A preliminary geological interpretation of the Mount Grant–Evelyn Creek area, southern Yukon (parts of 105C/11, 12, 13, 14)

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Abstract

The Evelyn Creek–Mount Grant area includes a large region of igneous and meta-igneous rocks; here termed the Mount Grant batholith. The batholith comprises mostly deformed Mississippian metatonalite of the Simpson Range suite and variably, but mostly non-deformed Cretaceous granitic rocks of the Cassiar suite. The metatonalite has a sheet-like geometry and is in contact with contrasting metasedimentary successions. Overlying the metatonalite is the Slate Mountain succession, which includes quartzite, psammite, phyllite and limestone. The metatonalite overlies rocks of the Evelyn Creek succession (new), which has a tripartite stratigraphy; its lower part is dominated by chert and siliceous argillite, the middle unit comprises chlorite-muscovite schist and quartzite, while the upper unit is a prominent interval of pale coloured marble/calc-silicate. The contact between the Evelyn Creek succession and the overlying Mississippian metatonalite is interpreted to be structural rather than intrusive. Rocks of the Cassiar suite include large volumes of non-deformed granite and quartz monzonite and lesser amounts of foliated equivalents. Low pressure metamorphism is recorded by andalusite and/or sillimanite bearing schists that are restricted to the eastern part of the area. This metamorphism and deformation did not affect the remainder of the area, where latest penetrative structures are crosscut by Early Jurassic rocks of the Lokken suite.

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Introduction

This report describes the geology of part of the Big Salmon Range in southern Yukon, based on 1:50 000 scale mapping carried out during the summer of 2022 (Fig. 1). The area described (Fig. 2) is approximately enclosed by the South Canol road, the access road to the Red Mountain deposit, and the Teslin River valley. It includes parts of the NTS 1:50 000 map sheets 105C/11—14 and is along strike to the south of the area described in Moynihan and Crowley (2022).

The Big Salmon Range is mostly underlain by rocks of the Yukon-Tanana terrane (Fig. 1). The Teslin fault crosses the southwestern edge of the map area and separates Yukon-Tanana terrane from rocks of the Whitehorse trough (Figs. 1 and 2). Previous mapping of the area was carried out by Mulligan (1963) and Stevens (1993). Mulligan (1963) documented the presence of hornblende-bearing gneiss, as well as assorted schistose and gneissic rocks, which he collectively referred to as the Big Salmon complex. Stevens *et al.* (1996) established that hornblende-bearing gneissic rocks are Mississippian orthogneisses that are characteristic of the Simpson Range plutonic suite (Mortensen, 1992; Murphy *et al.*, 2006); they also recognized two main metasedimentary units, one dominated by graphitic phyllite, and another dominated by more quartzose rocks. Stevens *et al.* (1996) assigned rocks east of the Teslin fault to the Nisutlin allochthonous assemblage, a now obsolete term that comprises part of Yukon-Tanana terrane (Colpron *et al.*, 2006). The previous authors also recognized the presence of Cretaceous plutonic rocks in the area.

The new mapping (Fig. 2) shows that metaplutonic rocks of the Simpson Range suite are more widespread than previously recognized (Mulligan, 1963; Stevens, 1993). The central part of the area is dominated by the Mount Grant batholith, which includes deformed Mississippian rocks of the Simpson Range suite, as well as mostly post-tectonic Cretaceous granitic rocks (Fig. 2). The metasedimentary rocks of the area are assigned to two successions, which differ from the subdivisions of Stevens (1993). The Slate Mountain succession (Moynihan and Crowley, 2022) is interpreted to overlie a large sheet of metatonalite, while the Evelyn Creek succession (this report) underlies the metatonalite (Figs. 2 and 3). The contact between the Evelyn Creek succession and the overlying metatonalite is interpreted to be a folded thrust fault.

Rock units

Evelyn Creek succession

A succession of siliceous metasedimentary rocks overlain by schist and marble is exposed below Mississippian metatonalite in the vicinity of Evelyn Creek. The same rocks are exposed to the southwest, on the west side of a NW–SE striking fault that extends from the Teslin fault to the north end of the Murphy Creek pluton. The succession comprises three divisions.

The lower division is dominated by metachert and siliceous argillite (Fig. 4a-d). Metachert ranges from black to white-pale grey to pale brown, is typically strongly banded, and commonly breaks along partings that are spaced at intervals ranging from several millimetres to several centimetres. Partings and thin layers of medium grey siliceous argillite alternate with metachert layers. This compositional layering is commonly repeated across tight to isoclinal folds and in highly deformed areas, layering forms prominent parallel ribs on outcrop surfaces. More massive varieties of metachert include brown layers up to 1 m-thick, and paler metachert with prominent colour striping. These outcrops have smooth weathering surfaces and layering is mostly defined by subtle colour variations. These cherts are mostly pale coloured, with thin lamellae of grey, black, green or pink. These grade into intervals of medium grey to black, carbonaceous, siliceous argillite and chert.

