Toward a regional stratigraphic framework for the Nicola Group: Preliminary results from the Bridge Lake – Quesnel River area

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Abstract
The Nicola Group (Triassic) is the principal volcano-sedimentary unit of the Quesnel arc terrane, well known for its prolific porphyry Cu ±Au-Mo-Ag deposits. Although studied since the late 1800s, a comprehensive regional stratigraphic framework for the Nicola Group, integrating local informal subdivisions introduced by different workers at different times, has hitherto been lacking. In 2015, the British Columbia Geological Survey initiated a multi-year program to establish the regional temporal and spatial variation of Nicola Group subunits. Preliminary investigations were in the Bridge Lake – Quesnel River area of south-central British Columbia, which encompasses a wide belt of Nicola rocks that have been mapped in sufficient detail to allow an initial assessment of stratigraphic divisions over a relatively large area. Some Triassic rocks previously included in the Nicola Group are reassigned to the Slocan Group, and those retained as Nicola Group are separated into four assemblages. Assemblage one, identified only along the northeast margin of the Nicola belt, contains mainly Middle Triassic siltstone and argillite, but also includes volcaniclastic sandstone and pillowed basalt. Assemblage two (Carnian and early Norian) is a widespread and heterogeneous unit that includes basalt flows and basalt breccia, but consists mainly of volcanic sandstone and conglomerate derived from these, or similar, mafic volcanic rocks. Assemblage three is a relatively homogeneous succession of pyroxene-phyric basalt flows and basalt breccia that reflect a major Norian constructional phase of the Nicola arc. Assemblage four (latest Triassic), possibly separated from underlying rocks by an unconformity, contains polymictic conglomerate with abundant hypabyssal and plutonic rock fragments, but also includes red feldspathic sandstone, pyroxene-phyric basalt, and a distinctive coarse, crowded plagioclase-phyric andesite. The four assemblages established in the Bridge Lake – Quesnel River area provide a preliminary framework for ongoing studies of Nicola Group stratigraphy, and will be expanded and modified with further work.

Keywords: Nicola Group, Slocan Group, Triassic, volcanic arc, basalt, basalt breccia, volcanic sandstone, conglomerate, Quesnel terrane, Slide Mountain terrane, Kootenay terrane

1. Introduction

Quesnel terrane constitutes an important metallogenic belt that hosts numerous Cu-Au-Mo porphyry and skarn deposits along the length of the Canadian Cordillera (Fig. 1). It is characterized by a Mesozoic arc complex that includes Triassic to Jurassic volcanic and sedimentary rocks, and related calcalkaline and alkaline intrusions. In south-central British Columbia the supracrustal component is represented mainly by the Nicola Group, originally named for exposures of volcanic rocks and limestones on the south side of Nicola Lake (Dawson, 1879), and presently referring to diverse assemblages of mainly Late Triassic volcanic, volcaniclastic, and sedimentary rocks that are exposed over a broad area, including parts of NTS map sheets 82E, 82L, 92H, 92I, 92P, 93A, 93B, and 93G. The Nicola Group has been mapped in reasonable detail in many areas, and numerous informal local subdivisions have been applied by those working in different areas at different times and scales. However, no regional-scale stratigraphy has been established. In 2015, the British Columbia Geological Survey initiated a multi-year program to establish the regional

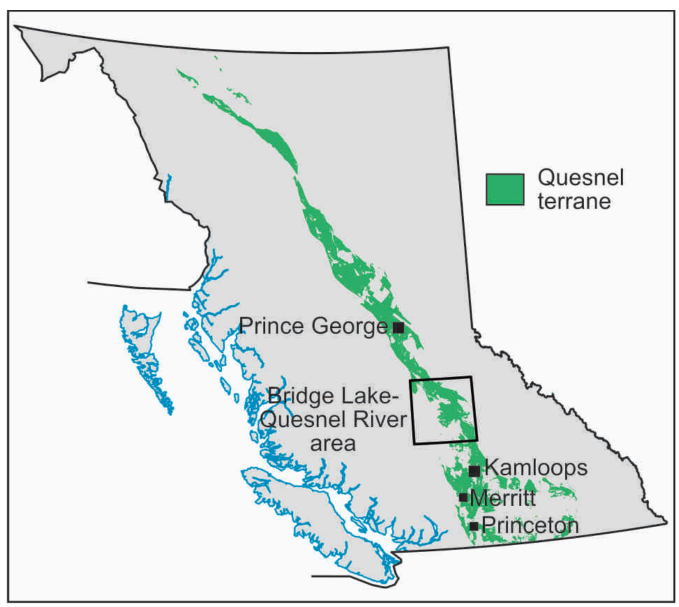

Fig. 1. Location of the Bridge Lake – Quesnel River area and distribution of Quesnel terrane in British Columbia.

temporal and spatial variation of Nicola Group subunits. This regional stratigraphic framework, combined with space-time-composition patterns of associated plutons, will help better define the general architecture of the arc, and improve the geologic framework within which to interpret the settings and controls of mineral occurrences in this important metallogenic domain.

The initial investigations were carried out in the Bridge Lake – Quesnel River area (Figs. 1, 2), an area of subdued topography that is mainly in the Fraser Plateau and Quesnel Highland physiographic provinces, and covers parts of the traditional territories of the Secwepemc, Esk'etemc, and Tsilhqot'in First Nations. This area encompasses a wide belt of Nicola rocks that have been mapped in sufficient detail to evaluate possible stratigraphic divisions over a large area. The geology of the northern part of this area is provided mainly by Panteleyev et al. (1996), which incorporates the work of Campbell (1978), Bailey (1978, 1990), Rees (1987) and Bloodgood (1987, 1990), with subsequent revisions by Logan and Mihalynuk (2005) and Logan et al. (2007). The geology to the south, summarized by Schiarizza et al. (2013), was mapped by Schiarizza and Israel (2001), Schiarizza et al. (2002), Schiarizza and Boulton (2006), Schiarizza and Macauley (2007), Schiarizza and Bligh (2008), and Schiarizza et al. (2009). The preliminary results, presented here, include separation of Triassic rocks into the Nicola and Slocan groups, and dividing Nicola Group rocks into four assemblages.

2. Geologic setting

The Triassic Nicola Group, the main stratigraphic unit of the Quesnel arc terrane, extends across the Bridge Lake – Quesnel River area in a northwest-trending belt that is 30 to 70 km wide (Fig. 2). This belt also includes abundant Late Triassic to Early Jurassic calcalkaline and alkaline arc intrusions, and fault-bounded panels of Lower to Middle Jurassic arc-derived siliciclastic sedimentary rocks of the Dragon Mountain succession (Petersen et al., 2004; Logan and Moynihan, 2009). The Harper Ranch Group, an upper Paleozoic sedimentary and volcanic succession that is well exposed farther south, is represented by two fault-bounded inliers of Permian limestone and siltstone in the southern part of the study area (Fig. 2).

The Nicola Group is flanked to the east by a belt of Triassic sedimentary rocks, mainly black phyllite, slate, and quartz sandstone, which is herein assigned to the Slocan Group. Farther east, the Slocan Group is in contact with the Slide Mountain terrane, including basalt, chert and gabbro of the Fennell Formation south of the Raft batholith, and a narrow, discontinuous belt of mafic schist, referred to as the Crooked amphibolite, to the north. The Slide Mountain terrane is in turn flanked to the east by a wide belt of Proterozoic and Paleozoic siliciclastic, carbonate, and local volcanic and plutonic rocks included in the pericratonic Kootenay terrane. The Cache Creek terrane, including late Paleozoic to early Mesozoic basalt, chert, and limestone, is west of the Nicola belt and is generally interpreted as an accretionary complex genetically related to the subduction that generated the Quesnel magmatic arc. Younger rocks found in the study area include late Middle Jurassic and Early Cretaceous granitic intrusions, Eocene volcanic and sedimentary rocks, and flat-lying Neogene and Quaternary basalt.

Kootenay terrane is commonly interpreted as an outboard facies of the ancestral North American miogeocline (Colpron and Price, 1995; Nelson et al., 2013). Among the youngest units of the terrane are volcanic and plutonic rocks that reflect Devonian-Mississippian initiation of arc magmatism (Schiarizza and Preto, 1987; Paradis et al., 2006). Slide Mountain terrane, the most inboard tract of oceanic rocks in the Canadian cordillera, comprises the remnants of a marginal basin that opened in the late Paleozoic as the locus of arc magmatism migrated westward (Schiarizza, 1989). The active, frontal part of this arc system became the Harper Ranch Group (late Paleozoic; Smith, 1979; Beatty et al., 2006). Collapse of the Slide Mountain marginal basin during the Sonoma orogeny (Permo-Triassic) led to thrust-emplacement of Slide Mountain terrane above Kootenay terrane (Schiarizza, 1989; Ferri, 1997), and may have brought the Harper Ranch Group, and underlying rocks, back into proximity with the pericratonic assemblages of Kootenay terrane. The Slocan Group forms part of a Triassic basin that was deposited unconformably above the thrust-imbricated Slide Mountain and Kootenay terranes (McMullin, 1990; McMullin et al., 1990). The Nicola Group is part of a volcanic arc complex that formed west of the Slocan Group, in response to easterly-dipping subduction that also generated the accretionary complex represented by Cache Creek terrane.

