The Bear Creek assemblage: A latest Triassic volcano-sedimentary succession in southwest Yukon

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ABSTRACT

The bedrock geology in the Mount Decoeli area of southwest Yukon is characterized by Paleozoic to Triassic stratigraphy of the Alexander terrane, Wrangellia and the Bear Creek assemblage, overlain and intruded by Jurassic and younger rocks. Alexander terrane rocks comprise mainly Devonian mafic to intermediate volcanic and volcaniclastic rocks overlain by thick successions of carbonate and phyllite. Wrangellia is characterized by Mississippian to Permian volcanic and siliciclastic rocks of the Station Creek and Hasen Creek formations, overlain by Upper Triassic basalts and calcareous rocks of the Nikolai and McCarthy formations respectively. The Alexander terrane and Wrangellia are separated by the Duke River fault, a mainly Late Cretaceous northeast-verging thrust fault. To the northeast, Wrangellia is separated from the Bear Creek assemblage by the Denali fault, a strike-slip fault with as much as 400 km of right-lateral motion.

The Bear Creek assemblage comprises metamorphosed and deformed siltstone, mudstone and sandstone interlayered with mafic to intermediate volcanic and volcaniclastic rocks. Preliminary ages suggest the Bear Creek assemblage is Late Triassic (*ca.* 204 Ma). Regional correlation of the Bear Creek is unclear, but similarities between the assemblage and rocks of the Taku and Alexander terranes suggest possible linkages. Correlation with Upper Triassic rocks of Wrangellia is less favourable.

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INTRODUCTION

During ten days of fieldwork in early June 2014, the Yukon Geological Survey undertook an accelerated 1:50 000-scale bedrock mapping project of the Mt. Decoeli area in southwest Yukon. The purpose of this project was to characterize the succession of enigmatic metavolcanic and metasedimentary rocks in the Bear Creek assemblage, found west-southwest of Haines Junction (Fig. 1). These rocks are associated with anomalous gold in regional geochemical samples and volcanogenic massive sulphide occurrences. Their characterization will help refine current understanding of the regional tectonic and stratigraphic framework of southwest Yukon.

Vehicle access to the area is limited to an all-wheel drive road in the southeast, through the Bear Creek subdivision and along the Dezadeash River, south of the Alaska Highway. Less maintained roads are present in the areas of Kimberly and Telluride creeks, however their condition is unknown and are likely only useable by quads or walking. Helicopter is the only means of access to most of the area, and is only a short distance from Haines Junction. Exposure is excellent in the southeast and southwest parts of the area and very poor in the northeast and northwest. This report highlights the preliminary findings of this mapping project and serves as companion to YGS Open File 2014-18 (Israel *et al.*, 2014a).

REGIONAL GEOLOGY

Southwest Yukon is characterized by several Paleozoic to Mesozoic terranes, assembled into larger composite terranes and accreted to one another in the Middle Jurassic or earlier (McClelland *et al.*, 1992; van der Heyden, 1992; Nelson *et al.*, 2013). The Intermontane terranes, which in southwest Yukon includes Yukon-Tanana and Stikinia, formed a western continental margin in Mesozoic to which the Insular terranes, Alexander and Wrangellia, were accreted. This led to mountain building, exhumation and erosion of both tectonic elements. The detritus shed from the uplifted terranes was deposited in a series of Jura-Cretaceous basins along the tectonic boundary (McClelland *et al.*, 1992; Umhoefer *et al.*, 2002; Nelson *et al.*, 2013). These basins include rocks of the Dezadeash Formation and the Kluane schist, both located in southwest Yukon (Fig. 1). The Dezadeash Formation is sourced from the Insular terranes and overlaps these terranes as well as rocks assigned to the Yukon-Tanana terrane (Eisbacher, 1976; Gehrels and Saleeby, 1987). The Kluane schist is sourced from the Intermontane terranes, more specifically the Yukon-Tanana terrane, as well as post-amalgamation plutons that intrude the terrane (Israel *et al.*, 2011). The Yukon-Tanana terrane was subsequently thrust over the Kluane schist in Late Cretaceous. This structural boundary is intruded by Paleocene granodiorite of the Ruby Range suite.

The present boundary between Insular and Intermontane terranes is defined by the Denali fault, a continental-scale dextral strike-slip fault with as much as 400 km of movement from the latest Cretaceous (?) to the present (Fig. 1). Other large structures in the region include the Duke River fault, a northeast-directed thrust fault that places rocks of the Alexander terrane over Wrangellia and that was mainly active in Late Cretaceous through the present (Cobbett, 2011). The Shakwak and Tatshenshini faults, northeast of the Denali (Fig. 1), are not well constrained, but together with the Denali fault they bound a structural wedge between the Intermontane and Insular terranes that is underlain by enigmatic rocks of the Bear Creek assemblage.

LITHOLOGY

A preliminary bedrock geology map of the Mt. Decoeli area is shown in Figure 2. The area can be divided into three geographically distinct stratigraphic successions separated by major faults, from southwest to northeast: 1) Alexander terrane; 2) Wrangellia; and 3) the Bear Creek/Dezadeash succession. The Duke River fault separates Alexander from Wrangellia, and Wrangellia is juxtaposed to the Bear Creek/Dezadeash succession along the Denali fault (Fig. 2). An extensive description of lithologies from the Bear Creek/Dezadeash succession, the focus of the project, is provided below, but only brief descriptions of Alexander terrane and Wrangellia are given here. The reader is referred to Dodds and Campbell (1992a), Israel *et al.* (2006, 2014b), and Israel and Cobbett (2008) for more detailed descriptions of Alexander and Wrangellia regional stratigraphy.

ALEXANDER TERRANE

The Alexander terrane in the map area is composed mainly of Silurian to Devonian sedimentary and minor volcanic and volcaniclastic rocks, as seen in the exposed hanging wall of the Duke River fault (Fig. 2). Limited amount of work was done on Alexander rocks within this project; our limited observations were compiled with the more detailed work by Dodds and Campbell (1992b,c). Three main units were identified in the Alexander terrane.

