Geology and Mineral Occurrences of the Hendrix Lake Area (NTS 093A/02), South-Central British Columbia

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INTRODUCTION

The Takomkane project is a multiyear bedrock mapping program initiated by the British Columbia Geological Survey during the 2005 field season. This program is focused on Mesozoic arc volcanic and plutonic rocks of the Quesnel Terrane in the vicinity of the Takomkane batholith, which straddles the Bonaparte Lake (NTS 092P) and Quesnel Lake (NTS 093A) map sheets (Fig 1). Previous bedrock maps of the area are based on reconnaissance-scale mapping carried out by the Geological Survey of Canada in the 1960s. The purpose of the Takomkane project is to provide more detailed maps and an improved geological framework for interpreting mineral occurrences and geochemical anomalies, and for predicting favourable settings for future discoveries.

The first year of mapping for the Takomkane project covered about 1000 km^2 centred near Canim Lake, and tied in with 1:50 000 scale mapping carried out to the south during the 2000–2001 Bonaparte project (Fig 1). The results of the 2005 field program are summarized by Schiarizza and Boulton (2006a, b). Here, we present preliminary results from the second year of mapping for the Takomkane project, which was carried out by the authors from mid-June to early September 2006. The area mapped covers about 650 km^2 centred near Hendrix Lake, site of the former mining town that serviced the past-producing Boss Mountain molybdenum mine. It is situated within the Quesnel Highland physiographic province. Topography is generally subdued, although alpine ridges occur around Takomkane Mountain in the western part of the map area, and mountainous terrain along the eastern edge of the area is transitional into the high Cariboo Mountains to the east. The map area is transected by a north-south, all-season gravel road that connects with 100 Mile House to the southwest, and with Horsefly and Williams Lake to the northwest and west. Networks of secondary logging and Forest Service roads that branch from this main road provide access to most parts of the map area.

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The Hendrix Lake map area is within the southern part of the Quesnel Lake sheet (NTS 093A), which is covered by a 1:125 000 scale map produced by R.B. Campbell (1978). The northeastern part of the map area borders the thesis study areas of K.V. Campbell (1971), Fillipone (1985), Carye (1986) and Bloodgood (1987, 1990), and the northern boundary of the area abuts the southern end of the Quesnel River – Horsefly map area described by Panteleyev *et al*. (1996). Detailed studies of the Boss Mountain molybdenum mine are presented by Soregaroli (1968), Soregaroli and Nelson (1976) and Macdonald *et al.* (1995). Descriptions of other mineral occurrences within the map area are found in assessment reports available through the BC Geological Survey's Assessment Report Indexing System (ARIS).

REGIONAL GEOLOGICAL SETTING

The regional setting of the Takomkane project area is summarized by Schiarizza and Boulton (2006a), and is only briefly reviewed here. The Quesnel Terrane, which underlies most of the project area, is characterized by Late Triassic to Early Jurassic volcanic, volcaniclastic and plutonic rocks that represent a magmatic arc that formed along or near the western North American continental margin (Mortimer, 1987; Struik, 1988a, b; Unterschutz *et al*., 2002). These rocks form an important metallogenic province, particularly for porphyry deposits containing copper, gold and molybdenum. To the east, the Quesnel Terrane is faulted against Proterozoic and Paleozoic siliciclastic, carbonate and volcanic rocks of the Kootenay Terrane, and locally an intervening assemblage of mid to Late Paleozoic oceanic basalt and chert assigned to the Slide Mountain Terrane (Fig 1). The Kootenay Terrane probably represents an outboard facies of the ancestral North American miogeocline (Schiarizza and Preto, 1987; Colpron and Price, 1995), whereas the Slide Mountain Terrane is interpreted as the imbricated remnants of a Late Paleozoic marginal basin (Schiarizza, 1989; Roback *et al*., 1994). Late Paleozoic through mid-Mesozoic oceanic rocks of the Cache Creek Terrane occur to the west of the Quesnel Terrane, and are interpreted as part of the accretion-subduction complex that was responsible for generating the Quesnel magmatic arc (Travers, 1978; Struik, 1988a). Younger rocks commonly found in the region include Cretaceous granitic stocks and batholiths, Eocene volcanic and sedimentary rocks, and flat-lying basalts of both Neogene and Quaternary age (Fig 1).

The structural geology of the Quesnel Terrane includes generally poorly understood faults that exerted controls on Late Triassic volcanic-sedimentary facies distributions and the localization of plutons and associated mineralization and alteration systems (Preto, 1977, 1979; Nelson and

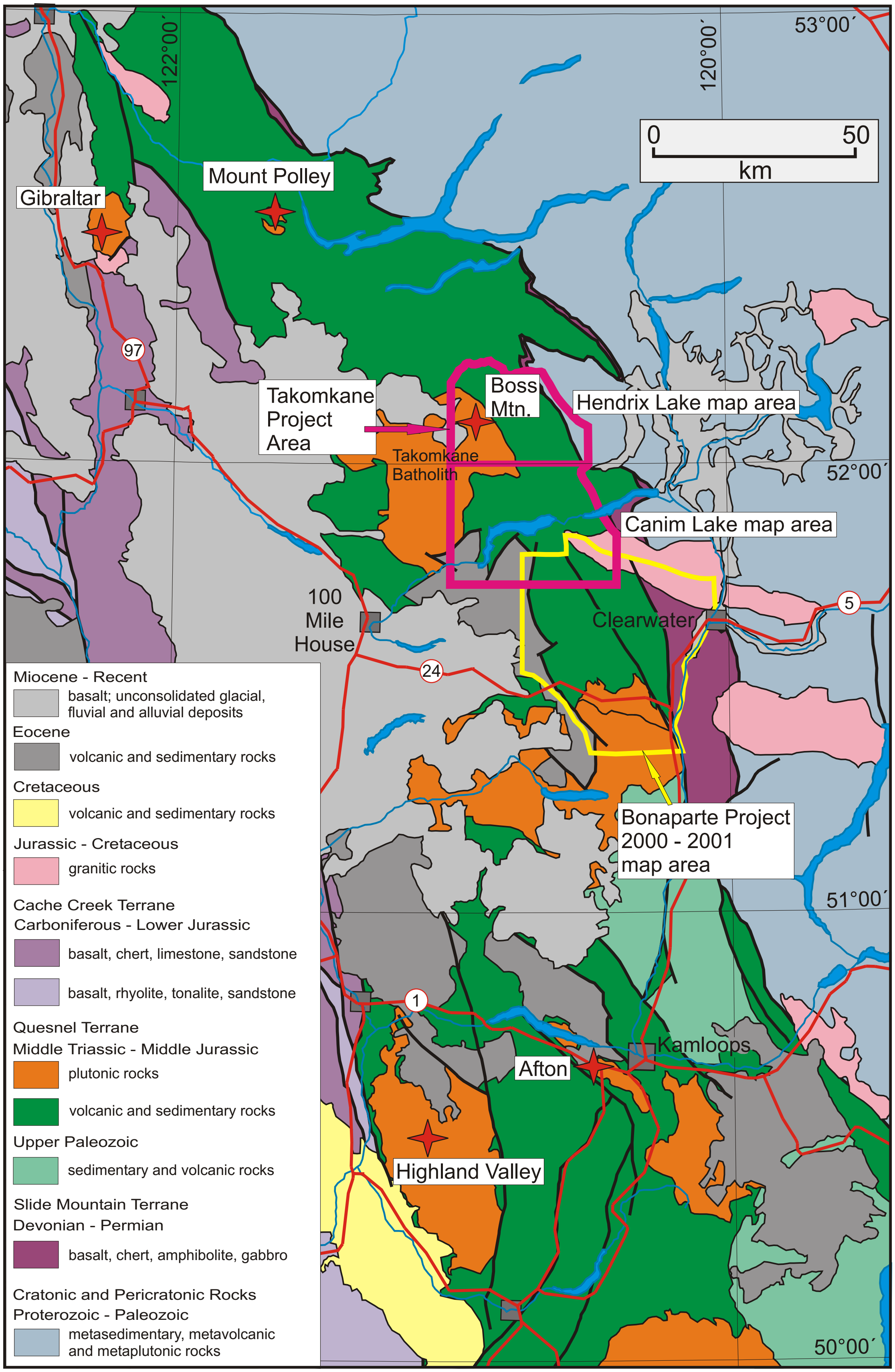


Figure 1. Regional geological setting of the Takomkane project area, showing the areas mapped in 2005 and 2006, the area mapped during the 2000–2001 Bonaparte project, and the locations of selected major mineral deposits.

Bellefontaine, 1996; Logan and Mihalynuk, 2005; Schiarizza and Tan, 2005). East-directed thrust faults and associated folds, of Permo-Triassic and/or Early Jurassic age, are documented within the eastern part of the Quesnel Terrane and the structurally underlying rocks of the Slide Mountain and Kootenay terranes (Struik, 1986, 1988b; Rees, 1987; Schiarizza, 1989; Ferri, 1997). Younger structures include west to southwest-verging folds, in part of early Middle Jurassic age, that deform the east-directed thrust faults (Ross *et al*., 1985; Brown *et al*., 1986; Rees, 1987; Schiarizza and Preto, 1987), and prominent systems of Eocene dextral strike-slip and extensional faults (Ewing, 1980; Panteleyev *et al*., 1996; Schiarizza and Israel, 2001).

LITHOLOGICAL UNITS

The distribution of the main lithological units within the Hendrix Lake area is shown on Figure 2. The oldest rocks belong to the Proterozoic-Paleozoic Snowshoe Group of the Kootenay Terrane, which underlies the eastern part of the map area. These rocks are bounded to the west by a narrow belt of mafic schist assigned to the Crooked amphibolite of the Slide Mountain Terrane. East of the Crooked amphibolite, and underlying most of the map area, are Mesozoic rocks of the Quesnel Terrane. These include Middle to Late Triassic sedimentary and volcaniclastic rocks of the Nicola Group, as well as Late Triassic to Early Jurassic plutonic rocks of the Takomkane batholith. Ultramafic and mafic intrusive rocks exposed west and south of Hendrix Lake are also part of the Quesnel magmatic arc, whereas the Deception, Hendrix and Boss Mountain Mine stocks represent younger, mainly Cretaceous granitic suites that crosscut the terrane boundaries. The youngest rocks exposed in the area are small outliers of Quaternary basalt that are exposed on Takomkane Mountain and along Boss and Deception creeks.

Snowshoe Group

The Snowshoe Formation, named for the Snowshoe Plateau south of Barkerville, was defined by Holland (1954) as the uppermost formation of the Cariboo Group. Campbell *et al.* (1973) removed the formation from the Cariboo Group and suggested that it might be equivalent to the Proterozoic Kaza Group, which underlies the Cariboo Group in the Cariboo Mountains. The Snowshoe Formation was traced into the eastern part of the current study area by Campbell (1978), who mapped the formation in a wide, southeast-trending belt extending from the Snowshoe Plateau to Spanish and Deception creeks. The Snowshoe Formation was elevated to group status by Struik (1986, 1988c), who subdivided it into 14 informal units in the Cariboo Lake – Barkerville area and suggested that it ranged from Proterozoic to mid-Paleozoic in age. He assigned the Snowshoe Group to the Barkerville Terrane, which was interpreted as an outboard facies of the North American miogeocline (Struik, 1987, 1988a). Struik (1986) correlated the Snowshoe Group with Proterozoic to Paleozoic successions in the Kootenay Lake and Adams Lake areas, which are included in the Kootenay Terrane. Ferri and Schiarizza (2006) suggested revisions to Struik's (1988c) Snowshoe Group stratigraphy and regional correlations, but concurred with the general interpretation that it is a northern extension of Kootenay Terrane and an outboard facies of the North American miogeocline.