The fault that juxtaposes the Crooked amphibolite of Slide Mountain terrane above Kootenay terrane (Fig. 2) was named the Eureka thrust by Struik (1986), and is equivalent to the Quesnel Lake shear zone of Rees (1987). The kinematic history is best constrained by fabrics preserved in footwall orthogneiss north of Quesnel Lake, where Rees (1987) documented rotated feldspar megacrysts, S-C mylonites, and shear band foliations that indicate a top-to-the-east sense of shear. Struik (1986) and Rees (1987) inferred that the Eureka thrust was an early Jurassic structure that carried both the Crooked amphibolite and the overlying Triassic rocks above Kootenay terrane. The interpretation preferred here, integral to the general tectonic history outlined in the previous paragraph, follows McMullin (1990) and McMullin et al. (1990), who studied a conglomerate unit in the basal part of the Slocan Group a short distance above the Eureka thrust near Wingdam, east of Quesnel. The conglomerate contains clasts derived from both Kootenay terrane and the Crooked amphibolite that were deformed and foliated before being deposited as part of the conglomerate. This suggests that the Eureka thrust is a Permo-Triassic structure that emplaced Slide Mountain terrane above Kootenay terrane, and that the Slocan Group depositionally overlapped these two older terranes after a period of erosion (McMullin et al., 1990). This scenario is consistent with observations and interpretations made elsewhere in the region, as Campbell (1971) documented structural fabrics in the Crooked amphibolite near Crooked Lake that predate deposition of the Slocan Group, and Schiarizza (1989) inferred that east-directed thrust-emplacement and structural imbrication of the Fennell Formation, representing Slide Mountain terrane south of the Raft batholith, occurred in the Late Permian or Early Triassic.

Early Jurassic, east-directed thrust faults are interpreted to imbricate the Slocan Group and western part of the Nicola Group in the Quesnel Lake and Crooked Lake areas (Struik, 1988; Bloodgood, 1990), but are not well documented and are of uncertain extent or regional significance. These structures may correlate with late Early Jurassic east-directed thrust faults that formed during the latter stages of arc magmatism in north-central Quesnel terrane, and juxtapose Quesnel rocks above miogeoclinal rocks (Nixon et al., 1997). A protracted period of contractional deformation and metamorphism that began in early Middle Jurassic time is reflected in polyphase mesoscopic structures in Kootenay terrane, Slide Mountain terrane, the Slocan Group, and eastern parts of the Nicola Group, as well as map-scale structures, including an anticline-syncline pair near Crooked Lake (Fig. 2), that fold these units and their mutual contacts (Campbell, 1971; Rees, 1987; Bloodgood, 1990; Fillipone and Ross, 1990). Correlative structures are not well documented in the central part of the Nicola belt, but it is suspected that a regional syncline (Panteleyev et al., 1996), reflected in the distribution of the younger units of the Nicola Group (Fig. 2), formed at the same time. The youngest structures in the region include systems of Eocene dextral strike-slip and extensional faults (Panteleyev et al., 1996; Schiarizza and Israel, 2001).

3. Triassic rocks of the Bridge Lake – Quesnel River area

Triassic sedimentary and volcanic rocks in the study area are herein assigned to the Slocan Group and the Nicola Group. The Nicola designation was applied to most Triassic rocks in the southern part of the area by Campbell and Tipper (1971), and was used for all Triassic rocks to the north by Panteleyev et al. (1996), including rocks that had previously been referred to as Quesnel River Group (Campbell, 1978; Tipper, 1978) or Takla Group (Rees, 1987). Schiarizza et al. (2013) adopted the approach of Panteleyev et al. (1996) and assigned all Triassic stratified rocks in the southern and central parts of the current study area to the Nicola Group. Sedimentary rocks herein assigned to the Slocan Group were mapped as a distinct unit (the Lemieux Creek succession) in the Nicola Group by Schiarizza et al. (2013), corresponding to rocks that had been excluded from the group by Campbell and Tipper (1971; their unit 10). Likewise, rocks herein mapped as Slocan Group farther north were included in the Nicola Group by Panteleyev et al. (1996) and Bloodgood (1990), but were recognized as a lithologically distinct component (unit Tra), corresponding to rocks that Rees (1987) excluded from the Takla Group and informally referred to as the black phyllite unit. Rees (1987) correlated the black phyllite unit with the Slocan Group of southeastern British Columbia. This correlation is adopted here because, although these rocks are equivalent in age to the Nicola Group, they are lithologically distinct and form a discrete belt to the east of the Nicola Group. Furthermore, as noted by Rees (1987) they: 1) are lithologically identical to the Slocan Group; 2) are, at least in part, the same age as the Slocan Group; and 3) rest unconformably on older rocks (Slide Mountain and Kootenay terrane) that correlate with rocks beneath the Slocan Group (Thompson et al., 2006). The type area of the Slocan Group, near Slocan Lake, is in the Nelson (NTS 82F) and Lardeau (NTS 82K) map areas (Little, 1960), but from there it has been traced northwestward across the entire Vernon (NTS 82L) map area, to a location less than 50 km south-southeast of the Lemieux Creek succession/Slocan Group near Little Fort (Thompson et al., 2006). The Slocan Group in the northwest corner of the Vernon map sheet is juxtaposed with the Nicola Group, to the west, across the Louis Creek fault. This structure tracks northward along the valleys of Louis Creek and the North Thompson River to a system of faults that includes the Lemieux Creek fault, which separates the Lemieux Creek succession/Slocan Group from the Nicola Group north of Little Fort (Fig. 2; Schiarizza et al., 2002).

3.1. Slocan Group

The Slocan Group forms a continuous, relatively narrow belt that extends the full length of the study area, and separates rocks of Slide Mountain and Kootenay terranes to the east from the Nicola Group to the west. Rocks in this belt include the Lemieux Creek succession of Schiarizza et al. (2013), unit Tra of Bloodgood (1990), the black phyllite unit of Rees (1987), and unit uTrp of Struik (1983). The Slocan Group consists mainly of dark grey to black slate and phyllite (Fig. 3), commonly with light to medium grey siltstone laminae, and less commonly with thin interbeds of quartzose siltstone and laminated siltstone. Exposures between Little Fort and the Raft batholith also include thin to thick beds of fine-grained quartzite and quartzose sandstone, locally with conspicuous grains of detrital muscovite and biotite (Schiarizza et al., 2002). A thinly bedded quartzite unit is at the base of the group at several places between Crooked Lake and Horsefly Lake (unit Tra1 of Bloodgood, 1990), and fine-grained, thin- to medium-bedded quartzose sandstone was noted in exposures examined during the 2015 field season, east-southeast of Spanish Lake (Fig. 4). Limestone forms discontinuous lenses, 1-2 m wide, scattered sparsely through parts of the Slocan Group, and is a prominent component near the faulted eastern edge of the group north of Little Fort, where it locally forms thin to thick beds intercalated with siltstone and slate over stratigraphic intervals approaching 100 m (Schiarizza et al. 2002).

Volcanic rocks, generally absent from the Slocan Group, form a local lens, 8 km long and up to 1 km wide, east of Spanish Lake (Struik, 1983; Rees, 1987). This lens includes pale to medium green plagioclase-actinolite-biotite-chlorite (±epidote±calcite) schist that contains flattened quartz amygdules, and 1-2 mm clots of actinolite-biotite-chlorite that may be altered mafic phenocrysts. It also includes plagioclase-quartz-biotite-chlorite-sericite schist, and schist that contains