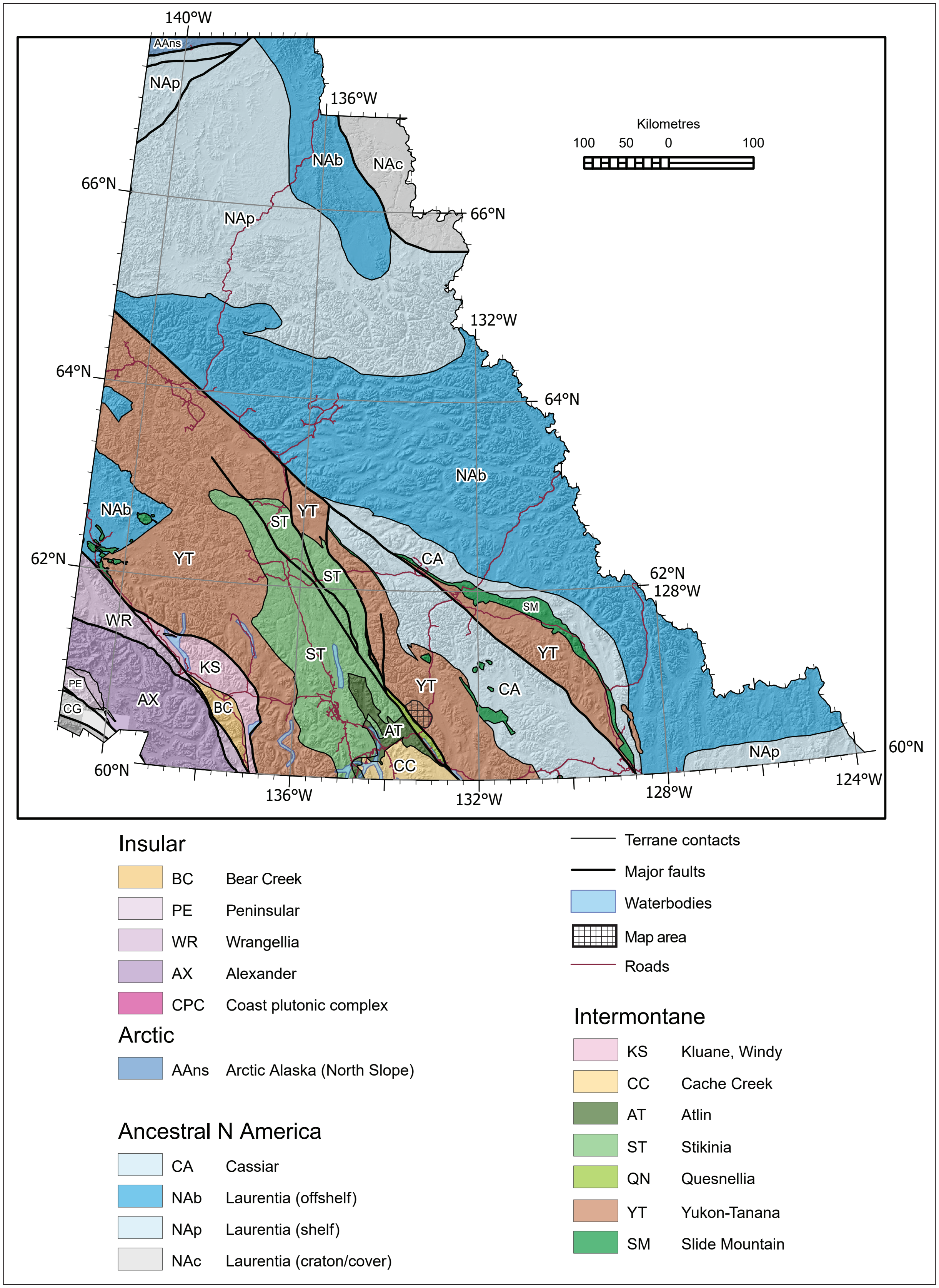

Figure 1. *Terrane map of southern Yukon (Yukon Geological Survey, 2022), showing the location of the study area (outlined).*

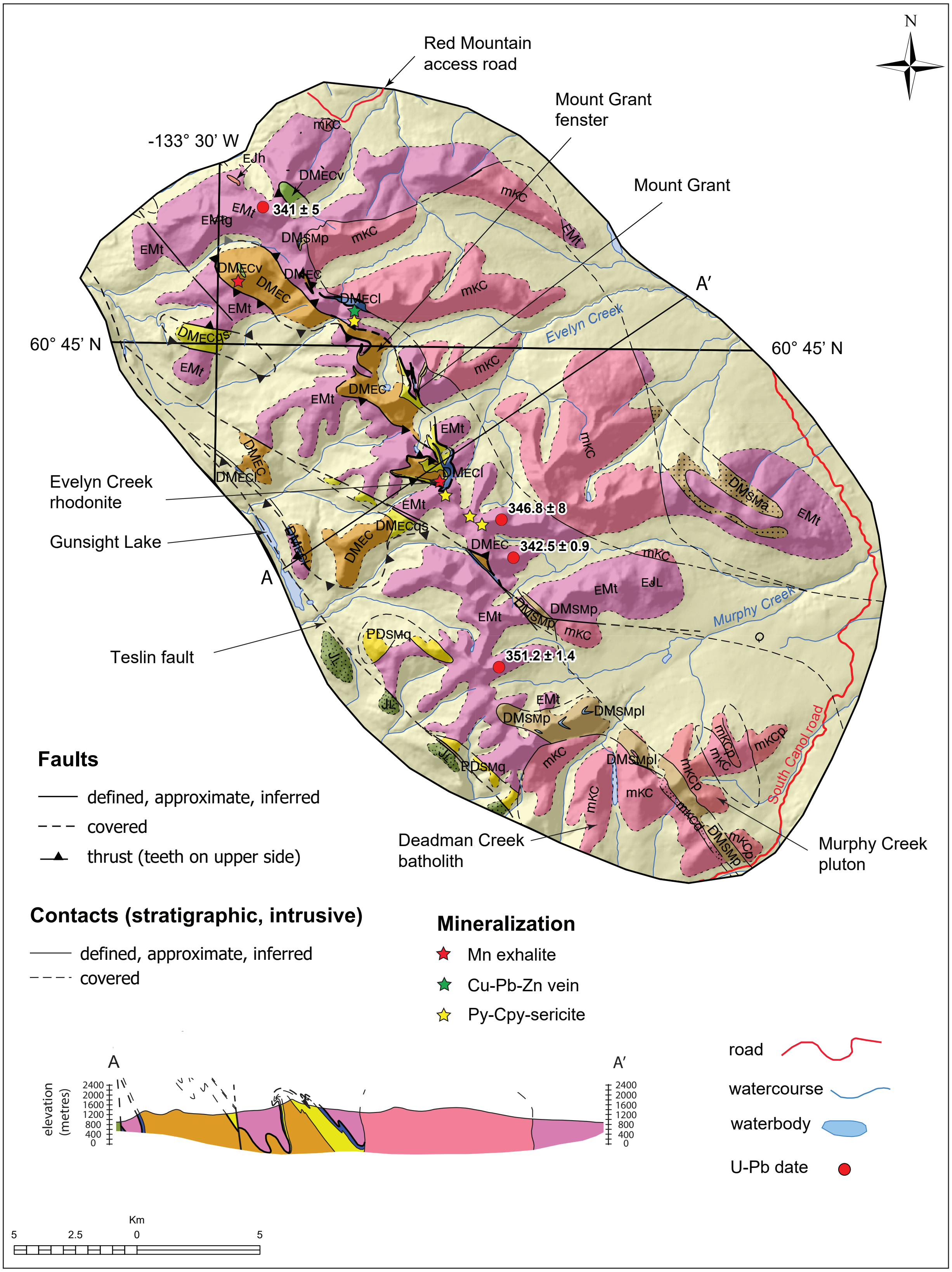

Figure 2. Simplified geological map and cross-section (A-A') of the study area. Features and areas discussed in the text are labelled. U-Pb dates are from Stevens et al. (1996). Map legend on next page.