The Snowshoe Group was not studied in detail during the 2006 field season, but was examined in the Bassett Creek area at the northern end of the map area, and in the Deception Creek area to the south. Detailed descriptions of the group in part of the intervening area are provided by Fillipone (1985).

The Snowshoe Group, where examined during the present study, consists mainly of quartzite and pelitic schist, accompanied by minor amounts of marble and calcsilicate gneiss. The dominant rock type is light grey, brownish grey–weathering micaceous quartzite consisting of fine to medium-grained recrystallized quartz accompanied by scattered grains of feldspar and evenly distributed flakes of metamorphic biotite and muscovite. The quartzite commonly occurs as layers, from a few centimetres to several tens of centimetres thick, that are separated by thin partings or centimetre-thick layers of pelitic schist (Fig 3). The layering is parallel to the predominant metamorphic foliation and is accentuated by parallel lenses of vein quartz. The layers of pelitic schist consist of medium to coarse-grained, well-foliated quartz, muscovite, biotite and feldspar, with garnet porphyroblasts. Similar schist locally dominates intervals up to several tens of metres in thickness, where it is interlayered with subordinate amounts of micaceous quartzite (Fig 4). In the Bassett Creek area, pelitic schist becomes the dominant rock type at the eastern limit of our mapping. Fillipone (1985) showed a similar west to east transition from a quartzite-dominated to a schist-dominated succession. He also noted that staurolite appears as a component of the metamorphic assemblage just a few hundred metres east of the contact with the Crooked amphibolite.

Marble is a relatively minor component of the Snowshoe Group, but occurs locally as brown, tan or grey-weathered units, from less than a metre up to several tens of metres thick, intercalated with quartzite and pelitic schist. Layering in the marble is defined by colour variations in shades of light to medium grey, and is accentuated by parallel, centimetre-scale layers of dark grey quartz-biotite schist, and millimetre-scale lenses and stringers of rusty-weathered material containing quartz and muscovite. Well-layered, pale green to grey calcsilicate gneiss is another minor component of the Snowshoe Group, and commonly shows a spatial association with marble units. The mineralogy of the calcsilicate rocks includes quartz, garnet and fine-grained green minerals that may include amphibole, epidote and pyroxene.

The age of the Snowshoe Group within the Hendrix Lake area is unknown, but it is inferred to be Early Carboniferous or older because the succession is cut by foliated granitic rocks a short distance east of the area (Boss Mountain gneiss; Fillipone, 1985), and U-Pb analysis of zircons from these granitic rocks suggests a minimum emplacement age of 338.5 Ma (Mortensen *et al*., 1987). The rocks exposed in the Hendrix Lake area are lithologically similar to successions assigned to units EBQ and EBH of the Eagle Bay assemblage, which crop out directly east of the Slide Mountain Terrane on the south margin of the Raft batholith (Schiarizza and Preto, 1987). These rocks were assigned an early Cambrian or older age based, in part, on the stratigraphic position of unit EBH beneath a succession that included Lower Cambrian *archaeocyathid*-bearing limestone. More recently, Thompson *et al*. (2006) suggested that all or parts of units EBQ and EBH might be Devonian in age, based on correlation with the lithologically similar

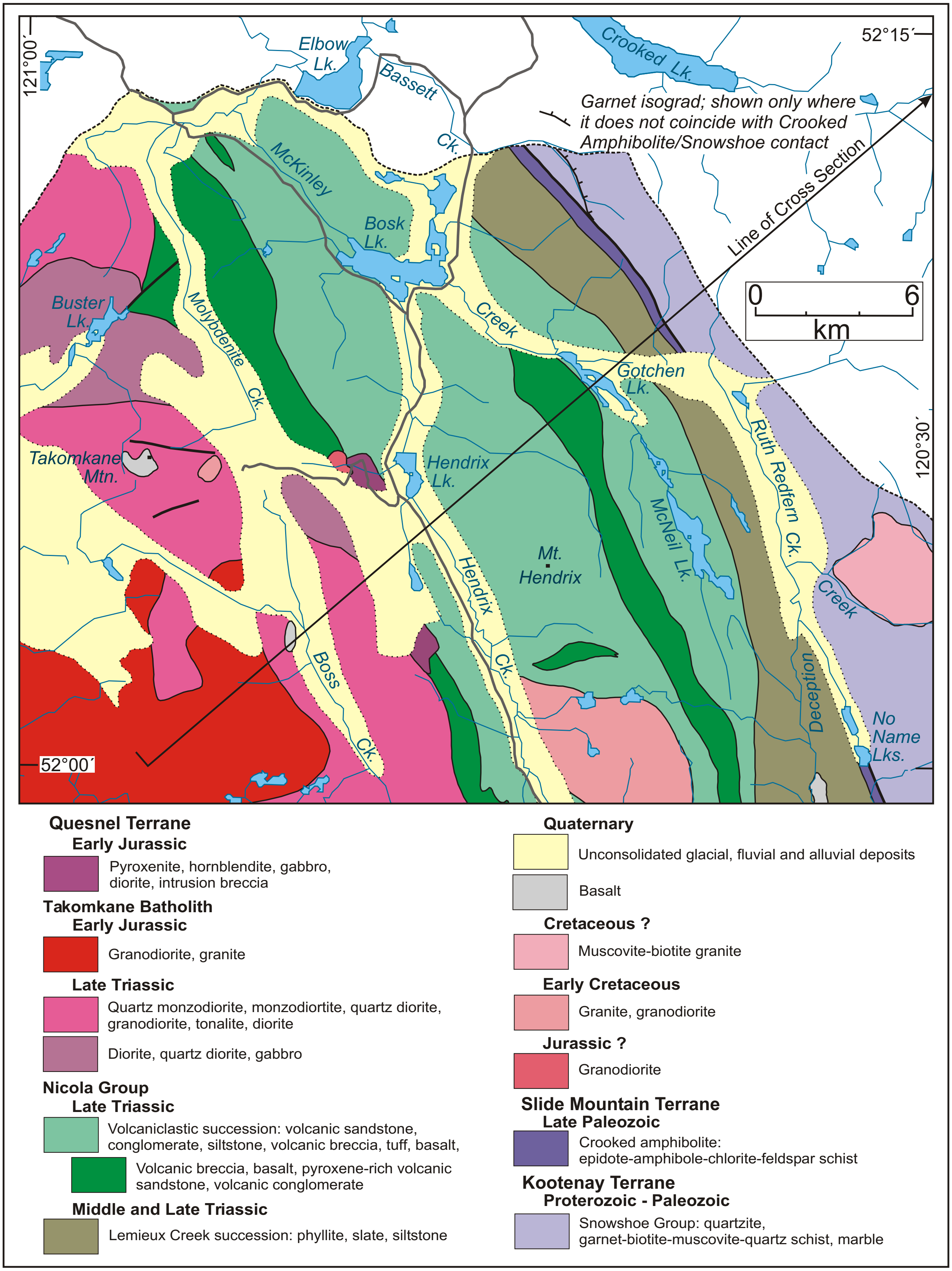


Figure 2. Generalized geology of the Hendrix Lake map area, based mainly on 2006 fieldwork.

Figure 3. Quartzite of the Snowshoe Group, Bassett Creek area.

Figure 4. Garnetiferous schist of the Snowshoe Group, Bassett Creek area.

Silver Creek Formation, which crops out farther to the southeast.

Crooked Amphibolite

The Crooked amphibolite comprises a narrow, discontinuous belt of foliated mafic and ultramafic rocks that defines the contact between the Kootenay and Quesnel terranes over a distance of more than 200 km, from the Hendrix Lake area northwestward to the vicinity of Prince George (Campbell, 1978; Struik, 1985, 1988c). These rocks were assigned to the Antler Formation of the Slide Mountain Group by K.V. Campbell (1971), R.B. Campbell (1978) and Struik (1982). The name 'Crooked amphibolite' was subsequently introduced by Struik, who considered the unit to be either the basal part of the Quesnel Terrane (Struik, 1985) or a part of the Slide Mountain Terrane (Struik, 1988c). The basal contact of the Crooked amphibolite is interpreted to be an east-directed thrust fault (Ross *et al*., 1985; Brown *et al*., 1986; Rees, 1987; Struik, 1988c). The upper contact, with Triassic sedimentary rocks of the Quesnel Terrane, has been interpreted as a sheared unconformity (Campbell, 1971; Rees, 1987; Struik, 1988c).

The Crooked amphibolite is locally well exposed in the northeastern part of the Hendrix Lake map area, and is represented by sparse subcrop in the southeastern corner of the area, south of No Name Lakes. It is not apparently exposed in much of the intervening area, due to an extensive blanket of till and alluvium adjacent to Ruth Redfern Creek. Where exposed, it forms a distinctive, dark green map unit that is easily distinguished from the grey rocks of the Snowshoe Group to the east, and the black rocks of the Lemieux Creek succession to the west. Where upper and lower contacts are well constrained, in the northeast corner of the map area, the Crooked amphibolite forms a layer about 500 m thick that is more or less concordant with the strong metamorphic foliation and transposed layering in bounding rocks of the Snowshoe Group and Lemieux Creek succession.

The Crooked amphibolite within the Hendrix Lake map area consists of medium to dark green, green-brown–weathered, epidote-actinolite-chlorite-feldspar schist. The moderate to strong metamorphic foliation is typically parallel to compositional layering (metamorphic segregation?) defined by dark, chlorite-rich lenses alternating with lighter coloured, relatively plagioclase-rich lenses. This layering is developed on a scale of 2 to 10 mm, and is accentuated by parallel veins and stringers consisting of epidote, quartz and rusty carbonate. Biotite was observed rarely within the schist, and black hornblende occurs locally as randomly oriented needles within, but locally crosscutting, foliation surfaces. Most of the schist is fine to medium grained, but local sections are distinctly coarser grained, due to a large proportion of 2 to 6 mm grains and aggregates of epidote-altered plagioclase.

The composition of the Crooked amphibolite indicates a mafic igneous protolith. Hints of relict texture in the coarser grained sections suggest derivation from gabbroic rocks. The more common, finer grained schist might be a more highly sheared equivalent of the same rock type, or might be derived from a finer grained diabase or basalt protolith. Elsewhere, the Crooked amphibolite includes greenstone and mafic schist thought to be derived from basalt (including some with possible pillow forms), gabbroic rocks and serpentinized ultramafic rocks (Campbell, 1971; Rees, 1987; Struik, 1988c).

The main representatives of the Slide Mountain Terrane in the region are the Antler and Fennell formations, which comprise internally imbricated assemblages of mainly basalt, gabbro and chert that are in thrust contact with underlying rocks of the Kootenay Terrane. The Crooked amphibolite is included in the Slide Mountain Terrane because it shows a similar allochthonous relationship to the Kootenay Terrane and consists mainly of mafic rocks that have geochemical signatures similar to the ocean-floor tholeiite of the Fennell and Antler formations (Campbell, 1971; Rees, 1987). It is not in physical continuity with the Antler Formation, but seems to trace southward into the Fennell Formation (Fig 1). The Crooked amphibolite is not dated, but is inferred to be Late Paleozoic based on its correlation with the Late Devonian to Permian Antler and Fennell formations (Struik and Orchard, 1985; Schiarizza and Preto, 1987).