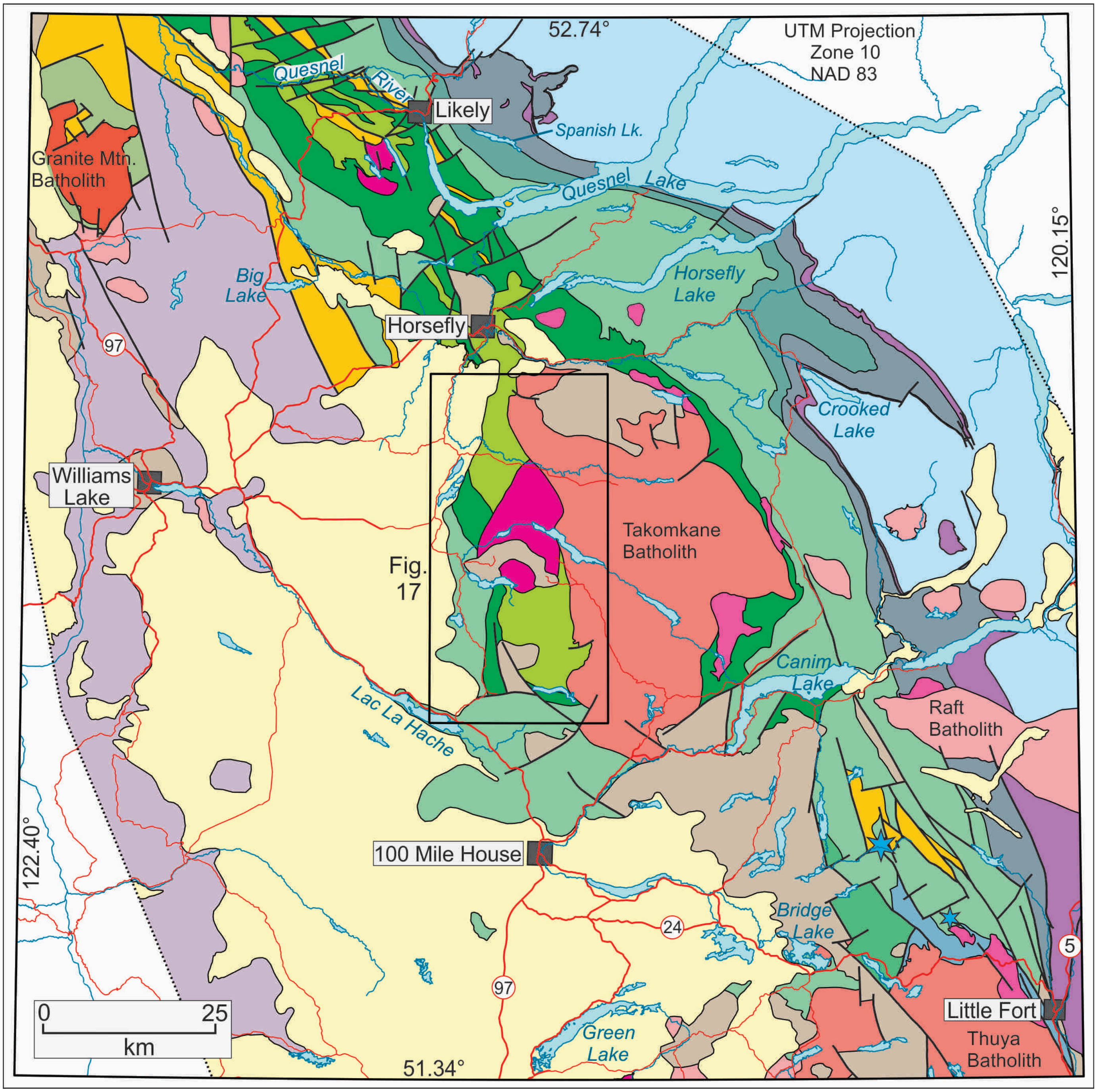

Fig. 2a. Geologic map of the Bridge Lake – Quesnel River area showing the Slocan Group and Nicola Group subdivisions from this study. Based on Struik (1983, 1988), Rees (1987), Bloodgood (1990), Panteleyev et al. (1996), Logan et al. (2007), Schiarizza et al. (2013), Schiarizza (2015), and this study.

flattened fragments of both pale grey quartz-sericite schist and medium green plagioclase-actinolite-biotite-chlorite schist. This lens also includes substantial amounts of well-foliated, platy biotite-sericite-quartz schist that was probably derived from fine-grained quartz-rich sedimentary rocks. The metavolcanic and intercalated metasedimentary rocks are tentatively included in the Slocan Group, but they are very similar to late Paleozoic metavolcanic units found within Kootenay terrane (Schiarizza and Preto, 1987; Ferri, 2001; Paradis et al., 2006). Because contacts with surrounding Slocan phyllites are covered, it is possible that they are an inlier, or fault sliver, derived from that terrane.

Late Triassic macrofossils were collected from the Slocan Group north of Little Fort (Campbell and Tipper, 1971), and conodonts extracted from numerous limestone samples in the same area include Middle and Late Triassic forms (Anisian,

Fig. 2b. Legend for Figure 2a.

Ladinian and early Carnian; Schiarizza et al., 2013). Conodonts have also been extracted from limestone lenses in the group east-southeast of Spanish Lake, and were assigned to the late Anisian-early Ladinian, Ladinian, unrefined Middle Triassic, and unrefined Triassic (Struik, 1988; Panteleyev et al., 1996).

In the southern part of the Bridge Lake – Quesnel River map area, the eastern contact of the Slocan Group is defined mainly by faults, including east-dipping Middle Jurassic thrusts (Campbell and Tipper, 1971) and Eocene normal and dextral strike-slip faults (Schiarizza et al., 2002; Schiarizza and Macauley, 2007; Schiarizza et al., 2013). Farther north, in the Crooked Lake and Spanish Lake areas, the basal contact of the Slocan Group is interpreted as an unconformity that was folded, and variably sheared and transposed, during Jurassic deformation (Campbell, 1971; Rees, 1987). Bloodgood (1990) mapped this contact as a pre-folding, east-directed thrust fault, but this interpretation is based on observations of sheared rock along and near the contact at only a few localities, with little evidence for major displacement, or that these sheared contacts are part of a single fault system. Therefore, following Campbell (1971) and Rees (1987) the basal contact of the Slocan Group is inferred to be an unconformity. This interpretation is consistent with observations made by McMullin et al. (1990), 40 km to the northwest, who identified foliated clasts from the Crooked amphibolite and Kootenay terrane in a conglomerate near the base of the Slocan Group, and concluded that the Slocan Group was deposited unconformably above the Crooked amphibolite after it had been thrust above Kootenay terrane along the Permo-Triassic Eureka thrust fault.

Fig. 3. Dark grey, well-cleaved slate of the Slocan Group, northeast of Canim Lake.

Fig. 4. Thin to medium-bedded, fine-grained quartzose sandstone, with thin interbeds of slaty siltstone; Slocan Group, east-southeast of Spanish Lake. View is northwest; beds dip steeply southwest but are overturned.

3.2. Nicola Group

The Nicola Group in the Bridge Lake – Quesnel River area is subdivided into 4 units (Fig. 5). Assemblage one is mainly Middle Triassic and forms a belt that is juxtaposed against the Slocan Group in the northeastern part of the study area. It corresponds to rocks mapped as unit Trb by Bloodgood (1990), and unit TrJTa by Rees (1987). The other three assemblages form a stratigraphic sequence that spans all of the Late Triassic, and are derived from major map units defined by Schiarizza et al. (2013) in the southern and central parts of the area. Assemblage two corresponds to the Bosk Lake succession, a heterogeneous unit that contains mainly volcanic sandstone but also includes significant proportions of basalt and basalt breccia. Assemblage three corresponds to the Hawkins Lake succession, a relatively homogeneous unit of basalt flows and related breccias. Assemblage four consists of polymictic conglomerate, sandstone and associated volcanic rocks that correspond to the Timothy Creek succession. Other Nicola units mapped by Schiarizza et al. (2013) are considered part of assemblage two (Meridian Lake and Wavey Lake successions), or have been assigned to the Slocan Group (Lemieux Creek succession).

Assemblages two, three and four, defined in the southern part of the area, are easily traced to the north where, with some modifications, they correspond to units 1, 2 and 3 of Panteleyev et al. (1996). Assemblage two includes most rocks assigned to unit 1 by Panteleyev et al. (1996), but excludes some rocks (separated out as units Tra and Trb by Bloodgood, 1990), that are herein assigned to either the Slocan Group (Tra) or assemblage one (Trb). Assemblage three includes most rocks assigned to unit 2 by Panteleyev et al. (1996), but excludes some rocks, stratigraphically beneath their main unit 2 belt, on the west limb of the regional syncline, which are included in assemblage two. Assemblage three also includes analcime-bearing basalts assigned to unit 4 by Panteleyev et al. (1996), following Logan and Mihalynuk (2005) and Logan et al. (2007) who suggest that these distinctive basalt units occur at one, rather than two, stratigraphic levels. Assemblage four includes most rocks assigned to unit 3 by Panteleyev et al. (1996), but excludes Lower Jurassic fossiliferous sedimentary rocks, which are assigned to a separate Jurassic unit (Dragon Mountain succession on Fig. 2), following Logan et al. (2007). Assemblage four, which was assigned a Jurassic age by Panteleyev et al. (1996; their unit 3), is then considered to be mainly or entirely Late Triassic, based on constraints provided in the southern part of the area (Schiarizza et al., 2013).

3.2.1. Assemblage one

Assemblage one is the easternmost element of the Nicola Group in the northern part of the study area. It forms a belt that is bounded by the Slocan Group to the east, and extends from Crooked Lake more than 80 km northwest to the north boundary of the area. Most of this belt comprises rocks mapped as unit Trb by Bloodgood (1990), but in the area north of Quesnel Lake it excludes some rocks of this unit, which are instead assigned to the Slocan Group, and more closely corresponds to rocks mapped as unit TrJTa by Rees (1987), and the basal part of the Quesnel volcanic unit by Struik (1988). Assemblage one is distinguished from the Slocan Group mainly by the presence of feldspathic sandstone that is very similar to sandstone elsewhere in the Nicola Group. The description presented here is biased towards the area north of Quesnel Lake, where the rocks were examined during the 2015 field season.

