of the 'Mendocina Creek' area was based on reconnaissance mapping from the 1970s at a 1:250 000 scale (Tempelman-Kluit, 1977a). At the time, most of the rocks in the 'Mendocina Creek' area were assigned to the Pelly-Cassiar platform (Cassiar terrane) and included minor occurrences of the Yukon Cataclastic Complex (Nisutlin assemblage[1]) which was interpreted to occupy a klippe in the southern part of the area. The boundary between the Yukon Cataclastic Complex and Cassiar terrane was considered to be the d'Abbadie fault, the western limit of the present study area. Tempelman-Kluit (1979) interpreted the Yukon Cataclastic Complex west of the d'Abbadie fault as a subduction complex (his Teslin Suture zone[1]) that formed during the Jurassic accretion of Stikinia to the western margin of North America.

The rocks that were included within the Yukon Cataclastic Complex are now assigned to the Yukon-Tanana terrane, a pericratonic terrane that occurs mainly within the central portion of the northern Canadian Cordillera (Colpron *et al.*, 2006, 2007). Detailed studies of the terrane have progressively established a coherent regional stratigraphic framework that records the evolution of a system of rifted continental fragments, island arcs and back-arc basins that evolved off the western Laurentian margin between mid-Paleozoic and early Mesozoic time (Mortensen, 1992; Colpron *et al.*, 2006, 2007; Nelson *et al.*, 2006). The Yukon-Tanana terrane consists of a pre-Upper Devonian metasedimentary basement complex (Snowcap assemblage) overlain by up to three unconformity-bounded Upper Devonian to Permian volcanic arc sequences (Finlayson, Klinkit and Klondike assemblages; Colpron *et al.*, 2006). These rocks are coeval with oceanic chert, argillite and basalt of the Slide Mountain terrane, an upper Paleozoic back-arc ocean that separated the Yukon-Tanana arcs from the western Laurentian margin (Nelson *et al.*, 2006; Colpron *et al.*, 2007).

The boundary between the Yukon-Tanana and Cassiar terranes remains cryptic in the western Quiet Lake and eastern Laberge map areas (*cf.* Colpron, 2006a; Colpron *et al.*, 2006, p. 9). Recent studies in the eastern Laberge map area demonstrated that the 'Teslin Suture zone' represents a zone of complex, superposed deformation of late Paleozoic to Cretaceous age, bounded by the Big Salmon and d'Abbadie faults, and is therefore not the product of deformation in a

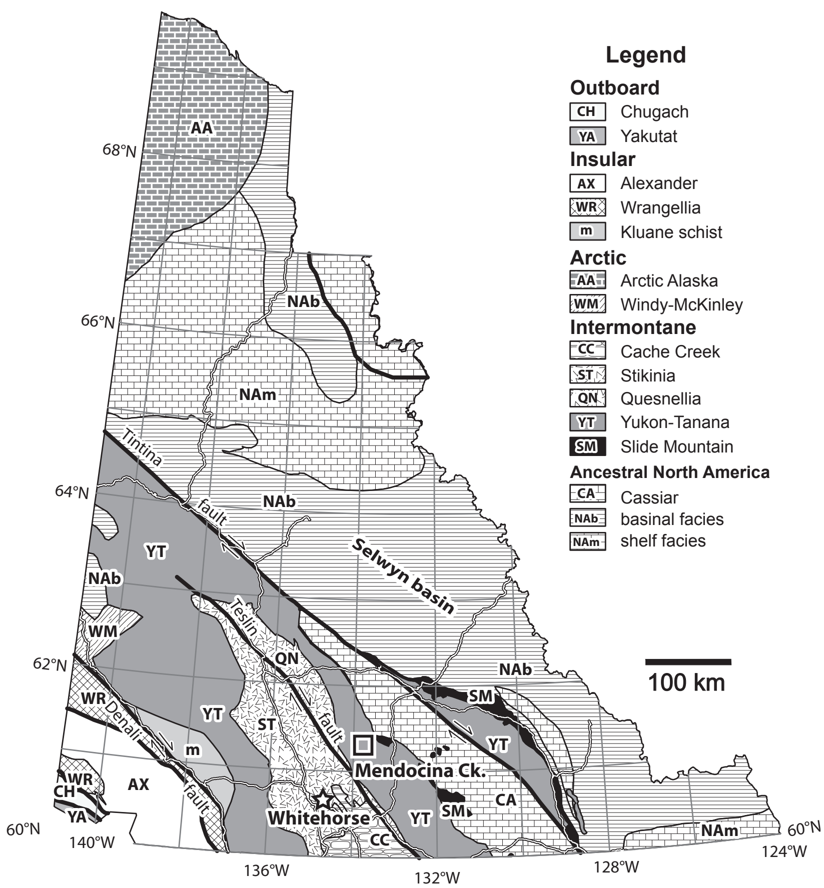

Figure 1. Terrane map of Yukon illustrating the location of the 'Mendocina Creek' area in south-central Yukon.