Nicola Group

The Nicola Group, originally named for exposures on the south side of Nicola Lake (Dawson, 1879), comprises a diverse assemblage of Middle and Late Triassic volcanic, volcaniclastic and sedimentary rocks that crop out over a broad area in south-central British Columbia. The name is applied to Triassic rocks in the Takomkane project area following Campbell and Tipper (1971) and Panteleyev *et al*. (1996), although the Triassic rocks in the Quesnel Lake map sheet have also been referred to as Quesnel River Group (Campbell, 1978) or Takla Group (Rees, 1987). The former term has generally been superseded by Nicola Group, and the latter continues to be applied to Triassic rocks in central and northern British Columbia that correlate with the Nicola Group (*e.g*., Nelson and Bellefontaine, 1996; Schiarizza and Tan, 2005).

The Nicola Group in the Hendrix Lake map area includes two major subdivisions: the Lemieux Creek succession, comprising Middle and Late Triassic sedimentary rocks in the eastern part of the group; and the volcaniclastic succession, an assemblage of volcaniclastic and volcanic rocks that crops out over a broad area to the west. Coarse volcanic breccia forms mappable units at several different stratigraphic levels within the volcaniclastic succession, and is assigned to breccia subunits. These subdivisions of the Nicola Group correlate directly with units mapped in the contiguous Canim Lake map area by Schiarizza and Boulton (2006a, b).

LEMIEUX CREEK SUCCESSION

The Lemieux Creek succession comprises dark grey to black phyllite, slate and siltstone, and forms the easternmost part of the Quesnel Terrane in the region. It has been traced as a continuous belt from the Hendrix Lake area southward to Little Fort, where it pinches out between strands of the Rock Island Lake and Lemieux Creek fault systems (Schiarizza and Israel, 2001; Schiarizza and Boulton, 2006a). Correlative rocks farther to the southeast are assigned to the Slocan Group (Thompson *et al*., 2006). Rocks equivalent to the Lemieux Creek succession have been traced the length of the Quesnel Lake map sheet (unit uTra1 of Campbell, 1978; unit Tra of Bloodgood, 1990), and continue northward to near Prince George (unit Trp of Struik, 1985). Correlative rocks also occur in north-central British Columbia, where they are assigned to the Slate Creek succession of the Takla Group (Ferri and Melville, 1994; Nelson and Bellefontaine, 1996).

The Lemieux Creek succession is generally not well exposed, and is generally represented by small isolated exposures and subcrop. However, fairly continuous exposures are found in a logging cut northeast of Bosk Lake and along an east-flowing tributary to Deception Creek, west of No Name Lakes. Exposures northeast of McNeil Lake were not examined during the 2006 field season, but are included in the Lemieux Creek succession after Campbell (1978).

The Lemieux Creek succession within the Hendrix Lake map area consists mainly of dark grey to black, grey to rusty-weathered phyllite and slate, commonly containing small rusted-out porphyroblasts of siderite and/or pyrite. The strong phyllosilicate foliation is accentuated by parallel stringers of quartz a few millimetres wide. Thicker veins and lenses of quartz and quartz-carbonate are also common; most are parallel to cleavage, but some crosscut it at high angles. Transposed bedding is locally represented by cleavage-parallel laminae of light to medium grey siltstone, and less commonly by units of light grey platy quartzose siltstone up to 5 m thick.

The Lemieux Creek succession is not dated within the Hendrix Lake map area, but near Lemieux Creek, to the south, limestone-bearing intervals within the succession have yielded macrofossils and conodonts of Middle and Late Triassic age (Campbell and Tipper, 1971; Schiarizza *et al*., 2002a; M.J. Orchard, pers comm, 2001). Samples collected from correlative rocks to the north, near Quesnel Lake, have yielded Middle Triassic conodonts (Struik, 1988b, his pelite unit).

VOLCANICLASTIC SUCCESSION

The volcaniclastic succession of the Nicola Group forms a belt, 12 to 14 km wide, that is bounded by the Lemieux Creek succession to the east and the Takomkane batholith to the west. It consists mainly of volcanic sandstone, but also includes conglomerate, siltstone, volcanic breccia, basalt and minor amounts of silty limestone. Although it includes local siltstone intervals that are similar to rocks of the Lemieux Creek succession, the volcaniclastic succession is, for the most part, easily distinguished by the presence of sandstone and coarser rocks containing abundant pyroxene and feldspar. The contact between the volcaniclastic succession and the Lemieux Creek succession is not exposed, and is generally poorly constrained within the Hendrix Lake map area.

The volcaniclastic succession consists mainly of grey to green, fine to coarse-grained, commonly gritty volcanogenic sandstone (Fig 5). Mineral grains of pyroxene, feldspar and less common hornblende, together with lithic fragments containing these same minerals, are the dominant constituents. The sandstone is well bedded in places, but elsewhere forms massive units, up to several tens of metres thick, in which bedding is not apparent. In well-bedded sections, thin to thick sandstone beds commonly alternate with thin beds of green to grey siltstone, and locally display graded bedding, flame structures and rip-up clasts. Locally, thin-bedded to laminated siltstone forms intervals up to several metres thick with no sandstone interbeds. Sandstone and siltstone beds are locally calcareous, and beds of brown-weathered, laminated silty limestone occur rarely in the northwestern part of the map area.

Coarse-grained intervals, including pebble conglomerate, pebbly sandstone and volcanic breccia, are fairly common within the volcaniclastic succession, and dominate much of the interval in the vicinity of Mount Hendrix. Conglomerate and conglomeratic sandstone commonly occur as grey-green, medium to very thick beds intercalated

Figure 5. Volcanic sandstone and gritty sandstone of the Nicola volcaniclastic succession, northeast of Hendrix Lake.

with volcanic sandstone and siltstone. The matrix is typically sandy, and the angular to subrounded clasts are dominated by pyroxene-feldspar-phyric basaltic rocks, locally with minor proportions of siltstone, sandstone, limestone, hornblende-feldspar porphyry and diorite. However, a distinctive pebble conglomerate unit that was traced intermittently for about 6 km south and west of McNeil Lake has a dark grey, rusty-weathered, pyritic siltstone matrix and a heterogeneous clast population that includes abundant limestone, siltstone and sandstone, as well as pyroxene-feldspar porphyry, hornblende-feldspar porphyry and aphyric volcanic rocks. Massive volcanic breccia, as found in the mappable breccia subunits, is also common within the undivided portions of the volcaniclastic succession, where it forms units ranging from a few metres to a few tens of metres thick that are intercalated with volcanic sandstone and conglomerate.

Pyroxene-feldspar-phyric basaltic rocks are scattered throughout the volcaniclastic succession, but are not common. Some clearly form dikes and sills that intrude the clastic rocks, but some may be flows.

The Nicola volcaniclastic succession is not dated within the Hendrix Lake map area, but correlative rocks to the south locally contain Late Triassic macrofossils and conodonts (Campbell and Tipper, 1971; Schiarizza *et al*., 2002a). Similar rocks to the north have yielded both Middle and Late Triassic fossils (Struik, 1988b; Panteleyev *et al*., 1996). The succession is no younger than Late Triassic, because stratigraphic top indicators are consistently to the west and the western part of the succession is cut by the Boss Creek unit of the Takomkane batholith, which has yielded a latest Triassic U-Pb crystallization date.

Breccia Subunits

Mappable units dominated by coarse volcanic breccia containing fragments of mainly pyroxene-phyric basalt are assigned to breccia subunits within the volcaniclastic succession. Two major breccia subunits have been mapped, one in the eastern part of the volcaniclastic succession and one forming the westernmost exposures of the succession, adjacent to the Takomkane batholith. Smaller breccia subunits have been mapped north of the Hendrix stock and southeast of the confluence of Molybdenite and McKinley creeks (Fig 2). These breccia subunits are interpreted as relatively proximal accumulations of coarse volcanic material at several spatially and stratigraphically distinct sites within the volcaniclastic succession.

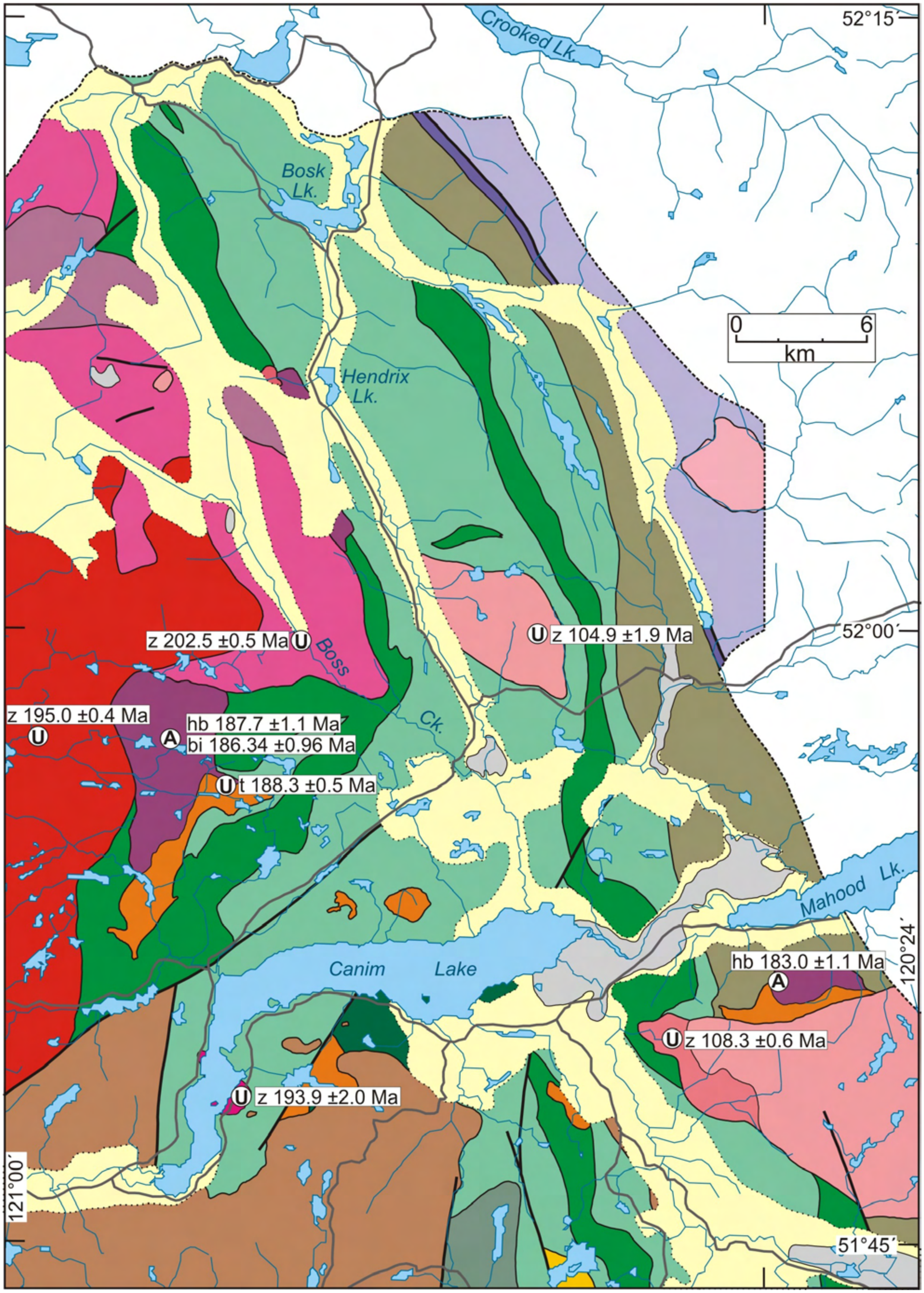
The breccia subunits are dominated by massive, unstratified, medium to dark green or grey-green, greenish brown to rusty brown–weathered volcanic breccia (Fig 6). Fragments are typically angular to subangular, and commonly range from a few centimetres to 10 cm in diameter, although much larger fragments occur locally. In most exposures, the fragments are dominantly or exclusively pyroxene and pyroxene-feldspar-phyric basalt, but show considerable textural variation based on size, abundance and feldspar versus pyroxene proportions in the phenocryst population, as well as degree of vesiculation and presence or absence of amygdules. The matrix is dominated by pyroxene and feldspar grains, and, in many exposures, the compositional similarity between clasts and matrix obscures the fragmental texture. Clasts of aphyric volcanic rock, hornblende-feldspar porphyry, hornblende-pyroxene-feldspar porphyry, diorite, pyroxenite, sandstone and siltstone occur locally. In a small area southwest of Gotchen Lake, a part of the easternmost breccia subunit comprises clasts of ultramafic rock floating in a fine-grained, strongly indurated feldspathic matrix. The fragments range from less than 1 cm to more than 50 cm across, and consist mainly of clinopyroxenite, hornblende clinopyroxenite and hornblendite. The western breccia subunit likewise includes local sections containing fragments derived from an ultramafic-mafic intrusive complex just to the south of the Hendrix Lake map area (Schiarizza and Boulton, 2006a). These fragments were derived from erosion of, or extrusion through, ultramafic-mafic intrusive complexes similar to the Iron lake, Aqua Creek and Hendrix Lake complexes described later in this report. However, the ultramafic-mafic complexes currently exposed in the Takomkane project area are Early Jurassic in age, so are too young to have been the source for the fragments in these Triassic breccia units.