Assemblage one consists mainly of siltstone, argillite, and slate, but also includes feldspathic sandstone, basalt, and limestone. The most common lithology is dark to medium grey platy argillite to siltstone, comprising beds 1-4 cm thick that are separated by dark greenish grey chloritic partings and/or thin interbeds of dark grey slate (Fig. 6). These beds consist of dark grey argillite in some exposures, and in others are medium to

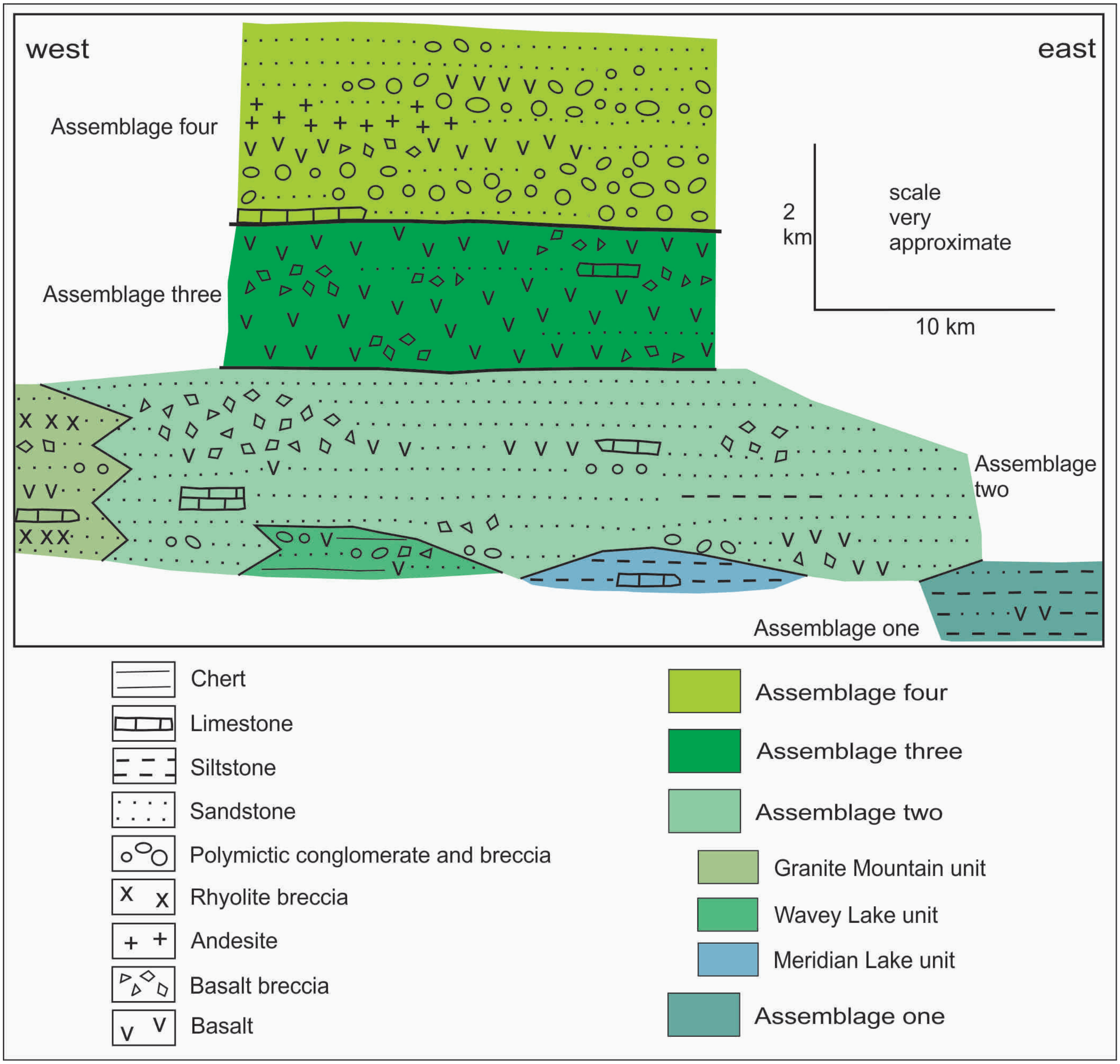

Fig. 5. Schematic stratigraphy of the Nicola Group in the Bridge Lake – Quesnel River study area.

dark grey quartzose siltstone. Less common lithologies include dark grey slate, locally with lighter grey siltstone laminae, and dark grey siltstone and slaty siltstone with thin (2-10 cm) planar beds.

Green to grey, medium to coarse-grained sandstone, very similar to the sandstone of assemblage two, occurs locally within assemblage one, as massive or thin to medium-bedded intervals intercalated with dark grey siltstone. The sandstone is typically feldspathic, but also includes grey to green volcanic lithic grains, and altered mafic mineral or lithic grains. Basalt also occurs locally, as green massive to pillowed units, locally variolitic, that are heavily altered with calcite, epidote and chlorite (Fig. 7). Medium to dark grey limestone forms rare lenses, <1-2 m thick, intercalated with siltstone.

Assemblage one is mainly Middle Triassic, based on conodonts extracted from limestone lenses on the north side of Quesnel Lake. Struik (1988) reported that one collection, from the eastern edge of the assemblage on the north shore of the lake is early-middle Anisian (early Middle Triassic), and another, also from the north shore of the lake but near the western edge of the assemblage, is late Ladinian to Carnian (Middle to Late Triassic). A third collection, from the central part of the assemblage, 2 km south of the east end of Spanish Lake, is early Anisian (Panteleyev et al., 1996; sample 87MB-16-02).

Rees (1987) inferred that assemblage one (his unit TrJTa)

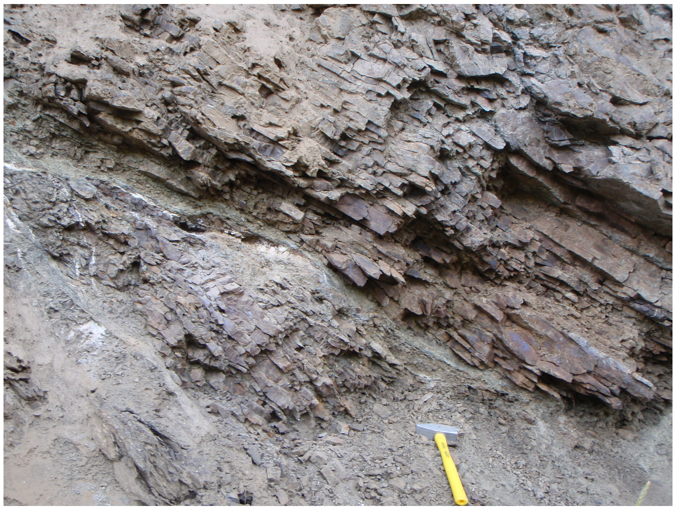

Fig. 6. Platy siltstone, assemblage one of the Nicola Group, 1800 m south of the east end of Spanish Lake.

Fig. 7. Pillowed basalt, assemblage one of the Nicola Group, 1100 m south of Spanish Lake.

overlies the adjacent Slocan Group (his black phyllite unit) across a variably tectonized stratigraphic contact. Struik (1988) noted that the two units are in part the same age, and that conodonts extracted from the lower part of assemblage one on the north shore of Quesnel Lake are older than conodonts extracted from the upper part of the Slocan Group a short distance to the west-northwest. He postulated that the basal contact of assemblage one is a thrust fault along which the Nicola Group was emplaced above the Slocan Group, and suggested that this thrust fault (the Spanish thrust) might have regional extent (Struik, 1988). Observations made during the 2015 field season did nothing to clarify the relationship, but highlighted the difficulties in assessing the nature of the contact because of poor exposure, the similarity of rock types common to both units, and strong deformation expressed as two well-developed cleavages, two or more generations of folds, and ubiquitous outcrop-scale faults of various orientations. External contact relationships provisionally accepted for assemblage one are that it is in thrust contact with the Slocan Group to the northeast (Struik, 1988), and rests stratigraphically beneath assemblage 2 of the Nicola Group to the southwest (Rees, 1987; Struik, 1988), although this latter contact may also, at least locally, be marked by a fault (Bloodgood, 1990).

3.2.2. Assemblage two

Assemblage two is a heterogeneous succession of mainly volcanic sandstone, but with substantial basalt and basalt breccia, and local polymictic conglomerate, siltstone, chert, and limestone. It is the most widespread component of the Nicola Group in the study area, where it forms a continuous belt, locally more than 25 km wide, that extends the full length of the area. On its east side, the belt is juxtaposed against the Slocan Group or assemblage one; to the west it is overlain by assemblage three or is in fault contact with Eocene rocks. Assemblage two also forms a separate western belt, exposed north of 100 Mile House and northwest of Horsefly, which forms the western limb of the regional syncline cored by assemblages three and four (Fig. 2).

Assemblage two consists mainly of rocks referred to as the Bosk Lake succession by Schiarizza et al. (2013), and unit 1 by Panteleyev et al. (1996). It includes 3 separate subunits (Fig. 5): the Meridian Lake unit, comprising siltstone exposed north of the Thuya batholith (Schiarizza et al. (2013); the Wavey Lake unit, a chert-rich unit exposed east and north of Bridge Lake (Schiarizza et al. (2013); and the Granite Mountain unit, unique because it contains substantial amounts of felsic volcanic rock, which is exposed on the margins of the Granite Mountain batholith (Schiarizza, 2014, 2015).

