Bedrock geology of southwest McQuesten (NTS 115P) and part of northern Carmacks (NTS 115I) map area

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ABSTRACT

The Southwest McQuesten-northern Carmacks area is primarily underlain by rocks of the Yukon-Tanana terrane which is divided into two distinct belts separated by the Willow Creek fault: 1) a central belt of polydeformed, upper greenschist-amphibolite facies metasedimentary and metaplutonic rocks of Permian and older ages; and 2) a northeastern belt of generally undeformed and unmetamorphosed volcano-plutonic rocks of the Early Mississippian Reid Lakes complex. The southern part of the area is underlain mainly by rocks of Quesnellia and Stikinia, including: 1) Paleozoic retrogressed metamorphic rocks of the Boswell assemblage; 2) Upper Triassic augite-phyric volcanic rocks; and 3) Early Jurassic granitoids of the Aishihik plutonic suite. These rocks are dissected by a series of dextral strike-slip faults, probably related to the Teslin fault system. Post-accretion rocks include: 1) mid-Cretaceous biotite monzogranite plutons; 2) dacite and minor basalt of the Upper Cretaceous Carmacks Group; and 3) Quaternary basalt of the Selkirk volcanics. The southwest McQuesten-northern Carmacks area is under-explored, but shares many geological attributes with nearby, highly prospective districts such as the Dawson Range mineral belt, the recently discovered White Gold area and the producing Minto Mine.

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INTRODUCTION

Regional bedrock mapping of the southwest McQuesten and northern Carmacks map areas was carried out between July and early August 2009 (Fig. 1), as part of a joint initiative of the Geological Survey of Canada and Yukon Geological Survey. The project was conducted under the auspices of the Edges project (Multiple Metals Northwest Canadian Cordillera) as part of National Resources Canada's Geomapping for Energy and Minerals (GEM) program. The area was selected for bedrock mapping because it had not been mapped since reconnaissance mapping by H.S. Bostock in the 1940s (published in 1964), and it was highlighted as a priority area by the Yukon Geological Survey (e.g., Abbott, 2005) due to limited understanding of its mineral prospectivity. Recent mapping of the southwest McQuesten-northern Carmacks area has been the first instalment of a three-year program that will continue westward across the northern Dawson Range (north Stevenson Ridge map

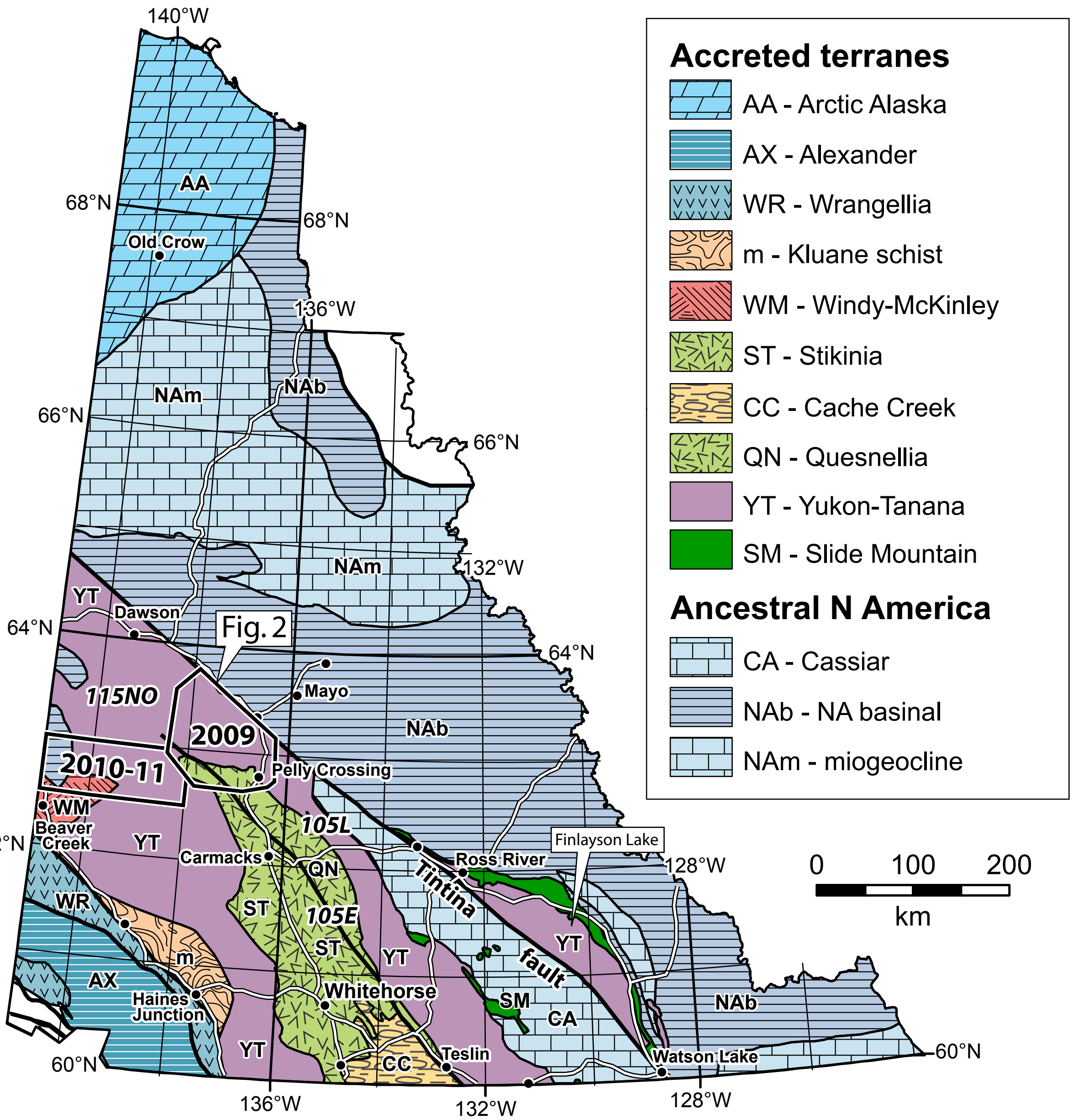


Figure 1. *Terrane map of Yukon. Outlines between Pelly Crossing and Beaver Creek illustrate the extent of the area mapped in 2009 (Fig. 2) and the planned mapping area for 2010-2011. They also approximate the area covered by new aeromagnetic surveys (Kiss and Coyle, 2009 a-r, for McQuesten, see Figure 3; and Kiss and Coyle, 2009 s-af, for northern Stevenson Ridge).*

sheet - NTS 115J,K) to the Alaska border (see 2010-11 in Fig. 1).

The southwest McQuesten-northern Carmacks area is characterized by rolling hills of the deeply entrenched Yukon Plateau. It is generally covered by dense vegetation and soil, and bedrock is typically poorly exposed. Much of the area was glaciated by the early to middle Pleistocene (pre-Reid) glaciations, and is now bounded by unglaciated terrain to the west and by glacial deposits of the Illinoian glaciation (Reid) to the east. Thick sequences of pre-Reid drift are found in valley bottoms, while slopes are covered in thin colluvium and weathered bedrock (Bond and Lipovsky, this volume). Due to the lack of bedrock exposure, ground-truthing efforts were maximized with the aid of a detailed aeromagnetic survey which was acquired in the previous winter (Kiss and Coyle, 2009a-r).

Access to the southwest McQuesten-northern Carmacks area is limited. It is approximately bounded on the northeast by the North Klondike Highway, which follows in part the Tintina Trench (see Tintina fault, Fig. 1). Near its southern limit, the area can be accessed via a 50 km dirt road extending westward from Pelly Crossing and leading to the Pelly River Ranch, where 2009 field operations were based. The area is also accessible by rivers, namely the Stewart River, along the northwest limit of the map, and the Pelly and Yukon rivers, near the southern limit of the map (Fig. 2). The historical site of Fort Selkirk, a traditional settlement of the Selkirk First Nation, and the first Hudson's Bay Company trading post in Yukon, established by Robert Campbell in 1848, is located near the western apex of the map area. The centre of the map area is mainly accessible by helicopter, although dense vegetation commonly limits the number of possible landing sites. Since the northern area is situated in the semi-arid Yukon Plateau of central Yukon, a region regularly subjected to forest fires, the forest cover is open in many parts of McQuesten, thus facilitating helicopter access. In 2009, forest fires impeded access to parts of the area along its western limit and dense smoke hampered visibility while flying.

Here we present the bedrock geology for southwest McQuesten-northern Carmacks area based primarily on observations made during the 2009 field season, in combination with recently acquired U-Pb geochronological data. This report is to accompany the 1:250 000-scale map of the area which is to be published as an Open File by the Geological Survey of Canada (Ryan *et al.*, in prep.). Continued geochronological, geochemical and petrographical studies will inevitably provide further constraints that will lead to revisions of the preliminary interpretations presented here.

REGIONAL SETTING AND PREVIOUS WORK

The southwest McQuesten-northern Carmacks area is situated southwest of the Tintina fault and is predominantly underlain by metamorphic rocks of the Yukon-Tanana terrane (Figs. 1, 2). The Carmacks and McQuesten map sheets were first mapped at a scale of 1:253,440 by H.S. Bostock, who accessed these areas with horse pack parties in the mid-1930s and 1940s (Bostock, 1936; 1964), respectively. With the exception of an area that was mapped in some detail around the White Mountains (Erdmer, 1982), the McQuesten area has received little attention since the work of H.S. Bostock. The Carmacks area was remapped at 1:250 000 scale by Tempelman-Kluit (1984; 2009). The southwest McQuesten-northern Carmacks area is between two areas that were recently mapped under the auspices of the Ancient Pacific margin NATMAP project and include: i) Stewart River (115N,O) to the northwest (Ryan and Gordey, 2004; Gordey and Ryan, 2005); and ii) Glenlyon (105L) to the southeast (Colpron *et al.*, 2002; 2003; 2006b). These and other Ancient Pacific margin NATMAP projects (*cf.* Colpron and Nelson, 2006) have contributed to a significant improvement in our knowledge and understanding of the Yukon-Tanana terrane that has resulted in the development of its regional stratigraphic framework (Colpron, 2006; Colpron *et al.*, 2006a). The Yukon-Tanana terrane comprises a basement complex of metasedimentary origin (Snowcap assemblage) overlain by three unconformity-bounded, volcano-sedimentary sequences of predominantly arc affinity: the Finlayson (Upper Devonian to Lower Mississippian), Klinkit (Upper Mississippian to Lower Permian) and Klondike (Middle to Upper Permian) assemblages. Plutonic suites associated with these arc sequences include the Grass Lakes suite (*ca.* 365-357 Ma), the Simpson Range suite (*ca.* 355-345 Ma), the Tatlmain suite (*ca.* 342-336 Ma) and the Sulphur Creek suite (*ca.* 264-252 Ma). Rocks of the Yukon-Tanana terrane experienced at least two phases of penetrative deformation and metamorphism in the Late Permian and Early Jurassic, and show evidence for older, less pervasive events in the Late Devonian and mid-Mississippian (Murphy *et al.*, 2006; Colpron *et al.*, 2006a; 2006b; Berman *et al.*, 2007).