Minor components of the breccia subunits include thin to thick-bedded, pyroxene-rich sandstone, gritty sandstone and conglomerate, as well as massive units of pyroxene-feldspar porphyry probably derived from sills, dikes and flows. Chloritized amygdaloidal basalt with vague pillow structures was observed at one locality within the western breccia subunit, about 6 km south of Hendrix Lake. Hornfelsed and heavily chlorite-epidote-altered rocks of the western breccia subunit northeast of Buster Lake include some breccia, but are dominated by finer grained rocks that include gritty pyroxene-feldspar sandstone and sills of pyroxene-feldspar porphyry.

Intrusive Rocks

Intrusive rocks within the Takomkane project area include several Late Triassic to Early Jurassic suites that are part of the Quesnel magmatic arc, including the polyphase Takomkane batholith, as well as younger plutons of mainly Cretaceous age. Here, we describe the intrusive units found within the Hendrix Lake area, and also present preliminary isotopic dates for plutonic rocks mapped and sampled in the contiguous Canim Lake area during the 2005 field season. Figure 7, which summarizes the geology of the entire Takomkane project area, shows the locations of these dated samples.

Figure 6. Volcanic breccia containing pyroxene-feldspar-phyric basalt fragments, eastern breccia subunit, west of McNeil Lake.



52°15′
Crooked Lk.
Bosk Lk.
Hendrix Lk.
0 6 km
z 202.5 ±0.5 Ma
Boss Ck.
z 104.9 ±1.9 Ma
52°00′
z 195.0 ±0.4 Ma
hb 187.7 ±1.1 Ma
bi 186.34 ±0.96 Ma
t 188.3 ±0.5 Ma
Mahood Lk.
120°24′
Canim Lake
hb 183.0 ±1.1 Ma
z 108.3 ±0.6 Ma
z 193.9 ±2.0 Ma
121°00′
51°45′

TAKOMKANE BATHOLITH

The Takomkane batholith is a large, Late Triassic – Early Jurassic granitic pluton that crops out in the northern Bonaparte Lake (NTS 092P) and southern Quesnel Lake (NTS 093A) map sheets (Fig 1). It cuts the Triassic Nicola Group, is itself cut by the Cretaceous Boss Mountain Mine stock, and is locally overlain by volcanic and sedimentary rocks of Eocene, Neogene and Quaternary age. The northeastern part of the batholith crops out in the western part of the Hendrix Lake map area, where it cuts coarse volcaniclastic rocks assigned to the breccia subunit of the Nicola volcaniclastic succession and is subdivided into three lithological units. The two most extensive units, the Boss Creek and Schoolhouse Lake units, were traced northward from the Canim Lake map area, where they were first described by Schiarizza and Boulton (2006a, b). The third lithological division, comprising mainly dioritic rocks, is informally referred to as the Buster Lake unit. All units typically form massive, resistant outcrops. Textures are generally isotropic, but weak, steeply dipping foliations defined by the alignment of mafic minerals and clots were observed locally in all units. Weak to strong epidote-chlorite alteration is ubiquitous, and is commonly concentrated along northwest and northeast-striking fractures and joints.

Rocks assigned to the Boss Creek unit comprise much of the northeastern part of the Takomkane batholith (Fig 7). This unit consists mainly of light grey, medium to coarse-grained, equigranular rocks of predominantly quartz monzodiorite composition, but quartz and K-feldspar proportions (as estimated in the field) vary considerably, such that monzodiorite, granodiorite, quartz diorite, diorite and tonalite are also present. Mafic minerals commonly form 15 to 25% of the rock, and include varying proportions of clinopyroxene, hornblende and biotite. A porphyritic phase, comprising quartz monzodiorite to granodiorite containing phenocrysts of biotite and plagioclase, occurs locally at the Boss Mountain mine (Soregaroli and Nelson,

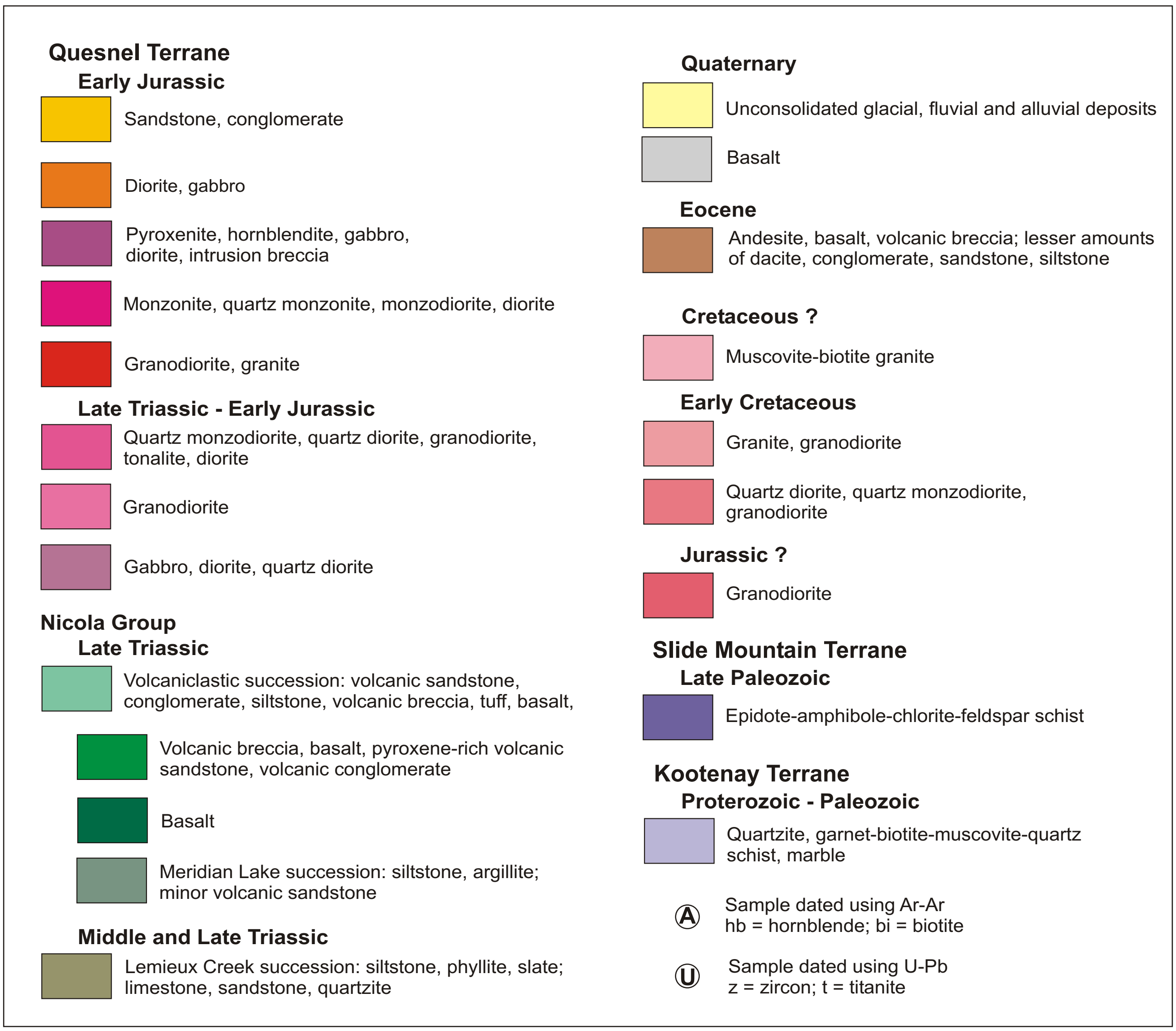


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Figure 7. Simplified geology of the Takomkane project area, showing locations of isotopically dated samples collected during the 2005 field season.

1976). Zircons extracted from a sample of fairly typical quartz monzodiorite, collected from the unit on the west side of Boss Creek in 2005, have yielded a preliminary Late Triassic U-Pb date of 202.5 ±0.5 Ma (Fig 7; R. Friedman, pers comm, 2006). The only other isotopic date reported for this unit is from a sample of quartz monzodiorite collected by R.B. Campbell about 550 m east-southeast of Takomkane Mountain. A biotite separate from this sample yielded a K-Ar date of 187 Ma (Lowdon, 1963). This cooling age was recalculated as 191 ±15 Ma by Breitsprecher and Mortensen (2004) using International Union of Geological Science (IUGS) constants, but the date is considered unreliable because the biotite was altered and there was no correction for atmospheric argon.

The Buster Lake unit of the Takomkane batholith comprises dioritic rocks that crop out northwest and southeast of Buster Lake, as well as on a prominent knob about 4 km west of Hendrix Lake. It is enveloped by the Boss Creek unit to the north and south, and is in direct contact with the Nicola Group to the northwest. The Buster Lake unit consists mainly of medium greenish grey, coarse to medium-grained diorite, locally grading to quartz diorite. Mafic minerals typically form 25 to 50% of the rock, and consist mainly of clinopyroxene with minor amounts of biotite. Hornblende is prominent in some areas, but absent in others. Light grey leucocratic diorite to quartz diorite occurs locally as late-stage veins and/or matrix to intrusion breccia containing fragments of diorite. Rocks that are lithologically similar to the Buster Lake unit occur locally within the Late Triassic Boss Creek unit, and it is suspected that the two units are closely related. Alternatively, the Buster Lake unit might be more closely related to the Early Jurassic ultramafic-mafic complexes within the area.

The Schoolhouse Lake unit is a prominent component of the Takomkane batholith from its southern margin, west of Canim Lake, northward to Boss Creek. It forms the eastern margin of the batholith in the south, but farther north is enveloped by the Boss Creek unit to the east and north. Reconnaissance mapping suggests that it forms a major component of the southern part of the batholith for a considerable distance west of the Takomkane project area. The Schoolhouse Lake unit consists mainly of light grey to pinkish grey, coarse to medium-grained hornblende-biotite granodiorite to monzogranite. The texture is typically porphyritic, with pink orthoclase phenocrysts up to several centimetres in size. However, the rock is not porphyritic in some exposures, and grey plagioclase phenocrysts accompany the orthoclase in others. Mafic minerals typically form 10 to 20% of the rock, with hornblende predominating over biotite. The contact between the Schoolhouse Lake and Boss Creek units was not observed; however, at one locality where it is well constrained, both the phenocrysts and groundmass of the Schoolhouse Lake unit become finer grained as the contact is approached. This apparent chilled margin is consistent with preliminary isotopic dating, as a sample collected from the Schoolhouse Lake unit in 2005 yielded a U-Pb zircon date of 195.0 ±0.4 Ma (Fig 7; R. Friedman, pers comm, 2006). This Early Jurassic date is similar to the U-Pb zircon date of 193.5 ±0.6 Ma obtained by Whiteaker *et al*. (1998) from a sample collected at Ruth Lake, just 2 km west of the southern part of the Takomkane project area. The Ruth Lake sample is from granodiorite that was correlated with the Schoolhouse Lake unit by Schiarizza and Boulton (2006a).