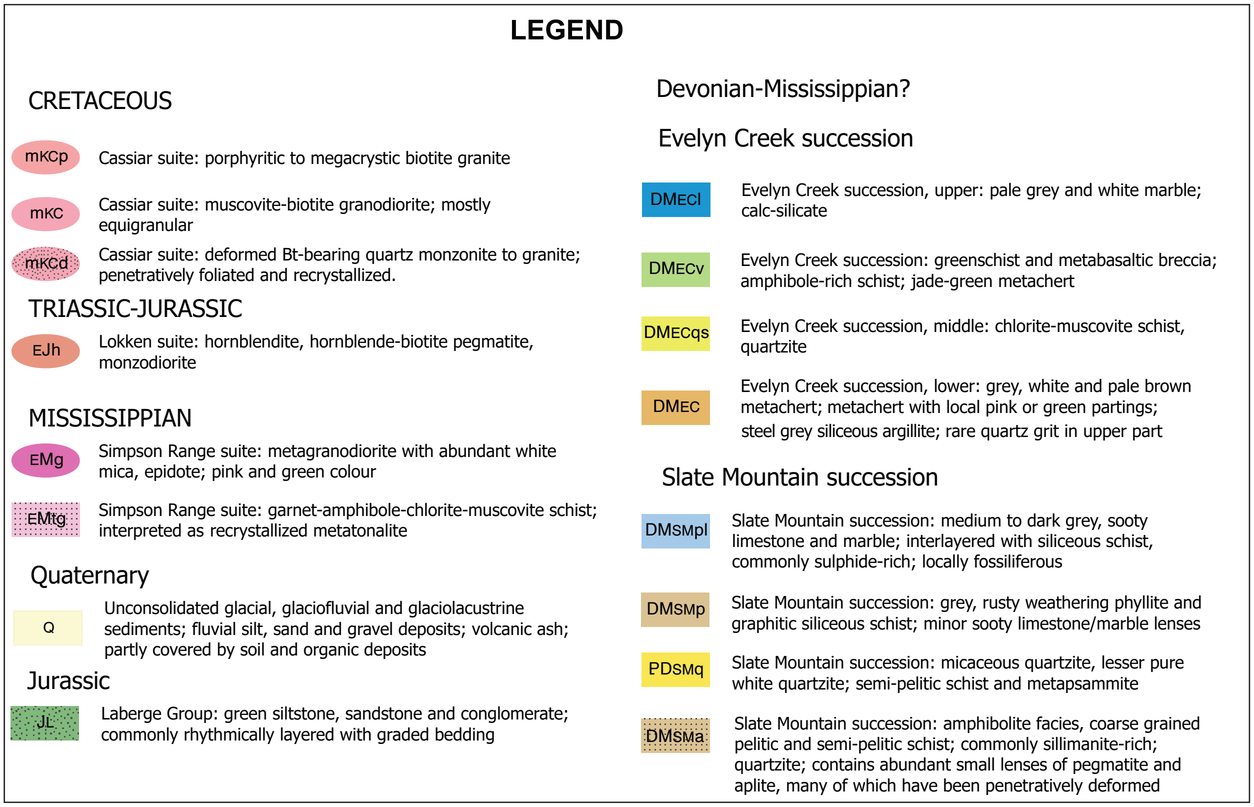

***Figure 2** continued.*

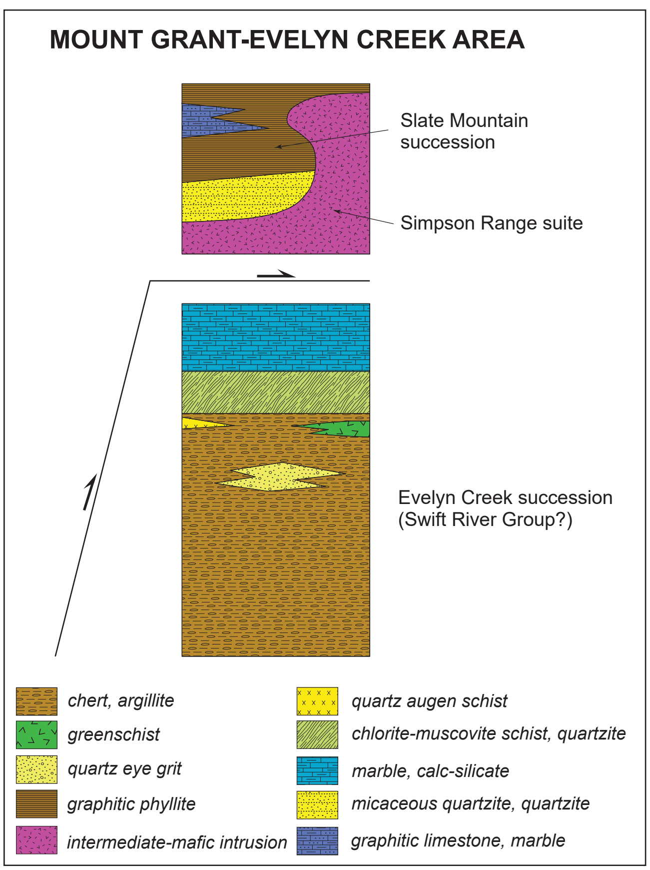

Figure 3. *Schematic summary of stratigraphic and tectonic relationships in the Mount Grant area. An upper structural level, comprising the Simpson Range suite and Slate Mountain succession is interpreted to have been thrust over the Evelyn Creek succession. Not to scale.*

The lower interval also includes extensive intervals of sooty grey siliceous argillite. While ostensibly similar to some fine-grained clastic rocks of the Slate Mountain succession, these rocks are more siliceous, and have little phyllitic sheen or penetrative cleavage, owing to the relative paucity of micaceous minerals. The grey siliceous argillite hosts resistant layers of white quartzite, which is also probably recrystallized metachert.

At one locality, a thick layer of quartz granule grit was identified within an interval of siliceous argillite and quartzite (Fig. 4e). In another locality, a single 30 cm-thick layer of greenschist is interlayered with metachert (Fig. 4f). A pale green quartz-eye schist was identified at a single location. This rock is highly strained and it contains millimetre-scale quartz and feldspar augen in a pale green sericite-rich matrix; it is interpreted as a volcanic rock or high-level subvolcanic intrusion. Each of these unusual rock types occur near the upper boundary of the lower division. A single garnet and amphibole-bearing layer was recognized in the lower part of the Evelyn Creek succession; elsewhere chlorite is widespread and higher-grade minerals were not recognized. The anomalous garnet-bearing horizon may result from an unusual bulk composition (e.g., a Mn-rich layer) rather than higher metamorphic grade.

The lower siliceous interval is overlain by grey or green chlorite-muscovite schist and quartzite (Fig. 5).

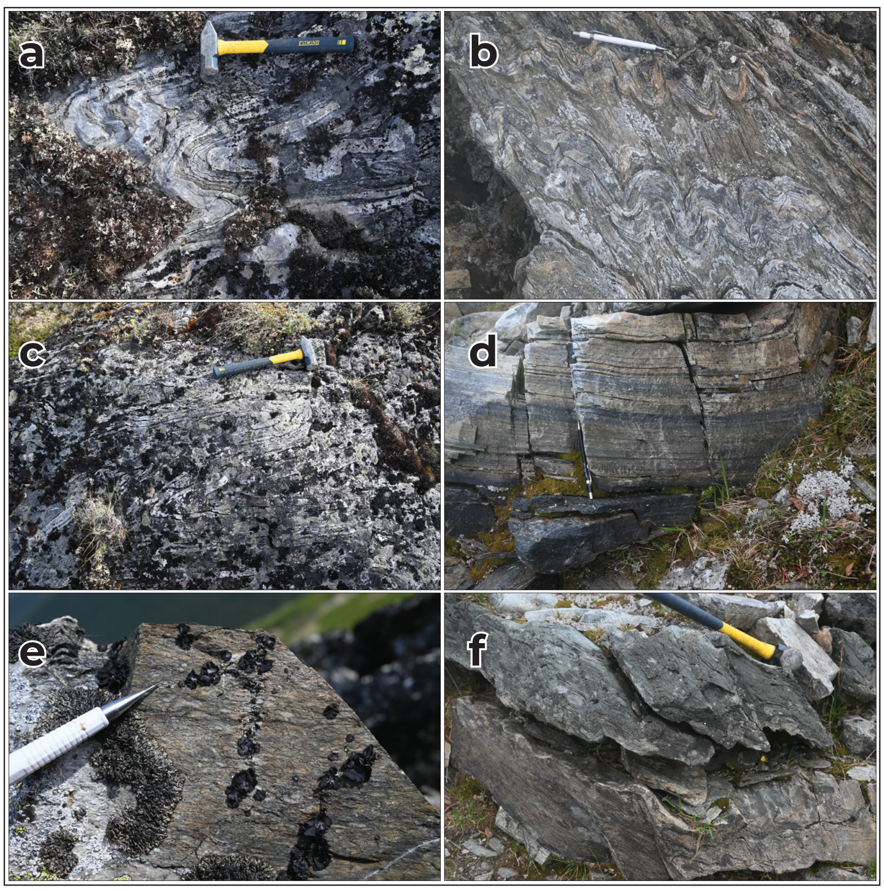

***Figure 4.** Evelyn Creek succession, lower division. **(a)** Tight to isoclinally folded, white to pale grey metachert interlayered with grey weathering siliceous argillite. Hammer for scale. **(b)** Pale grey chert alternating with pale cream-brown weathering argillite layers. Pencil for scale. **(c)** Tight to isoclinally folded white to pale grey metachert. Hammer for scale. **(d)** Black metachert (lower part of outcrop) grades into pale metachert. The pale metachert includes numerous thin black layers. Pencil for scale. **(e)** Rare, thin (~30 cm thick) layer of metabasaltic greenschist within the metachert succession. Hammer for scale. **(f)**Grit layer containing quartz augen several mm in diameter. Pencil for scale.*