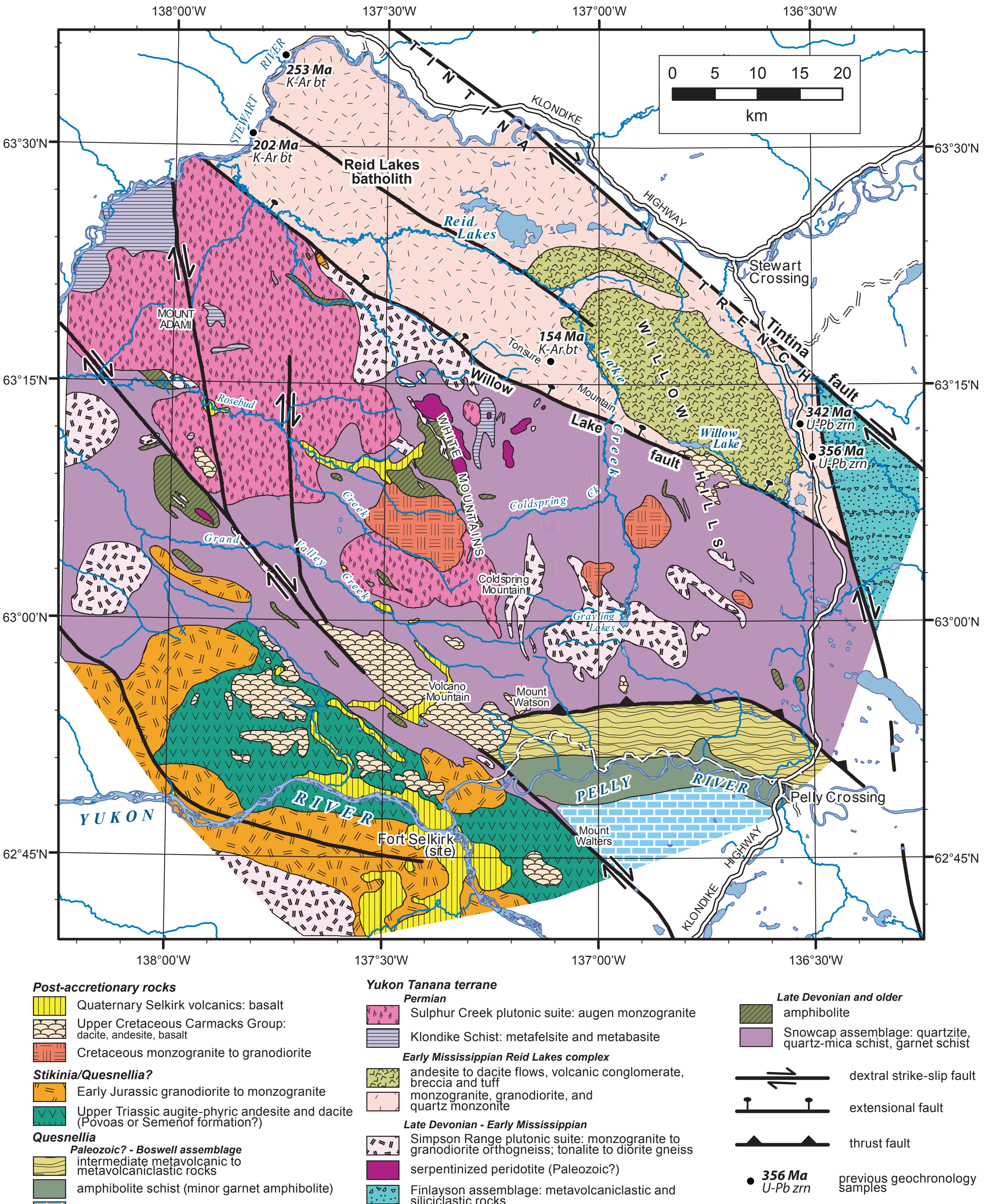


Figure 2. *Simplified geological map of southwest McQuesten-northern Carmacks area (after J.J. Ryan, M. Colpron and N. Hayward, in prep.).*

The southern edge of the map area is underlain by rocks assigned to Quesnellia and Stikinia (Fig. 2), two major mid-Paleozoic to early Mesozoic arc terranes that are distinguished in British Columbia by their occurrence on either side of the oceanic Cache Creek terrane. The McQuesten project area is situated at the northern apex of these two arc terranes (Fig. 1). Both Quesnellia and Stikinia are primarily characterized by Upper Triassic augite (± plagioclase)-phyric andesite and basaltic andesite, locally overlying mid- to upper Paleozoic volcano-sedimentary sequences. In Yukon, Late Triassic to Early Jurassic granite plutons intrude the Stikinia, Quesnellia and Yukon-Tanana terranes. Plutons of this suite occupy the southwestern corner of the map area (Fig. 2), and are of particular metallogenic importance as they host many significant porphyry Cu-Au(± Mo) deposits in British Columbia, as well as the Yukon's high-grade Cu-Au Minto Mine and Carmacks Copper (Williams Creek) deposit (Schroeter, 1995; Nelson and Colpron, 2007).

The area is locally underlain by younger, post-accretion, mid-Cretaceous plutonic rocks; volcanic rocks of the Upper Cretaceous Carmacks Group; and Tertiary to recent lavas of the Selkirk volcanics. We have found all of these units to be less extensive than what was previously mapped (*cf.* Gordey and Makepeace, 1999).

MCQUESTEN AEROMAGNETIC SURVEY

In the winter prior to the 2009 field season, a GEM-funded aeromagnetic survey was flown to support bedrock mapping of the poorly exposed McQuesten project area (Kiss and Coyle, 2009a-r). The new survey covered approximately 23 000 line-kilometres at a spacing of 400 m, and 150-m-nominal terrain clearance (Kiss and Coyle, 2009a-r). This new survey was an improvement on the 800 m line-spacing of the previously available regional coverage. Results of the survey are available for download from the GSC's Geoscience Data Repository website *(http://gdr.nrcan.gc.ca/aeromag/)*.

In general, the new survey offers an increased resolution that sharpens major anomalies and highlights subtle magnetic features that were not obvious in the older data. In particular, the latest aeromagnetic data highlights a number of prominent anomalies that may represent major structures or lithological features in the area (Fig. 3). The data proved useful in extrapolating limited ground observations across areas with poor bedrock exposure, and was beneficial to strategic planning of ground traverses.

Figure 3 is an image of the first vertical derivative of the magnetic data, which enhances the signal from near-surface sources, and is most useful for bedrock mapping. The most intense anomalies reflect highly magnetic ultramafic bodies in the centre of the map area, the Selkirk volcanic flows in the west, and the Carmacks volcanic flows in the south and east (Figs. 2, 3). Major faults are outlined by magnetic lows and truncation of the magnetic fabric (Fig. 3). Further processing and filtering of the data will likely outline additional structures in the area. For the mineral exploration industry, recent exploration successes in the Stewart River and Dawson Range areas have relied, in part, on detailed geophysical surveys, thus the recent McQuesten dataset will likely prove useful for guiding exploration in this under-explored, poorly exposed area.

YUKON-TANANA TERRANE

The Yukon-Tanana terrane in the McQuesten area occurs in two distinct northwest-trending belts that are separated by the Willow Lake fault (Fig. 2). Southwest of the fault, rocks that typify the terrane are variably deformed, metamorphosed (up to amphibolite facies) and include: siliciclastic, pelitic (commonly carbonaceous) and carbonate sedimentary rocks; mafic, intermediate and felsic volcanic rocks; and a wide variety of plutonic rocks ranging from ultramafic to felsic in composition (*e.g.*, Colpron *et al.*, 2006a). In contrast, rocks exposed on the northeast side of the Willow Lake fault are generally undeformed and only weakly altered (essentially unmetamorphosed). They comprise primarily intrusive rocks of intermediate to felsic composition and, near the eastern limit of our map area, a sequence of intermediate to felsic volcanic and volcaniclastic rocks coeval with the main plutonic body, the Reid Lakes batholith (Fig. 2).

We describe below the metamorphic rocks exposed on the southwest side of the Willow Lake fault, followed by a description of the volcano-plutonic complex that is northeast of the fault. Together with preliminary U-Pb data (not presented here) and past experience in mapping of the Yukon-Tanana terrane, we propose initial correlations with regional stratigraphic units. It is recommended that the reader remain aware of the preliminary nature of our conclusions. As new geochronological and geochemical data become available, correlations presented here will likely be revised.

LAYERED ROCKS SOUTHWEST OF THE WILLOW LAKE FAULT

Based on composition and field relationships, the rocks exposed southwest of the Willow Lake fault are tentatively assigned to regional tectonostratigraphic units of the Yukon-Tanana terrane (*cf.* Colpron *et al.*, 2006a). These rocks preserve at least two penetrative foliations and show evidence for metamorphism at upper greenschist to middle amphibolite facies conditions. Metasedimentary rocks in the area have been assigned to the Snowcap assemblage (Fig. 2) while associated metabasites have

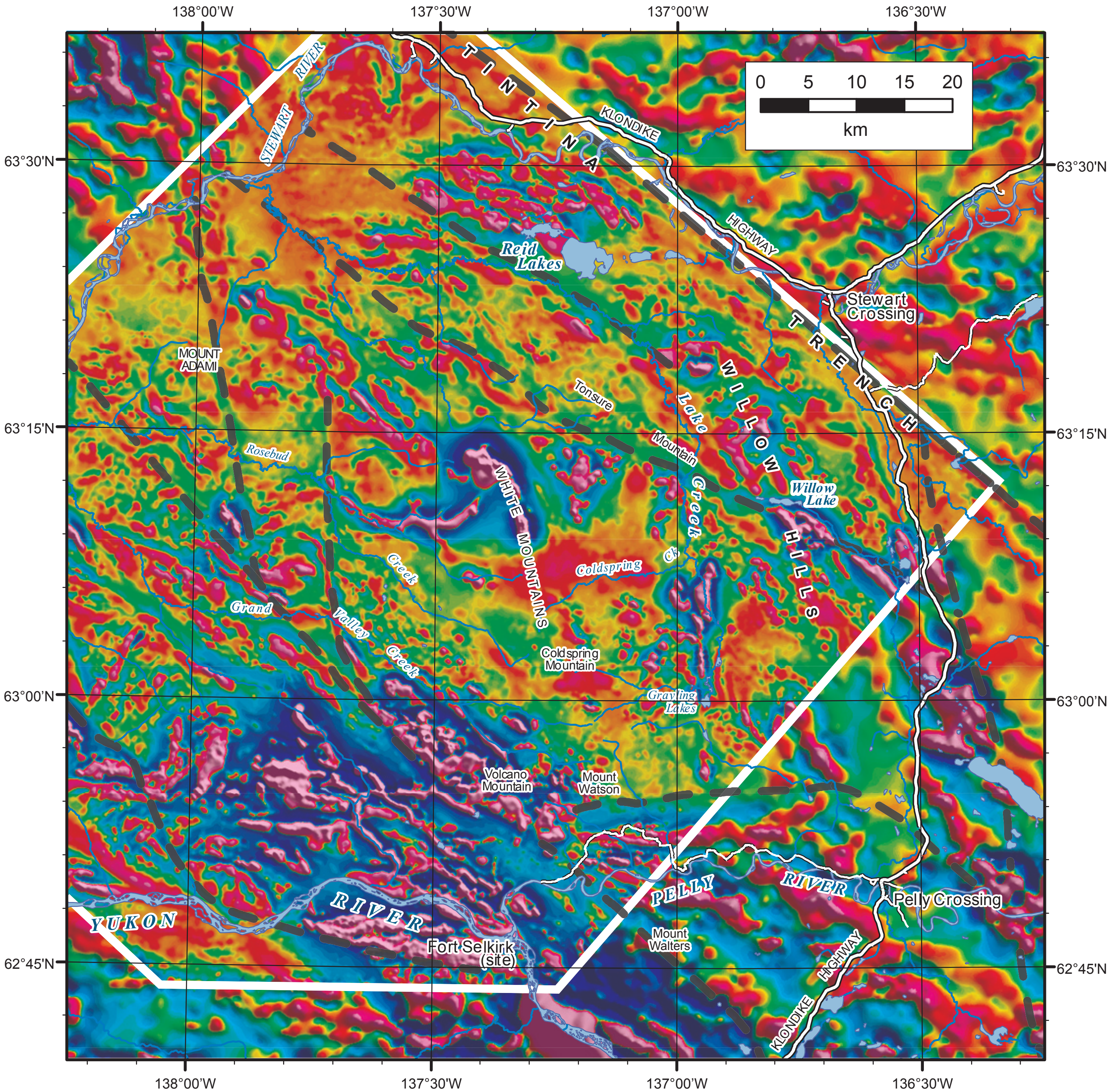


Figure 3. *First vertical derivative of aeromagnetic data; 2009 detailed data (outlined in white; 400 m line-spacing) fused with regional archived data (800 m line-spacing). Grey dashed lines are major faults from Figure 2.*

been classified as either the Snowcap assemblage, or the overlying Finlayson assemblage. Intermediate to felsic metavolcanic rocks have been assigned to the Klondike assemblage.