The predominant and characteristic lithology of assemblage two is grey to green, fine- to coarse-grained, commonly gritty, volcanogenic sandstone (Fig. 8). Grains of feldspar, pyroxene, and less common hornblende, together with lithic fragments

Fig. 8. Thick gritty sandstone beds intercalated with thinly bedded sandstone and siltstone, assemblage two of the Nicola Group, 15 km southwest of Crooked Lake.

containing these same minerals, are the main constituents. The sandstone is well bedded in places, but elsewhere forms massive units, up to several tens of metres thick. In well-bedded sections, thin to thick sandstone beds commonly alternate with thin beds of green to grey siltstone or dark grey argillite, and locally display graded bedding, flame structures, and rip-up clasts. Locally, rusty-weathered, thinly bedded to laminated siltstone, intercalated with dark grey slate or slaty argillite, forms intervals up to 10 m thick. The Meridian Lake unit represents a much thicker siltstone sequence that forms the base of the assemblage north of the Thuya batholith.

Pebble conglomerate and pebbly sandstone occur locally in assemblage two, typically as grey-green, medium to very thick beds interspersed with thin intervals of volcanic sandstone and siltstone. Most conglomerates have a sandy matrix and a clast population consisting mainly of pyroxene-feldspar-phyric basaltic fragments. Less common are pebble conglomerates with a rusty-weathered siltstone matrix, and a heterogeneous clast population that includes abundant fragments of limestone, siltstone, and sandstone, as well as pyroxene-plagioclase-phyric basalt, hornblende-feldspar porphyry and aphyric volcanic rock (Schiarizza and Macauley, 2007).

Basalt and basalt breccia are a common component of assemblage two, and in places form accumulations, up to several hundred metres thick, that can be separated out on 1:100,000-scale and more detailed maps (unit uTrNbb of Schiarizza et al., 2013; unit 1a of Panteleyev et al., 1996). One of these mafic volcanic bodies, exposed in several fault panels north of Little Fort, is in the lower part of assemblage two (Schiarizza and Israel, 2001; Schiarizza et al., 2002), whereas others are repeated higher in the section (Schiarizza and Boulton, 2006; Schiarizza and Macauley, 2007). These volcanic units include pillowed and massive pyroxene-plagioclase-phyric basalt (Fig. 9), but volcanic breccia, locally intercalated with lenses and layers of dark green pyroxene-rich sandstone, is predominant. The breccia is typically dark green or grey-green and rusty brown to greenish brown-weathered, but locally the colour is mottled because of varicoloured fragments (light to dark green, grey and maroon). Fragments are typically angular to subangular, and commonly range from a few millimetres to more than 10 cm. In most exposures the fragments are compositionally uniform, consisting almost exclusively of pyroxene±plagioclase-phyryic basalt (Fig. 10), but display considerable textural variation in proportion of phenocrysts, degree of vesiculation, and abundance of amygdules. The matrix is typically sandy, and composed mainly of feldspar, pyroxene, and mafic lithic grains.

Thin intervals of dark grey, brown-weathered limestone and silty limestone, up to a few metres thick, occur rarely in the eastern exposure belt, where they are intercalated with volcanic sandstone or siltstone. Thicker limestone units outcrop locally in the western belt, including an isolated ridge 10 km southeast of Lac La Hache that exposes 30 to 40 m of flaggy bedded limestone (Fig. 11; Schiarizza and Bligh, 2008), and a poorly exposed, but apparently substantial limestone interval west of Antoine Lake, 14 km northwest of Horsefly (Logan et al., 2007).

Chert is a prominent component of the Wavey Lake unit, but is very uncommon elsewhere in assemblage two, where it forms rare thin beds intercalated with siltstone, argillite and sandstone (Schiarizza and Israel, 2001; Schiarizza and Boulton, 2006). Rhyolite-clast volcanic breccia is the defining component of the Granite Mountain unit, because felsic volcanic rocks have been documented at only one locality elsewhere in assemblage two. This occurrence is 23 km northwest of Little Fort, where massive and fragmental feldspar-phyric dacite forms a set of isolated outcrops in an area with mainly basalt and basalt breccia (Schiarizza and Israel, 2001; unit uTrNbf of Schiarizza et al., 2013). Directly beneath these dacites is a succession of volcanic sandstones that enclose a thin unit of fossiliferous lower Carnian limestone.

Conodonts and macrofossils from a few scattered localities

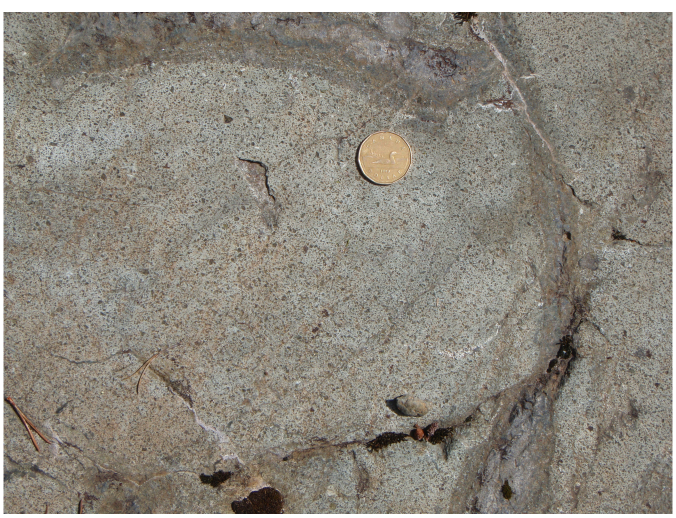

Fig. 9. Pillowed pyroxene-plagioclase-phyric basalt, assemblage two of the Nicola Group, 15 km north-northwest of Little Fort.

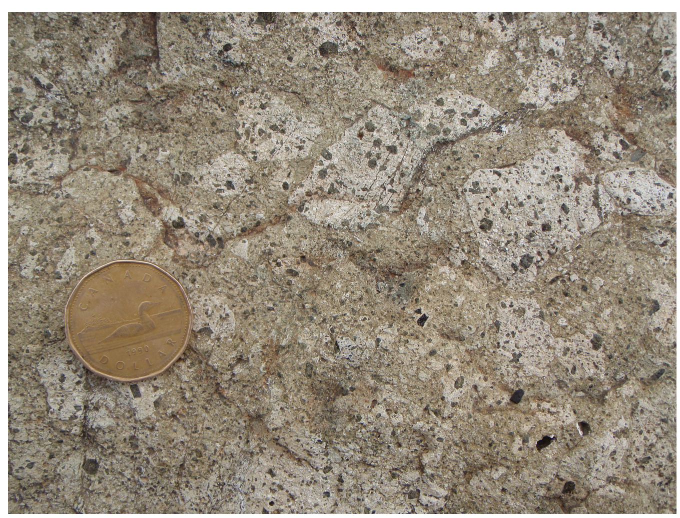

Fig. 10. Pyroxene porphyry breccia, assemblage two of the Nicola Group, Viewland Mountain, 20 km northeast of Horsefly.

Fig. 11. Limestone, assemblage two of the Nicola Group, 10 km southeast of Lac La Hache.

in assemblage two indicate that it is mainly Late Triassic, early Carnian to early Norian. These localities include a narrow limestone unit 10 km northwest of Little Fort with Carnian conodonts and another, 23 km northwest of Little Fort with late Ladinian to early Carnian conodonts and Carnian to middle Norian macrofossils (Schiarizza et al., 2013). Conodonts of probable early Norian age were extracted from limestone west of Antoine Lake (14 km northwest of Horsefly) and a locality 15 km farther to the northwest (6 km northeast of Big Lake) yielded late Carnian conodonts (Panteleyev et al., 1996). Conodonts from a locality 1 km south of the west end of Horsefly Lake are late Carnian, and macrofossils collected 7 km farther south include probable late Carnian or early Norian *Halobia?* (Panteleyev et al., 1996). Conodonts from the Meridian Lake unit are Carnian and late Ladinian to early Carnian (Schiarizza et al., 2013), and a conodont fragment from limestone in the Granite Mountain unit is early Norian (Schiarizza, 2015).

3.2.2.1. Meridian Lake unit

Siltstone that crops out on the north and northeast margins of the Thuya batholith, in the southern part of the study area, is assigned to the Meridian Lake unit (Fig. 2). These rocks are part of the Meridian Lake succession of Schiarizza et al. (2013), but volcanic sandstone and conglomerate that were also included in this succession are excluded, and are incorporated in the adjacent, undivided part of assemblage two (Fig. 5). Thus modified, the Meridian Lake unit consists mainly of rusty-weathered, dark to medium grey, laminated to thinly bedded siltstone and slaty siltstone (Fig. 12), with local thin interbeds of dark grey argillite and chert. Dark grey micritic limestone and limy argillite forms local thin to thick beds intercalated with siltstone and argillite. One of these limestone units yielded Late Triassic (Carnian) conodonts, and another contains Middle or Late Triassic (late Ladinian to early Carnian) conodonts (Schiarizza et al., 2013).