SOUTH CANIM STOCK

The South Canim stock cuts volcanic sandstone and related rocks of the Nicola volcaniclastic succession along the southern part of Canim Lake. It consists mainly of light greenish grey to pinkish grey, medium to coarse-grained, hornblende-biotite monzonite, locally grading to quartz monzonite, monzodiorite and diorite. The stock was mapped as Cretaceous by Campbell and Tipper (1971), but Schiarizza and Boulton (2006a, b) suggested that it is more likely part of the Quesnel Terrane magmatic suite, and Late Triassic or Early Jurassic in age. A sample of quartz monzonite was collected from the stock during the 2005 field season and submitted for U-Pb dating of zircons. The zircons extracted from this sample yielded an Early Jurassic U-Pb laser-ablation date of 193.9 ±2.0 Ma (Fig 7; R. Friedman, pers comm, 2006).

ULTRAMAFIC-MAFIC PLUTONIC COMPLEXES

Iron Lake Ultramafic-Mafic Complex

The Iron Lake complex comprises ultramafic and mafic plutonic rocks that crop out north of the west end of Canim Lake (Schiarizza and Boulton, 2006a, b). It intrudes the Nicola volcaniclastic succession, mainly the breccia subunit, along its east, south and southwest margins, but is juxtaposed against the Schoolhouse Lake and Boss Creek units of the Takomkane batholith across poorly exposed contacts to the northwest and north. At the scale of Figure 7, the Iron Lake complex is subdivided into an ultramafic unit and a mafic unit. The ultramafic unit consists mainly of clinopyroxenite and hornblende clinopyroxenite, but also includes olivine clinopyroxenite, wehrlite, hornblendite, gabbro, diorite and intrusion breccia (Schiarizza and Boulton, 2006a). The mafic unit consists mainly of medium to coarse-grained hornblende-pyroxene gabbro to monzogabbro, and medium to fine-grained hornblende diorite and microdiorite.

Melanocratic gabbro from the ultramafic unit of the Iron Lake complex yielded Ar/Ar plateau ages of 187.7 ±1.1 Ma and 186.34 ±0.96 Ma on hornblende and biotite separates, respectively (T. Ullrich, pers comm, 2006). Titanite from a diorite sample collected from the mafic unit of the complex has yielded a preliminary U-Pb concordia age of 188.3 ±0.5 Ma (R. Friedman, pers comm, 2006). These Early Jurassic dates are significantly younger than the dates obtained from the Boss Creek and Schoolhouse Lake units, indicating that the Iron Lake complex is younger than the Takomkane batholith, and has presumably intruded the batholith as well as the Nicola Group.

Aqua Creek Ultramafic-Mafic Complex

The Aqua Creek complex comprises ultramafic and mafic plutonic rocks that crop out on the north side of the Raft batholith, south of the west end of Mahood Lake (Fig 7). These rocks intrude the Lemieux Creek succession of the Nicola Group, and are themselves cut by Early Cretaceous granodiorite of the Raft batholith. The Aqua Creek complex is lithologically very similar to the Iron Lake complex, and has likewise been subdivided into an ultramafic and a mafic unit. The ultramafic unit consists mainly of clinopyroxenite, hornblende clinopyroxenite, hornblendite, mafic gabbro and pegmatitic gabbro, whereas the mafic unit consists mainly of medium to coarse-grained hornblende-pyroxene gabbro and medium-grained hornblende diorite.

Hornblende separated from a sample of pegmatitic gabbro collected from the ultramafic unit of the Aqua Creek complex in 2005 yielded an Early Jurassic Ar/Ar plateau age of 183.0 ±1.1 Ma (T. Ullrich, pers comm, 2006). Uranium-lead laser-ablation dating of zircons extracted from diorite of the mafic unit is currently in progress.

Hendrix Lake Ultramafic-Mafic Complex

The Hendrix Lake complex is a newly recognized ultramafic-mafic pluton that is represented mainly by sparse exposures along and near the Boss Mountain Mine road, a short distance west of Hendrix Lake. These exposures include pyroxenite, melanocratic gabbro and diorite, as well as intrusion breccia comprising fragments of pyroxenite, hornblendite and mafic gabbro within a diorite matrix (Fig 8). The south end of this intrusive complex may be represented by subcrop of similar diorite and intrusion breccia located in a logging cut 6 km south of Hendrix Lake. The intrusive rocks are not apparently exposed in the intervening area, but the two areas of exposure are linked by a prominent aeromagnetic high that suggests they represent the north and south ends, respectively, of a single, narrow ultramafic-mafic intrusion about 8 km long. This intrusion is suspected to be Early Jurassic in age, based on correlation with other ultramafic-mafic complexes in the area.

GRANODIORITE STOCK WEST OF HENDRIX LAKE

Light grey, medium-grained, equigranular hornblende-biotite granodiorite that crops out along and near the Boss Mountain Mine road forms a small stock that apparently cuts the Hendrix Lake ultramafic-mafic complex to the east and southeast, and the Nicola breccia subunit to the north. This stock was assigned a Jura-Cretaceous age by Campbell (1978), as were the Hendrix and Boss Mountain Mine stocks. However, the stock west of Hendrix Lake differs from the other two stocks, which are now known to be of Early Cretaceous age, in that hornblende is the dominant mafic phase. It is suspected that this stock is older than the Cretaceous stocks, perhaps correlative with the Middle Jurassic Ste Marie pluton, a hornblende granite that cuts Quesnel Terrane rocks southeast of Prince George (Struik *et al*., 1992).

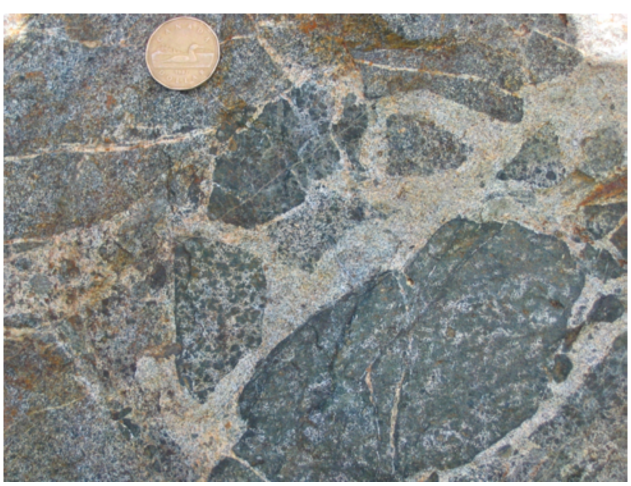

Figure 8. Intrusion breccia, Hendrix Lake ultramafic-mafic complex, west of Hendrix Lake.

CRETACEOUS PLUTONS

Raft Batholith

The Raft batholith is an elongate granitic pluton that extends for about 70 km in a west-northwesterly direction and cuts across the boundaries between the Kootenay, Slide Mountain and Quesnel terranes (Fig 1). A significant portion of the western part of the batholith was mapped by Schiarizza *et al*. (2002a) and Schiarizza and Boulton (2006a). They found that it consists mainly of light grey, medium to coarse-grained biotite-hornblende granodiorite to monzogranite. However, a lithologically distinct unit at the west end of the batholith consists mainly of medium to fine-grained, equigranular hornblende-biotite quartz monzodiorite, locally grading to quartz diorite, diorite or granodiorite. A sample collected from the predominant granodiorite to monzogranite unit in 2001, about 10 km east of the Takomkane project area, yielded a concordia U-Pb zircon date of 105.5 ±0.5 Ma (Schiarizza *et al*., 2002b). A sample collected from the quartz monzodiorite unit at the west end of the batholith in 2005 yielded a slightly older U-Pb zircon date of 108.3 ±0.6 Ma (Fig 7; R. Friedman, pers comm, 2006).

Hendrix Stock

The Hendrix stock is a granitic pluton that crops out east of Hendrix Creek and straddles the boundary between the Canim Lake and Hendrix Lake map areas. The stock has an elliptical shape in plan view, with a northwest-trending major axis about 9 km long. It intrudes the Nicola volcaniclastic succession to the south, east and north, but its western margin is obscured by Quaternary drift along Hendrix Creek. Hornfelsed country rocks along the north margin of the stock are locally mineralized at the Hen and Dyke showings.

The Hendrix stock consists mainly of light-grey, medium to coarse-grained, equigranular biotite-hornblende monzogranite to granodiorite, locally grading to tonalite along its margins. The stock was assigned a Cretaceous age by Campbell and Tipper (1971) and Schiarizza and Boulton (2006a, b). This interpretation has been confirmed by radiometric dating of zircons extracted from a sample collected from the western part of the stock in 2005. These zircons yielded a late Early Cretaceous U-Pb laser-ablation date of 104.9 ±1.9 Ma (Fig 7; R. Friedman, pers comm, 2006).

Boss Mountain Mine Stock

The Boss Mountain Mine stock is an elliptical body of granite, about 1000 m long by 600 m wide, that intrudes older plutonic rocks of the Takomkane batholith 2 km east of Takomkane Mountain. The stock is spatially and genetically associated with molybdenum mineralization at the Boss Mountain mine, which lies within Takomkane rocks near the southwestern margin of the stock (Soregaroli, 1968; Soregaroli and Nelson, 1976). The stock is not well exposed at surface, but is represented locally by subcrop of brown-weathered, sericite-pyrite-chlorite-altered granitic rock northeast of the mine pits. The outline of the stock shown on Figure 2 is after Soregaroli (1968), and is in part projected from underground information.

The Boss Mountain Mine stock is pervasively altered, but descriptions and modal analyses presented by Soregaroli (1968) show that it consists mainly of porphyritic monzogranite, comprising phenocrysts of quartz, plagioclase and orthoclase within a medium to coarse-grained groundmass of quartz and orthoclase. Biotite and minor amounts of hornblende, zircon and apatite also occur as primary minerals. Secondary minerals include sericite, carbonate, pyrite, chlorite, rutile, epidote and zeolite. Where observed in underground workings, the contacts of the stock are sharp and are defined by a chilled margin about 2 m wide. A graphic intergrowth of quartz and orthoclase forms a narrow outer zone of the chilled margin and grades rapidly into an inner chill zone comprising quartz and plagioclase phenocrysts within a fine-grained groundmass of aplitic to granophyric quartz and orthoclase (Soregaroli, 1968; Soregaroli and Nelson, 1976).

The Boss Mountain Mine stock is not directly dated. However, three separate samples of hydrothermal biotite from the Boss Mountain mine yielded K-Ar dates of 98 ±4, 104 ±4 and 105 ±4 Ma, respectively (White *et al*., 1968). Soregaroli and Nelson (1976) interpreted these dates as providing a general indication of the age of the stock, because the hydrothermal biotite is related to molybdenum mineralization, which was shown to be genetically related to the Boss Mountain Mine stock.