Snowcap assemblage

The Snowcap assemblage comprises quartzite, micaceous quartzite and psammitic quartz-muscovite-biotite (± garnet) schist. The quartzite is generally fine grained, banded to massive, grey to white in colour (Fig. 4a), and most commonly intercalated (on a centimetre-scale) with garnet-bearing pelitic schist. Locally, pebble meta-conglomerate horizons occur within the quartzite (Fig. 4b). In places, the quartzite and intercalated pelitic schist are dark grey in colour, carbonaceous, and locally graphitic (Fig. 4c). It is unclear whether the carbonaceous rocks are a variation of the Snowcap assemblage as described near its type locality in the Glenlyon area to the southeast (Colpron *et al.*, 2003; Piercey and Colpron, 2009), or if they might be equivalent to carbonaceous rocks of the Nasina quartzite in the Stewart River area to the northwest (Gordey and Ryan, 2005). In the Stewart River area, the Nasina quartzite is a regionally extensive unit of the Finlayson assemblage that is not typically associated with metavolcanic rocks or intercalated with Snowcap assemblage rocks (Gordey and Ryan, 2005; Colpron *et al.*, 2006a). In the McQuesten area, carbonaceous meta-siliciclastic rocks are rare and generally associated with metabasic rocks (see following section). They occur as 10 to 100-m-thick horizons within the Snowcap assemblage and may be indicative of compositional variations within the siliciclastic assemblage.

Marble and calc-silicate schist are minor constituents of the metasedimentary belt that occupies the centre of the McQuesten map area. Marble is present in isolated lenses up to tens of metres in thickness. In outcrop, these rocks appear massive and light grey in colour (Fig. 4d), with little obvious compositional variation.

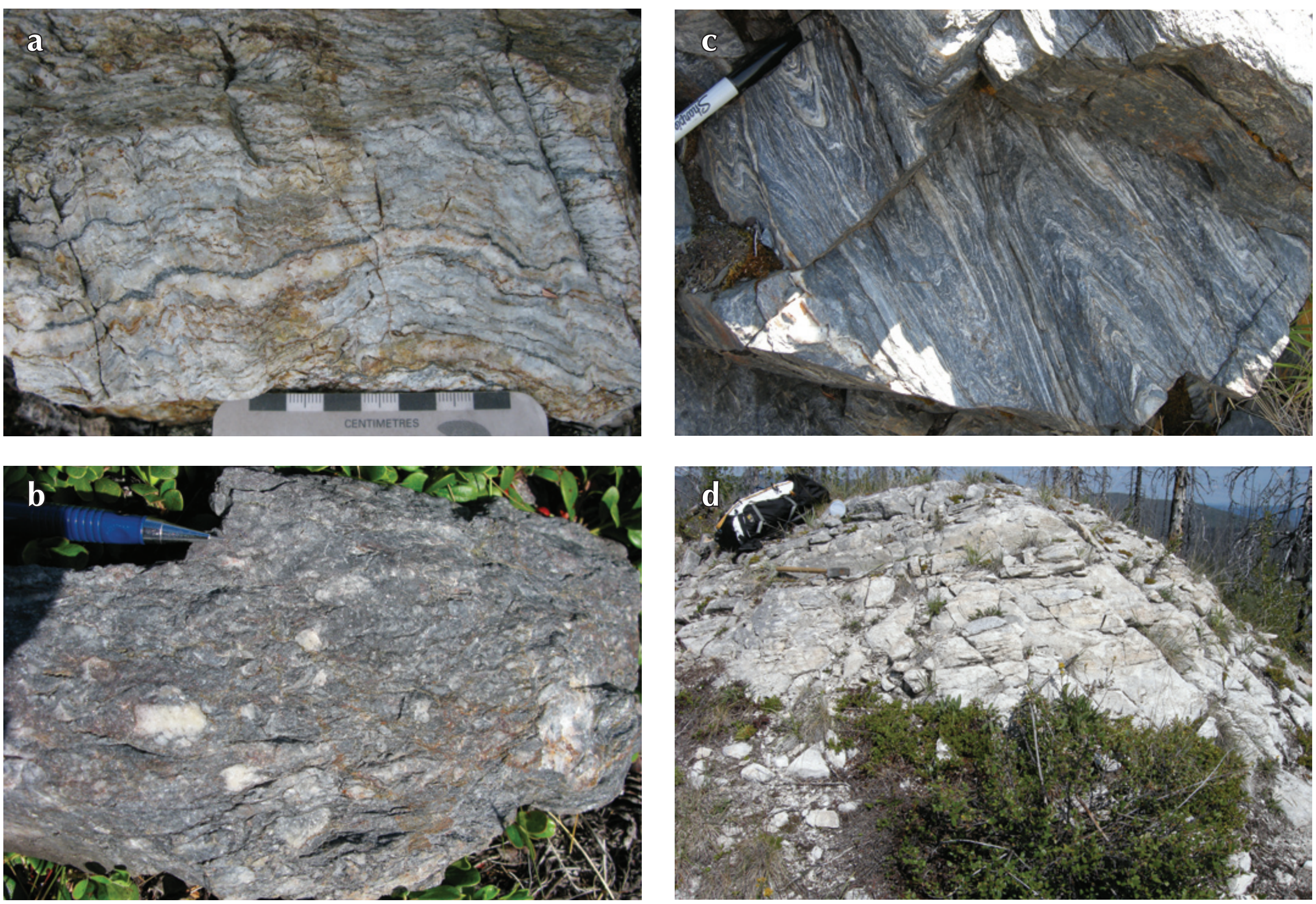


Figure 4. *Representative lithologies of the Snowcap assemblage in southwest McQuesten map area:* ***(a)*** *banded quartzite;* ***(b)*** *pebble metaconglomerate;* ***(c)*** *tightly folded carbonaceous quartzite; and* ***(d)*** *marble.*

Regionally, the Snowcap assemblage is constrained to be Late Devonian and older by cross-cutting plutons and overlying metasedimentary rocks (Colpron *et al.*, 2006a, 2006b). Detrital zircon profiles and geochemistry of the assemblage are consistent with derivation of protoliths from late Proterozoic to early Paleozoic continental margin similar to the northwest Laurentian miogeocline (Piercey and Colpron, 2009).

Metabasites

Amphibolite and greenstone are locally associated with metasedimentary rocks of the Snowcap assemblage throughout southwestern McQuesten map area (Fig. 2). Amphibolites are most prominent near the White Mountains. They are typically fine to medium-grained and composed of hornblende-plagioclase (± garnet)-bearing, massive to schistose rock (Fig. 5a). Coarser grained, homogeneous (Fig. 5b) varieties also occur and may reflect an intrusive origin for some amphibolites. Garnet porphyroblasts (≤1cm) are common to most occurrences (Fig. 5b). Occasionally, amphibolites are retrogressed to chlorite-biotite schist, but most often are characterized by heterogeneous layering and local preservation of volcanic and/or volcaniclastic textures that provide clues to their protolith.

Greenstone is less common; its main exposures occur near Coldspring Mountain (Fig. 2). The greenstone is characterized by a chlorite-actinolite assemblage typical of greenschist facies metamorphism. It is commonly medium green and fine grained, locally preserving relict volcanic and volcaniclastic textures that are evident when viewed down the stretching lineation. The greenstone may represent a lower grade equivalent of the amphibolites mapped to the north, or may be a distinct volcanic sequence that records lower peak metamorphic conditions. It could also represent an isolated occurrence of the Permian Klondike assemblage, rather than the Mississippian or older metabasites.

We do not know with which unit(s) of the Yukon-Tanana terrane the amphibolite and greenstone are most closely affiliated. Garnet amphibolite occurrences are a common constituent of the Snowcap assemblage at its type locality in central Yukon (Piercey and Colpron, 2009) and in the correlative Dorsey complex of northern British Columbia (Nelson and Friedman, 2004). In both regions, Snowcap assemblage amphibolites are characterized by enriched mid-ocean ridge basalt (E-MORB) and/or ocean island basalt (OIB) geochemical signatures. In contrast, garnet amphibolites intercalated with metasedimentary rocks

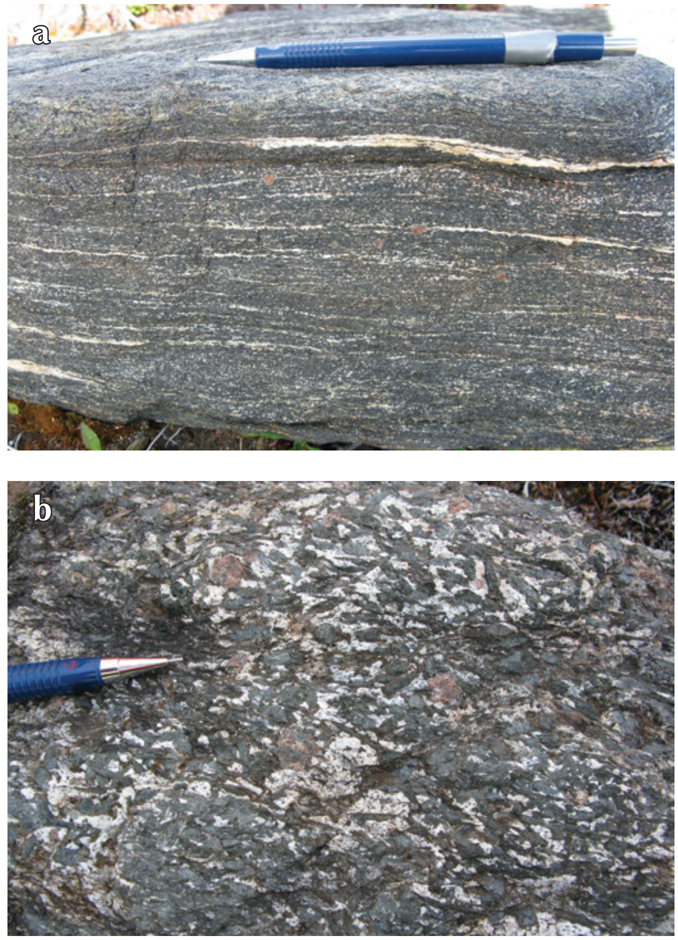


Figure 5. *Metabasite of Devono-Mississippian Yukon-Tanana terrane:* ***(a)*** *fine-grained garnet amphibolite; and* ***(b)*** *coarse-grained garnet amphibolite (metagabbro?).*

that may be correlative with the Snowcap assemblage in the Stewart River area have geochemical signatures more typical of island arc tholeiites (IAT; S.J. Piercey and J.J. Ryan, unpublished data) and thus are correlated with arc sequences of the Finlayson assemblage of Yukon-Tanana terrane (Piercey *et al.*, 2006). Whole-rock geochemical data for similar rocks in southwest McQuesten area are critical to establishing the setting in which they were emplaced, and ultimately their stratigraphic position within the terrane.

Klondike assemblage

Intermediate chlorite- and quartz-feldspar augen muscovite schists exposed mainly in the northwestern part of the map area are assigned to the Middle to Late Permian Klondike assemblage (Fig. 2). These rocks are typically spatially associated with quartz and K-feldspar augen granite of the Permian Sulphur Creek plutonic suite (see below). Felsic to intermediate schists of the Klondike assemblage are characterized by a sericite and quartz matrix with more altered and/or metamorphosed examples preserving decussate hornblende (Fig. 6a) and locally coarse (>1 cm) garnet porphyroblasts (Fig. 6b). Hornblende porphyroblasts are in places pseudomorphed by chlorite and biotite. The felsic to intermediate schists are likely derived from volcanic or hypabyssal intrusive protoliths. Locally, the distinction between volcanic rocks of the Klondike assemblage and plutonic rocks of the Sulphur Creek suite is difficult to make. It can be demonstrated in places that the felsic Klondike schist is a highly strained equivalent of the Sulphur Creek suite.

Chlorite schist exposed northwest of Mount Adami is thought to represent intermediate to mafic metavolcanic rocks of the Klondike assemblage. They commonly have pitted weathering surfaces resulting from oxidation of pyrite crystals (Fig. 6c), and locally preserve relict volcanic textures. These rocks are typical of the intermediate to mafic compositions mapped in the Klondike assemblage of the Stewart River area to the west (Gordey and Ryan, 2005).

INTRUSIVE ROCKS SOUTHWEST OF WILLOW LAKE FAULT

Metaplutonic rocks in the Yukon-Tanana terrane exposed southwest of the Willow Lake fault are assigned to two distinct plutonic suites, based primarily on composition and field characteristics: 1) the Early Mississippian Simpson Range suite; and 2) the Middle to Late Permian Sulphur Creek suite (Fig. 2). Akin to the metasedimentary and metavolcanic rocks described above, metaplutonic rocks southwest of the Willow Lake fault also preserve at least two penetrative foliations and metamorphism at greenschist to amphibolite facies conditions.