[1]*Note that use of the terms Yukon Cataclastic Complex, Nisutlin assemblage, and Teslin Suture zone are obsolete (see Colpron et al., 2006, p. 14).*

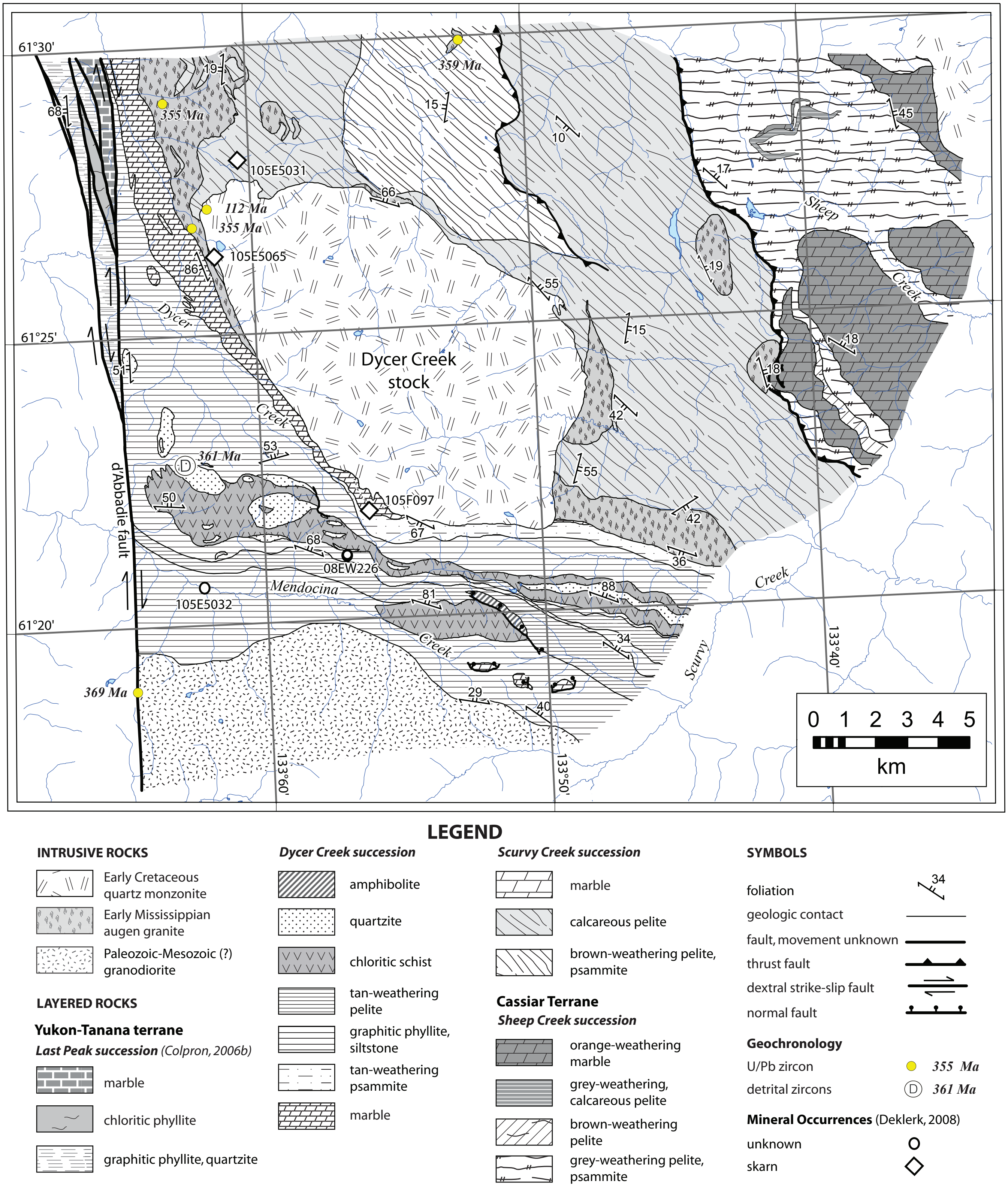

Figure 2. *Simplified bedrock geology of the 'Mendocina Creek' (NTS 105F/5) and eastern Livingstone Creek (NTS 105E/8) areas. Geology near the d'Abbadie fault modified from Colpron (2005b). U-Pb zircon dates in eastern part of the area are from Hansen et al. (1989) and Gallagher (1999); location of our preliminary U-Pb zircon date of ca. 359 Ma (B. Kamber, pers. comm., 2008) is shown along northern edge of the study area.*

subduction zone environment (de Keijzer *et al.*, 1999). More recent mapping in the Livingstone Creek area has suggested that rocks of the Yukon-Tanana terrane probably extend to the east of the d'Abbadie fault zone into the 'Mendocina Creek' area, and consequently the d'Abbadie fault does not mark the boundary between Yukon-Tanana and Cassiar terranes (Colpron, 2005a, b; 2006b). Our mapping in the 'Mendocina Creek' area supports this interpretation and proposes a revised location for this terrane boundary, approximately 20 km to the east of the d'Abbadie fault zone.