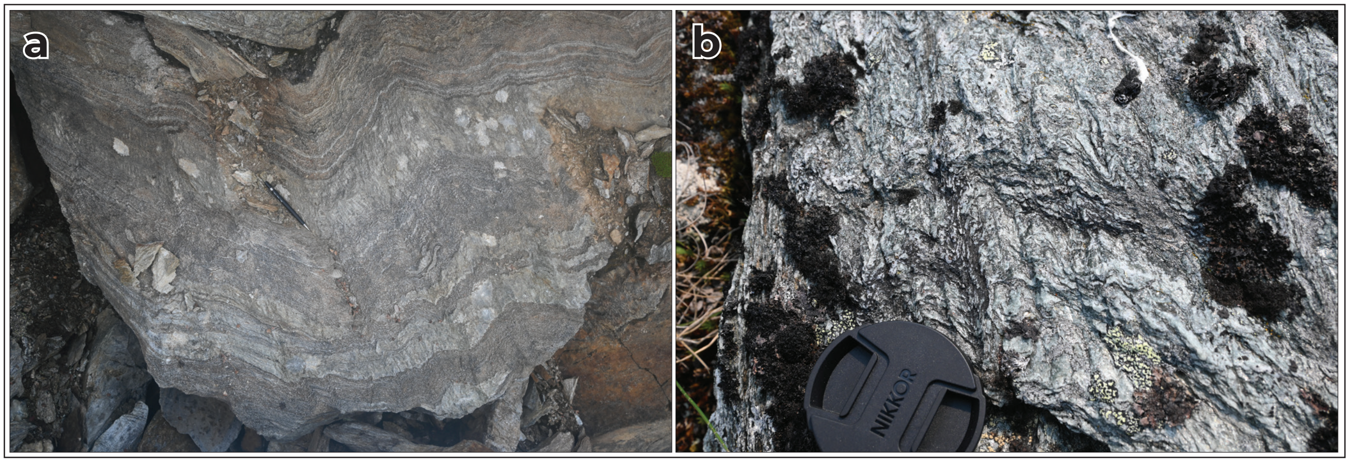

Figure 5. *Evelyn Creek succession, middle division.* ***(a)*** *Chlorite and muscovite-rich schist interlayered with layers of quartzite and quartz-rich schist. Pencil for scale.* ***(b)*** *Crenulated chlorite-muscovite schist, composed of streaky quartz-rich layers separated by chlorite and muscovite-rich folia. 46 mm lens cap for scale.*

Figure 6. *Evelyn Creek succession, upper division. Marble forms prominent, vegetation-poor exposures in the central part of the area. This example is from south of the Evelyn Creek rhodonite occurrence. Tents for scale. The elevation difference between the tents and the peak is approximately 120 m.*

The schist has variable mica content and ranges from near pure quartzite to highly crenulated/folded micaceous schist (Fig. 5 a,b). The quartzite is platy and pale grey to white, while the chlorite schist weathers pale brown to yellow and is grey green on fresh surfaces (Fig. 5b). This unit is relatively resistant, but does not form the massive slabby outcrops exhibited by many rocks of the Simpson Range suite. The contact between metachert and the overlying schist is sharp (over <1 m) but was not directly observed.

The upper division of the Evelyn Creek succession is a thick (tens of metres thick) band of marble and calc-silicate. The marble is white or grey on fresh surfaces and weathers pale grey to buff; and locally, near the contact with the underlying schist the marble weathers yellow to pale brown. The marble unit includes varying proportions of siliceous folia and selvages, and zones of calc-silicate. The bright colour and vegetation-free character of the marble make it easily identifiable from a distance (Fig. 6). The marble is thoroughly recrystallized and no fossil remnants were identified. Some interlayering of marble and chlorite schist was noted at the contact between these units, but it is unclear whether this results from sedimentary alternation or (more likely) structural repetition.

The marble is in sharp contact with overlying metatonalite (Fig. 7). This is generally a single surface, but centimetre-scale repetition of the contact was observed at one locality. The contact is invariably parallel to the foliation in marble and metatonalite, and no metatonalite was identified in the underlying rocks. This contact is interpreted as a fault due to the sharp, geographically extensive nature of the surface, the absence of metatonalite below the surface, and the contrasting nature of the rock units above and below the metatonalite. Where marble is absent, metatonalite is in direct contact with lower parts of the Evelyn Creek succession along the same fault.

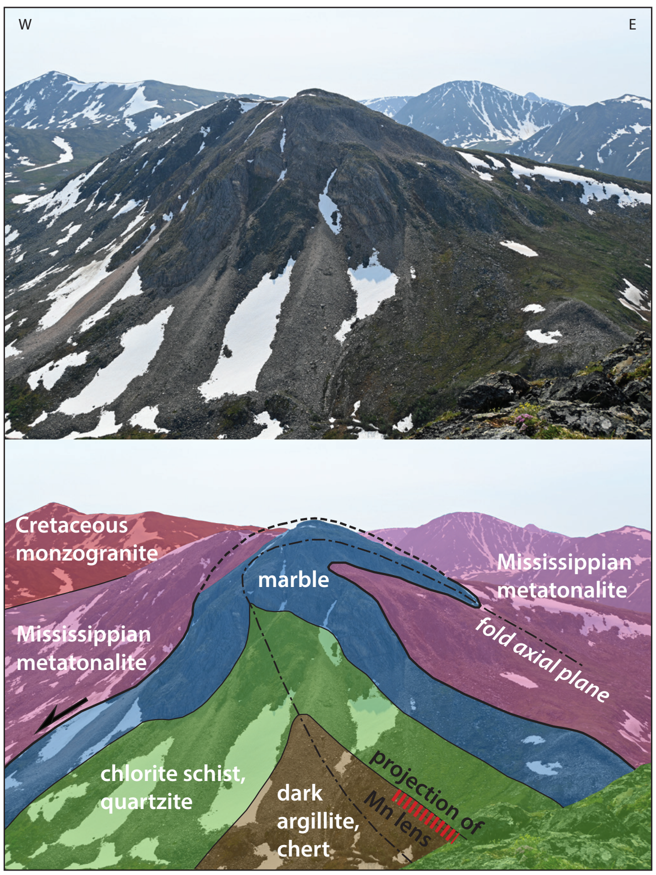

Figure 7. *View towards the south of the hillslopes, south of the Evelyn Creek rhodonite occurrence. The Mn lens is hosted by metachert in the core of a refolded fold, above which lies chlorite schist, quartzite and a thick marble. The marble is in contact with metatonalite of the Simpson Range suite. This contact is interpreted to be a folded thrust fault. The height of the slope facing the viewer (to the peak underlain by marble) is approximately 220 m.*

There are two small regions of anomalous rock types in the northern part of the area that have been recorded as a separate map unit (DMECv). Carbonate-altered mafic volcanic breccia and amphibole schist is in contact with metatonalite of the Simpson Range suite. The breccia is mostly composed of clasts of greenschist but includes some serpentinite clasts, while the amphibole schist is a banded, pale green unit with abundant crystals of metamorphic amphibole and biotite. To the southwest, there is another small region of foliated greenschist that is interlayered with jade green metachert. These outcrops are adjacent to more typical rocks of the Evelyn Creek succession, but the contacts are not exposed. These two small belts may represent a volumetrically minor part of the Evelyn Creek succession; alternatively they may be a younger unit.