Simpson Range plutonic suite

The Simpson Range plutonic suite encompasses rocks of widely varying composition, from monzogranite to diorite. The rocks are generally fine to medium grained, equigranular, and weakly to strongly foliated; they commonly are gneissic. Monzogranite to granodiorite are most common. In outcrop, rocks of this suite are typically biotite bearing and pink to orange in colour (Fig. 7a). Locally, monzogranite and granodiorite are porphyritic with K-feldspar phenocrysts (or augens) up to 1 cm long (Fig. 7b). The porphyritic phase resembles the Permian augen granite of the Sulphur Creek suite (see below), but

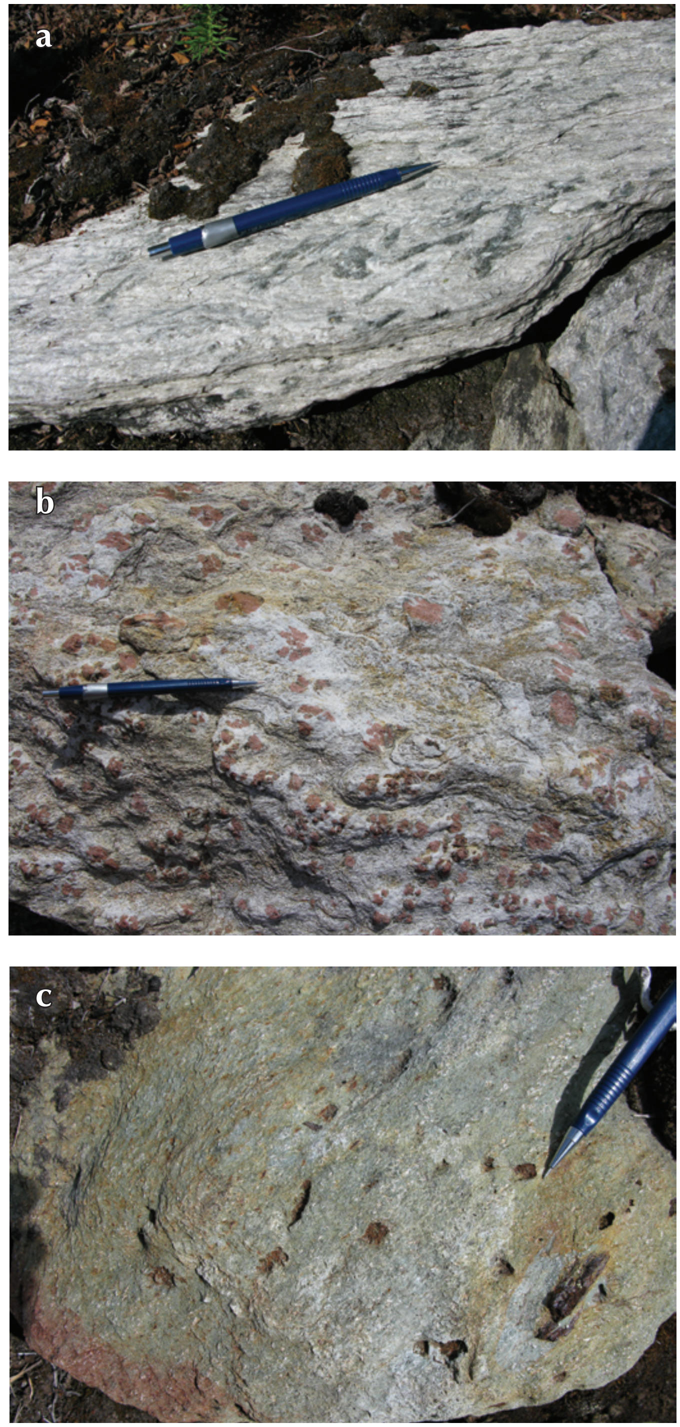


Figure 6. *Representative lithologies of the Klondike assemblage:* ***(a)*** *felsic schist with decussate hornblende porphyroblasts;* ***(b)*** *garnet-muscovite schist; and* ***(c)*** *pitted chlorite schist.*

are in general, more feldspathic than the Sulphur Creek suite.

Medium to dark grey tonalite to diorite are also common constituents of the Simpson Range suite. These rocks are invariably fine grained, equigranular, and biotite bearing (Fig. 7c). Locally, elongate biotite clots are suggestive of biotite pseudomorphs after hornblende. In outcrop, the compositionally mafic varieties of this suite of rocks are commonly homogeneous and locally layered (Fig. 7d).

On the regional scale of the Yukon-Tanana terrane, the Simpson Range plutonic suite includes felsic to intermediate plutons ranging in age from 357 Ma to 345 Ma (Mortensen, 1992; Piercey *et al.*, 2006). In southwest McQuesten area, plutons that have been assigned to this suite are presently undated, but are inferred to be Early Mississippian in age. Similar plutons in adjacent parts of Yukon-Tanana terrane to the northwest (Stewart River area; J.J. Ryan and S.P. Gordey, unpublished data; Ruks *et al.*, 2006; Mortensen, 1992) and the southeast (Glenlyon area; Colpron *et al.*, 2006b) yield Mississippian ages ranging from *ca.* 357 Ma to *ca.* 343 Ma. However, preliminary U-Pb results from a foliated tonalite body on Coldspring Mountain indicate that some 'Simpson Range' rocks may actually be Permian in age (see below).

Sulphur Creek plutonic suite

Metaplutonic rocks assigned to the Sulphur Creek suite are primarily exposed in the northwestern part of the map area, between Mount Adami and the White Mountains (Fig. 2). They consist of monzogranites that are variably deformed, fine to medium grained, biotite bearing, and quartz and K-feldspar porphyritic to augen bearing (Fig. 8a). They commonly display a strong transposition foliation overprinted by up to two crenulations (Fig. 8b). Locally, metaplutonic rocks of the Sulphur Creek suite are porphyroclastic straight gneisses. In places, the Sulphur Creek suite is represented by fine-grained, homogeneous felsic gneiss with a sugary texture. Augen granites of the

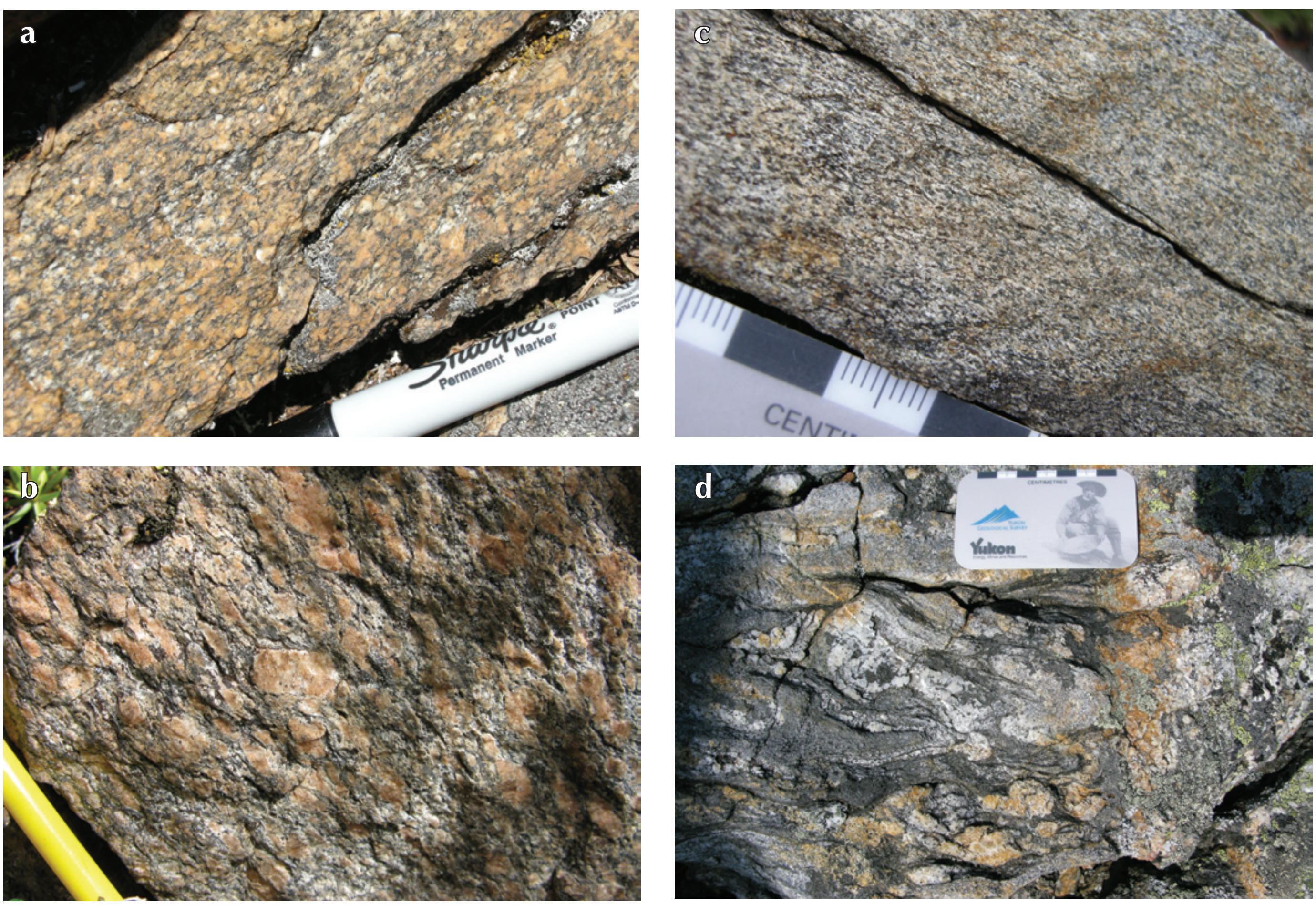


Figure 7. *Representative lithologies of the Simpson Range plutonic suite: **(a)** pink monzogranite; **(b)** K-feldspar augen monzogranite; **(c)** fine-grained tonalite; and **(d)** layered diorite gneiss.*

Sulphur Creek suite are spatially associated with felsic to intermediate schists of the Klondike assemblage (Fig. 2). As noted above, the distinction between metaplutonic rocks of the Sulphur Creek suite and felsic metavolcanic rocks is often difficult to discern, and may reflect variations in the degree of strain (Fig. 8b). The Sulphur Creek plutonic suite and Klondike assemblage range in age from 264 Ma to 252 Ma in the Klondike region to the northwest, and the Stewart River map sheet in general (Mortensen, 1990; Ruks *et al.*, 2006).

During 2009 field mapping, strongly foliated, fine-grained, hornblende-biotite tonalite to granodiorite that is exposed on Coldspring Mountain was assigned to the Simpson Range plutonic suite described above. However, preliminary U-Pb zircon dating suggests a Middle Permian age (N. Joyce, pers. comm., 2009), thereby casting doubt on how metaplutonic rocks in southwest McQuesten map area are classified through field descriptions alone. Additional geochronology of metaplutonic bodies in southwestern McQuesten area is necessary to discriminate between the Mississippian and Permian suites on the map.

Figure 8. *Representative lithologies of the Sulphur Creek plutonic suite:* ***(a)*** *quartz-feldspar augen granite; and* ***(b)*** *Klondike schist derived from plutonic quartz monzonite superposed by transposition foliation and crenulation.*

Ultramafic rocks

Outcrops of ultramafic rocks can be found underlying the peaks of the White Mountains, as smaller exposures to the east, as well as isolated exposures associated with amphibolites north of Grand Valley Creek (Fig. 2). These rocks most commonly comprise fine-grained, massive and homogeneous, serpentinized peridotite. In places, the ultramafic bodies occur as medium-grained, serpentinized pyroxenite locally associated with coarse-grained garnet amphibolite (metagabbro). The degree to which rocks have been serpentinized is variable, with the margins of individual bodies marked by fish-scale textured serpentinite. Proximal to the White Mountains, orientation of the serpentinite-hosted schistosity is consistent with that observed in the encompassing metamorphic rocks, dipping moderately to the west-southwest. The observed structural relationship suggests ultramafic bodies are not confined to klippe that sit structurally above Yukon-Tanana terrane rocks (Erdmer, 1982), but are instead structurally interleaved with them. It is plausible that the array of ultramafic bodies originally formed a continuous sheet that was emplaced prior to the onset of regional Permian deformation (Berman *et al.*, 2007).