Regional studies indicate that the Yukon-Tanana terrane was subjected to four, and locally five, episodes of deformation and associated metamorphic events (Colpron *et al.*, 2006; Berman *et al.*, 2007). These events range in age from Late Devonian to Cretaceous, and detailed thermobarometric studies in western Yukon suggest that the terrane experienced at least two significant crustal thickening events (Berman *et al.*, 2007). However, the regional extent of these various deformation and metamorphic events in the Yukon-Tanana terrane remains unclear. In western Quiet Lake area, occurrences of amphibolite-facies metamorphic rocks and locally abundant Cretaceous intrusions, although well known, have yet to be properly documented. De Keijzer (2000) speculated that a late, regional metasomatic event overprints amphibolite-facies metamorphic assemblages and was probably related to regional Cretaceous extension. Proper documentation of metamorphic and structural relationships supporting this interpretation is still lacking.

The present study was initiated to address the lack of knowledge regarding the stratigraphy, structure and metamorphic evolution of the western Quiet Lake map-area, and to further constrain the nature and location of the boundary between Yukon-Tanana and Cassiar terranes in the area. The study area was mapped at a 1:20 000 scale during the summers of 2007 and 2008 and a suite of rock samples was collected for future microstructural, metamorphic, geochemical and geochronological analyses. A 1:50 000-scale geological map of the area is in preparation (a simplified version of this map is presented in Fig. 2). Herein we summarize some of the geological relationships represented on this map of the 'Mendocina Creek' area. Our study builds upon previous observations made by Colpron (2005a,b; 2006b) to the west in the Livingstone Creek area.

STRATIGRAPHY

Metasedimentary and related metavolcanic rocks in the 'Mendocina Creek' area are divided into three successions: the Sheep Creek, Scurvy Creek and Dycer Creek successions.

SHEEP CREEK SUCCESSION

Metasedimentary rocks of the Sheep Creek succession occupy the northeastern portion of the map area (Fig. 2) and comprise intercalated light grey and orange-buff-weathering dolomitic marble (Fig. 3); silvery-grey-weathering, variably siliceous, biotite-quartz-muscovite phyllite/schist; and tan-weathering, calcareous, quartz-

Figure 3. *Looking northeast at interfingered grey and orange-buff-weathering marble, Sheep Creek succession.*

Figure 4. ***(a)*** *Quartz-muscovite schist of the Sheep Creek succession cut by sheared quartz vein. View is to the southeast. Slickenlines on the shear plane are oriented with a trend of N120° and plunge 20° to the southeast;* ***(b)*** *garnet-quartz-plagioclase-biotite-muscovite schist, Scurvy Creek succession.*

muscovite ± garnet schist (Fig. 4a). Millimetre-wide partings in the quartz-muscovite schist and centimetre to decimetre-wide laminations in the biotite-quartz-muscovite schist parallel the dominant foliation. Aligned biotite books form a faint mineral lineation on the foliation plane, suggesting a component of syn-tectonic growth. A medium green, locally dolomitic, chloritic schist and fine-grained, tan-weathering, variably micaceous quartzite are locally contained within the Sheep Creek succession.

SCURVY CREEK SUCCESSION

Metasedimentary and meta-igneous rocks of the Scurvy Creek succession occupy the north-central portion of the map area and are divided into two units (Fig. 2). The lower unit of the Scurvy Creek succession is exposed at the favour of a west-dipping thrust panel north of the Dycer Creek stock (Fig. 2). It consists of decimetre to metre-wide intercalations of grey and brown-weathering, medium to coarse-grained quartz-plagioclase-biotite-muscovite schist (psammite); biotite-muscovite-plagioclase-quartz schist; micaceous quartzite; quartzite; and calc-silicate schist. The quartzite and psammite weather in blocky, decimetre-wide layers while the pelitic schist parts along millimetre to centimetre-wide planes. Retrograded garnet (replaced by new quartz grains and plagioclase) is variably present in both, and varies in size from 1 mm to 3-4 cm in diameter (Fig. 4b). At one location, a zebra-striped, garnet-diopside calc-silicate forms a marker horizon within the psammitic schist. Notably, marble is absent from this unit.