The lower part of the Evelyn Creek succession is similar to the Swift River Group of the Yukon–BC border region (Roots *et al.*, 2006). The Swift River Group is overlain by a thick Mississippian limestone/marble unit, which could plausibly correlate with the upper division of the Evelyn Creek succession. Further age constraints are required to evaluate this possible correlation.

Mississippian metatonalite (Simpson Range plutonic suite)

Most of the central part of the Big Salmon Range in the study area is underlain by Mississippian metatonalite of the Simpson Range plutonic suite (Fig. 8). The rocks are plagioclase-rich schist and gneiss with variable amounts of mafic minerals, now mostly represented by chlorite (Fig. 8a, see Moynihan and Crowley, 2022 for further description and images). There is a broad range of composition from quartz diorite to granodiorite and many outcrops are compositionally variable, with a banded or streaky appearance. Distinctive varieties include leucotonalite, and metatonalite with abundant long bladed amphibole crystals or pseudomorphs (Fig. 8b). The latter is mostly developed near structural boundaries and is locally sulphide-rich. In most places, metatonalite is well foliated, strongly recrystallized, and the dominant foliation is commonly overprinted by younger fold structures.

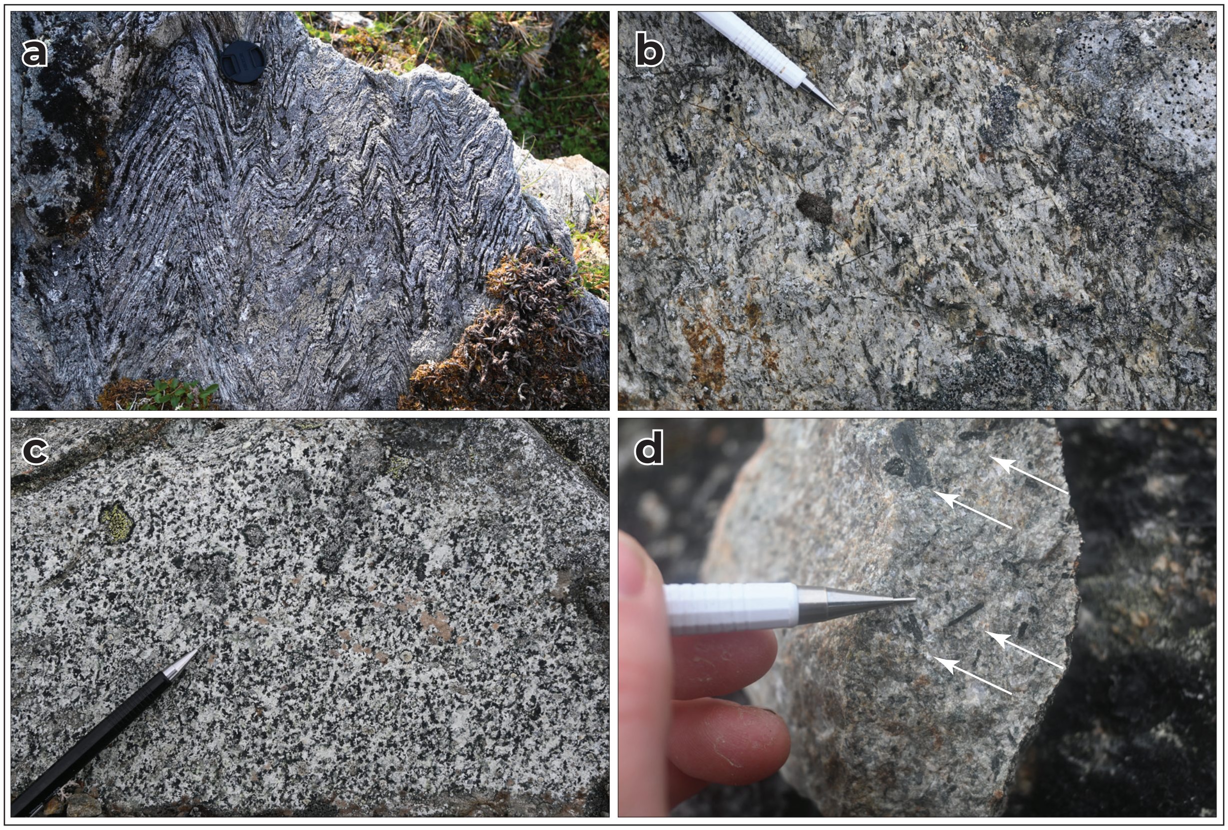

Figure 8. Simpson Range suite. ***(a)*** *Metatonalite is penetratively foliated and commonly folded in much of the area. 46 mm lens cap for scale.* ***(b)*** *Foliated, sulphide-rich metatonalite with abundant elongate amphibole crystals. Pencil for scale.* ***(c)*** *Hornblende metatonalite in the southern part of the area is locally non-foliated.* ***(d)*** *Primary twinned hornblende crystals are preserved in non-foliated metatonalite. Plane polarized light; field of view is 2.8 mm.*

In contrast, some of the tonalite in the southern part of the area (structurally high in the metatonalite sheet) lacks penetrative deformation, and primary (igneous) crystals are preserved (Fig. 8c,d). Garnet-chlorite-muscovite schist is developed in a small region within metatonalite in the northern part of the area (map unit EMtg). This schist has gradational boundaries with non-garnet-bearing metatonalite, which is interpreted as the protolith of the schist.

Slate Mountain succession

In the southern part of the area, on the eastern flank of the Big Salmon Range, metatonalite is overlain by graphitic phyllite and associated rocks, all of which exhibit a penetrative foliation. These are similar to rocks exposed farther north in the Big Salmon Range (Moynihan and Crowley, 2022). The main rock type is rusty weathering, dark grey graphitic phyllite (Fig. 9a). This is thinly interlayered with pale grey siliceous quartzite, and locally with sooty grey limestone or marble (Fig. 9b). Limestone layers range from centimetre-thick intervals within graphitic phyllite and siliceous schist, to limestone-dominated intervals several metres to tens of metres thick. Limestone is generally sooty grey to blue–grey and thinly laminated. Locally, it contains resistant nodules from 2 mm to 2 cm in diameter (Fig. 9c). Where affected by contact metamorphism adjacent to the Murphy Creek pluton, calcareous layers weather buff to yellow and comprise a mix of relatively pure marble and calc-silicate layers; the boundaries between these rock types are irregular and siliceous layers are commonly disarticulated.

On the west flank of the Big Salmon Range in the southern part of the area, metatonalite is in contact with interlayered phyllite, metasandstone and quartzite. The quartzite layers are typically tens of centimetres-thick, weather white, and are white and translucent on fresh surfaces. Poorly sorted detrital grains are visible and range from medium to very coarse sand-sized particles. Metasandstone is grey and fine-grained with indistinct layering. Phyllite is cream to brown weathering and fresh surfaces are grey to pale green. Primary thin laminations are locally discernible in the phyllite. In addition to quartzite and phyllite, the succession includes rare cream to brown weathering calcareous layers less than 30 cm thick.

While phyllite is generally penetratively foliated throughout, there is significant variation in the degree of strain recorded by these rocks. Quartzite lacks a penetrative foliation, whereas adjacent to the southwestern boundary of the Mount Grant batholith, it exhibits a foliation and stretching lineation. In some locations near the trace of the Teslin fault, foliated quartzite is brecciated and the foliation rotated between adjacent breccia clasts (Fig. 9d).

Several thin screens of Slate Mountain succession are included within metatonalite. A screen on Mount Grant includes garnet schist, garnet-bearing amphibole schist (calc-silicate) and marble. It is not clear whether these rocks record regional metamorphism, contact metamorphism from the nearby Cretaceous intrusion, or both.