ROCKS NORTHEAST OF WILLOW LAKE FAULT – REID LAKES COMPLEX

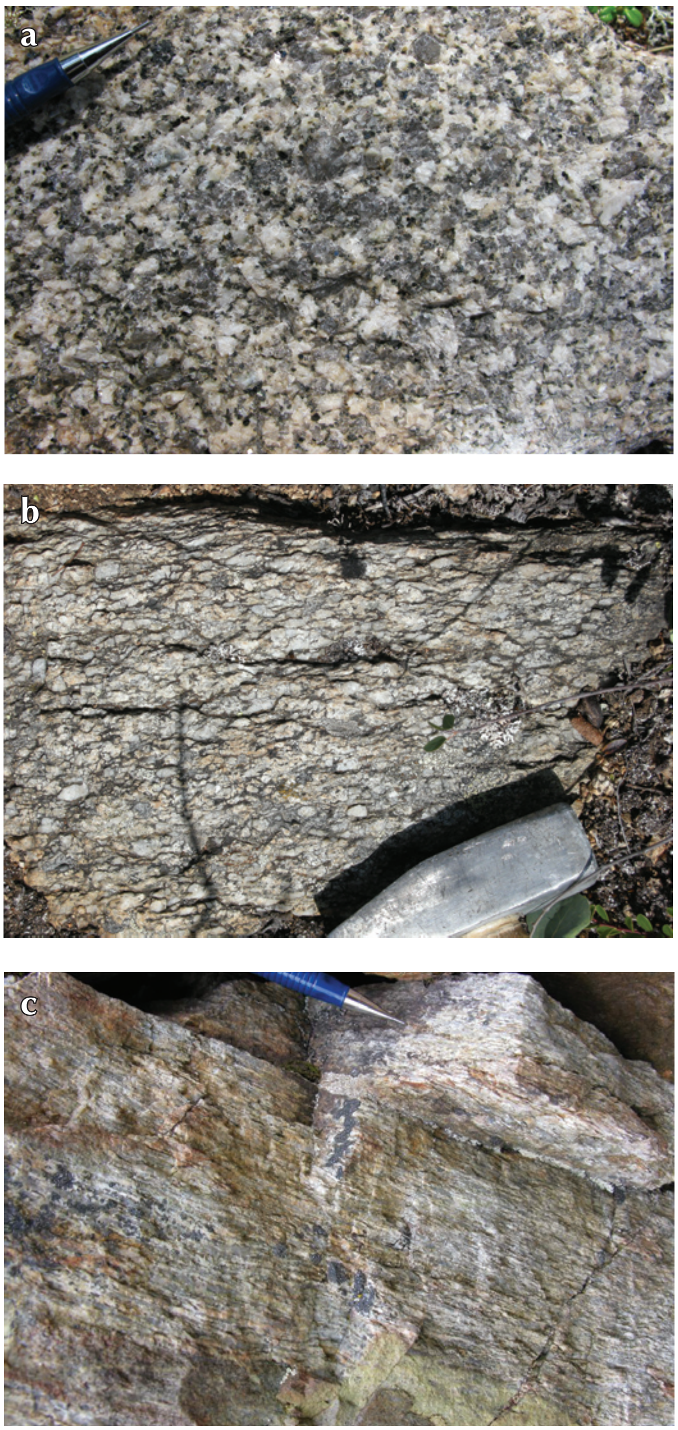
Northeast of the Willow Lake fault, rocks of the Yukon-Tanana terrane appear markedly different from those described above in that they are generally undeformed and weakly metamorphosed. The rocks on this side of the fault include intermediate to felsic intrusive rocks of the Reid Lakes batholith and, in the eastern limit of the map area, a sequence of intermediate to felsic volcanic and volcaniclastic rocks that are interpreted to be coeval with the main plutonic body (Fig. 2). Both the plutonic and extrusive rocks characteristically contain grey to blue smokey quartz phenocrysts.

Reid Lakes batholith

Much of the Reid Lakes batholith comprises a compositionally homogeneous, coarse-grained, massive, quartz-phyric, biotite monzogranite (Fig. 9a). The main granitic phase of the batholith is generally devoid of solid-state deformation, except in close proximity to the Willow Lake fault where a weakly developed fabric is observed (Fig. 9b). At a locality near Willow Lake, the Reid Lakes granite displays a protomylonitic fabric that is defined by strung-out smokey quartz ribbons (Fig. 9c).

On Tonsure Mountain (Fig. 2), the granitic phase of the Reid Lakes batholith intrudes an earlier phase of coarse-grained, locally pegmatitic, hornblende gabbro (Fig. 9d). As with the main granite phase, the gabbro is devoid of solid-state deformation fabrics. Coarse-grained, K-feldspar porphyritic granodiorite to quartz monzonite is common in the northeastern part of the batholith (Fig. 9e). This phase of the batholith commonly is characterized by the presence of hornblende and biotite.

Bostock (1964) originally assigned the granitic rocks of the Reid Lakes batholith to the Coast Intrusions and



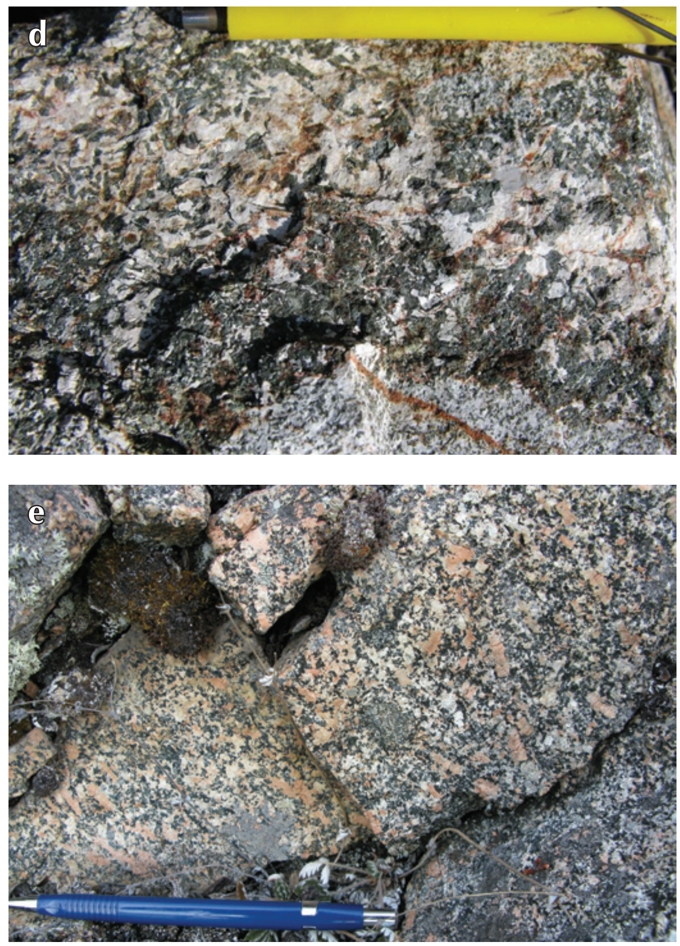


Figure 9. *Representative lithologies of the Reid Lakes plutonic complex:* ***(a)*** *quartz-phyric monzogranite typical of most of the batholith;* ***(b)*** *weakly foliated quartz-phyric monzogranite in proximity of the Willow Lake fault;* ***(c)*** *strongly foliated, ribbon quartz mylonite derived from Reid Lakes batholith near the Willow Lake fault;* ***(d)*** *coarse-grained gabbro on Tonsure Mountain; and* ***(e)*** *K-feldspar porphyritic, hornblende-bearing granodiorite phase, northeastern part of Reid Lakes batholith.*

inferred their Jurassic and/or Cretaceous age. It is based on this original classification that the Reid Lakes batholith is currently assigned to the mid-Cretaceous period on the existing compilation map for Yukon (Gordey and Makepeace, 1999). However, K-Ar biotite ages from two Reid Lakes batholith samples collected along the Stewart River (Fig. 2, Hunt and Roddick, 1992) yielded a Permian to Triassic age. This led Colpron (2006) to postulate a Mississippian age for the batholith — a hypothesis that was recently confirmed with U-Pb zircon data obtained for two phases exposed along the North Klondike Highway, east of Willow Lake (Fig. 2), which yielded ages of 341.5 ± 0.7 Ma and 355.7 ± 0.9 Ma (Mortensen, 2009). Preliminary U-Pb results acquired for additional samples collected in this study confirm that the entire batholith is Early Mississippian in age (N. Joyce, pers. comm., 2009).

Reid Lakes volcanic succession

Exposures of volcanic and volcaniclastic rocks dominate the ridges between Reid Lakes and Willow Lake in the eastern portion of the map area (Fig. 2). Volcanic rocks include andesite to dacite flows, and rhyolite to rhyodacite porphyries (Fig. 10a). Volcaniclastic rocks include sandstone (Fig. 10b), conglomerate and breccia (Fig. 10c), and tuffaceous rocks. Near Stewart Crossing, the sequence also includes a quartz sandstone unit, with blue-grey quartz grains that are similar in appearance to quartz phenocrysts in the Reid Lakes batholith. The volcanic rocks are commonly massive and lack internal structures (Fig. 10a). They typically weather to a buff orange to grey colour. The volcaniclastic rocks locally preserve well-defined sedimentary structures such as parallel laminae and bedding that is commonly inclined to moderately dipping. Conglomerate and breccia are poorly sorted and composed of pebbles to cobbles of a variety

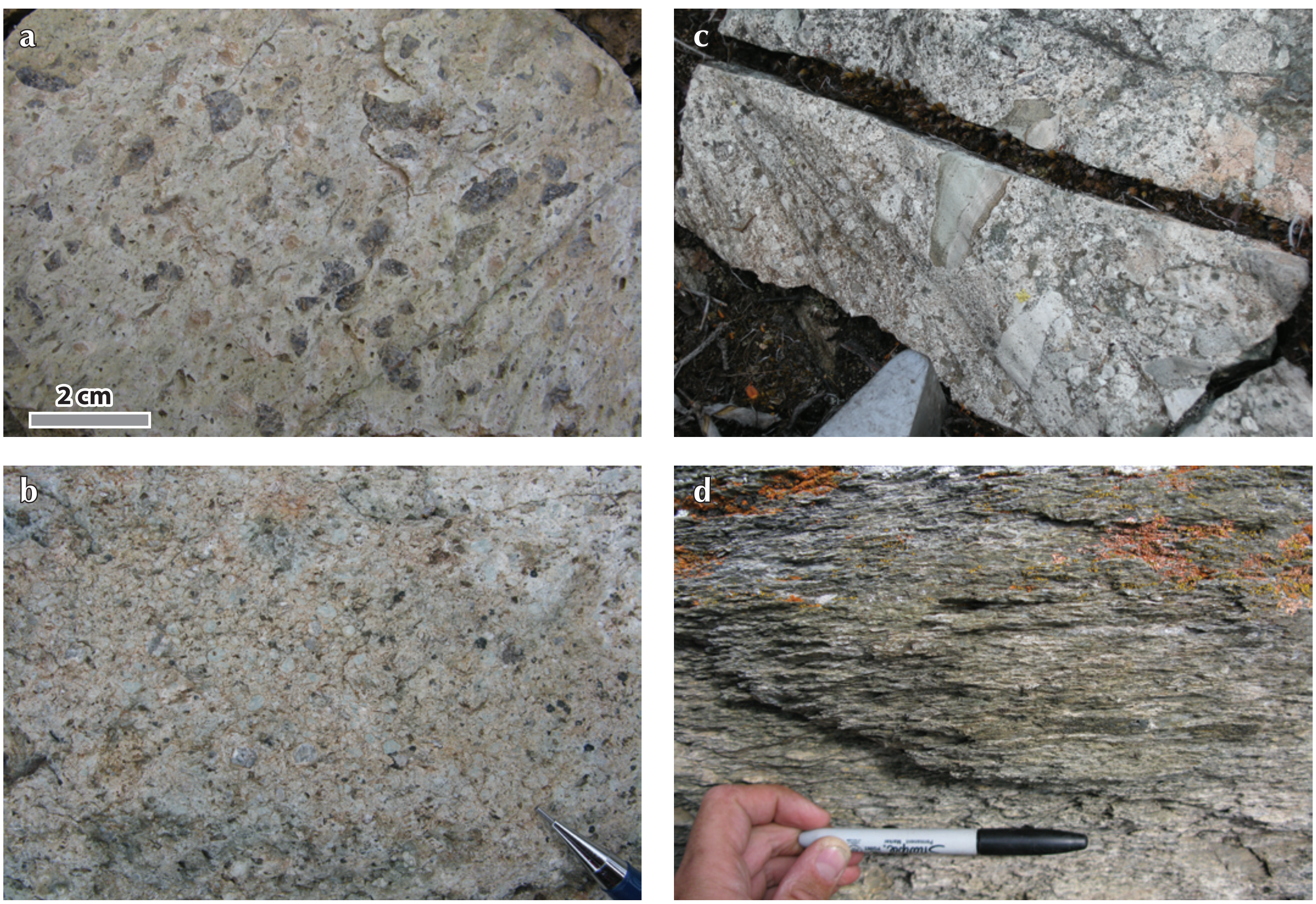


Figure 10. *Representative lithologies of the Reid Lakes volcanic succession:* ***(a)*** *quartz-feldspar porphyritic volcanic flow;* ***(b)*** *quartz-hornblende-phyric hypabyssal intrusion;* ***(c)*** *volcanic breccia (scale is indicated by hammer point at bottom of the photo, which is up to 3 cm wide); and* ***(d)*** *strongly foliated intermediate volcanic rocks near the Willow Lake fault.*

of felsic to intermediate volcanic and hypabyssal intrusive rocks, and less commonly, well-bedded tuffaceous rocks (Fig. 10c). Clasts in the volcanic conglomerate are generally of similar composition as nearby volcanic rocks, though exotic clasts of limestone and chert are also locally observed. As with the plutonic rocks of the batholith, the Reid Lakes volcanic sequence is generally devoid of solid-state deformation fabric, except in close proximity of the Willow Lake fault (Fig. 10d).