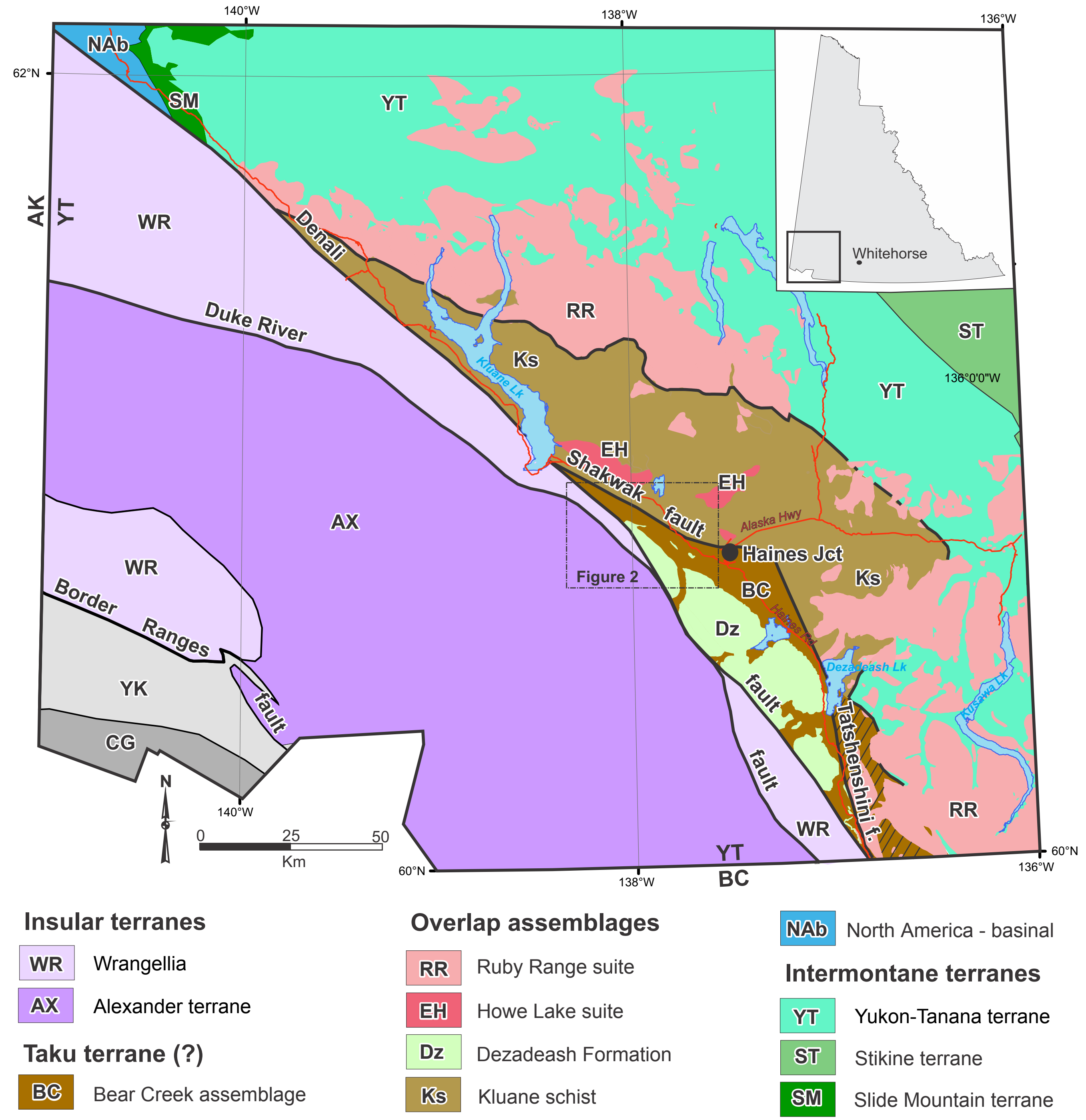

Figure 1. *Terrane map of southwest Yukon (modified after Colpron and Nelson, 2011). Inset map shows location with respect to the rest of Yukon. Location of the study area (Fig. 2) is shown by dashed line box. AK-Alaska, YT-Yukon Territory, BC-British Columbia.*

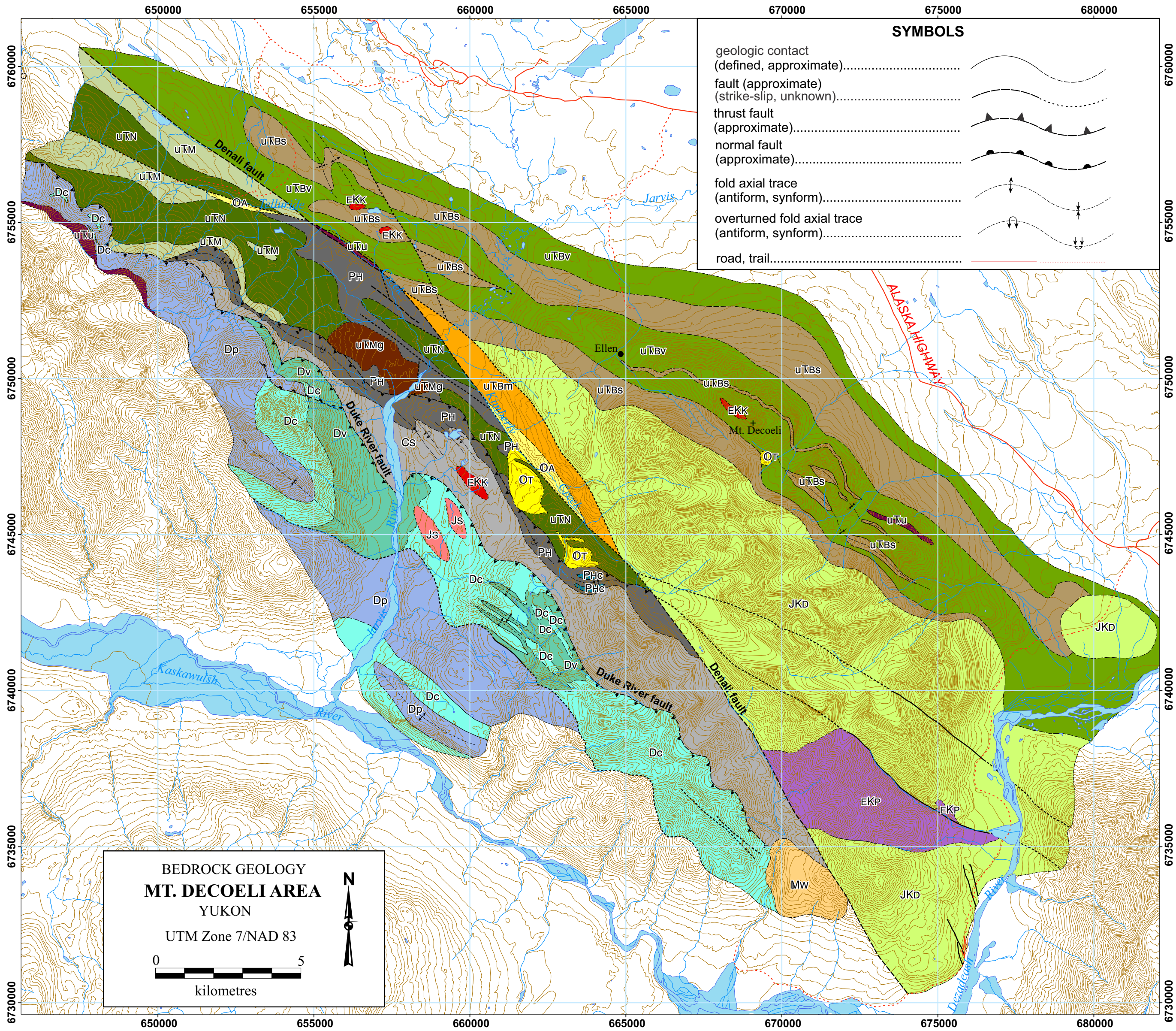

Figure 2. *Generalized bedrock geology map of the Mt. Decoeli area, parts of NTS 115A/12, 13 and 115B/9, 16. Legend is on opposite page.*