In the easternmost part of the area, metatonalite is in contact with polydeformed amphibolite-facies, semi-pelitic to pelitic schist (Fig. 10). The schist is rusty brown weathering, coarse grained and comprises biotite, muscovite, quartz, plagioclase and andalusite ± sillimanite; the presence of the latter minerals indicates low pressure metamorphism. The schist is interlayered with quartzite layers centimetre to decimetre thick and locally marble or calc-silicate. The schist is locally migmatitic, with abundant, variably deformed granitic lenses and pods, including pegmatite and aplite (± muscovite, garnet) similar to that exposed in the region between the Deadman Creek batholith and Murphy Creek pluton (see below).

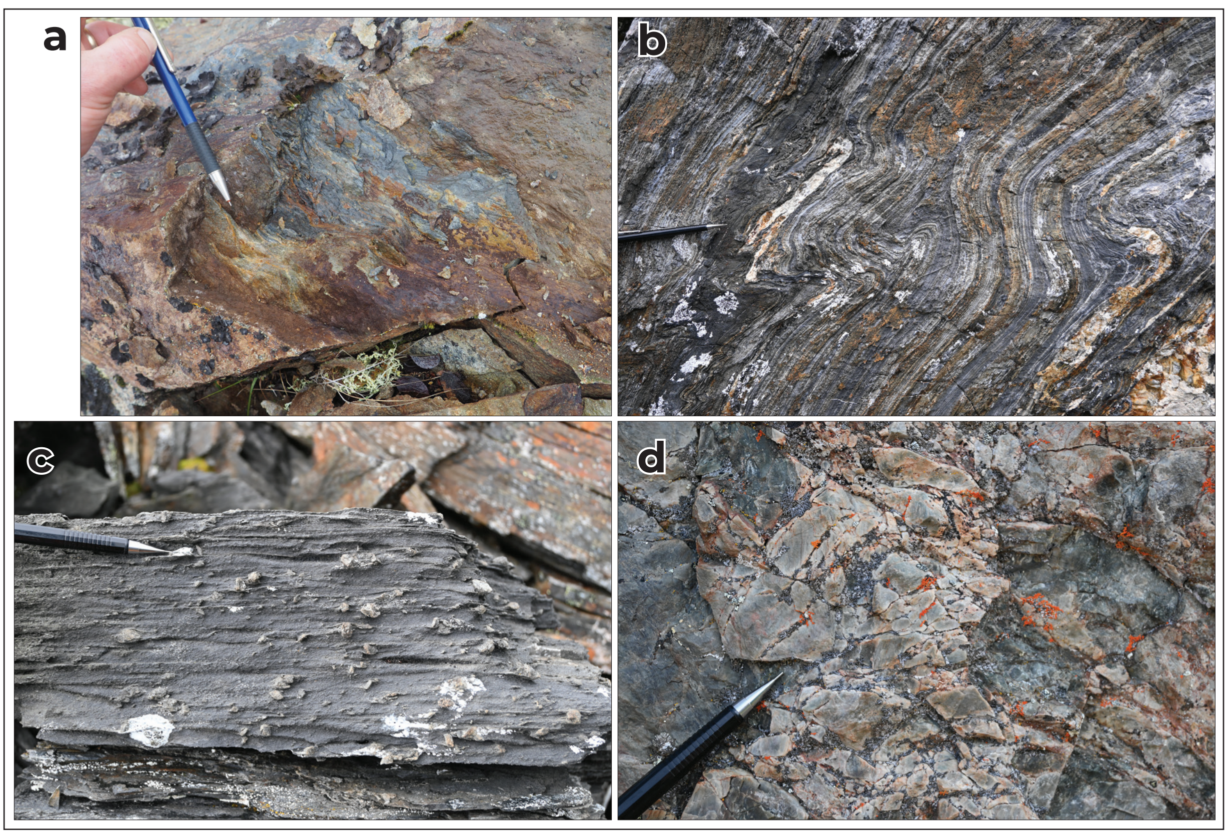

***Figure 9.** Slate Mountain succession. **(a)** Rusty weathering graphitic phyllite. Pencil for scale. **(b)** Interlayered sooty limestone and sulphide-rich, siliceous schist. Pencil for scale. **(c)** Grey carbonaceous limestone with prominent nodules (fossil pseudomorphs?). Pencil for scale. **(d)** Quartzite of the Slate Mountain succession is brecciated near the trace of the Teslin fault. Pencil for scale.*

This belt of schist/gneiss is interpreted as part of the Slate Mountain succession that was metamorphosed at higher grade than other parts of the succession.

Cassiar suite intrusions and associated rocks

The eastern part of the Mount Grant batholith includes a large body of largely non-deformed biotite quartz monzonite, and similar intrusions occupy most of the southernmost part of the study area (Fig. 2). These plutons are assigned to the Cassiar plutonic suite based on their composition, their largely non-deformed nature, and their similarity/continuity with dated intrusions.

The pluton east of Mount Grant is composed of mostly equigranular, locally sparsely K-feldspar porphyritic, coarse-grained biotite quartz monzonite to granite (Fig. 11a,b). The western and northern contacts were observed, and each is sharp, with no deformation of the intrusive rock near these boundaries.

To the south, the Murphy Creek pluton is dominated by porphyritic biotite quartz monzonite or granite. K-feldspar phenocrysts are abundant (Fig. 11c,d) and glomerophyric clusters are locally developed (Fig. 10e). A second, volumetrically less significant phase within this pluton is pale grey, equigranular, finer grained biotite granite (Fig. 11f). The Murphy Creek pluton is not deformed, except for a narrow zone along its northern boundary. Here, there is a foliated zone approximately 5 m wide that includes scaly slip surfaces with subhorizontal slickenlines. An intrusive boundary on the western margin of the Murphy Creek pluton is indicated by the presence of an andalusite-bearing contact aureole in the narrow belt of country rocks separating it from the Deadman Creek batholith (Fig. 2).