Deception Stock

The Deception stock is a small, two-mica granite pluton that cuts metasedimentary rocks of the Snowshoe Group north of Deception Creek, along the eastern boundary of the map area. The granite was first recognized by Helson (1982), who also noted its spatial association with tungsten soil anomalies. The Fox molybdenum-tungsten mineral showing was discovered along the south margin of the stock in 1999 (Ridley, 2000a), and the boundaries of the stock, which measures 4 to 5 km in diameter, were established during subsequent exploration in the area (Blann and Ridley, 2005b).

The Deception stock consists mainly of light grey, medium-grained, equigranular, biotite-muscovite granite that commonly contains small red garnets as an accessory phase. Dikes of leucocratic pegmatite and aplite occur locally within the granite and the adjacent country rock. Skarn alteration occurs along the southern margin of the stock, where it is associated with molybdenum-tungsten mineralization at the Fox occurrence, and also along the northeastern margin of the stock (Blann and Ridley, 2005b). The age of the stock is unknown, but a sample collected during the 2006 field season has been submitted for U-Pb dating of zircons. It is suspected that it is of mid-Cretaceous age, as two-mica granite bodies of this age occur elsewhere in the region, and commonly have associated molybdenum-tungsten mineralization (Logan, 2002).

Quaternary Volcanic Rocks

Quaternary alkali olivine basalt flows and related pyroclastic rocks are a prominent feature of Wells Gray Provincial Park to the east of the Hendrix Lake map area (Fig 1; Hickson and Souther, 1984). Similar basalt occurs as isolated occurrences to the west of the main volcanic field, within the northeastern part of the Bonaparte Lake map sheet and parts of the Quesnel Lake map sheet. These include, within the Hendrix Lake map area, a volcanic centre on Takomkane Mountain and remnants of flows located east of Boss Creek and along Deception Creek (Fig 2).

The volcanic rocks on Takomkane Mountain cover an area of about 1.5 km^2. The eastern part, including the twin peaks of the mountain (Fig 9), consists mainly of an eroded cinder cone, whereas the western part comprises a basalt flow that is about 5 m thick at its western extremity (Sutherland Brown, 1958; Soregaroli, 1968). Basalt also occurs locally along the northeast corner of the cinder cone, where it forms a steep wall, about 10 m high, at the edge of a small cirque. Sutherland Brown (1958) suggested that this reflects ponding of lava against a glacier that occupied the cirque at the time of eruption. For the most part, however, the Takomkane cone and lava flow lie above granitic rocks of the Takomkane batholith across a gently dipping contact. Sutherland Brown (1958) noted that the surface on which the volcano was built had already been glaciated, but the cone was partially eroded by subsequent glacial action, and both the cone and lava flow are locally overlain by granitic boulders inferred to be glacial erratics. He concluded that the Takomkane volcano erupted late in the Pleistocene epoch.

Basalt from the northeastern corner of the Takomkane volcano was studied by Fiesinger and Nicholls (1977). It comprises olivine microphenocrysts in a groundmass of augite, nepheline and magnetite, and is classified as a nephelinite. The basalt at this locality is host to a large number of mantle-derived peridotite xenoliths, and fewer granitic xenoliths derived from crustal rocks. The peridotite xenoliths, mainly spinel lherzolite, are commonly 2 to 15 cm across and rarely approach 50 cm in size (Fig 10; Soregaroli, 1968). They have received some attention as a potential source of peridot, the gem variety of olivine (Galloway, 1918; Reinecke, 1920), and a number of samples were submitted to Tiffany and Co., New York, for evaluation in 1915 or 1916. The ensuing report noted that, although the specimens were of a remarkably good colour, they were more or less flawed and therefore of little value as gem material (Galloway, 1918).

The remnants of a basalt flow on the west side of Boss Creek are represented by two small exposures along the

Figure 9. View westward to the eroded Quaternary cinder cone on Takomkane Mountain. Prominent ridge to the south is underlain by the Boss Creek unit of the Takomkane batholith. Workings of the past-producing Boss Mountain mine are partially obscured in the bowl beneath the ridge.

Figure 10. Lherzolite xenoliths within Quaternary basalt, east flank of Takomkane Mountain.

Boss Creek logging road, 8 km southeast of Takomkane Mountain. The grey basalt exposed here is weakly vesicular and contains abundant xenoliths, up to 6 cm in size, of peridotite, as well as sparse xenoliths of diorite and quartz diorite. Quaternary basalt, largely or entirely covered by alluvium, is also suspected to occur along part of Deception Creek, based on sparse exposures just south of the map area (Schiarizza and Boulton, 2006b). Campbell (1978) also mapped young basalt flows along Hendrix Creek. These flows were not located during the present study, but they may be present and largely covered by recent fluvial or alluvial deposits.

Soregaroli (1968) noted that basalt dikes, related to the Takomkane volcano, are common in the underground workings of the Boss Mountain molybdenum mine, where they occupy vertical fractures that strike north-northeast and east-southeast. Relatively fresh olivine basalt dikes were observed rarely elsewhere in the map area, and may be of similar age. A light grey, finely crystalline intrusive (?) rock observed in a single exposure about 1.3 km north of the Hendrix stock may also be related. It consists mainly of randomly oriented plagioclase laths, but also contains 1 to 5 mm grains and xenocrysts of olivine and lherzolite, and rare 1 to 2 cm xenoliths of gabbro, diorite and pyroxenite.

STRUCTURE AND METAMORPHISM

There is a major change in metamorphic grade and structural style from east to west across the Hendrix Lake map area. Penetratively deformed rocks of the Snowshoe Group are characterized by garnet-bearing assemblages in pelitic schist throughout most of the map area, and staurolite-bearing rocks occur locally in some eastern exposures (Fillipone, 1985). However, somewhat lower grade metamorphism was attained in a narrow wedge of westernmost Snowshoe rocks at the north end of the map area, where pelitic rocks are biotite-muscovite-quartz schist without garnet. The Crooked amphibolite displays penetrative fabrics comparable to those of the Snowshoe Group, but the metamorphic assemblage (typically chlorite-epidote-amphibole-plagioclase±biotite) cannot be directly compared to the Snowshoe Group because of their contrasting compositions. The Lemieux Creek succession also displays a strong penetrative fabric, comparable to the Snowshoe Group and Crooked amphibolite, but the metamorphic assemblage is characterized by chlorite-muscovite without biotite, so is distinctly lower grade than nearby rocks of comparable composition within the Snowshoe Group. There is a distinctive change in structural style farther west, where rocks of the Nicola volcaniclastic succession do not generally display penetrative fabrics. However, slaty cleavage is developed locally, typically within finer grained sections of the volcaniclastic succession, so this change may be primarily a function of lithology. Metamorphic chlorite, actinolite and clinozoisite occur locally within the volcaniclastic succession, suggesting that there is not a significant metamorphic break between it and the Lemieux Creek succession.

Mesoscopic Structure

All rocks of the Snowshoe Group display a penetrative foliation, varying from a strong schistosity in pelitic schist to well-oriented, but dispersed, mica flakes in quartzite. This metamorphic foliation is parallel to compositional layering, defined typically as alternating quartzite and schist layers. Quartz veins and lenses are common, and are typically oriented parallel to the metamorphic foliation, although some veins crosscut the foliation. Thin quartzite layers and quartz veins within pelitic schist are locally boudinaged, and some quartz veins are isoclinally folded. Boudin necks and fold hinges typically plunge gently to the south. Only at one locality, in the northeastern part of the area, was the metamorphic foliation observed to be axial planar to a fold of lithological layering. There, an isoclinal fold pair outlined by compositional layering within micaceous quartzite plunges gently to the west-northwest and shows southward vergence. A vague mineral lineation, defined by quartz lenses and biotite aggregates, also plunges to the northwest in this area, but plunges to the southeast in the southern part of the belt. A more or less coaxial crenulation lineation likewise plunges to the northwest in the northern part of the area and to the southeast in the southern part. In the north, this crenulation lineation is locally associated with a weak crenulation cleavage that dips to the southwest at a steeper angle than the primary metamorphic foliation. A second, younger crenulation lineation was observed rarely, and plunges to the west or southwest.

The Crooked amphibolite is well exposed only in the northern part of the map area, where it displays a strong, southwest-dipping, penetrative metamorphic foliation that is parallel to the foliation within adjacent rocks of the Snowshoe Group. The foliation is defined mainly by platy chlorite grains and flattened grains and aggregates of feldspar and epidote. The metamorphic foliation is commonly accentuated by compositional layering, developed on a scale of a few millimetres to 1 cm, comprising dark chlorite-rich lenses interleaved with lenses of lighter coloured, relatively chlorite-poor material. It is also accentuated by parallel veins, stringers and lenses consisting of various combinations of epidote, quartz and rusty carbonate. At one locality, however, stringers and veins of quartz-epidote are folded into a northeast-verging, isoclinal, anticline-syncline pair, while chlorite defines an axial-planar foliation that cuts across the fold hinges. The main metamorphic foliation within the Crooked amphibolite is locally deformed by two sets of crenulations and associated folds, plunging northwest and west-southwest, as seen also in the adjacent Snowshoe Group.

The Lemieux Creek succession is characterized by slate and phyllite that display a well-developed cleavage. In the eastern part of the succession, this cleavage dips at moderate to steep angles to the west-southwest, and is parallel to the metamorphic foliation in the adjacent Crooked amphibolite. Farther west, the cleavage dips variably to the east-northeast or south-southwest, due in part to medium-scale folds that plunge gently to the southeast. The cleavage is parallel to compositional layering that is locally defined by quartzose siltstone units, and it is almost everywhere accentuated by parallel stringers of quartz a few millimetres wide. Locally, these quartz stringers are deformed into southeast-plunging folds that generally verge to the southwest. In the hinge zones of these folds, the predominant cleavage has the form of a crenulation cleavage that cuts an earlier phyllosilicate foliation that is parallel to the folded quartz stringers. It appears, therefore, that the predominant cleavage is actually a composite of two synmetamorphic foliation surfaces. This cleavage is locally deformed by a set of younger crenulations and open folds that plunges northwest or southeast, and rarely by a separate set of crenulations that plunges southwest. These younger structures are readily correlated with the two sets of crenulations observed in the Crooked amphibolite and Snowshoe Group.

Penetrative fabrics comparable to those in rock units to the east are generally not apparent within the Nicola volcaniclastic succession. A weak to moderately developed slaty or fracture cleavage, usually dipping steeply to the southwest or northeast, is developed locally, but outcrop-scale structures are more commonly represented by brittle faults and fractures. Bedding orientations are quite variable, but moderate to steep dips to the northeast or southwest are most common. Facing directions, where they could be established, are invariably to the southwest. Folds of bedding were observed at a few widely scattered localities and have highly variable orientations. There is no axial-planar foliation associated with any of the bedding folds observed within the volcaniclastic succession.

Map-Scale Structure

The main stratigraphic divisions within the Hendrix Lake map area are arranged as a succession of parallel, north-northwest-striking belts that are traced the full length of the area with no significant repetitions (Fig 2). Metamorphic foliations and transposed bedding in the Snowshoe Group, Crooked amphibolite and eastern part of the Lemieux Creek succession dip moderately to steeply toward the west-southwest. Foliation and bedding orientations within the western part of the Lemieux Creek succession and the adjacent volcaniclastic succession are more variable, but generally dip steeply to the west-southwest or east-northeast. The most significant departure from these orientations is in the area north of the Hendrix stock, where bedding strikes east, parallel to the northern margin of the stock. Stratigraphic facing directions within the volcaniclastic succession are toward the west throughout most of the area, and are to the south in the east-striking zone north of the Hendrix stock.