Bostock (1964) interpreted these rocks to be of Carboniferous(?) to Cretaceous age. Gordey and Makepeace (1999) defined the volcaniclastic rocks near Reid Lakes as Upper Triassic in age, and correlated volcanic rocks in the Willow Hills to the south with the mid-Cretaceous Mount Nansen Group. A distinguishing feature of the extrusive rocks described here is the presence of coarse, smokey quartz phenocrysts that resemble those observed in the main phase of the Reid Lakes batholith. It is this correlation that leads us to postulate a co-genetic relationship between the volcanic and plutonic rocks of the Reid Lakes batholith. Preliminary U-Pb zircon results also confirm this relationship and indicate an Early Mississippian age for the volcanic rocks (N. Joyce, pers. comm., 2009)

STIKINIA AND QUESNELLIA

The southern part of the map area is mainly underlain by rocks of Quesnellia and Stikinia. In the southeast, underlying the Pelly River valley, are Paleozoic metamorphic rocks that form the basement to Triassic rocks of Quesnellia in Glenlyon and Laberge map areas (Boswell assemblage; Colpron, 2006, 2010, in prep.). To the southwest, the Yukon River valley is underlain by Triassic volcanic rocks intruded by Early Jurassic granite plutons that could be of Quesnellian or Stikinian affinity.

BOSWELL ASSEMBLAGE – PALEOZOIC BASEMENT TO QUESNELLIA

Rocks on either sides of the Pelly River valley are assigned to the mid-Paleozoic Boswell assemblage of Quesnellia (Colpron, 2006). It includes intermediate metavolcanic rocks, amphibolite (± garnet), minor ultramafic rocks, and prominent marble bluffs south of the Pelly River. All are strongly foliated and recrystallized rocks that were subjected to high-grade (amphibolite facies?) metamorphism followed by overprinting at greenschist facies conditions. Their distinct lithological sequence, metamorphic history, and the discordance in structural trends of the Boswell rocks set them apart from the metamorphic rocks of the Yukon-Tanana terrane to the north (Fig. 2).

The northernmost belt of the Boswell assemblage comprises a heterogeneous sequence of intermediate metavolcanic, metavolcaniclastic and metaplutonic rocks (Fig. 2). These rocks are typically light grey quartz-feldspar-biotite-muscovite schist that commonly show strong compositional layering of quartz-feldspar and mica-rich domains (Fig. 11a). This strong compositional heterogeneity is suggestive of volcanic and/or volcaniclastic protoliths compounded by a metamorphic segregation resulting from the development of a differentiated crenulation cleavage. Elsewhere along this belt, the rocks are more homogeneous, fine to medium grained, crystalline, and lack compositional layering. These rocks are compositionally similar to crystalline layers in the segregated schist. In places, they are clearly metaplutonic rocks of granodiorite to diorite compositions. Elsewhere, that distinction is difficult to establish in the field.

Metavolcanic rocks of intermediate composition are commonly intercalated with amphibolite that characterizes the Boswell assemblage to the south, along the shores of the Pelly River (Figs. 2, 11b). The medium to coarsely recrystallized amphibolite is overprinted by greenschist facies assemblages, and preserves strong compositional layering and evidence of high strain deformation (Fig. 11c). Garnet is locally preserved, but more commonly pseudomorphed by chlorite. At one locality, along the north shore of the Pelly River, serpentinized pyroxenite cumulates occur at low structural level beneath garnet amphibolite.

Ridge tops south of the Pelly River are mainly underlain by marble of the Boswell assemblage. The marble is closely interrelated with amphibolite along the Pelly River (Fig. 11d), and amphibolite possibly underlies much of the unexposed recessive areas between carbonate ridges south of the river (Fig. 2). The marble is typically coarse grained (up to 6 mm) and beige to light medium grey. It locally contains dark grey, recrystallized chert nodules (Fig. 11e) and brecciated dark quartzite, presumably derived from chert. At the west end of this belt, a few outcrops of grey quartzite are intercalated with mafic metavolcanic rocks and carbonate.

Rocks of the Boswell assemblage can be traced for nearly 200 km to the southeast into the Glenlyon (105L) and Laberge (105E) map areas (Fig. 1). Along this trend, garnet amphibolite and marble transition into low-grade chlorite schist and metabasalt near Little Salmon Lake (Colpron *et al.*, 2002, 2003), and well-preserved pillow basalts in southeastern parts of the Laberge map area (Simard, 2003; Simard and Devine, 2003). There, at its type section on Boswell Mountain, the Upper Devonian pillow basalt is unconformably overlain by Upper Triassic augite-phyric volcanic and volcaniclastic rocks that are typical of Quesnellia (Simard, 2003; M. Colpron and R.-L. Simard, unpublished data). Felsic units associated with mafic rocks of the Boswell assemblage yield Late Devonian to Early Mississippian zircon ages in Glenlyon and Laberge areas (M. Colpron, unpublished data). A similar age is indicated by preliminary U-Pb zircon results for a foliated tonalite intruding amphibolite of the Boswell assemblage in the northern Carmacks area (N. Joyce, pers. comm., 2009). In

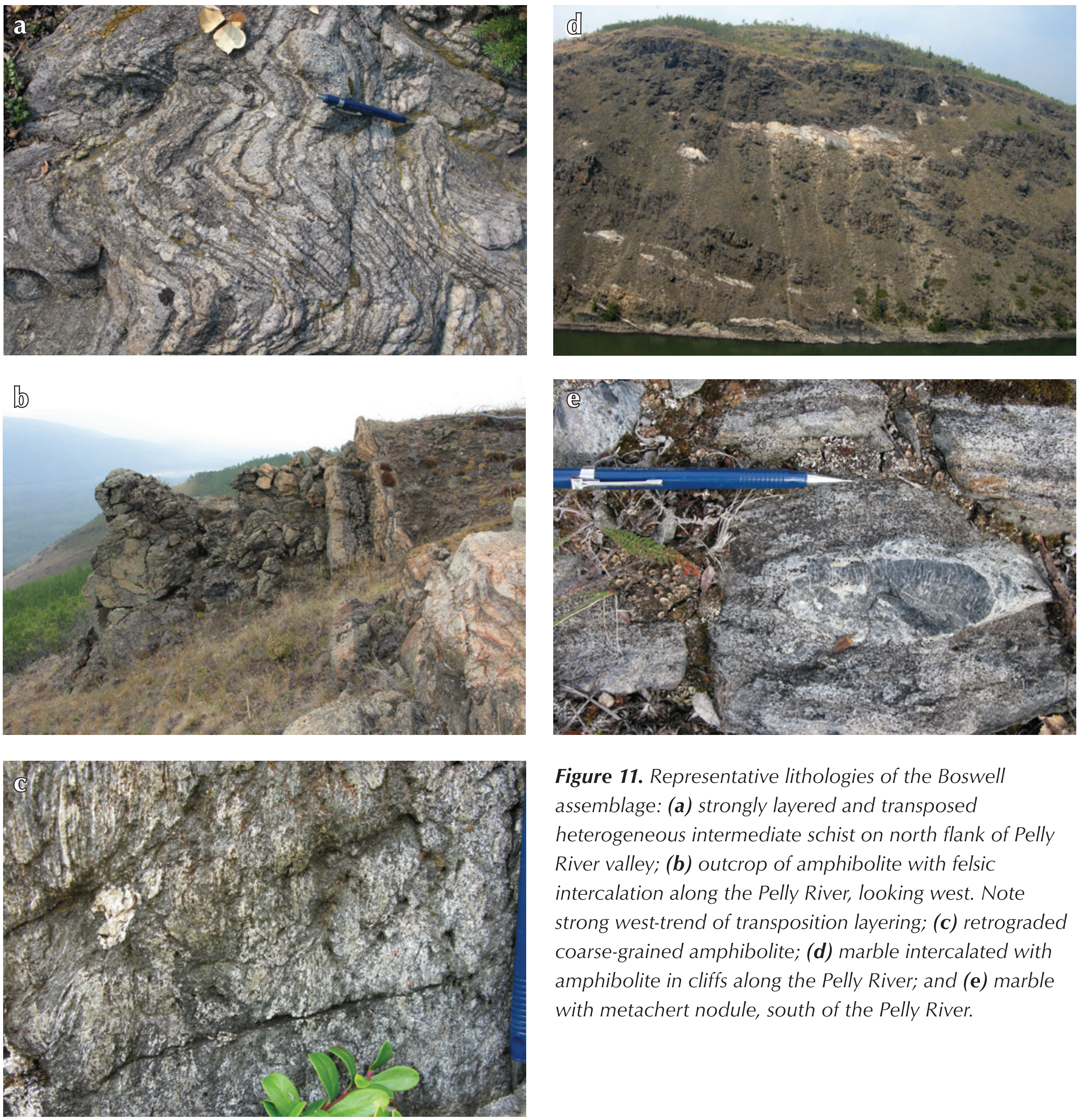


Figure 11. *Representative lithologies of the Boswell assemblage:* ***(a)*** *strongly layered and transposed heterogeneous intermediate schist on north flank of Pelly River valley;* ***(b)*** *outcrop of amphibolite with felsic intercalation along the Pelly River, looking west. Note strong west-trend of transposition layering;* ***(c)*** *retrograded coarse-grained amphibolite;* ***(d)*** *marble intercalated with amphibolite in cliffs along the Pelly River; and* ***(e)*** *marble with metachert nodule, south of the Pelly River.*

the Laberge map area, mafic rocks are overlain by a sedimentary sequence that includes Pennsylvanian limestone (Tempelman-Kluit, 1984, 2009; Simard, 2003). In Glenlyon, felsic metavolcanic and metaplutonic rocks also yield Pennsylvanian U-Pb ages (M. Colpron, unpublished data). Thus, it is possible that marble exposed in the northern Carmacks area (Fig. 2) are also Pennsylvanian in age.

TRIASSIC VOLCANIC ROCKS – STIKINIA OR QUESNELLIA?

The southwest corner of the map area is primarily underlain by volcanic and plutonic rocks of early Mesozoic age that could be part of either Stikinia or Quesnellia (Fig. 2). Augite-phyric andesitic to dacitic volcanic flows (Fig. 12a) and volcaniclastic rocks occur in a northwest-trending belt that roughly follows the north bank of the Yukon River (Fig. 2). The rocks can readily be distinguished from adjacent Yukon-Tanana terrane rocks (see earlier descriptions) by the presence of primary augite phenocrysts that have been overprinted by a weakly to moderately developed cleavage and metamorphism at sub-greenschist to greenschist facies. These rocks resemble Upper Triassic volcanic rocks assigned to either the Povoas formation of the Lewes River Group (Stikinia), or the Semenof formation (Quesnellia), depending on which side of the Teslin fault they occur (Tempelman-Kluit, 1984, 2009; M. Colpron and R.-L. Simard, unpublished data).