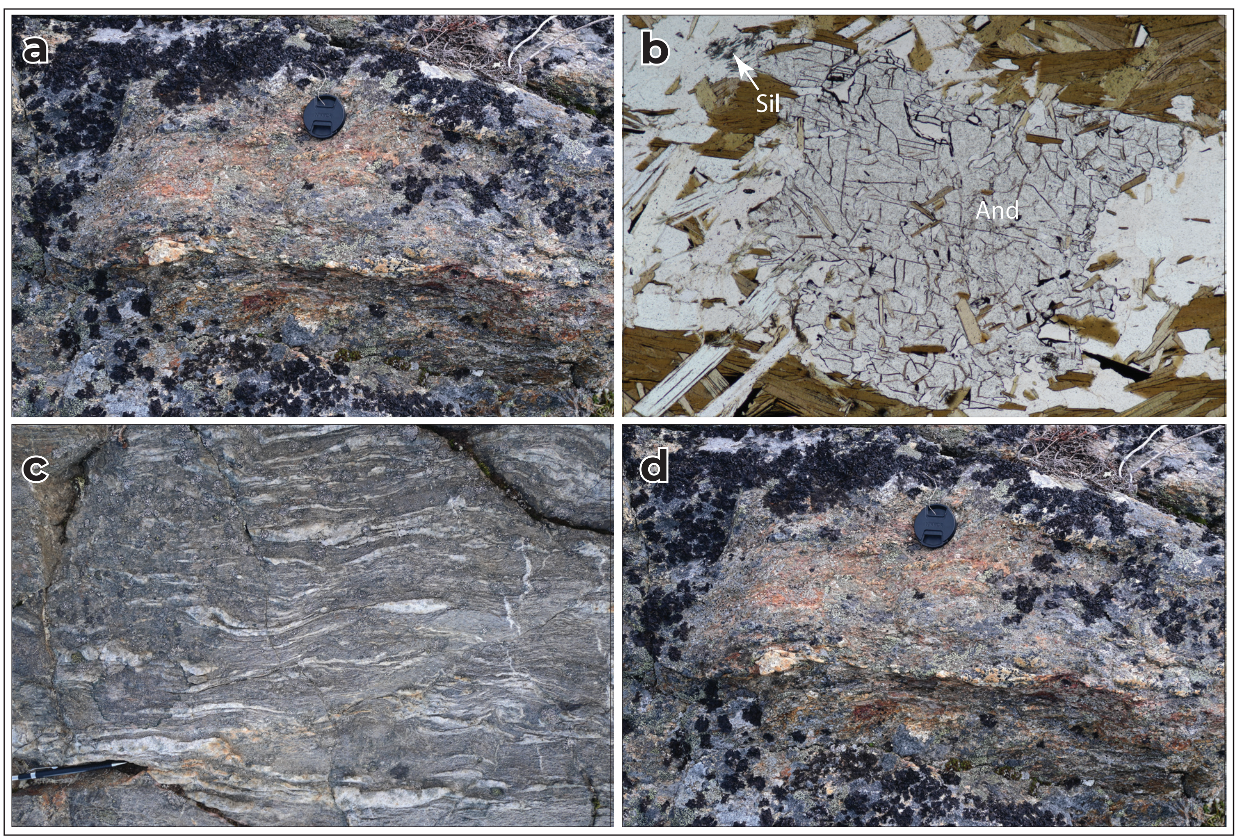

Figure 10. *Amphibolite-facies schist and gneiss in the eastern part of the study area.* ***(a)*** *Coarse, rusty-weathering metapelitic schist. 46 mm lens cap for scale.* ***(b)*** *Andalusite and sillimanite in pelitic schist indicates low pressure metamorphism. The field of view is ~2.8 mm; plane polarized light.* ***(c)*** *and* ***(d)*** *The amphibolite-facies schist contains abundant layers, lenses and pods of leucosome. These exhibit a range of relationships to the foliation, suggesting their generation and emplacement during deformation. Pencil for scale in* ***(c)*** *and* ***(d)****.*

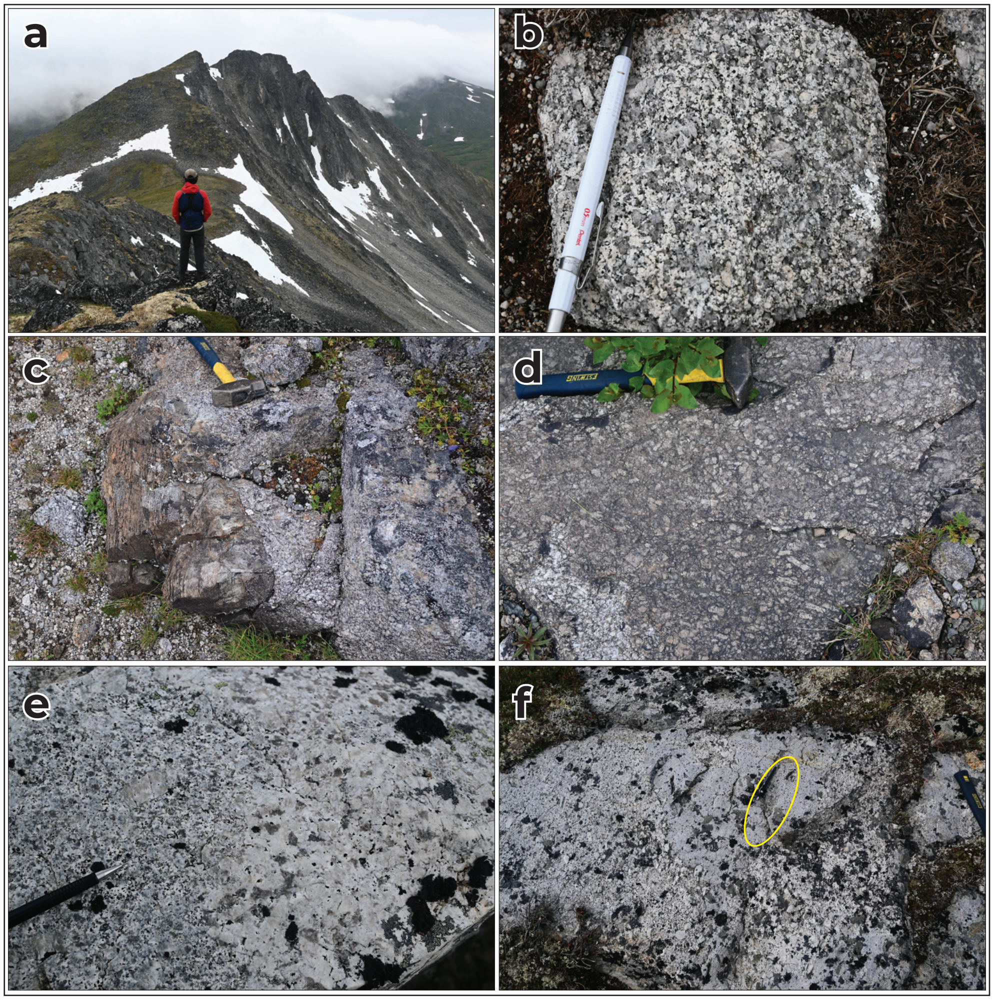

Figure 11. *Undeformed Cretaceous intrusions.* ***(a)*** *Steep talus slopes derived from granitic rocks in the northern part of the Mount Grant batholith (Cassiar suite phase). Man for scale.* ***(b)*** *Coarse-grained, mostly equigranular biotite quartz monzonite from the northern part of the Mount Grant batholith (Cassiar suite phase). Pencil for scale.* ***(c)*** *Sharp contact between country rock (metasandstone of the Slate Mountain succession) and porphyritic biotite quartz monzonite of the Murphy Creek pluton. Hammer for scale.* ***(d)*** *Close-up view of crowded porphyritic texture near the western margin of the Murphy Creek pluton. Hammer for scale.* ***(e)*** *Boundary between a glomerophyric cluster and sparsely porphyritic phase of the Murphy Creek pluton. Pencil for scale.* ***(f)*** *Boundary between relatively fine-grained, pale grey, equigranular biotite quartz monzonite and coarse, porphyritic phase of the Murphy Creek pluton. Pencil for scale.*

The northern end of the Deadman Creek batholith extends across the Canol Road into the southernmost part of the area (Fig. 2). Most of this is non-foliated, coarse-grained biotite quartz monzonite with intergrown perthitic, pink K-feldspar, white plagioclase and grey quartz. Locally hornblende is also present. The eastern boundary of the Deadman Creek batholith is marked by a zone of deformation approximately 200–300 m wide (Fig. 12a–c). There is an eastward increase in strain across this zone from unfoliated massive granitoid to slabby outcrops of recrystallized biotite-bearing orthogneiss with foliation that dips NE at moderate angles. The most deformed rocks exhibit stretching lineations that are approximately down the dip of the foliation (Fig. 12c).

The belt of country rock that separates the Murphy Creek pluton and Deadman Creek batholith (Fig. 2) is host to numerous small lenses (from <1 m to tens of metres long) of pegmatite and aplite (Fig. 12d–f). Pegmatite locally contains coarse muscovite and/or garnet (Fig. 12f). These lenses are variably foliated and recrystallized. The boundaries of these intrusions generally crosscut the foliation (Fig. 12e), indicating emplacement relatively late in the deformation history, after much of the strain recorded in the country rocks had accumulated.