The upper unit of the Scurvy Creek succession comprises rusty-brown-weathering, garnet-quartz-plagioclase-biotite-muscovite schist (Fig. 4b) intercalated with decimetre to 20 m-scale horizons of coarse-grained, grey and brown-weathering marble. Locally, decimetre-long marble lenses occur within the pelitic schist, suggesting a gradational intercalation of these lithologies. Garnet-diopside-epidote skarn occurs locally within marble horizons in close proximity to the Cretaceous Dycer Creek stock. Occasionally, a medium to fine-grained, white and grey-banded quartzite is structurally above the marble and forms a prominent 1 to 5 m-wide marker bed. Radiating crystals of tremolite are randomly oriented along the foliation near the contact between the marble and banded quartzite. Coarse-grained amphibolite occurs throughout the Scurvy Creek succession. When not concealed by the Dycer Creek stock, the top of the Scurvy Creek succession is defined by a large sheet(?) of augen granite (see descriptions of 'Intrusive Rocks' on the following page).

DYCER CREEK SUCCESSION

The base of the Dycer Creek succession is defined by an ~1 km-thick, southeast-striking, light grey to white, medium to coarse-grained marble unit (Fig. 5). Garnet-diopside-epidote skarn is locally developed in the marble. In the south, the marble interfingers with, and grades into, a biotite-quartz-muscovite schist. The marble is structurally overlain by fine to medium-grained, black graphitic schist (Fig. 6a) and quartzite; medium to light grey, carbonaceous, quartz-muscovite schist; and fine-grained,

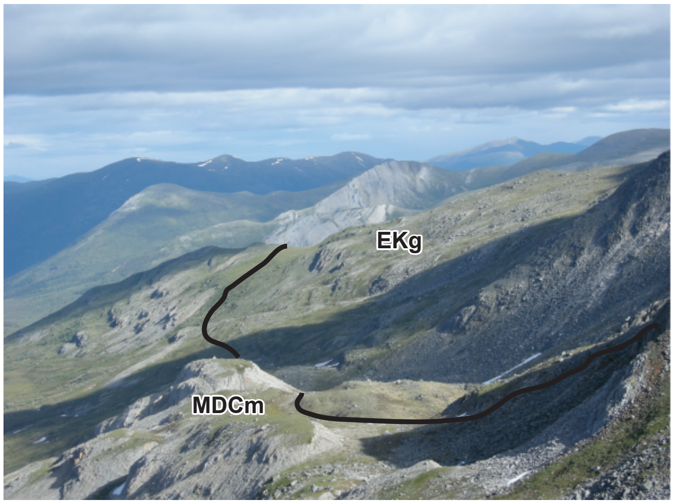

***Figure 5.** Looking north towards marble (MDCm) of the Dycer Creek succession intruded by quartz monzonite of the Dycer Creek stock (EKg).*

black, calcareous metasiltstone and marble. A grey and buff-weathering, variably calcareous, quartz-biotite-muscovite ± garnet schist locally interfingers with centimetre to decimetre-wide horizons of graphitic phyllite, suggesting a gradational contact between these lithologies. In the southeastern part of the study area, decimetre-wide lenses of medium-grained, brown-buff-weathering dolomitic marble occur in the graphitic schist. A fine-grained, light to dark green, locally dolomitic, chloritic schist (greenstone) structurally overlies the graphitic unit. Large (0.5 cm) biotite booklets and hornblende crystals are randomly oriented along the dominant foliation in the greenstone; their growth is interpreted to be related to contact metamorphism around the Cretaceous Dycer Creek stock. The chloritic schist is gradationally intercalated with white to light green, fine to medium-grained quartzite and micaceous quartzite (Fig. 6b).

LAST PEAK SUCCESSION

In the Mendocina Creek area, metasedimentary and metavolcanic rocks of the Last Peak succession lie in the northwestern portion of the map area and are entirely contained within the 1 km-wide d'Abbadie fault zone (Fig. 2). Rocks belonging to the Last Peak succession comprise buff-weathering, dolomitic marble, chloritic phyllite, variably siliceous graphitic phyllite and quartzite (Colpron, 2005b). Colpron (2006b) suggested that rocks of the Last Peak and Dycer Creek successions were probably correlatives seperated by the d'Abbadie fault.