The oldest exposed parts of the Alexander terrane occur within tight antiforms on a northeast-trending ridge between the Kaskawulsh River and Kimberly Creek and on steep slopes west of the Jarvis River (Fig. 2). Mixed, interlayered volcaniclastic and hornblende-phyric mafic flows dominate this succession (Fig. 3a). The volcanic rocks become strongly foliated greenschist near faults and within tight fold axes. Locally thin layers of intermediate to felsic metavolcanic rocks occur within the mafic rocks. The age of these volcanic rocks is not known.

The volcanic rocks are overlain by a thick sequence of marble, which occurs as coherent, bedded carbonate, carbonate breccia and calcareous phyllite assigned to the informal Bullion Creek assemblage of Dodds and Campbell (1992a). It commonly forms large, mountain-scale exposures several hundreds of metres thick (Fig. 3b), and laterally continuous for several kilometres. Several fossils collected from within the Bullion Creek assemblage yielded Late Silurian to Devonian ages (Dodds *et al.*, 1993).

LEGEND

OVERLAP ASSEMBLAGES

MIOCENE (?)

WRANGELL VOLCANICS

MW — coherent flow-banded andesitic to dacitic lavas and subvolcanic intrusions; silicic tuff and lapilli tuff

OLIGOCENE

OA — pebble to cobble and locally boulder, clast supported conglomerate; clast types include well-rounded to subangular rock types found in the immediate area including mafic to intermediate volcanic and intrusive rocks, fine-grained clastic rocks and marble

TKOPE SUITE (*ca.* 34-23 Ma):

OT — medium to coarse-grained, plagioclase, quartz porphyry

EARLY CRETACEOUS

KLUANE RANGES SUITE (*ca.* 124 - 116 Ma):

EKK — medium to coarse-grained, strongly foliated, hornblende, biotite granodiorite to quartz diorite

PYROXENITE CREEK SUITE (*ca.* 124 Ma):

EKP — fine to coarse-grained, strongly foliated to massive hornblende, biotite granodiorite; white to beige weathered, salt and pepper fresh; garnet is common

DEZADEASH FORMATION:

JKD — interbedded light to dark buff-grey lithic greywacke, sandstone, siltstone, thin dark grey shale, argillite and conglomerate; mass-flow conglomerate; rare light grey tuff

UNKNOWN TECTONIC AFFINITY

LATE TRIASSIC

BEAR CREEK ASSEMBLAGE

uTrBm — foliated and faulted melange-like assemblage of medium to dark green, medium to coarse-grained clastic or volcaniclastic rocks and lesser grey chert and mudstone, with local highly foliated, cm- to dm-scale, cream-coloured layers and lenses of more felsic composition (tuff?)

uTrBs — fine-grained meta-siltstone, mudstone and sandstone; phyllitic to schistose, locally more massive; abundant pyrite cubes observed in mudstone

uTrBv — fine to medium-grained, strongly foliated to massive intermediate to mafic metavolcanic rocks; greenschist near fault zones; interlayered with metasedimentary rocks of uTrBs and thin carbonate horizons; locally pillowed

LEGEND EXPLANATION

(oval) **PLUTONIC SUITES:** grouping of plutonic rock units based on age, regional distribution and in some cases composition

(box) **LAYERED ROCK ASSEMBLAGES:** regionally mappable units generally of Group or Formation rank

WRANGELLIA

LATE TRIASSIC

MAPLE CREEK GABBRO: (*ca.* 232 Ma)

uTrMg — medium to coarse-grained, gabbro and diorite; massive to strongly foliated near fault zones

KLUANE MAFIC/ULTRAMAFIC SUITE: (*ca.* 232-228 Ma)

uTru — medium to fine-grained peridotite, dunite and gabbro; where deformed abundant serpentinite

MCCARTHY FORMATION

uTrM — fine-grained calcareous to carbonaceous mudstone and siltstone; massive beige to cream weathered carbonate; white to light grey, strongly deformed evaporite

NIKOLAI FORMATION

uTrN — dark green to maroon, massive to locally foliated, amygdaloidal and vesicular basalt; rare pillow and volcanic breccia

MISSISSIPPIAN TO PERMIAN

HASEN CREEK FORMATION

PHc — beige to white weathered, laterally discontinuous carbonate; light to dark grey banded to massive

PH — fine-grained, mudstone, siltstone and sandstone; minor volcaniclastic rocks; locally phyllitic

STATION CREEK FORMATION

CS — dark green metabasalt, volcanic breccia, greenschist; minor carbonate and fine-grained siliciclastic rocks

ALEXANDER TERRANE

JURASSIC

SAINT ELIAS SUITE: (*ca.* 152-148 Ma)

JS — coarse-grained, dark brown-black, hornblende +/- biotite granodiorite and quartz diorite

SILURIAN TO DEVONIAN (?)

SDp — fine-grained, dark to light grey phyllite and calcareous phyllite

BULLION CREEK ASSEMBLAGE

SDc — fine to medium-grained, grey-cream weathered, light grey to white marble; internally strongly deformed