The Meridian Lake unit is cut by Early Jurassic granodiorite of the Thuya batholith, and by a suite of Early Jurassic ultramafic to mafic intrusions. Other contacts are mainly faults, but locally the unit is overlain, to the northeast, by volcanic sandstone and conglomerate typical of assemblage two across an inferred stratigraphic contact. This contact is not well exposed, but seems to be defined by a transitional interval where thin to medium beds of green volcanic sandstone interlayer with dark grey laminated siltstone.

The Meridian Lake unit is provisionally included in assemblage two, apparently representing a siltstone facies in its lower part. Nonetheless, other correlations are possible, given that the unit is markedly similar to the Slocan Group, which includes rocks of the same age, and is also similar to parts of assemblage one, which is mainly older but may also include rocks of the same age.

3.2.2.2. Wavey Lake unit

The Wavey Lake unit (Wavey Lake succession of Schiarizza et al., 2013) forms a distinctive element of assemblage two that is exposed in fault panels east and north of Bridge Lake (Fig. 2). It is characterized by an abundance of grey to green chert (Fig. 13), which occurs as thin-bedded intervals, up to 10 m thick, comprising millimetre to centimetre-scale chert beds separated by partings and thin interbeds of argillite or slate. The chert intervals are interbedded with fine- to medium-grained volcanic sandstones, similar to sandstone elsewhere in assemblage two, which locally form channels that cut into

Fig. 12. Thinly bedded light (quartzose) and dark grey siltstone, assemblage two of the Nicola Group, Meridian Lake unit, north margin of the Thuya batholith.

Fig. 13. Thinly bedded chert, assemblage two of the Nicola Group, Wavey Lake unit, 10 km east-northeast of Bridge Lake.

Fig. 14. Volcanic breccia with mainly rhyolite fragments, assemblage two of the Nicola Group, Granite Mountain unit, northeast margin of the Granite Mountain batholith.

the chert (Schiarizza et al., 2002). The Wavey Lake unit also includes basalt and basalt breccia, similar to volcanic rocks elsewhere in assemblage two, and bodies of polymictic pebble to cobble conglomerate, up to several tens of metres thick, that are more abundant than elsewhere in the assemblage. The conglomerate contains subangular to rounded clasts of mainly laminated siltstone, cherty argillite, and argillite, but also includes fragments of chert, limestone, pyroxene-plagioclase-phyric basalt, and microdiorite. The Wavey Lake unit is undated, but is suspected to be a relatively old component of assemblage two because the narrow panel north of Bridge Lake is stratigraphically overlain by a thick sandstone sequence in the undivided part of the assemblage. The Meridian Lake unit, or a similar succession, may have been the source of most clasts within the Wavey Lake conglomerates.

3.2.2.3. Granite Mountain unit

Nicola rocks on the margins of the Granite Mountain batholith form an outlier, faulted against Cache Creek terrane, comprising the westernmost part of the group exposed in the Bridge Lake – Quesnel River study area (Fig. 2). Here, the group consists of sandstone and gritty to pebbly sandstone, with local intercalations of conglomerate, mafic and felsic volcanic breccia, siltstone, limestone, and basalt (Schiarizza, 2014, 2015). These rocks are included in assemblage two on the basis of lithology, particularly the predominance of volcanic sandstone, and their early Norian and older age, constrained by conodonts from one limestone unit, and crosscutting plutonic rocks as old as 222.71 ±0.22 Ma (Schiarizza, 2015). This succession is unique, however, because it includes two substantial intervals of felsic volcanic breccia (Fig. 14), with mainly angular to subrounded fragments of pale green, grey or purplish-grey rhyolite, commonly with 1-2 mm phenocrysts of quartz ±feldspar (Schiarizza, 2014). Rhyolites have not been documented in the Nicola Group elsewhere in the Bridge Lake – Quesnel River area, and the Granite Mountain belt may be part of a unique, but poorly-exposed, western facies, with possible affinities to the rhyolite-bearing western Nicola belt exposed in the Princeton-Merritt area farther to the south (Preto, 1979).

3.2.3. Assemblage three

Assemblage three is a relatively homogeneous succession of basalt flows and breccias. It includes the Hawkins Lake succession of Schiarizza et al. (2013), most rocks assigned to unit 2, particularly subunits 2a, 2b, 2c and 2e, by Panteleyev et al. (1996), and most rocks assigned to units LTrNvb, LTrNpv and LTrNav by Logan et al. (2007). Assemblage three forms a generally synclinal belt, underlain by assemblage two to the northeast and southwest, which extends 120 km from the southern part of the Takomkane batholith to the northern boundary of the map area (Fig. 2). It is overlain by assemblage four, in the core of the syncline, east of Likely and on the west margin of the Takomkane batholith.

Assemblage three is mainly dark green, locally grey or maroon, brownish-weathered, massive and pillowed basalt (Fig. 15). Textures vary, but most of the basalt is coarsely porphyritic, with large clinopyroxene phenocrysts and smaller plagioclase phenocrysts comprising 30-70% of the rock. The groundmass includes plagioclase laths and small clinopyroxene grains, but commonly displays an alteration assemblage that includes calcite, epidote and chlorite. Amygdules, typically epidote and calcite, may be present, and varioles occur in some pillowed units.

Olivine, typically replaced by iddingsite and other secondary minerals, forms part of the phenocryst assemblage in some basalt units, including those mapped as unit 2a by Panteleyev et al. (1996), which forms the lower part of assemblage three in the Horsefly-Likely area. In this same area, analcime occurs as

Fig. 15. Pillowed pyroxene-plagioclase-phyric basalt, assemblage three of the Nicola Group, 1.5 km north of western Canim Lake.

Fig. 16. Breccia containing pyroxene-phyric basalt fragments, assemblage three of the Nicola Group, 16 km south-southwest of Likely.

phenocrysts in clinopyroxene-plagioclase-olivine-phyric basalt flows and related breccias that are mainly in the upper part of the assemblage, including units 2e and 4 of Panteleyev et al. (1996) and unit LTrNav of Logan et al. (2007). Hornblende-pyroxene-plagioclase-phyric basalt is a minor component of assemblage three, and occurs mainly near the northern boundary of the study area, north of the Quesnel River (unit LTrNhv of Logan et al., 2007).

Breccia, consisting mainly or entirely of basalt fragments, is a common, and locally predominant component of assemblage three. It forms massive to weakly stratified units, up to several tens of metres thick, interlayered with basalt flows. Fragments are angular to subrounded, range from less than 1 cm to more than 20 cm, and are typically supported by a sandy to gritty matrix with predominantly plagioclase, pyroxene and mafic lithic grains (Fig. 16). The fragments are mainly pyroxene-plagioclase-phyric basalt, but they may show considerable variation in size, abundance, and proportion of phenocrysts, and locally are accompanied by other clast-types, including limestone, volcanic sandstone, siltstone, pyroxenite, hornblendite, and diorite (Schiarizza and Boulton, 2006; Schiarizza et al., 2009).

Feldspar-pyroxene sandstone and gritty sandstone is a minor component of assemblage three, and typically forms narrow intervals intercalated with basalt breccia. Lenses of limestone and calcareous mudstone also occur locally (Panteleyev et al., 1996; Schiarizza and Boulton, 2006), and a rusty-weathered laminated siltstone interval, at least 10 m thick, was traced for 1.3 km in the assemblage west of the Takomkane batholith (Schiarizza et al., 2009).

Assemblage three is inferred to be Norian, based on its stratigraphic position between assemblage two (Carnian and early Norian), and assemblage four (latest Triassic). Macrofossils collected from the lower part of the assemblage north of Gavin Lake, 16.5 km southwest of Likely, include *Monotis* sp. (Norian), and a collection from the lower part of the unit east of Lemon Lake, 6 km south of western Horsefly Lake, includes *Halobia* sp. (probably late Carnian or early Norian; Panteleyev et al., 1996).

3.2.4. Assemblage four

Assemblage four contains predominantly polymictic conglomerate and breccia bearing a diverse clast population not seen in older parts of the Nicola Group. It also includes substantial intervals of feldspathic sandstone and volcanic rock, including some volcanic units that are lithologically distinct from those in underlying units. Assemblage four is well exposed locally on the west margin of the Takomkane batholith (Figs. 17, 18) where it was identified as a lithologically distinct, upper unit of the Nicola Group by Schiarizza and Bligh (2008) and Schiarizza et al. (2009), and later referred to as the Timothy Creek succession by Schiarizza et al. (2013). These rocks are equivalent to those included in the lower part of unit 3 by Panteleyev et al. (1996), which are well exposed west of Likely and correspond to units LTrNpt and LTrNvl of Logan et al. (2007).