EARLY JURASSIC AISHIHIK SUITE

Triassic augite-phyric volcanic rocks described in the previous section are intruded and bounded to the southwest by a biotite ± hornblende granodiorite to monzogranite that is continuous with Early Jurassic granitoids exposed in the neighbouring Stewart River

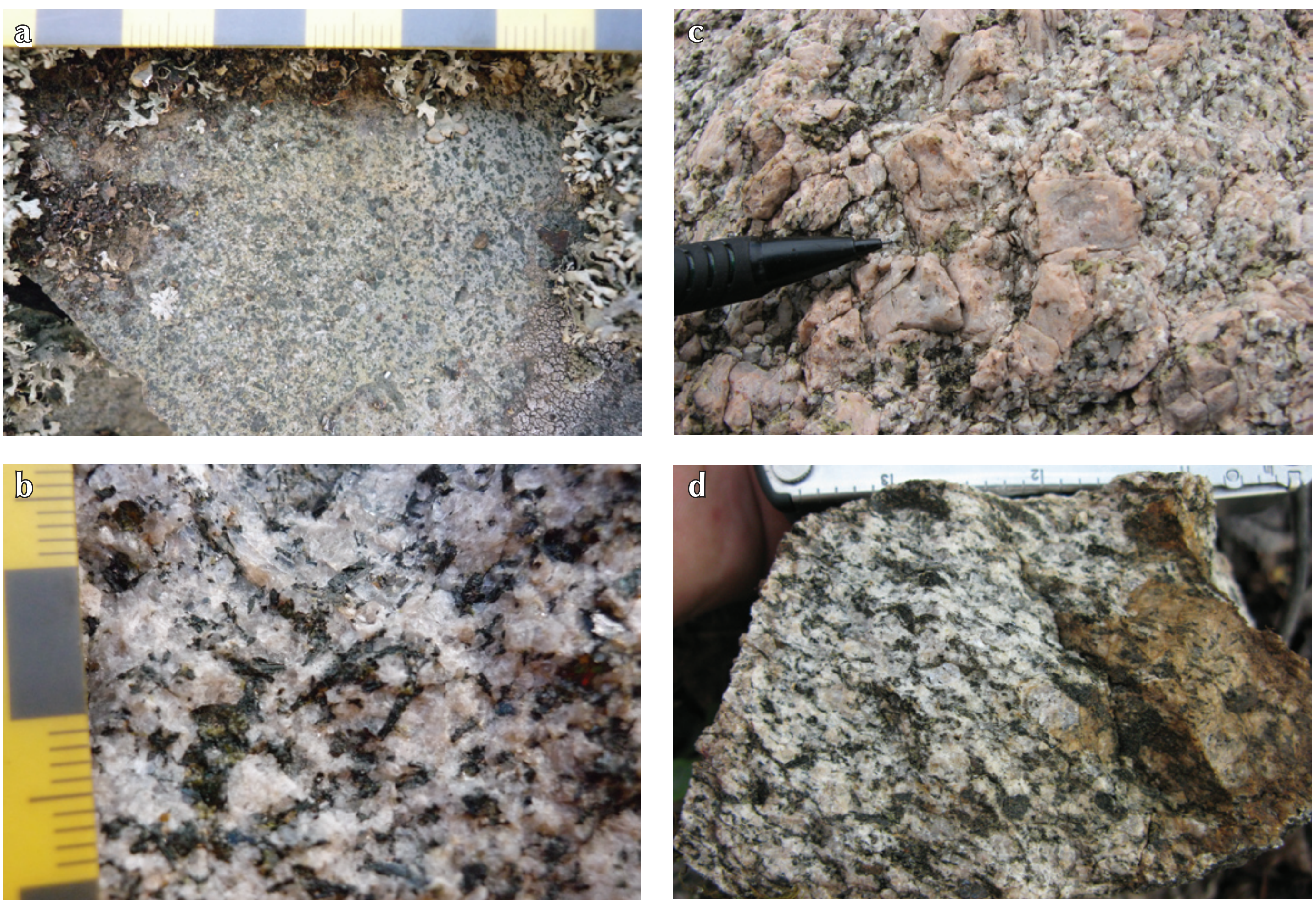


Figure 12. *Representative photographs of Triassic and Jurassic rocks from northern Carmacks area.* ***(a)*** *Upper Triassic(?) augite-phyric volcanic rock of Stikinia or Quesnellia;* ***(b)*** *hornblende-biotite-epidote granodiorite, Early Jurassic Aishihik suite;* ***(c)*** *K-feldspar porphyritic biotite syenogranite, Aishihik suite; and* ***(d)*** *moderately foliated hornblende granodiorite of the Early Jurassic Aishihik suite.*

(M.E. Villeneuve, unpublished data) and central Carmacks map areas (Breitsprecher and Mortensen, 2004). These Early Jurassic plutonic rocks form part of the Aishihik plutonic suite (Fig. 2). The granodiorite to monzogranite (locally quartz monzonite and quartz monzodiorite) phases are generally medium to coarse grained, equigranular, and have magmatic epidote which is indicative of crystallization at mid-crustal depths (Fig. 12b). K-feldspar porphyritic monzogranite is also common (Fig. 12c). Alteration of the granitoid is locally evidenced by chloritization of the mafic phases and epidote-filled fractures. Granitoids of the Aishihik suite are generally undeformed, but locally may have a well-developed solid-state foliation (Fig. 12d). This belt of plutonic rocks represents the northwest extension of the Minto pluton which hosts the high-grade Cu-Au Minto Mine approximately 10 km to the southeast.

Figure 13. *Mid-Cretaceous biotite monzogranite of the Whitehorse plutonic suite.*

POST-ACCRETIONARY ASSEMBLAGES

The youngest rocks in the southwest McQuesten-northern Carmacks map area include mid-Cretaceous granitoid plutons of the Whitehorse plutonic suite, and Upper Cretaceous and Quaternary volcanic rocks of the Carmacks and Selkirk groups, respectively. Emplacement of all these rocks postdates the regional deformation.

MID-CRETACEOUS WHITEHORSE PLUTONIC SUITE

A number of granite plutons intrude metamorphic rocks of the Yukon-Tanana terrane in the central part of the map area (Fig. 2). In outcrop, they are commonly pink to light grey, equigranular, biotite monzogranite to granodiorite (Fig. 13). Locally, plutons and dykes of this suite are syenogranitic in composition and contain K-feldspar phenocrysts. Though the timing of their emplacement has not been constrained in the map area, field observations suggest emplacement following regional deformation. The rocks themselves resemble granites of the mid-Cretaceous Whitehorse plutonic suite to the south, and are tentatively assigned to this suite.

UPPER CRETACEOUS CARMACKS GROUP

Rocks of the Upper Cretaceous Carmacks Group occur as scattered exposures throughout the southwest McQuesten-northern Carmacks area (Fig. 2). They generally form topographic features with positive relief and are well defined by patchy high magnetic anomalies in the new aeromagnetic data (Fig. 3). Exposures of the Carmacks Group are likely to represent erosional remnants of what once formed an extensive volcanic cover. Though its contact with underlying rocks is generally not exposed, it is inferred to rest unconformably over all older rocks in the area (Fig. 2). In the southwest McQuesten and northern Carmacks areas, the Carmacks Group largely comprises dacite and rhyodacite, similar to those in the Stewart River area to the west (Bostock, 1942; Tempelman-Kluit, 1974; Ryan and Gordey, 2002; 2004; Gordey and Ryan, 2005), and minor brown to black basalt and basaltic andesite, that are more common to the southeast in Carmacks and Glenlyon areas (Bostock, 1936; Tempelman-Kluit, 1984, 2009; Colpron *et al.*, 2002). The intermediate volcanic rocks are commonly hornblende and/or plagioclase porphyritic (Fig. 14); the basalt is locally hornblende-phyric. Locally, flow banding

Figure 14. *Homogeneous, grey-weathering, biotite-hornblende porphyritic dacite of the Upper Cretaceous Carmacks Group.*

and flattened vesicles attest to the extrusive origins of these flows. They vary from a few metres to hundreds of metres in thickness. Both intermediate and mafic compositions have been dated by K-Ar and $^{40}Ar/^{39}Ar$ methods at *ca.* 70-65 Ma in the surrounding Stewart River and Carmacks area (Breitsprecher and Mortensen, 2004; J.J. Ryan and S.P. Gordey, unpublished data).

PLIOCENE-PLEISTOCENE SELKIRK VOLCANICS

Subaerial to subglacial mafic volcanic flows of the Selkirk volcanics occur as valley fill near Fort Selkirk, at Volcano Mountain, and along Rosebud Creek (Fig. 2). The young basalt lava flows and associated breccias are typically vesicular and fresh olivine-phyric basalt; they are expressed in the new aeromagnetic data by very strong positive anomalies that follow valleys (Fig. 3). The flows appear to have experienced little erosion, commonly preserving the volcanic geomorphology; this is spectacularly expressed at Volcano Mountain where a cinder cone, craters, lava domes and flows are well preserved (Fig. 15). Selkirk lavas form impressive palisades near the confluence of the Yukon and Pelly rivers (Jackson *et al.*, 2009) where they likely dammed the Yukon River on a number of occasions (Huscroft *et al.*, 2004). The Selkirk volcanics vary in composition from olivine nephelinite to basanite and alkaline olivine basalt (Francis and Ludden, 1990). A number of flows have been dated in the area and yield $^{40}Ar/^{39}Ar$ whole rock ages spanning *ca.* 3.25 Ma to <0.311 Ma. The youngest eruption took place at Volcano Mountain in the late Pleistocene (Nelson *et al.*, 2009; Huscroft *et al.*, 2004).

STRUCTURAL GEOLOGY

A variety of structural styles are observed in the southwest McQuesten-northern Carmacks area depending on the belt of rocks being mapped. The central belt of the Yukon-Tanana terrane is characterized by at least two phases of isoclinal folding and development of transposition foliations. The main foliation observed in these rocks developed at upper greenschist to amphibolite facies conditions and may be representative of a second generation fabric; this is most obvious in metasiliciclastic rocks of the Snowcap assemblage (*e.g.*, Fig 4c). Metaplutonic rocks of the Simpson Range and Sulphur Creek suites generally only exhibit this second regionally pervasive foliation that developed in the Late Permian (Berman *et al.*, 2007). This dominant foliation is itself deformed by two younger sets of open folds that are defined by an axial planar crenulation cleavage that likely developed during episodes of less pervasive Triassic and/or Jurassic deformation and metamorphism.

In the northeastern part of the map area, rocks of the Reid Lakes batholith and volcanic succession appear to have escaped the regional deformation recorded in the Yukon-Tanana terrane south of the Willow Lake fault (Fig. 2). Rocks of the Reid Lakes complex are only foliated in proximity to the fault and only show limited evidence for metamorphism in the form of local chloritization of mafic minerals. The Willow Lake fault is well defined in the aeromagnetic data where it corresponds to a magnetic low and truncation of anomalies (Fig. 3). Although the kinematics of the Willow Lake fault is unknown, the juxtaposition of undeformed, high-level Reid Lakes rocks next to intensely deformed and metamorphosed, mid-crustal level rocks of the Snowcap and Klondike assemblages to the south, suggests an important vertical component of displacement along this fault.