SDv — dark green metabasalt, meta-volcaniclastic rocks, greenschist

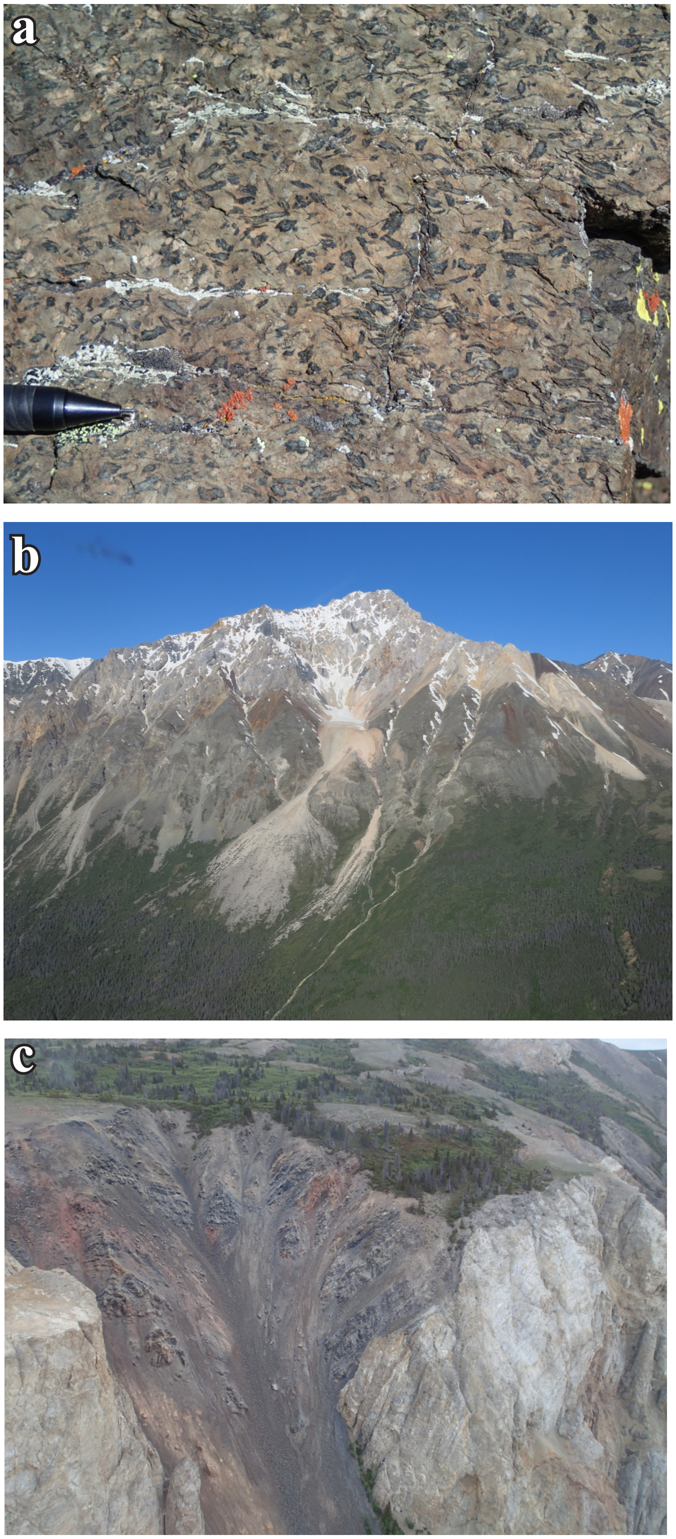

Figure 3. *(a) Hornblende-phyric metabasalt of unit Dv of the Alexander terrane; (b) several hundred metres-thick carbonate of unit Dc of the Alexander terrane capping an unnamed mountain west of the Jarvis River, view looking south; (c) bedded, dark grey calcareous phyllite of unit Dp overlying Dc carbonate.*

A thick succession of calcareous phyllite overlies the marble and is faulted against the older volcanic succession (Figs. 2 and 3c). The phyllite is light to dark grey banded and locally black and graphitic. Thin bands of cherty layers also occur locally. Total thickness of this unit is not known but must be at least several hundred metres based on exposures on steep mountain sides west of the Jarvis River. The age of the phyllite is Devonian based on several fossil localities within the unit (Dodds *et al.*, 1993).

WRANGELLIA

Rocks assigned to Wrangellia occur structurally sandwiched between the Duke River fault and the Denali fault (Fig. 2). The rocks are consequently strongly deformed and generally form overturned folds with northeast vergence. Wrangellia is well exposed near the Duke River fault, but exposures are sparse in areas of low topographic relief, such as the flats surrounding Telluride Creek.

In the Mt. Decoeli area, the oldest rocks in Wrangellia are mafic to intermediate volcanic breccia, volcaniclastic rocks and flows of the Station Creek Formation (Fig. 2). Breccia comprise pyroxene-phyric basaltic clasts within a fine-grained matrix of similar composition (Fig. 4a). Brown to grey carbonate clasts are common within the breccia (Fig. 4a) and carbonate occurs as thin layers within the volcaniclastic sequence. Flows are generally strongly deformed and schistose but locally occur as massive greenstone. The greenstone is locally pyroxene-phyric. The age of the Station Creek Formation is Mississippian to Pennsylvanian (Israel *et al.*, 2014). Metasedimentary rocks of the Hasen Creek Formation overly the Station Creek Formation. The contact between the two formations was not observed in the Mt. Decoeli area, but elsewhere in southwest Yukon this contact is gradational. The Hasen Creek Formation comprise siltstone, mudstone, sandstone and carbonate. Carbonate is thickest (up to 10 m) near the top of the unit where it is interlayered with black mudstone and siltstone (Fig. 4b). Abundant fossil collections throughout southwest Yukon constrain the age of the Hasen Creek Formation as Permian.

The Nikolai formation unconformably overlies the Hasen Creek Formation (Fig. 2). It is characterized by a thick sequence of highly vesicular to amygdaloidal mafic volcanic rocks that weather a distinct dark green to maroon colour that are easily distinguished from volcanic rocks of the Station Creek Formation (Fig. 4c). Massive flows are dominant but volcanic breccia and rare pillow basalt occur locally near the base of the unit. The thickness of the Nikolai formation in the Mt. Decoeli area is not well constrained but in other parts of southwest Yukon the basalt can be up to 3000 m thick (Read and Monger, 1976). The age of the Nikolai formation is Late Triassic (Carnian to Norian) based on dating of associated gabbro and ultramafic rocks, and on conodont collections from interlayered carbonate near the top of the unit (Greene *et al.*, 2009). A mixed sequence of carbonate and calcareous to graphitic mudstone overlies the basalt. The carbonate is likely part of the Chitistone Limestone, a Norian limestone unit well documented elsewhere in southwest Yukon, and the mudstone is part of the McCarthy Formation, which is also Norian. Poor exposure and structural interleaving of these units made it difficult to separate them into different units on the map so they are included together as the McCarthy Formation (Figs. 2 and 4d).

BEAR CREEK ASSEMBLAGE

The Bear Creek assemblage is found north of the Denali fault where it occupies much of the low land north of Telluride Creek and the peaks and front slopes of the mountains surrounding Mt. Decoeli (Fig. 2). The assemblage is characterized by strongly deformed metasedimentary and metavolcanic rocks. Metasedimentary rocks appear to underlie the volcanic rocks, however there is some interlayering of the two higher up in the sequence.