The conglomerates are commonly medium to dark green or greenish grey, and weather to light shades of brown, greenish brown or beige. In the upper part of the assemblage, and locally elsewhere, they are red to purple, or display patchy colour variations in shades of red, purple, grey and green (Fig. 19). They contain a variety of igneous clasts, including a significant proportion derived from intrusive rocks. Fine-grained, equigranular to weakly porphyritic hypabyssal feldspathic clasts are predominant, but clasts of medium-grained gabbro, diorite, monzodiorite and monzonite are common, as are mafic to intermediate volcanic clasts containing variable proportions of feldspar, pyroxene and hornblende phenocrysts. Angular to subrounded clasts (from a few mm to 20 cm) are supported in a sandy matrix consisting mainly of feldspar, with subordinate mafic mineral grains. The conglomerates are commonly massive, but locally display weak stratification that may be accentuated by intercalations of sandstone and pebbly sandstone.

Medium- to coarse-grained sandstone is predominant in intervals many tens of metres thick in the upper part of the assemblage west of the Takomkane batholith, both in the Mount Timothy area (red sandstone-conglomerate unit of Schiarizza and Bligh, 2008), and the Woodjam Creek area (upper part of the polylithic breccia unit of Schiarizza et al., 2009). Sandstone is also predominant in the lower part of the assemblage west of Likely, and is locally underlain by a substantial limestone interval that marks the base of assemblage four (Logan et al., 2007, section A-A'). The sandstones are mostly green to grey-green, but they may be red, particularly in the upper part of the assemblage, or mottled green and red. They consist largely of feldspar (both plagioclase and pinkish grains that are K-spar and/or hematite-altered plagioclase), along with variably-altered mafic grains (mainly pyroxene) and fine-grained, chlorite-epidote-calcite-altered matrix. Bedding is commonly defined by planar laminations and indistinct platy to flaggy partings (Fig. 20), but thin to medium beds are locally well defined by distinct units of contrasting grain size, ranging from coarse, gritty sandstone to siltstone. In the basal part of the unit, west of Likely, thin to medium beds commonly display normal grading, load casts and flame structures, and locally are deformed by soft-sediment folds (Fig. 21).

Volcanic rocks locally comprise a substantial component of assemblage four, and form mappable bodies west of the Takomkane batholith, in both the Mount Timothy and Woodjam Creek areas (Fig. 17). In each of these areas the volcanic section includes a lower unit of pyroxene-plagioclase-phyric basalt and basalt breccia, and an upper unit of coarse plagioclase-phyric andesite. The lower basalt units are similar to mafic volcanic rocks in assemblages two and three, but the plagioclase-phyric andesites are distinct, and were originally mapped as Eocene by Schiarizza and Bligh (2008). They contain 30-50% plagioclase phenocrysts, commonly 5-10 mm long (locally to 2 cm), in an aphanitic groundmass with mainly randomly oriented plagioclase microlites (Fig. 22). The plagioclase phenocrysts are locally accompanied by smaller pyroxene and/or hornblende phenocrysts, and by scattered amygdules of mainly epidote, calcite and quartz.

Assemblage four is mainly or entirely latest Triassic. This interpretation is based on a U-Pb age of 203.9 ±0.4 Ma on zircons extracted from plagioclase-phyric andesite west of Woodjam Creek (Fig. 17; Schiarizza et al., 2013), and by U-Pb zircon ages ranging from of 203.6 ±0.3 Ma to 205.0 ±0.3 Ma from monzodiorite stocks that crosscut the lower and middle portions of the assemblage east and southeast of Spout Lake (Fig. 17; Schiarizza et al., 2013). Panteleyev et al. (1996; unit 3) considered it Early Jurassic, but this was based mainly on the inclusion of fossiliferous Lower Jurassic sedimentary rocks that Logan et al. (2007) consider a separate unit, shown as Dragon Mountain succession on Fig. 2.

4. Discussion

The preliminary assessment of Nicola stratigraphy presented here indicates that some rocks previously included in the group should be reassigned to the Slocan Group, and that the remaining rocks, retained as Nicola Group, comprise four main units, referred to as assemblages one, two, three, and four. These subdivisions are a starting point for continuing studies on Nicola Group stratigraphy, and are expected to be expanded and modified with further work.

Assemblage one is predominantly Middle Triassic siltstone and argillite, but includes intercalations of volcanic sandstone and pillowed basalt. The age, predominant lithology, and location along the eastern margin of the Nicola belt suggest a possible link to the Slocan Group, a possibility that requires further study. Middle Triassic Nicola rocks are unknown from elsewhere in the Bridge Lake-Quesnel River area, but occur locally in other parts of southern British Columbia, including the Princeton-Merritt area where Nicola Group rhyolites with ~238 Ma U-Pb zircon ages have recently been documented (Mihalynuk et al., 2015, 2016).

Assemblage two (Carnian and early Norian) is a heterogeneous succession that includes virtually all rocks types commonly encountered in the Nicola Group. It includes basalt flows and basalt breccia, but is predominantly volcanic sandstone derived from these, or similar, mafic volcanic rocks. Our current level of understanding in the Bridge Lake – Quesnel River area suggests that mafic volcanic centres of several different ages were distributed across most of the known width of the arc during this time period. Broader-scale features include late Carnian to early Norian rhyolites in the western part of the area (Granite Mountain unit), which may have regional significance if equivalent to rhyolitic rocks (~224 Ma, Mihalynuk et al., 2016) in the western Nicola belt of the Princeton-Merritt area (Preto, 1979).

Assemblage three (Norian) consists mainly of basalt and basalt breccia that reflect a major constructional period in the Bridge Lake – Quesnel River segment of the Nicola arc. Further studies will address if this time interval was one of greater-than-average basalt accumulation in other parts of the arc, the location and arrangement of volcanic centres, and if siliciclastic and carbonate facies that accumulated during this time period can be distinguished from assemblage two. Previous work in the Nicola-equivalent Takla Group of central and northern British Columbia suggest that thick basalt sections of this age accumulated in other segments of the arc (Witch Lake succession of Nelson and Bellefontaine, 1996; Goldway Peak unit of Schiarizza and Tan, 2005).

Assemblage four is characterized by polymictic conglomerate bearing abundant hypabyssal and plutonic clasts, a common red colour, and a volcanic suite that includes distinctive coarse, crowded plagioclase-phyric andesite. It is in part latest Triassic, but neither an upper age limit nor its relationship to Early Jurassic sedimentary rocks (Dragon Mountain succession) have been established. This assemblage reflects significant unroofing of the arc, and it may rest above other parts of the

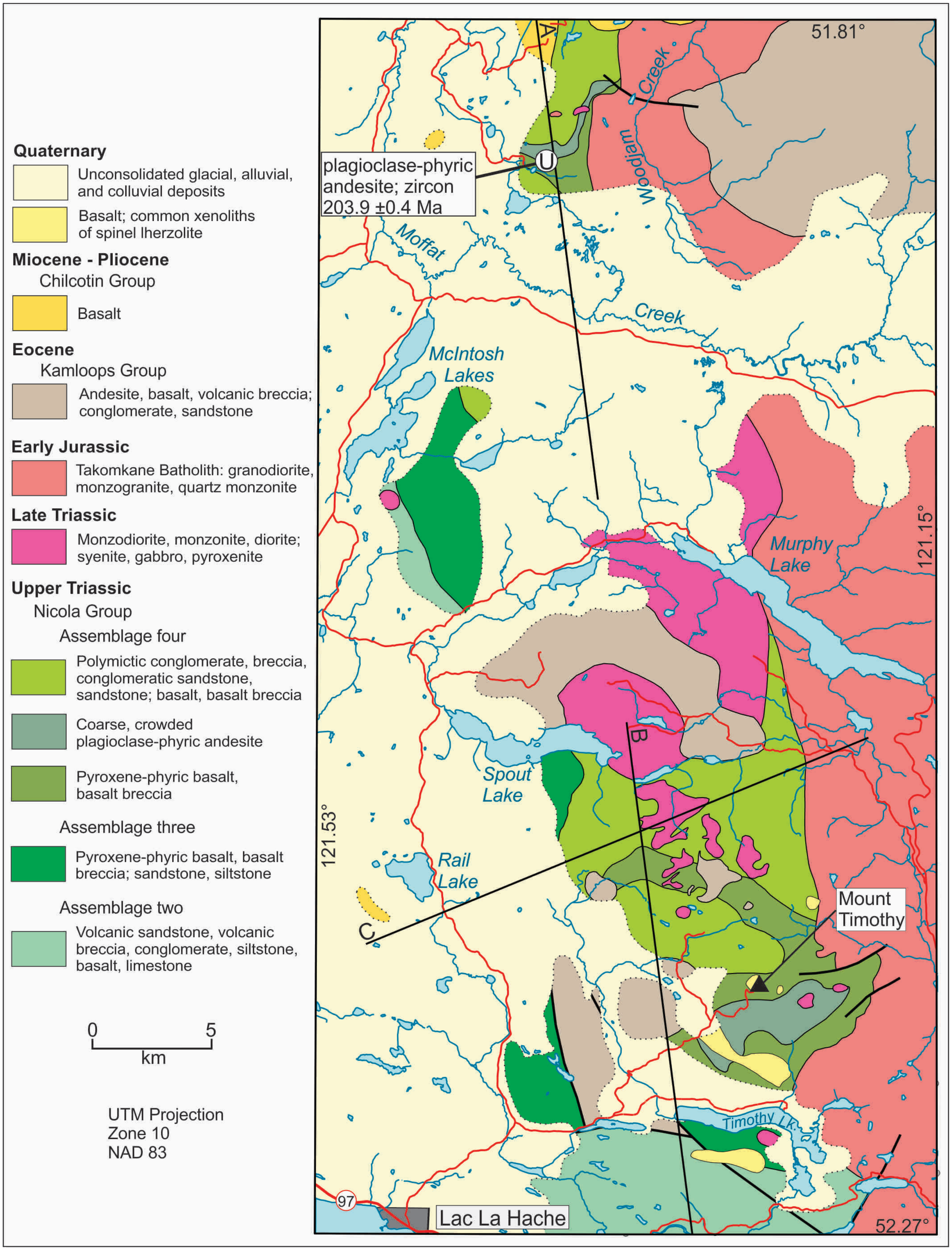

Fig. 17. Geology of the Timothy Lake – Woodjam Creek area. Modified from Schiarizza et al. (2013) mainly by assigning volcanic rocks on Mount Timothy, previously mapped as Eocene, to assemblage 4 of the Nicola Group.