To the south, rocks of the Boswell assemblage are also affected by two phases of tight isoclinal folding. In sharp contrast to the northwest-trending structures observed in the Yukon-Tanana terrane rocks to the north, structures

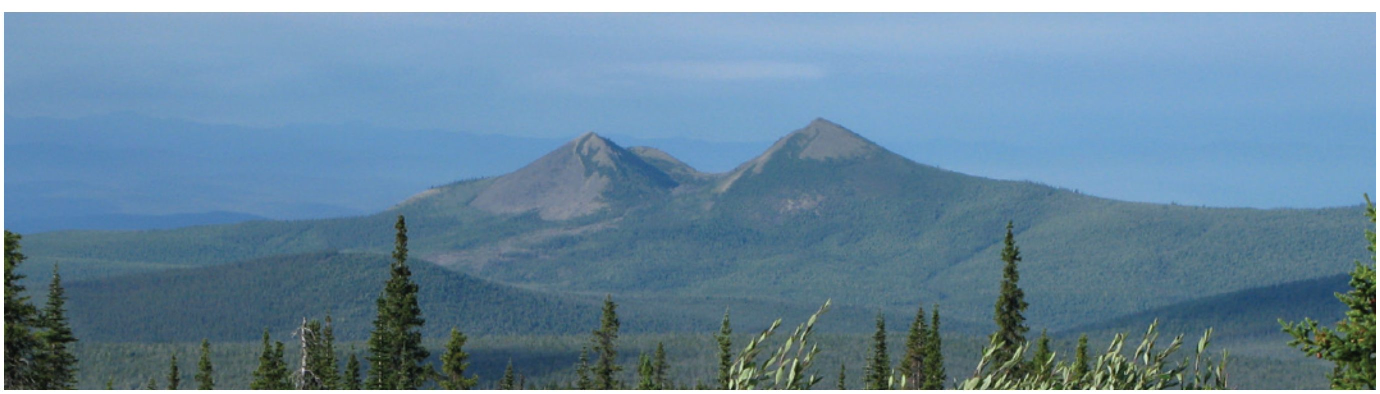


Figure 15. *Looking southwest at Volcano Mountain, underlain by Quaternary basalt of the Selkirk volcanics.*

within the Boswell assemblage trend east-west. This discontinuity is likely marked by a fault that is nowhere exposed in the map area, but is well delineated in the geophysical data by an east-trending low that extends eastward from Mount Watson (Figs. 2, 3). To the southeast, in the Glenlyon map area, a similar structure juxtaposes rocks of the Snowcap assemblage over amphibolite and marble of the Boswell assemblage (Colpron *et al.*, 2002). There, the Needlerock thrust is well exposed at one locality where fabric relationships indicate a top-to-the-south sense of displacement (Colpron *et al.*, 2003). A similar interpretation is considered for the fault bounding the Boswell assemblage in the northern Carmacks area (Fig. 2).

To the southwest, in the vicinity of Mount Walters, the Paleozoic Boswell assemblage has been juxtaposed with Triassic augite-phyric volcanic rocks along a dextral strike-slip fault. This structure is also well defined in the aeromagnetic data (Fig. 3) and can be traced northwestward beyond Volcano Mountain to Grand Valley Creek and the Mount Adami area where it splays out into a number of smaller faults (Fig. 2). This fault could be the northern extension of the Teslin fault system, which juxtaposes the Quesnellia and Cache Creek terranes, potentially recording ~125 km of Late Cretaceous dextral displacement near the Yukon-British Columbia boundary (Gabrielse *et al.*, 2006). Though it appears as a prominent structure in seismic sections (Cook *et al.*, 2004; Colpron *et al.*, 2007) in Yukon, displacement along the Teslin fault appears to wane progressively to the northwest into the area just east of Carmacks where the fault is entirely contained within Jurassic rocks of the Laberge Group. It is unclear whether the fault near Mount Walters in southwest McQuesten-northern Carmacks area is the continuation of the Teslin fault proper (Colpron *et al.*, 2007), or one of its many splays.

Another dextral strike-slip fault is inferred to separate metamorphic rocks of the Finlayson assemblage (east of the Klondike Highway) from undeformed rocks of the Reid Lakes complex (Fig. 2). This structure may form another splay of the Teslin system that separates the Reid Lakes complex from similar unstrained, quartz-phyric granite of the Tatlmain batholith situated approximately 30 km to the south in the Glenlyon map area (Colpron *et al.*, 2002, 2003, 2006b). This fault is apparently truncated by the Tintina fault (Fig. 2).

The Tintina fault marks the northeast boundary of the map area. It is well defined in the aeromagnetic data and is marked by one of the most prominent topographic lineaments in the northern Cordillera. The Tintina fault has a well-constrained dextral displacement of ~425 km since the Eocene, and up to 490 km since the Late Cretaceous (Gabrielse *et al.*, 2006). Restoration of this displacement juxtaposes the McQuesten area with part of the Finlayson Lake area of southeastern Yukon (Fig. 1), where relatively unstrained Mississippian rocks have also been documented (Murphy *et al.*, 2006).

MINERAL POTENTIAL

The southwest McQuesten-northern Carmacks area is an under-explored region that is situated at the juncture of many important mineral belts (Fig. 16). The region only has a few active mineral claims and a handful of occurrences reported in the Yukon MINFILE (*http://www.geology.gov.yk.ca/databases_gis.html*). Despite the limited activity, the rocks exposed in the project area do share many attributes with rocks observed in nearby prospective areas of the Dawson Range mineral belt, the recently discovered White Gold property to the west (Yukon MINFILE 115O 011-013, 165-166), and the producing Minto Mine to the south (Yukon MINFILE 115I 021-022; Fig. 16). Limited accessibility and geoscience information, compounded by the complex Quaternary history of the region, are all factors that have likely hindered exploration in the southwest McQuesten area. Thus, an objective of this project is to improve our geological understanding of the area and to provide new exploration tools (*e.g.*, high-resolution aeromagnetic data) to assist in evaluating the mineral prospectivity of the area.

The Yukon-Tanana terrane hosts significant syngenetic sulphide deposits in the Finlayson Lake district of southeastern Yukon (Fig. 1; Hunt, 2002). There, much of the sulphide mineralization is associated with Upper Devonian to Lower Mississippian felsic metavolcanic rocks (*e.g.*, Wolverine and Kudz Ze Kayah mineral deposits, Yukon MINFILE 105G 072 and 105G 117, respectively). Additional occurrences are associated with Upper Devonian (Fyre, Yukon MINFILE 105G 034) and Early Permian (Ice, Yukon MINFILE 105G 118) mafic metavolcanic rocks (Hunt, 2002). In most cases, many of the mineral occurrences developed in a back-arc environment within the Yukon-Tanana terrane. On the southwest side of the Tintina fault, in the Stewart River (Gordey and Ryan, 2005; S.J. Piercey and J.J. Ryan, unpublished data) and Glenlyon regions (Colpron *et al.*, 2003, 2006b), Yukon-Tanana rocks are dominated by

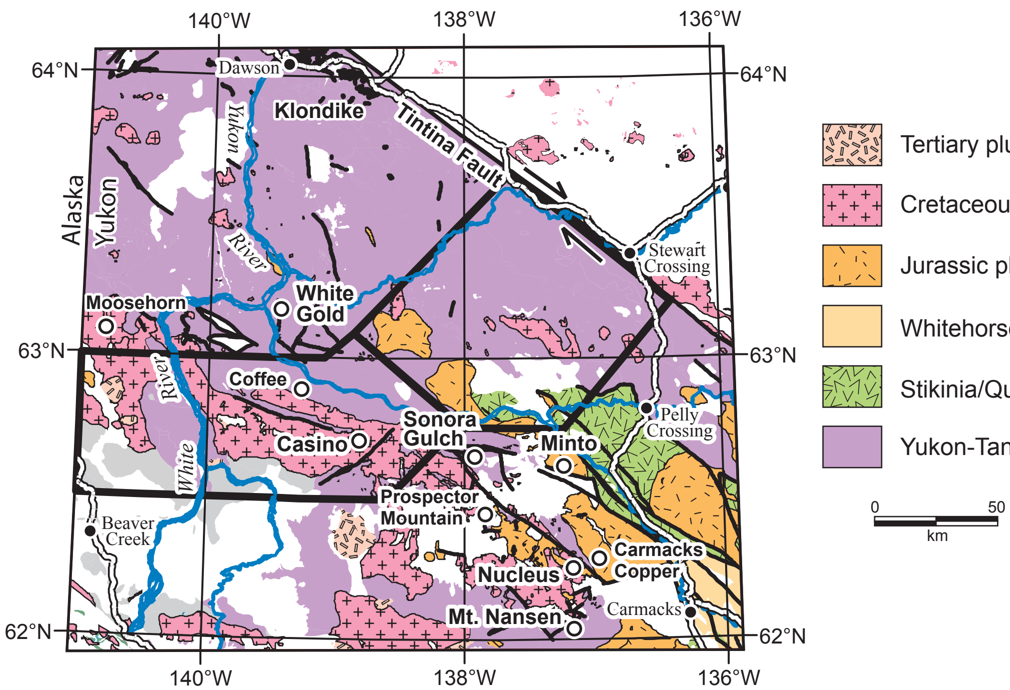


Figure 16. *Location of southwest McQuesten-northern Carmacks area with respect to major mineral occurrences of the Dawson Range mineral belt in west-central Yukon. Black outlines illustrate area of detailed aeromagnetic surveys in southwest McQuesten (Kiss and Coyle, 2009 a-r) and northern Stevenson Ridge (Kiss and Coyle, 2009 s-af).*

mafic to intermediate metavolcanic and metaplutonic rocks that are representative of an arc environment (Piercey *et al.*, 2006), and thus less prospective for syngenetic sulphide occurrences. In Stewart River, the Lucky Joe occurrence (Yukon MINFILE 115O 051) is probably an Early Mississippian, intrusion-related skarn or porphyry-style occurrence that developed in this arc setting (J. Peter and R. Presnell, pers. comm.).

In the southwest McQuesten area, the Yukon-Tanana terrane is dominated by metasedimentary rocks of the Snowcap assemblage with proportionally fewer metavolcanic rocks that appear limited in their prospectivity for massive sulphide deposits. Most of the metavolcanic rocks are mafic schists and amphibolite of unknown age and protolith. Their geochemical characterization will assist in evaluating their tectonic environment and prospectivity.

North of the Willow Lake fault, rocks of the Reid Lakes complex were emplaced at high levels in the crust and remained so for much of their history. An Early Mississippian age for this assemblage suggests they may be related to the Simpson Range plutonic suite – the suite with which the Lucky Joe prospect to the west is associated. At the Lucky Joe property, probable intrusion-related mineralization is overprinted by penetrative deformation and metamorphism, thus complicating exploration. In contrast, the well-preserved, high-level magmatic rocks of the Reid Lakes complex appear to have experienced little post-emplacement deformation and should perhaps be evaluated for their porphyry or epithermal mineralization potential.

Rocks of the Sulphur Creek suite and Klondike assemblage are associated with the source region for the renowned Klondike placer gold fields situated northwest of the McQuesten area (Fig. 16). These rocks are typically strongly altered, as indicated by high concentration of micas, and are commonly laced with quartz veins and pyrite. The unusual alteration of the Klondike assemblage may be the result of synmagmatic hydrothermal alteration that was later overprinted by regional amphibolite facies metamorphism. These rocks may be prospective for vein-hosted gold.

Granodiorite to monzogranite of the Early Jurassic Aishihik plutonic suite in the southwest part of the map area represents the northwest extension of the Minto pluton, which is host to the high-grade Cu-Au deposit of the

Minto Mine. This belt of rocks is currently the focus of most of the exploration activities in the map area. Due to forest fire activity in 2009, our evaluation of the belt was limited during the field season, but will be the focus of further mapping in 2010.

Finally, the southwest McQuesten-northern Carmacks area is northeast of the Dawson Range mineral belt which is known for its wealth of Cretaceous Cu-Au deposits, including the recent discovery at White Gold and auriferous gold veins of the Moosehorn Range (Yukon MINFILE 115N 024; Fig. 16). A series of small, post-tectonic plutons in southwest McQuesten are inferred to be part of the mid-Cretaceous Whitehorse plutonic suite and should be evaluated for their intrusion-related gold potential.

SUMMARY

Bedrock mapping of the southwest McQuesten-northern Carmacks area has confirmed that most of the area is underlain by rocks of the Yukon-Tanana terrane (Fig. 2). In the centre of the map area, metasedimentary and metavolcanic rocks are correlated with the Snowcap and Klondike assemblages of Yukon-Tanana, whereas the metaplutonic rocks are attributed to the Early Mississippian Simpson Range and Permian Sulphur Creek suites. Northeast of the Willow Lake fault, undeformed plutonic and volcanic rocks of the Reid Lakes complex are also part of the Yukon-Tanana terrane. They were previously interpreted to be of Cretaceous age, but recent U-Pb geochronology has demonstrated an Early Mississippian age for the complex. Juxtaposition along the Willow Lake fault of the high-level Reid Lakes volcano-plutonic complex to the north, against mid-crustal metamorphic rocks of the Snowcap and Klondike assemblages to the south, implies a significant component of vertical displacement along the fault. The southern part of the map area is underlain by mid-Paleozoic to early Mesozoic rocks of Quesenellia and/or Stikinia. The map area is dissected by a series of faults that we infer to be dextral strike-slip faults related to the Teslin fault system. The southwest McQuesten-northern Carmacks area is an under-explored region that shares many attributes with nearby, highly prospective areas of the Dawson Range, White Gold and Carmacks/Minto districts.

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