Metasedimentary rocks included within the Bear Creek assemblage are characterized by thinly bedded to massive siltstone, mudstone and sandstone (uTBs; Figs. 2 and 5a). Beds range in thickness from centimetre to metre-scale. Original sedimentary features, such as graded beds and

Figure 4. *(a) Pyroxene-phyric volcanic clasts within volcanic breccia of the Station Creek Formation, note brown weathered carbonate clast; (b) folded metasiltstone, mudstone and carbonate of the Permian Hasen Creek Formation; (c) Upper Triassic dark green, amygdaloidal basalt of the Nikolai formation; (d) mixed carbonate, evaporite and bedded carbonaceous limestone of the McCarthy Formation and the Chitistone Limestone.*

soft sediment deformation structures, are locally preserved (Fig. 5b). Elsewhere the rocks are more graphitic and deformed resulting in a black phyllite horizon that is easily identifiable in the field (Fig. 5c). Pyrite cubes up to 2-3 mm in size are commonly found within the black phyllite. Dark to light grey banded marble of variable thickness is interlayered with the phyllite and less deformed clastic sedimentary rocks (Fig. 5d). Marble occurs within the sedimentary horizons that are interlayered with the volcanic rocks near the top of the assemblage.

Intermediate to mafic volcanic rocks gradationally overly the sedimentary portion of the Bear Creek assemblage (uTrBv; Fig. 2). Similarly, thin horizons of metasedimentary rocks are interlayered with the volcanic rocks near the top of the sequence. The volcanic rocks are also highly deformed and often form greenschist. They are locally interlayered with carbonate bands (Fig. 6a). Pillows are preserved in areas of lesser deformation (Fig. 6b,c). More volcaniclastic-like material is found throughout the massive flows, likely representing tuffaceous deposits. Andesitic to basaltic compositions dominate the volcanic succession; however, more felsic, plagioclase and quartz-phyric horizons occur locally (Fig. 6d).

An enigmatic succession of metasedimentary rocks located next to the Denali fault, just north of Kimberly Creek, is tentatively assigned to the Bear Creek assemblage (uTrBm; Fig. 2). A strand of the main Denali fault separates these rocks from the Dezadeash Formation in the north and they are unconformably overlain by Oligocene Amphitheatre deposits in the south (Fig. 2). The rocks within this fault sliver are a highly deformed and metasomatically altered succession of melange-like, medium to dark green,

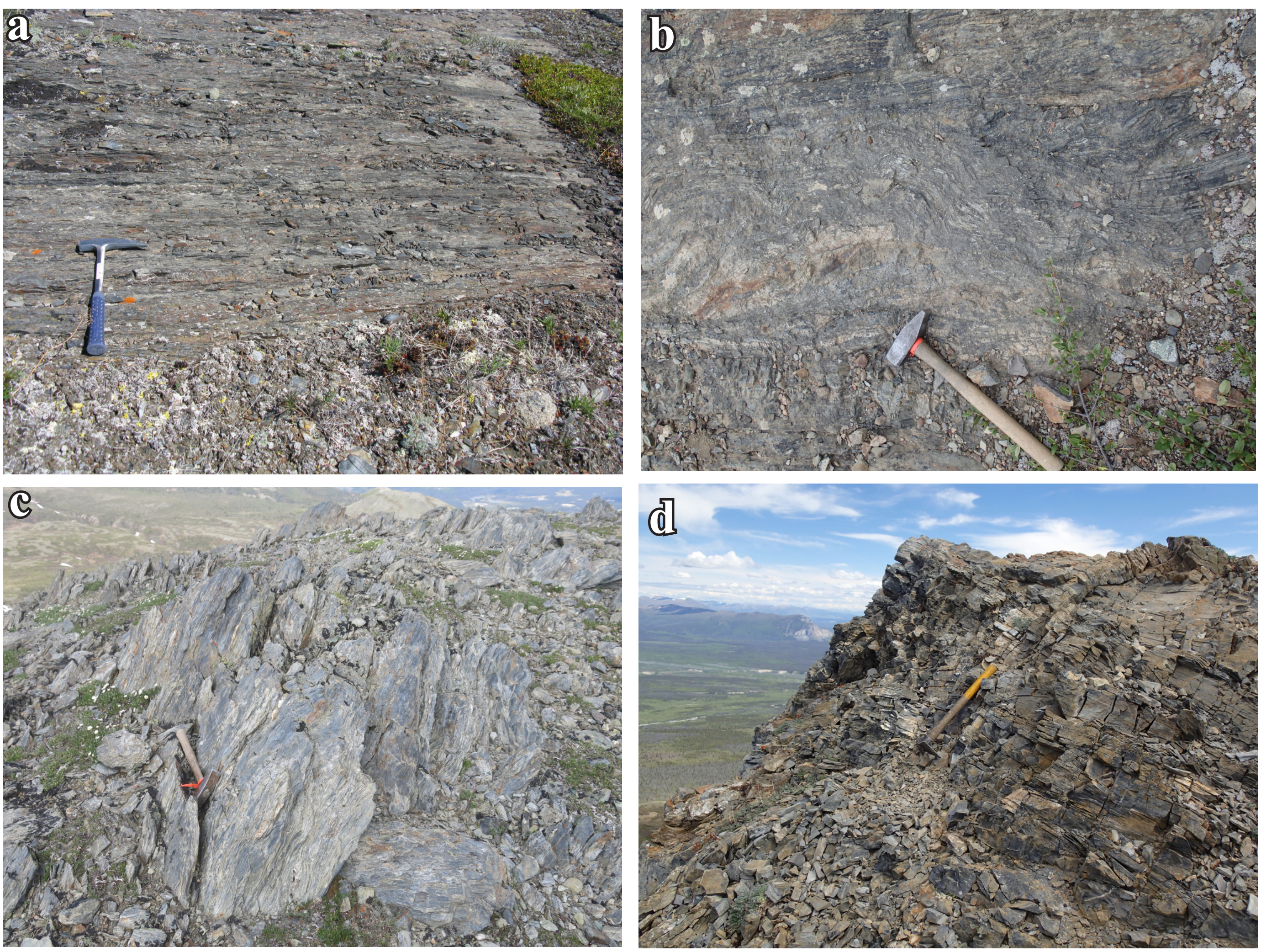

Figure 5. *(a) Interlayered, deformed and metamorphosed siltstone, mudstone and sandstone of the Bear Creek assemblage; (b) soft sediment slump folds within* uTrBs *of the Bear Creek assemblage; (c) black phyllite typical of* uTrBs; *(d) dark grey, bedded carbonate interlayered with siltstone and mudstone of* uTrBs.