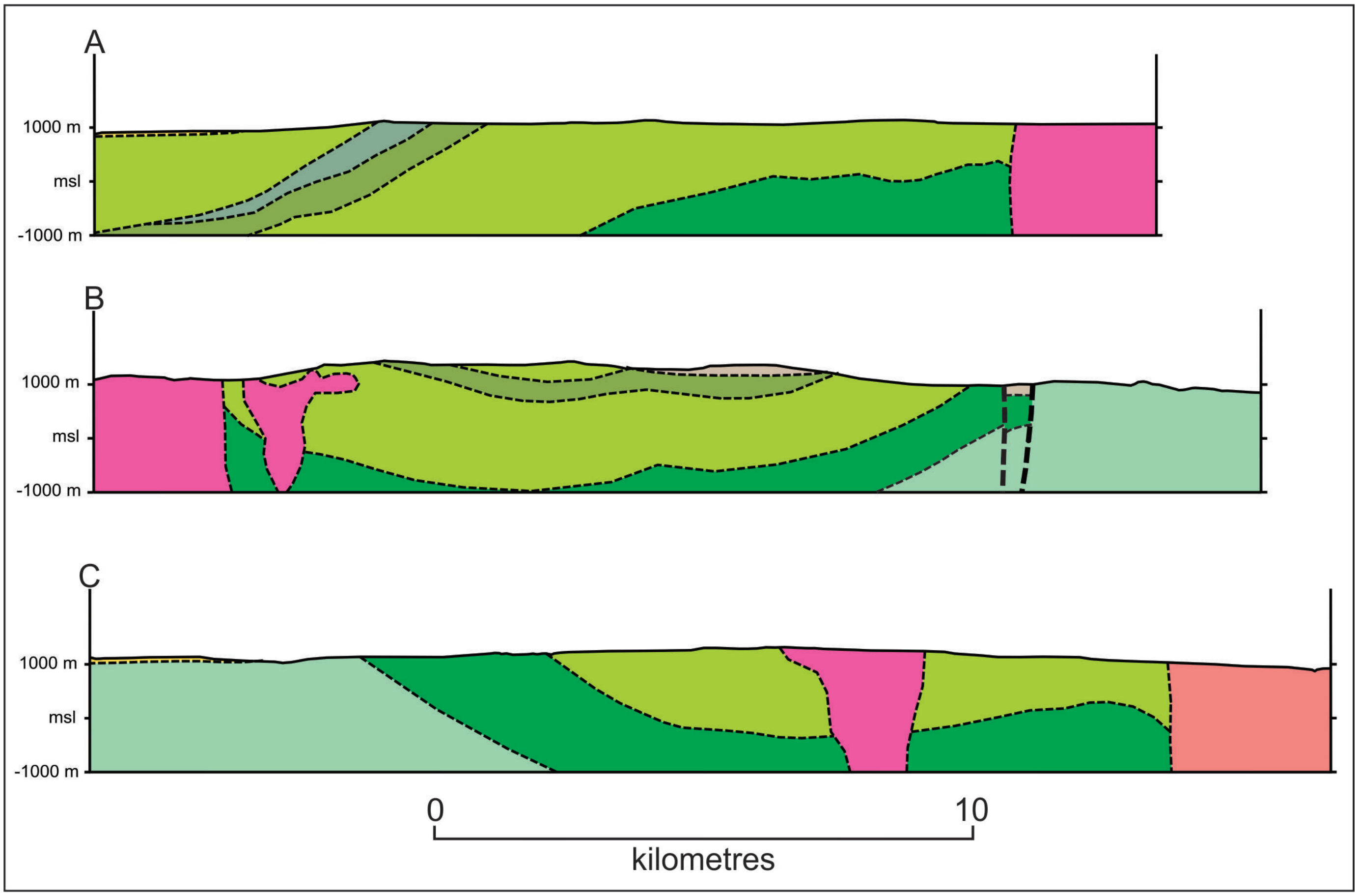

Fig. 18. Schematic vertical cross-sections along lines A, B and C, shown on Figure 17. See Figure 17 for legend.

Fig. 19. Conglomerate, assemblage four of the Nicola Group, 15 km west-southwest of Likely.

Fig. 20. Parallel-stratified red sandstone, assemblage four of the Nicola Group, 6 km northwest of Mount Timothy.

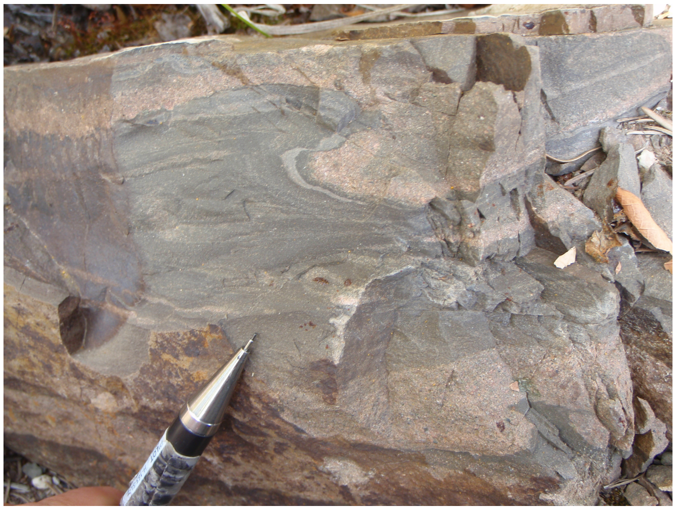

Fig. 21. Graded sandstone beds deformed by soft-sediment folds, assemblage four of the Nicola Group, 15 km west-southwest of Likely.

Fig. 22. Coarse, crowded plagioclase-phyric andesite, assemblage four of the Nicola Group, west of Woodjam Creek.

Nicola group across an unconformity. The present narrow, linear distribution of assemblage four may simply reflect its preservation in the core of a regional syncline, but future studies will address the possibility of sedimentation in an intra-arc rift. Rocks that probably correlate with assemblage four have recently been identified in the Shrimpton Creek area, south of Merritt (Harmon succession; Mihalynuk et al., 2015).

5. Conclusions

Triassic rocks in the Bridge Lake – Quesnel River area are assigned to the Slocan Group and the Nicola Group. The Slocan Group represents a Middle to Late Triassic siliciclastic basin that formed above Paleozoic rocks, including Slide Mountain and Kootenay terranes, which were structurally imbricated in Permo-Triassic time. The Nicola Group is a Middle to Late Triassic volcanic arc succession that accumulated to the west.

The Nicola Group is subdivided into four assemblages that span most of the Middle and Late Triassic. Assemblage one (mainly Middle Triassic), comprises siltstone with local intercalations of volcaniclastic sandstone and pillowed basalt, and is juxtaposed with the Slocan Group in the northeastern part of the study area. Assemblage two (Carnian and early Norian), includes basalt flows and basalt breccia, but is predominantly volcanic sandstone derived from these, or similar, mafic volcanic rocks. Notable variants include an early Carnian siltstone facies (Meridian Lake unit), a chert-rich facies of uncertain age (Wavey Lake unit), and a western facies, early Norian in part, that includes a substantial felsic volcanic component (Granite Mountain unit). Assemblage three is a relatively homogeneous succession of pyroxene-phyric basalt flows and breccias that reflect a major Norian constructional phase. Assemblage four is characterized by polymictic conglomerates that contain abundant hypabyssal and plutonic rock fragments, but also includes red feldspathic sandstone, pyroxene-phyric basalt, and distinctive coarse, crowded plagioclase-phyric andesite. These rocks are, at least in part, latest Triassic, and are suspected to rest unconformably above older assemblages of the group.

The four assemblages established in the Bridge Lake – Quesnel River area provide a preliminary framework for ongoing studies of Nicola Group stratigraphy, and will be expanded and modified with further work.

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