As summarized above, the structural-stratigraphic succession within the map area is essentially a west-southwest facing homocline. As shown in Figure 11, this homocline comprises part of the west limb of the Boss Mountain anticline, a significant map-scale structure that folds the Kootenay, Slide Mountain and Quesnel terranes and their mutual boundaries (Fig 1). This anticline, and the adjacent Eureka Peak syncline, fold metamorphic isograds but are generally interpreted as late-stage folds within a significant metamorphic-structural event that clearly affected all rocks of the Snowshoe Group, Crooked amphibolite and Nicola Group (Campbell, 1971; Ross *et al*., 1985; Fillipone and Ross, 1990). Peak metamorphic conditions were likely attained in the early Middle Jurassic, based on a 174 ±4 Ma U-Pb date on metamorphic sphene from near Quesnel Lake (Mortensen *et al*., 1987).

BASAL CONTACT OF THE CROOKED AMPHIBOLITE: THE EUREKA THRUST

The eastern contact of the Crooked amphibolite is well constrained over a length of several kilometres in the northeastern corner of the Hendrix Lake map area. The contact was not observed, but is locally defined by adjacent exposures of Snowshoe Group and Crooked amphibolite only a few metres apart. The rocks near the contact are strongly foliated and somewhat finer grained than is typical for these units, but mylonitic fabrics were not observed. Nevertheless, the contact is interpreted as an early east-directed thrust fault, following the more detailed studies of other workers in the region (*e.g*., Ross *et al*., 1985; Struik, 1986, 1988c; Rees, 1987). This fault is referred to as the Eureka thrust by Struik (1986, 1988c), and is equivalent to the Quesnel Lake shear zone of Rees (1987). It probably correlates with the basal thrust fault bounding an isolated klippe of ultramafic and mafic rocks, the Black Riders complex, that occurs structurally above the Snowshoe Group 10 km east of No Name Lakes (Montgomery, 1978).

The kinematic history of the Eureka thrust is best constrained by fabrics preserved in footwall orthogneiss and quartzofeldspathic metasedimentary rocks (Snowshoe Group) north of Quesnel Lake. There, Rees (1987) documented rotated feldspar megacrysts, S-C mylonitic fabrics and shear-band foliations that indicate a top-to-the-east

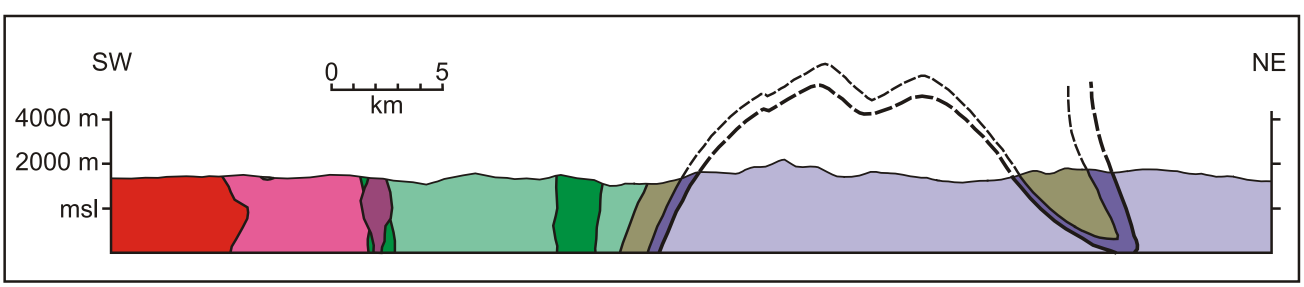

Figure 11. Schematic vertical cross-section along the line shown in Figure 2. The northeastern half of the section, beyond the limits of the Hendrix Lake map area, is from section C-D of Fillipone and Ross (1990).

sense of shear. He concluded that the shear fabrics formed under greenschist-facies conditions, and were in part overprinted by higher grade metamorphic assemblages associated with subsequent regional folding.

The Eureka thrust postdates the Crooked amphibolite and predates the regional folding event, of suspected early Middle Jurassic age (Mortensen *et al*., 1987; Murphy *et al*., 1995), that deforms the thrust contact. Rees (1987) suggested that the thrusting occurred in the Early Jurassic and that the Eureka thrust fault carried both the Crooked amphibolite and overlying Middle Triassic – Lower Jurassic rocks of the Quesnel Terrane eastward over the Kootenay Terrane. A different scenario is suggested by a study of a conglomerate unit that occurs within the basal part of the Quesnel Terrane a short distance above the Eureka thrust near Wingdam, east of Quesnel (McMullin, 1990 *et al*.). The conglomerate is mapped as Triassic by Struik (1988c) but is not dated. It contains clasts derived from the Kootenay Terrane and the Slide Mountain Terrane (Crooked amphibolite) that were deformed and foliated prior to their deposition as part of the conglomerate. This suggests that the Eureka thrust might be, at least in part, a Late Permian or Early Triassic structure that emplaced the Slide Mountain Terrane above the Kootenay Terrane, and that the Triassic rocks of the Quesnel Terrane depositionally overlapped these two older terranes after a period of erosion (McMullin *et al*., 1990). Campbell (1971) also documented structural fabrics within the Crooked amphibolite that apparently predate deposition of Triassic rocks of the Quesnel Terrane, and Schiarizza (1989) suggested that east-directed thrusting and structural imbrication of the Fennell Formation, representing the Slide Mountain Terrane directly to the south, occurred in Permo-Triassic time. Our 2006 fieldwork provides no additional constraints on the age of the Eureka thrust, but we suspect, from relationships summarized above, that it formed in Permo-Triassic time, although it may have been reactivated during subsequent structural events.

BASAL CONTACT OF THE LEMIEUX CREEK SUCCESSION

The contact between the Crooked amphibolite and the Lemieux Creek succession is not exposed within the Hendrix Lake map area, but is fairly well constrained northeast of Bosk Lake, where it is more or less parallel to the strong, concordant, southwest-dipping foliations in the two map units. Campbell (1971) studied this contact in some detail and inferred that the Lemieux Creek succession had been deposited above the Crooked amphibolite across an unconformity, but that the contact had been variably sheared and transposed by subsequent Jurassic deformation. Rees (1987) and Struik (1988c) also interpreted this contact as a sheared unconformity, and this interpretation is accepted here, although Bloodgood (1990) and Panteleyev *et al*. (1996) mapped the contact as an east-directed thrust fault. Rees (1987) inferred that the Lemieux Creek succession and overlying volcaniclastic rocks were carried eastward with the Crooked amphibolite along an Early Jurassic Eureka thrust. As discussed in the previous section, McMullin *et al*. (1990) presented an alternative interpretation, suggesting that the Lemieux Creek succession was deposited above the Crooked amphibolite after it had already been emplaced above the Snowshoe Group on a Permo-Triassic Eureka thrust.

BASAL CONTACT OF THE VOLCANICLASTIC SUCCESSION

The contact between the Lemieux Creek and volcaniclastic successions of the Nicola Group is not exposed, nor even particularly well constrained, within the Hendrix Lake map area. The contact has been traced southward almost 70 km to Little Fort, although it is locally interrupted by the Raft batholith (Schiarizza *et al*., 2002b, c; Schiarizza and Boulton, 2006b). Over this distance, it is partly defined by steeply dipping Eocene faults, but elsewhere it is not apparently faulted, although nowhere is it actually exposed. Relationships across the contact are not definitive, but permit the interpretation that it is an abruptly gradational contact across which the volcaniclastic succession stratigraphically overlies the Lemieux Creek succession (Schiarizza *et al*., 2002a; Schiarizza and Boulton, 2006a). Rees (1987) likewise inferred a gradational stratigraphic contact between the two units north of Quesnel Lake, but suggested that, on a broader scale, the western volcanic facies probably interfingers with the eastern pelitic facies (his Fig 2.10). Struik (1988b) subsequently demonstrated, with conodont ages, that the two units are, in part, the same age, and also that the basal rocks of the volcanic unit on the north side of Quesnel Lake are older than some of the underlying rocks of the pelitic unit. He postulated that the two units represent a western volcanic facies and age-equivalent eastern pelitic facies that are currently juxtaposed across an east-directed Jurassic thrust fault of regional extent. The work of Bloodgood (1990) supports this interpretation, as she mapped the contact as a layer-parallel fault from Quesnel Lake southward to the area west of Crooked Lake. The poorly exposed contact provides no opportunity for confirming or rejecting this interpretation within the Hendrix Lake map area.

LATE FAULTS AND LINEAMENTS

Schiarizza and Israel (2001) mapped a system of Eocene dextral strike-slip faults from Little Fort northwestward to Canimred Creek. It is suspected that at least one major component of this system, the Rock Island Lake fault, extends across Canim Lake and into the Hendrix Lake map area, following a pronounced topographic lineament defined by lower Boss Creek and Hendrix Creek (Schiarizza and Boulton, 2006a). Faulting is not proven along this lineament in the Hendrix Lake map area, however, because bedrock is obscured by extensive drift cover. A parallel north-northwest-trending lineament is defined by upper Boss Creek and Molybdenite Creek. Soregaroli (1968) inferred that this drift-covered lineament was structurally controlled, and referred to it as the Molybdenite Creek fault. Although displacement is not proven along this zone, the distribution of map units defined by our 2006 fieldwork is consistent with dextral offset of the Buster Lake unit of the Takomkane batholith across the lineament.

Soregaroli (1968) mapped several northeast to east-northeast-striking faults in the area south of Takomkane Mountain, some showing apparent sinistral offsets of older structures and map units. He also mapped less conspicuous north-northeast-striking faults that postdated the east-northeast structures. A fault parallel to these latter structures is inferred to occupy the valley of Buster Lake, and coincides with an apparent dextral offset of the Takomkane-Nicola contact (Fig 2).

The Ten Mile Creek fault is a conspicuous structure that strikes east-southeast across the area north of the

Takomkane volcano and the Boss Mountain Mine stock (Soregaroli, 1968). A prominent system of faults with similar orientation occurs on the north margin of the Hendrix stock, and may follow a system of east-southeast-trending lineaments to Deception Creek (Ridley, 1997a), although there is no apparent displacement of lithological contacts within the Nicola Group in this area (Fig 2). Ridley (1997a) suggested that the fault system north of the Hendrix stock is equivalent to the Ten Mile Creek fault, and that the two segments have been offset by a dextral fault in the Hendrix Creek valley. This correlation is speculative but consistent with the interpretation that the Hendrix Creek linear is part of an Eocene fault system with dextral displacement (Schiarizza and Boulton, 2006a).

MINERAL OCCURRENCES

The known mineral occurrences within the Hendrix Lake map area are shown on Figure 12. The DL (MINFILE 093A 089) and Art (MINFILE 093A 200) showings, near the southern boundary of the map area, were described by Schiarizza and Boulton (2006a), so are not described here. Other showings include disseminated pyrite-chalcopyrite in the Buster Lake unit of the Takomkane batholith; mineralized veins in the Snowshoe Group and Lemieux Creek succession northeast of Bosk Lake; the past-producing Boss Mountain porphyry molybdenum deposit, associated with a small Cretaceous stock that cuts the Takomkane batholith east of Takomkane Mountain; mineralized veins and stockworks in the Takomkane batholith west of the Boss Mountain mine; gold-bearing hornfelsed rocks along the northern margin of the Hendrix stock; and molybdenum-tungsten mineralization along the southern margin of the Deception stock. Many of the known showings are not yet included in the MINFILE (2006) database, but are in the process of being entered into the system.

Gus (MINFILE 093A 020)

The Gus showing is located about 3.5 km southeast of Buster Lake, within the Buster Lake unit of the Takomkane batholith. It was discovered in 1970 during an exploration program for Exeter Mines Ltd. The mineralization is described as disseminated chalcopyrite and pyrite within porphyritic diorite (Allen, 1970). There is no additional information on file, and the showing was not located during our 2006 field program, although some old drill pads were located that may have been constructed by Exeter Mines Ltd. in 1971 (Blann and Ridley, 2005a).