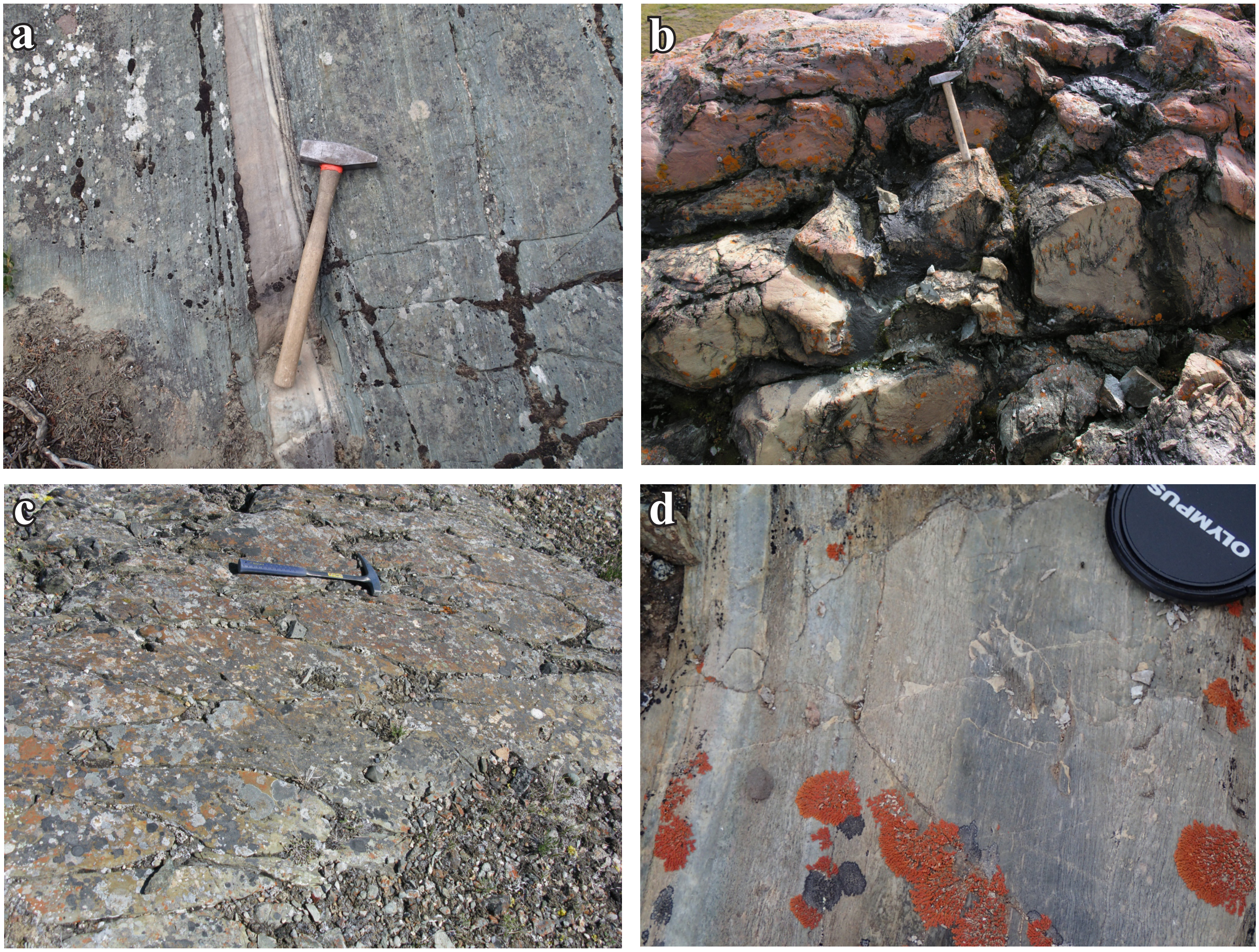

Figure 6. *(a) Thin, grey weathered carbonate horizon within greenschist of* uTrBv*; (b) strongly deformed pillows in the volcanic portion of the Bear Creek assemblage; (c) typical outcrop of deformed pillow basalt of* uTrBv*; (d) quartz and plagioclase-phyric intermediate to felsic meta-tuff within* uTrBv.

medium to coarse-grained siliciclastic and volcaniclastic rocks with lesser amounts of grey chert and mudstone (Fig. 7a). This succession includes centimetre to decimetre-scale layers of cream coloured rock that may be felsic tuff. This unit is locally conglomeratic, containing angular to subrounded clasts of variable compositions ranging from less than one centimetre to fifty centimetres (Fig. 7b). Stratigraphic relationships with other surrounding units are unclear. This unit does not look like Dezadeash Formation, nor does it resemble other units within the Bear Creek assemblage. However, its unconformable relationship with the Amphitheatre Formation suggests it is an older unit, and may be an unidentified part of the Bear Creek, perhaps an extremely altered and structurally modified part of the lower clastic unit.

A strongly deformed felsic tuff layer within the volcanic portion of the Bear Creek assemblage returned a U-Pb zircon age of ~204 Ma (J.L. Crowley, *pers. comm.*, 2014). The degree of deformation at this locality obscures original relationships and the felsic layer could also be a dike intruding the mafic volcanic rocks, so this date is considered the youngest age limit for this unit.

DEZADEASH FORMATION

The Dezadeash Formation outcrops north of the Denali fault where it seems to unconformably overlie the Bear Creek assemblage (Fig. 2). The formation consists of at least several hundred metres of siltstone, mudstone and sandstone, interpreted to be part of a submarine fan, turbidite succession (Eisbacher, 1976). Sandstone beds