INTRUSIVE ROCKS

The 'Mendocina Creek' area contains three distinct plutonic suites. The oldest suite is composed of moderately to strongly foliated, K-feldspar augen, two-mica granite. This meta-granite occurs as sheets that are concordant with the dominant foliation and intercalated with metasedimentary rocks of the Scurvy Creek succession. Prior to this study, augen granite had only been reported from the northwestern part of the 'Mendocina Creek' area, between Dycer Creek stock and d'Abbadie fault (Gallagher, 1999; Hansen *et al.*, 1989). This suite of meta-granite occurs throughout the Scurvy Creek succession (Fig. 2). It forms a large, continuous sheet that is only disrupted by intrusion of the Cretaceous

***Figure 6.** Photos of **(a)** folded, calcareous, graphitic schist, Dycer Creek succession; and **(b)** gradational boundary between the chloritic schist (MDCv) and white quartzite (MDCq) of the Dycer Creek succession.*

Dycer Creek stock, at the top of the Scurvy Creek succession. The nature of the contact between the augen granite and the Dycer Creek succession is not yet fully resolved; this contact could represent an unconformity or alternatively a fault. Augen granite is not observed in either the Sheep Creek or Dycer Creek successions (Fig. 2). An Early Mississippian age is assigned to this older meta-plutonic suite based on two U-Pb zircon dates from the northwestern part of the area (*ca.* 355; Hansen *et al.,* 1989; Gallagher, 1999); preliminary results from one of our samples collected in the north-central part of the study area confirm this age (*ca.* 359 Ma; B. Kamber, pers. comm., 2008). This intrusive suite corresponds in age and composition with the Grass Lakes plutonic suite, part of the first cycle of widespread arc magmatism in the Yukon-Tanana terrane (Finlayson cycle; Piercey *et al.*, 2006).

The age of the large body of granodiorite south of Mendocina Creek is uncertain. Near its northern contact with the Dycer Creek succession, the granodiorite is strongly foliated parallel to the regional transposition foliation. Further south into the pluton, the granodiorite is only weakly foliated. This variably foliated granodiorite has generally been considered to be of Paleozoic age on the basis of the localized high strain in the granodiorite and due to a poorly resolved, discordant U-Pb zircon age (Tempelman-Kluit, 1984; Hansen *et al.*, 1989; Fig. 2). Along its western edge, the granodiorite body is strongly altered and truncated by the vertical d’Abbadie fault zone (Colpron, 2005a,b). Colpron (2005a) raised the question whether this large intrusion could be a northern extension of the Quiet Lake batholith. Although it is locally highly strained, the granodiorite has a similar composition to the Early Cretaceous Quiet Lake batholith to the south, which is locally foliated (Tempelman-Kluit, 1977a), and for which preliminary geochronological analyses indicate a complex zoning pattern of zircons with Proterozoic, Paleozoic and Cretaceous age domains (C.J.R. Hart, pers. comm., 2004). Further field and geochronological studies of this granodiorite body are required to precisely determine its age and ascertain its possible relationship to the adjacent Quiet Lake batholith.

The youngest plutonic suite in the area comprises the Dycer Creek stock and an unnamed pluton at the northeastern edge of our study area (Fig. 2). The Dycer Creek stock is a medium to coarse-grained, biotite-quartz monzonite that has been dated by U-Pb zircon at 112 ± 1 Ma (Gallagher, 1999). The quartz monzonite is locally foliated and contains a moderately developed mineral lineation along its outer margin. Euhedral, millimetre-wide garnets are variably present within the stock, suggesting a component of crustal melt in the genesis of this pluton.

Two small, 1 to 10 m–wide, unfoliated, coarse-grained mafic pods intrude calcareous pelites of the upper unit of the Scurvy Creek succession. These pods intruded post-D_3 and may be related to Cretaceous magmatism. In one locality, a coarse-grained, unfoliated, talc-carbonate rock intrudes near the eastern contact of the lower and upper units of the Scurvy Creek succession (see section on ‘Structure’ below).

STRUCTURE

The ‘Mendocina Creek’ area has undergone at least four phases of deformation. The first observable phase of deformation is a cryptic transposition foliation locally preserved within competent, quartz-rich metasedimentary rocks (Fig. 7a). A second phase of deformation refolds the earlier fabric into rootless, intrafolial, tight to isoclinal folds whose axial planes define the regional transposition foliation. In the northern portion of the map area, the folds are overturned to recumbent, and the second phase axial planes strike south-southeast and dip shallowly to the southwest (Fig. 7b). In the south, these folds plunge gently to the northwest and the transposition foliation defines a structural fan that varies from moderate to steep southwest dips in the north to moderate northeast dips in the south (Fig. 2). A third phase of deformation refolds the stratigraphy and the transposition foliation into broad, upright, northwest-verging open folds (Fig. 7c). Southwest-verging thrust faults (Fig. 7d) and fault propagation folds are associated with this phase of deformation, locally, a crenulation cleavage and mineral lineation developed as a result of open folding. Brittle deformation related to a later period of extension resulted in normal faulting and is expressed on the map by abrupt unit truncations (Figs. 2, 7e,f). Throughout the study area, extension gashes, pull-apart features and boudinage occur at the macroscopic and microscopic scale and suggest extension towards the north-northeast.