Other intrusions

An intrusion of hornblendite and diorite forms cliffs above the Red Mountain access road, in the northernmost part of the area. This is similar to other intrusions of the Lokken suite farther north (Sack *et al.*, 2020; Moynihan and Crowley, 2022). Small hornblende-diorite dikes that are assigned to this suite were also identified in other parts of the area,

Figure 12. *Deformed Cretaceous intrusions.* ***(a)*** *Moderately foliated hornblende-biotite granodiorite from the northern part of the Deadman Creek batholith. Pencil for scale.* ***(b)*** *Slabby outcrops formed by highly strain rocks along the eastern margin of the Deadman Creek batholith. Hammer for scale.* ***(c)*** *A down-dip mineral lineation is developed in the outcrops. 46 mm lens cap for scale.* *d) Foliation in deformed portion of the Deadman Creek batholith is cut by more weakly deformed aplite and pegmatite. 46 mm lens cap for scale.* ***(e)*** *Similar pegmatite and aplite intrusions crosscut the foliation in adjacent phyllite of the Slate Mountain succession. Variable recrystallization and foliation of these intrusions demonstrates reactivation of the dominant foliation during or after their emplacement. Hammer for scale.* ***(f)*** *Abundant garnet in pegmatite that intrudes the Slate Mountain succession adjacent to the eastern flank of the Deadman Creek batholith. Some of these intrusions also contain coarse-grained muscovite. Pencil for scale.*

in the Evelyn Creek succession and the Simpson Range suite. These intrusions are not penetratively deformed. Other minor, post-tectonic biotite-bearing dikes were also observed.

Laberge Group

Rocks of the Laberge Group are exposed west of the Teslin fault, where they form bluffs overlooking the Teslin River valley. They were only given a cursory examination during this study. The outcrops are dominated by mint green, cream to brown weathering siltstone and sandstone, with lesser conglomerate. Siltstone-sandstone exhibits fine laminations and rhythmic layering.

Mineralization

The Evelyn Creek stratiform rhodonite occurrence (also known as the Marlin; Yukon MINFILE 105C 017) is located near the crest of the Big Salmon Range (Figs. 2 and 13). The mineralized zone has been traced for approximately 350 m along strike; the main pod is 4–7 m wide with a strike length of ~25 m (Shearer,1991). The ore rock, which is coated in black Mn oxide, includes raspberry red and pink gemstone composed of combinations of the minerals tephroite, rhodonite, rhodochrosite, bustamite and spessartine (Shearer, 1991). The host rock is metachert of the lower Evelyn Creek succession and the Mn lens is close to the top of this unit, near the contact with the overlying chlorite schist-quartzite unit. The pit where mining has taken place exposes a crosscutting dike of hornblende diorite, which is similar to other parts of the Lokken suite and therefore probably Early Jurassic. Rock similar to the host chert is widely distributed in the area; and another zone of black Mn oxide staining was recognized near the northern end of the Mount Grant fenster, approximately 11.5 km away (60.772943 N, -133.484435 W; Fig. 2). This suggests there is potential for further identification of stratiform Mn, and possibly VMS mineralization elsewhere in the lower Evelyn Creek succession.

Other mineralization reported in the area includes vein hosted Cu, base metal and Mo vein mineralization (Yukon MINFILE 105C 018, 105C016, 105C 030). Elsewhere, galena, sphalerite and malachite vein-hosted mineralization was observed along the margin of a post-tectonic dike (60.763450 N, -133.400756 W; Fig. 2). Metatonalite of the Simpson Range suite locally contains rusty weathering, approximately strike-parallel gossanous zones that range in thickness from metres to tens of metres (e.g., at 60.689538 N, -133.308202 W and 60.670557 N, -133.404287 W; Fig. 2). These zones include altered, sulphide-rich metatonalite that contains abundant pyrite, chalcopyrite and Cu-bearing replacement products, and more heavily altered sericite-rich rock.

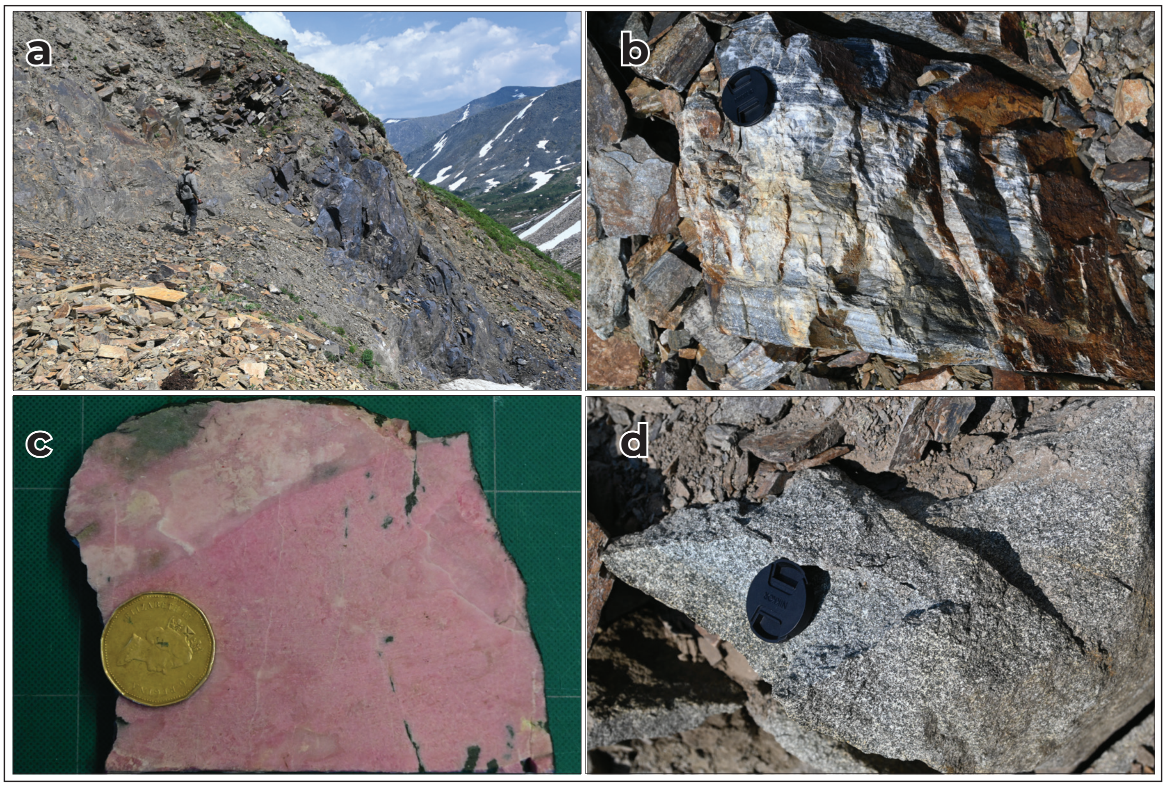

Figure 13. *Geology of the Evelyn Creek rhodonite occurrence.* ***(a)*** *Black weathering oxidized Mn-rich lens at the Marlin occurrence. Man for scale.* ***(b)*** *The Mn-enriched lens passes laterally into metachert. 46 mm lens cap for scale.* ***(c)*** *Pink rhodonite and associated minerals on freshly cut surface. Dollar coin for scale.* ***(d)*** *The pit where rhodonite has been extracted includes a dike of hornblende diorite. These dikes, which are scattered throughout the broader area, are interpreted to form part of the Early Jurassic Lokken suite. 46 mm lens cap for scale.*

Acknowledgements

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