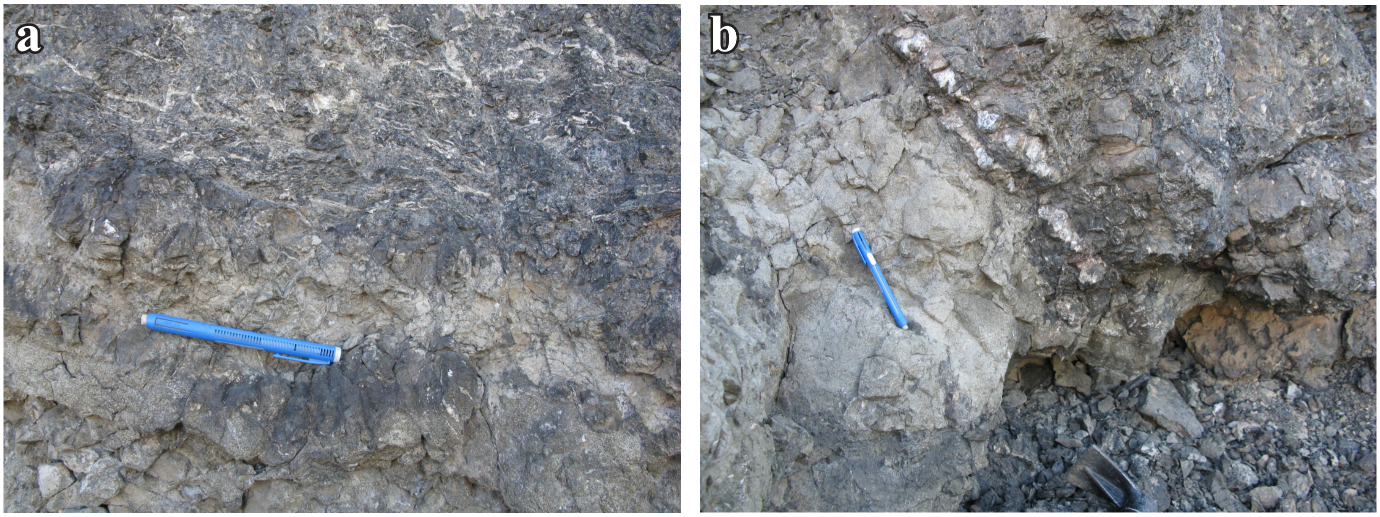

Figure 7. *(a) Convoluted layering within metamorphosed and altered sedimentary rocks of* uTrBm*; (b) large clast of possible granitic material (white) within the conglomeratic portion of* uTrBm.

range in thickness from less than one metre to several tens of metres. Graded beds, cross-laminations and other sedimentary structures are common. The unit is highly deformed, exhibiting at least two phases of folding. The first is a north-trending, tight, upright to overturned phase that is responsible for repeated stratigraphy, very steep bedding and a regionally developed penetrative cleavage. A second phase of folding trends northwest, is more open and re-folds the earlier phase. The Dezadeash Formation is Late Jurassic (Oxfordian) to Early Cretaceous (Valanginian) based on numerous fossil collections (Eisbacher, 1976).

AMPHITHEATRE FORMATION

The Amphitheatre Formation outcrops exclusively within the Denali fault zone, where it unconformably overlies enigmatic rocks assigned to the Bear Creek assemblage (uTrBm) and is faulted against rocks of Wrangellia (Fig. 2). The unit comprises poorly sorted conglomerate, with well-rounded to subangular clasts ranging in size from less than one centimetre to twenty centimetres (Fig. 8). Clast types include compositions similar to almost all local bedrock units. It is likely that the conglomerate is related to movement along the Denali fault, deposited as a fault scarp breccia/conglomerate. The steep orientation of the unconformable contact with underlying rocks and the presence of deformed clasts indicates movement on the fault continued after deposition of the Amphitheatre. The Amphitheatre Formation is Oligocene, based on regional fossil collections (Ridgway *et al.*, 1992).

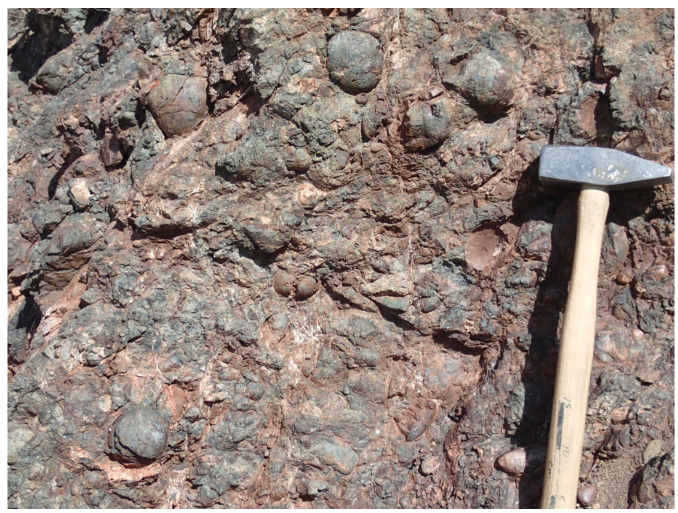

Figure 8. *Well-rounded to subangular clasts of metamorphic country rocks within poorly sorted conglomerate of the Oligocene Amphitheatre Formation.*

INTRUSIVE ROCKS

Several ages and compositions of intrusive rocks are found throughout the Mt. Decoeli area (Fig. 2). The oldest of these rocks are the granodiorite to quartz diorite of the St. Elias suite, which intrude the Alexander terrane south of the Duke River fault (Fig. 2). Regionally these range from 155-148 Ma (Dodds and Campbell, 1988). Three main intrusive suites are found within Wrangellia. These include the Late Triassic Maple Creek suite, the Early Cretaceous Kluane Ranges suite and the Oligocene Tkope suite.

The Maple Creek suite includes *ca.* 232 Ma medium to coarse-grained, pyroxene-hornblende gabbro (Mortensen and Hulbert, 1991). The Kluane Ranges suite includes granodiorite and hornblende quartz diorite ranging in age from 124 to 116 Ma. It mainly intrudes Wrangellia but may also include small intrusions within the Bear Creek assemblage just west of the Jarvis River. The youngest plutons to intrude Wrangellia are Oligocene quartz-plagioclase porphyries that are assigned to the Tkope suite. These rocks are found near the Denali fault and may have been intruded during deformation along the fault.

A large pyroxenite body intrudes the Dezadeash Formation west of the Dezadeash River (Fig. 2). These rocks have been assigned to the Pyroxenite Creek suite and are interpreted as Early Cretaceous based on K-Ar dates on hornblende and biotite (Dodds and Campbell, 1988).

DISCUSSION

REGIONAL STRATIGRAPHIC RELATIONSHIPS OF THE BEAR CREEK ASSEMBLAGE

The role of the Bear Creek assemblage in the overall stratigraphic and tectonic framework of the northern Cordillera is unclear. Other Upper Triassic rocks in the region include the Nikolai formation of Wrangellia, the Perseverance Group of the Taku terrane, and Upper Triassic stratigraphy of the Alexander terrane. Below we describe the general stratigraphy of each of these tectonic entities and compare them to the Bear Creek assemblage.

The Nikolai formation of southwest Yukon includes up to ~3000 m of subaerial to subaqueous basalt flows with locally preserved Middle Triassic mudstone below the basalt (Read and Monger, 1976; Israel *et al.*, 2006, 2007). Pillows are very rare in the Nikolai formation in southwest Yukon and found mainly near the base of the sequence. Thick accumulations of carbonate with lesser evaporites of the Chitistone Limestone and calcareous mudstone and siltstone of the McCarthy Formation overly the basalt (Fig. 9). The basalt is interpreted as the surficial expression of *ca.* 232-228 Ma mafic and ultramafic intrusions found throughout Wrangellia.