In the north-central part of our study area, the lower Scurvy Creek succession defines a west-dipping panel that is interpreted to be thrust over the upper unit of the Scurvy Creek succession along an east-verging thrust fault (Fig. 2). A relative increase in strain, the occurrence of talc-carbonate in the lower unit near its eastern contact, and the sharp transition into the structurally underlying, carbonate-rich upper unit to the east support this interpretation.

Figure 7. (a) *Relic foliation preserved in microlithons between crenulation cleavage planes of the dominant foliation in white quartzite, Dycer Creek succession (pencil end on the left for scale);* ***(b)*** *isoclinal folds (F_t) in marble (PScm) and pelitic schist (PScs), Scurvy Creek succession;* ***(c)*** *re-folded isoclinal fold (F_t) in grey phyllite, Sheep Creek succession;* ***(d)*** *looking west towards a southwest-verging thrust fault in a calcareous pelite, Scurvy Creek succession;* ***(e)*** *looking northeast at a down-dropped fault block in intercalated marble and calcareous pelite, upper unit of the Scurvy Creek succession;* ***(f)*** *looking southeast at normal faulting within marble of the Dycer Creek succession.*

Figure 8. *C-S fabric illustrating top-to-the-west kinematics in the hangingwall of a west-verging thrust fault in marble, Sheep Creek succession.*

In the eastern part of the study area, the Sheep Creek succession structurally overlies the Scurvy Creek succession along a west-verging thrust fault (Fig. 2). Evidence for thrust faulting along this contact includes shallow, northeast-plunging stretching lineations and C-S fabrics (Fig. 8) suggesting transport towards the west-southwest. Locally, the Sheep Creek succession contains small, southwest-verging, 1 to 10 m-scale thrust faults that are interpreted to explain abrupt lithological changes along strike in localities where there is a paucity of kinematic information. Late, brittle structures, such as development of cataclastic rocks (Fig. 9a) and foliated quartz veins that crosscut the regional transposition foliation and contain slickenlines plunging gently towards the southeast (Fig. 4a), are only developed in rocks of the Sheep Creek succession in the hangingwall of this thrust fault.

The 'Mendocina Creek' area is bounded on the west by the north-trending d'Abbadie fault zone, a Late Cretaceous system of brittle-ductile, dextral strike-slip faults that cut across the dominant foliation and regional structural trends (Gallagher, 1999; Colpron, 2005b). The d'Abbadie fault zone is characterized by multiple generations of ductile fabrics associated with dextral shear

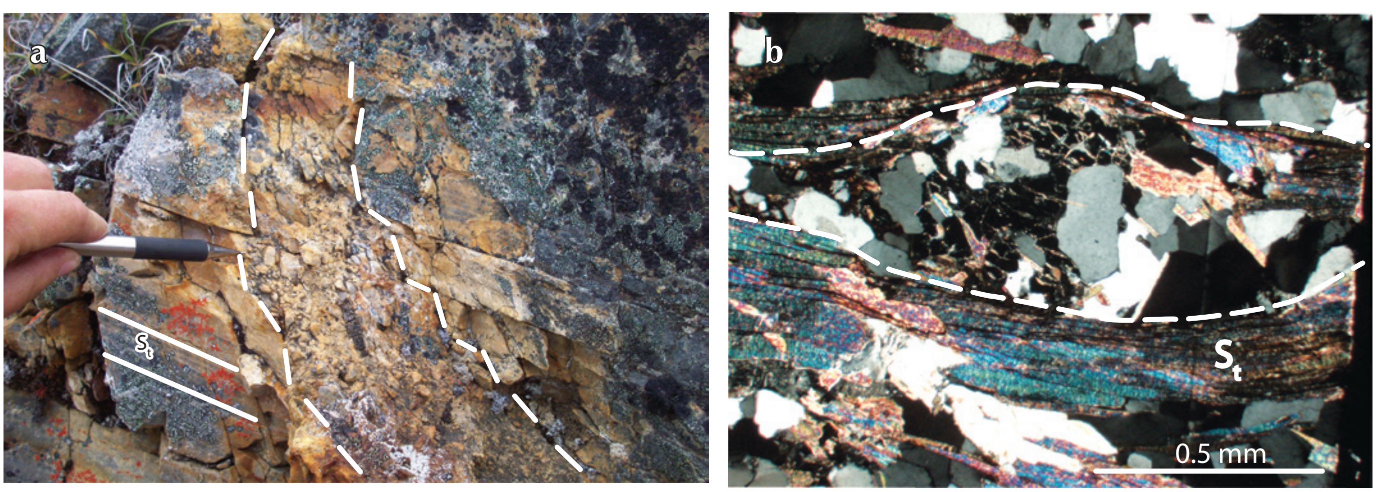

Figure 9. (a) *Cataclastic rock within white and black banded quartzite, Sheep Creek succession. Dashed lines represent the limit of the cataclastic zone, the transposition fabric is represented by S_t;* ***(b)*** *photomicrograph of a recrystallized, sigmoidal garnet porphyroblast within a quartz-biotite-muscovite-garnet schist, Scurvy Creek succession. S_t defines the regional transposition foliation, and recrystallized tails suggest syn-S_t garnet growth.*

that are overprinted by younger brittle structures associated with shallow, north-plunging lineations and stepped fibers; these features also support dextral movement (Colpron, 2005b). Part of the ductile strain recorded along the d'Abbadie fault zone has been dated at *ca.* 96 Ma based on a U-Pb zircon age of a syntectonic granite emplaced along the fault (Gallagher, 1999).

METAMORPHISM

Rocks of the 'Mendocina Creek' area are characterized by upper greenschist to amphibolite facies metamorphism. In the north, metasedimentary and meta-igneous rocks are generally coarse-grained and have garnet-grade assemblages. Pelites and psammites typically contain biotite, garnet and locally andalusite, whereas calc-silicates contain garnet-diopside-epidote assemblages, and metabasites contain hornblende-biotite-epidote assemblages and locally garnet. Garnet porphyroblasts developed prior to, or during, development of the regional transposition foliation (Fig. 9b). In the south, metasedimentary and metavolcanic rocks are generally finer grained and have biotite-grade assemblages consisting of chlorite and biotite. Garnet is locally found in pelites that are in close proximity to the southern granodiorite. Calc-silicates in the south contain garnet, epidote and rarely diopside.

MINERAL POTENTIAL

Mineralization within the 'Mendocina Creek' area is limited and generally occurs within skarn that developed near the Cretaceous Dycer Creek stock. Tungsten mineralization occurs along the southern margin of the Dycer Creek stock (Yukon MINFILE 105F097) and a small skarn occurrence was reported along the eastern margin of the stock by Colpron (2006b; Yukon MINFILE 105E065). A new showing of malachite was discovered during regional mapping in 2008 (UTM Zone 8, 556040E, 6802342N). Malachite is randomly distributed in a 1 m-wide quartz vein that crosscuts the graphitic schist of the Dycer Creek succession. Assay results from one sample yielded 5737.9 ppm in copper. This mineralization is probably related to circulating hydrothermal fluids from a nearby granite.

Regionally, small amounts of disseminated pyrite and pyrrhotite are locally contained within the graphitic phyllite of the Dycer Creek succession. Correlation of these carbonaceous rocks and their associated metavolcanic rocks with the Yukon-Tanana terrane (see below) suggests that these rocks may be prospective for syngenetic SEDEX or VMS-style sulphide mineralization.

DISCUSSION

Detailed mapping of the 'Mendocina Creek' area indicates that the region is underlain by three distinct stratigraphic sequences. The centre region of the study area is underlain by the Scurvy Creek succession, a sequence of predominantly metaclastic rocks containing amphibolite and minor marble that is intruded by numerous bodies of Early Mississippian granitoids. These combined characteristics resemble those of the Snowcap assemblage, the oldest unit in the Yukon-Tanana terrane (Colpron *et al.*, 2006). Occurrences of abundant Early Mississippian granitoids intruding siliciclastic rocks are more characteristic of the Yukon-Tanana terrane in the northern Cordillera than of the nearby Cassiar terrane. Cassiar terrane and correlative rocks of Selwyn basin northeast of the Tintina fault (Fig. 1) contain only local occurrences of Paleozoic magmatism, most of which is Late Devonian in age, which is somewhat older than granitoids in the 'Mendocina Creek' area. For these reasons, we propose that the Scurvy Creek succession correlates with the Snowcap assemblage and therefore represents part of the Yukon-Tanana terrane. However, it should be noted that Late Devonian to Early Mississippian granitoids (>356 Ma) are widespread in the western Kootenay terrane of southeastern British Columbia, a distal portion of the Laurentian continental margin (*cf.,* Paradis *et al.*, 2006 and references therein), and therefore their occurrence in the Scurvy Creek succession is not in itself uniquely diagnostic of the Yukon-Tanana terrane.