The thick accumulation of basalt and capping limestone of the Wrangellia does not fit with the stratigraphy observed within the Bear Creek assemblage. Also, no large mafic intrusions, similar to those of the Maple Creek suite in Wrangellia, have been observed within the Bear Creek assemblage. Small, highly deformed and altered ultramafic

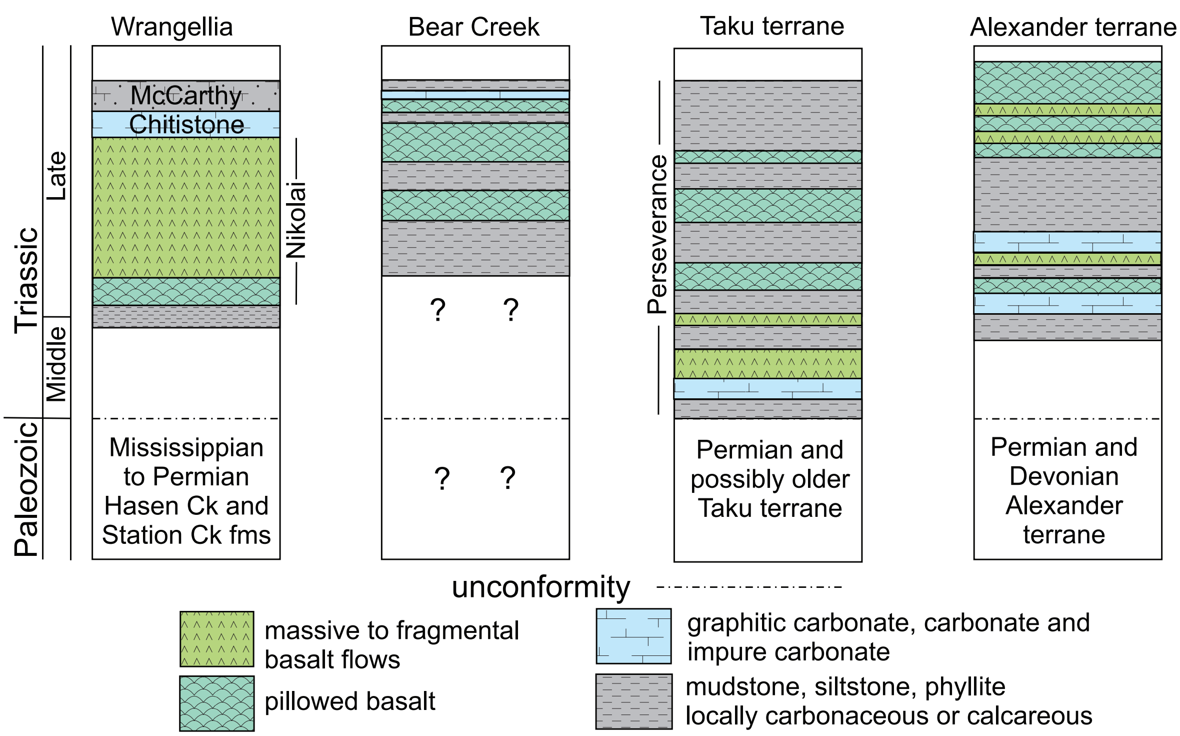

Figure 9. *Comparative, schematic stratigraphic sections through Upper Triassic Wrangellia, the Bear Creek assemblage, Taku terrane and Alexander terrane. Section for the Alexander terrane from Taylor et al. (2005); Wrangellia, Israel et al. (2005); Taku terrane, Gehrels et al. (1992).*

bodies are present in the Bear Creek assemblage, but it is unclear whether these are intrusions or tectonic slivers. Furthermore the ultramafic rocks associated with the Nikolai formation are almost entirely found within the underlying Paleozoic sequence, and never in Upper Triassic sedimentary rocks. The ultramafic rocks in the Bear Creek assemblage are found within the Triassic volcanic/sedimentary sequence (Fig. 2). Finally the age of the Nikolai (~232-228 Ma) does not overlap the age for the Bear Creek assemblage. Overall Wrangellia is not a good match for the Bear Creek assemblage.

Upper Triassic rocks in the Alexander terrane are mainly preserved in southeast Alaska and northwestern British Columbia. The sequence of Late Triassic stratigraphy in the Alexander terrane is laterally variable. It generally consists of Upper Triassic calcareous shale and mudstone, arkose, dolomitic limestone, basalt and local conglomerate and mafic/ultramafic intrusions, overlying a section of Paleozoic basement rocks (Fig. 9; Taylor *et al.*, 2005). The clastic rocks are primarily Carnian and Norian in age (237-205 Ma) with interlayered basalt, limestone and arkose. Basalt flows overlying calcareous mudstone containing upper Norian fossils cap the sequence. Mafic and ultramafic intrusions occur throughout these rocks, including within the upper basalt, and are possibly similar to ultramafic bodies found within the Bear Creek assemblage. The Upper Triassic stratigraphy of the Alexander terrane is known for its volcanogenic massive sulphide deposits (*e.g.*, Windy Craggy, Greens Creek). The Bear Creek assemblage is host to VMS-style mineralization at the Ellen prospect, just west of the Jarvis River (Fig. 2). It is possible the Bear Creek assemblage is a fault sliver of the northern extension of Upper Triassic Alexander terrane.

The Taku terrane is a sequence of Paleozoic to early Mesozoic rocks found in southeast Alaska, structurally juxtaposed between the Yukon-Tanana and Alexander terranes (Saleeby, 2000; Gehrels, 2002). Only brief summaries of its stratigraphy have been published: a Permian to possibly slightly older sequence of metamorphosed turbidites, marble and metabasalt, is overlain by Middle to Upper Triassic mudstone, calcareous and carbonaceous phyllite, carbonate and basalt of the Perseverance Group (Fig. 9; Gehrels *et al.*, 1992; Gehrels, 2002). The interlayered nature of the basalt and mudstone/phyllite is very similar to that observed in the Bear Creek assemblage. The carbonate within the Perseverance Group may also be similar to the carbonate found in the Bear Creek assemblage. The position of the Taku terrane between the Alexander and Yukon-Tanana terranes, as well as the similarities in stratigraphy, makes correlation with the Bear Creek assemblage attractive.

CONCLUSIONS

The Mt. Decoeli area is underlain by Paleozoic to Mesozoic rocks of the Alexander terrane, Wrangellia and the Bear Creek assemblage. These tectonic entities are separated by terrane bounding faults, such as the Duke River and Denali faults, which were mainly active in Late Cretaceous and Cenozoic. The Bear Creek assemblage is an enigmatic succession of metamorphosed and deformed clastic sedimentary rocks interlayered with mafic to intermediate volcanic rocks. These rocks appear to be unconformably overlain by Jura-Cretaceous turbidites of the Dezadeash Formation. Age determination from the Bear Creek assemblage suggests a Late Triassic age for the sequence. Correlation of the Bear Creek assemblage is unclear; however, preliminary indications suggest possible ties with the Taku or Alexander terranes. Correlation with Wrangellia is less favourable.

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