The Scurvy Creek succession is overlain to the southwest by marble, graphitic phyllite, greenstone and quartzite of the Dycer Creek succession (Fig. 2). Colpron (2006b) assigned these rocks to the Yukon-Tanana terrane based on the occurrence of Late Devonian detrital zircons in quartzite in the upper part of the Dycer Creek succession. The predominance of fine-grained carbonaceous rocks in the Dycer Creek succession suggests a possible correlation with the Finlayson assemblage of the Yukon-Tanana terrane (Colpron, 2006a; Colpron *et al.*, 2006). Colpron *et al.* (*ibid*) suggested that carbonaceous rocks in western Quiet Lake map area may represent a southern extension of the back-arc environment documented in the Finlayson assemblage northeast of Tintina fault (Murphy *et al.*, 2006; Piercey *et al.*, 2006). Quartzite and greenstone in the upper part of the Dycer Creek succession may alternatively correlate with the Klinkit assemblage of Yukon-Tanana terrane (*e.g.* Colpron, 2006a), an interpretation that would imply the presence of an unconformity within this succession (see Colpron *et al.*, 2006 for discussion of the sub-Klinkit unconformity). It should be noted that metaclastic rocks north of the Dycer Creek stock were formerly considered to be part of the Dycer Creek succession (Gallagher, 1999; Colpron, 2006b); they are herein reassigned to the upper part of the Scurvy Creek succession. The contact between the Scurvy Creek and Dycer Creek successions is marked by a large (<1 km-thick) sheet of augen granite (where not concealed by the Cretaceous Dycer Creek stock; Fig. 2). The nature of this contact remains enigmatic — it may be either an unconformity or a fault. The absence of Paleozoic intrusions in the Dycer Creek succession is notable, with the possible exception of the large granodiorite pluton at the south end of our study area. Both its age and contact relationship with the Dycer Creek succession remain uncertain.

In the eastern part of the 'Mendocina Creek' area, the Sheep Creek succession is in contrast with both the Scurvy Creek and Dycer Creek successions. It is composed predominantly of massive horizons of dolomitic marble and variably siliceous metaclastic rocks with rare, thin, decimetre-thick horizons of chloritic schist. Notably, the Sheep Creek succession does not contain amphibolite or metaplutonic rocks, which are defining characteristics of the Scurvy Creek succession to the west. The occurrence of thick marble units and the absence of metaplutonic rocks suggest that the Sheep Creek succession may correlate with the Cassiar terrane of eastern Quiet Lake map area, where it is predominantly composed of Cambrian-Mississippian platformal carbonate and coeval metasedimentary rocks (Tempelman-Kluit, 1977a,b). The boundary between the Sheep Creek and Scurvy Creek successions is interpreted to be a west-verging thrust fault, thus this fault places the parautochthonous Cassiar terrane on top of the allochthonous Yukon-Tanana terrane.

The boundary between Yukon-Tanana and Cassiar terranes is typically delineated by the presence of fault-imbricated, basalt, chert and argillite of the Slide Mountain terrane (*e.g.* Colpron *et al.*, 2005). Rocks of the combined Yukon-Tanana and Slide Mountain terranes are generally interpreted to have been emplaced on top of distal North America (Cassiar terrane, Selwyn basin) along east-verging thrust faults (*e.g.* the Inconnu thrust northeast of Tintina fault; Murphy *et al.*, 2006; Devine *et al.*, 2006; Tempelman-Kluit, 1979; Nelson and Friedman, 2004; Colpron *et al.*, 2005). Our interpretation of a west-verging structure along the terrane boundary in western Quiet Lake map area represents a departure from this regional pattern. It is however in agreement with the series of imbricated, west-verging thrust panels marked by carbonate rocks of Cassiar terrane to the east of 'Mendocina Creek' area (Tempelman-Kluit, 1977a).

In the southeastern Canadian Cordillera, allochthonous terranes were first emplaced over distal North America along east-verging structures in Early Jurassic time (Murphy *et al.*, 1995). They were subsequently deformed in west-verging structures during development of a regional fan structure of Middle Jurassic age (Colpron *et al.*, 1998; Gibson *et al.*, 2008), a structural style that presumably extended the length of the Canadian Cordillera (Price, 1986). West-verging structures in western Quiet Lake map area may be part of this Middle Jurassic regional structural style. The development of west-verging thrust faults has likely modified the original terrane boundary and may explain the apparent absence of the Slide Mountain terrane in the area (*cf.* Colpron, 2006a). Further studies of west-verging structures in western Quiet Lake map area are required in order to fully resolve the regional extent and significance of these structures.

Mapping of the 'Mendocina Creek' area and the correlations discussed above suggest that the Yukon-Tanana terrane is much more extensive in western Quiet Lake map area than previously interpreted by Tempelman-Kluit (1977a, 1979). Tempelman-Kluit (1977a) identified only limited occurrences of the Nisutlin assemblage (*i.e.* Yukon-Tanana terrane) in a klippe structurally overlying the Cassiar terrane immediately north of Mendocina Creek. These rocks — the quartzite and greenstone units in the upper part of the Dycer Creek succession on our map (Fig. 2) — represent only a portion of the rocks we now assign to the Yukon-Tanana terrane. In our interpretation of the geology (Fig. 2), the boundary between the Yukon-Tanana and Cassiar terranes is located approximately 20 km to the east of the previously inferred boundary, the d'Abbadie fault.

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