Vein Occurrences Northeast of Bosk Lake

Quartz veins, some mineralized with pyrite and galena, are common within the Lemieux Creek succession, Crooked amphibolite and Snowshoe Group northeast of Bosk Lake. These veins were covered by the Cruiser claim group and explored with rock and soil geochemical surveys in 1989 (Bysouth, 1989; Barker and Bysouth, 1990). For the purposes of this discussion, a cluster of mineralized veins within the Snowshoe Group is referred to as the Bassett showing, whereas a more widespread area of veins within the Lemieux Creek succession, some with distinctly different character than the Bassett veins, is referred to as the Cruiser showing. Quartz veins are also present within the intervening Crooked amphibolite, but they are not apparently mineralized.

BASSETT

The Bassett showing comprises a number of mineralized quartz veins within the Snowshoe Group, near its contact with the Crooked amphibolite. Mineralized veins, accompanied by nonmineralized veins, are exposed over a strike length of about 200 m within an interval of marble, quartzite and minor pelitic schist about 50 m wide. The veins are parallel, or at a low angle to, the strong foliation in the host rocks. Individual veins pinch and swell, but commonly range from a few centimetres to about 20 cm in thickness, although one poorly exposed vein within marble at the south end of the mineralized zone is at least 35 cm wide. The mineralized veins are generally cut by rusty hairline fractures and locally contain patches of ankerite and vugs containing subhedral crystals of quartz and carbonate. Mineralization comprises scattered grains and clots of galena and pyrite. Samples collected from three separate mineralized veins during the 2006 field season contained 1749 to 6450 ppm Pb, 51 to 888 ppm Mo and 1749 to 6449 ppb Ag, but did not contain significant amounts of Au (Table 1, samples 06PSC-282, 283, 284).

CRUISER

The Lemieux Creek succession in the area of the Cruiser showing is fairly well exposed over a width of about 2 km, mainly along roads and skid trails in an old logging cut. Quartz veins mineralized with galena and pyrite are scattered sparsely through this entire width (Bysouth, 1989) and are accompanied by a much larger number of nonmineralized veins. Some veins, particularly those in the east, are parallel to the strong southwest-dipping foliation within the enclosing phyllite. In the western part of the belt, however, mineralized and nonmineralized veins typically strike northeast to east-northeast, dip steeply to the southeast or northwest, and are hosted in grey-green, rusty-weathered alteration zones consisting of quartz, ankerite, sericite, mariposite and pyrite. In an area designated as the main prospect by Bysouth (1989), an isolated patch of pervasively altered rock is cut by several northeast-striking quartz veins, ranging from 25 to 50 cm wide. Contacts between the altered rock and nonaltered phyllite are not exposed in this area. Elsewhere, however, zones of similar alteration up to 3 m wide are approximately concordant with the foliation within the enclosing phyllite. Northeast-striking quartz veins within these alteration zones do not extend across the contacts into nonaltered phyllite.

The veins that cut pervasively altered rock at the main Cruiser showing comprise milky white quartz with vugs containing quartz and carbonate crystals, rare patches of rusty carbonate, and inclusions of altered wallrock. The veins are cut by rusty hairline fractures and contain sparsely scattered limonite-altered pyrite grains. A sample from the altered wallrock returned anomalous concentrations of Pb, Zn, Ag, Ni, Co, As and Sb (Table 1, sample 06PSC-73-1), whereas samples from two different veins did not yield significant base or precious metal values (samples 06PSC-73-2 and 3). A sample from a northeast-striking vein within a similar alteration zone, 500 m northwest of the main prospect, likewise did not yield significant base or precious metal values (Table 1, sample 06PSC-71). Thirteen samples from veins and alteration zones sampled by Bysouth

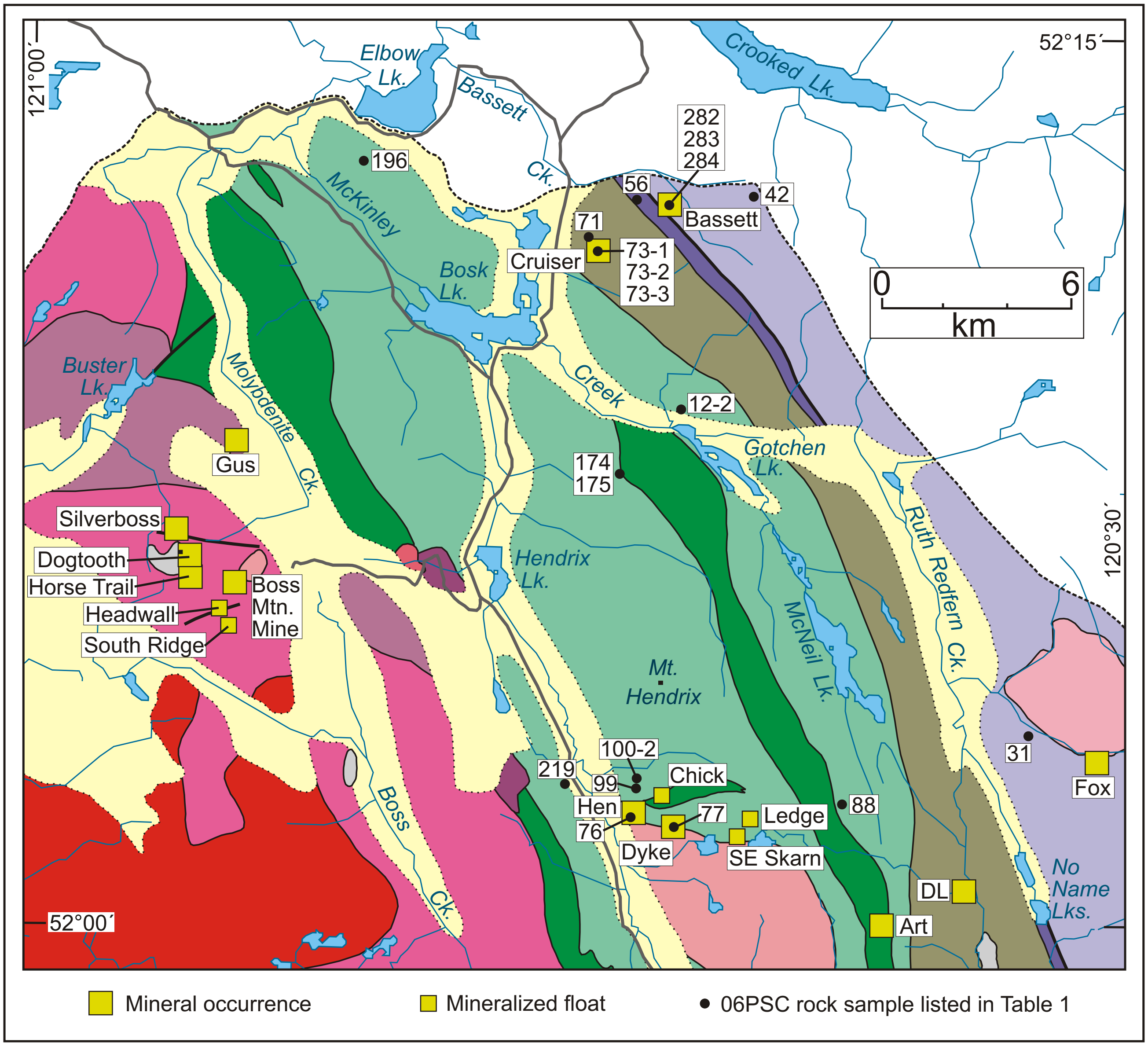

Figure 12. Locations of known mineral occurrences within the Hendrix Lake map area, and locations of rock samples listed in Table 1. See Figure 2 for legend.

(1989) returned Ag values ranging from 1.1 to 14.0 ppm, but did not yield anomalous Au concentrations.

Boss Mountain Molybdenum Mine (MINFILE 093A 001)

The past-producing Boss Mountain molybdenum mine is located on the east slopes of Takomkane Mountain, near the headwaters of Molybdenite Creek. The molybdenum mineralization was briefly described in the Annual Report of the BC Minister of Mines for 1917, when several hundred kilograms of ore were packed to Lac La Hache and subsequently shipped to Ottawa (Galloway, 1918). In the 1930s, the property was explored with surface trenches, open cuts and short adits by the Consolidated Mining and Smelting Company of Canada Ltd. In 1942, the British Columbia Department of Mines conducted 415 m of X-ray diamond-drilling (Eastwood, 1965). The property was acquired by H.H. Huestis and associates in 1955 and optioned to Climax Molybdenum Company, who conducted 11 277 m of diamond drilling before the option was dropped in 1960. Noranda Exploration Company Ltd. optioned the property in 1961 and brought it into production in 1965. The mine was in operation from 1965 to 1971, and again from 1974 to 1983. Production was from underground workings and two small open pits. In total, 15 546 034 kg of molybdenum were recovered from 7 588 072 t of ore milled. Current unclassified reserves are listed as 3 838 847 t grading 0.135% Mo (MINFILE, 2006).

The surface geology near the Boss Mountain mine pits was briefly examined during the 2006 field season, but most of the workings are inaccessible. However, detailed descriptions of the mineralization and local geology have been provided by Soregaroli (1968), Soregaroli and Nelson

TABLE 1. GEOCHEMICAL DATA FOR SELECTED ROCK SAMPLES COLLECTED DURING THE 2006 FIELD SEASON.

	Element:	**Mo**	**Cu**	**Pb**	**Zn**	**Ag**	**Ni**	**Co**	**As**	**Sb**	**Bi**	**Ba**	**Hg**	**Au****	**Pt****	**Pd****
	Units:	ppm	ppm	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	ppb	ppb	ppb	ppb
	Lab:	ACM	ACM	ACM	ACM	ACM	ACM	ACM	ACM	ACM	ACM	ACM	ACM	ACM	ACM	ACM
	Method:	ARMS	ARMS	ARMS	ARMS	ARMS	ARMS	ARMS	ARMS	ARMS	ARMS	ARMS	ARMS	FAIC	FAIC	FAIC
	Detection limit:	0.01	0.01	0.01	0.1	2	0.1	0.1	0.1	0.02	0.02	0.5	5	2	2	2
Field no.	**Rock type**															
06PSC-12-2	Skarny rock	1.85	102.63	3.63	25	52	5.9	23.3	-0.1	0.19	0.08	56.2	11	16	8	4
06PSC-31	Rusty muscovite-biotite-quartz schist	1.44	41.09	12.67	107.4	110	40.1	16.5	-0.1	0.08	0.28	154.9	5	-2	5	2
06PSC-42	Quartz vein	0.32	9.62	5.54	13	73	2.9	1.8	0.1	0.15	2.4	7.7	8	-2	-3	7
06PSC-56	Silica-rusty carbonate-pyrite-altered rock	0.14	34.46	4.5	75.2	40	62.3	34	6.4	3.66	0.06	26.6	-5	-2	-3	-2
06PSC-71	Quartz vein	0.36	3.02	7.08	13.6	106	7.1	1.3	6	0.24	0.07	8.1	-5	5	4	3
06PSC-73-1	Quartz-ankerite-sericite-mariposite alteration	0.25	41.13	56.09	89.7	434	549.1	56.3	426.9	5.05	0.05	21.2	-5	2	8	4
06PSC-73-2	Quartz vein	0.19	3.97	3.87	9.4	193	13.5	1.6	16.2	0.39	0.02	5.1	5	-2	4	4
06PSC-73-3	Quartz vein	0.15	3.57	5.28	12.5	58	14.2	1.2	13.1	0.28	0.04	6.9	-5	2	3	-2
06PSC-76	Rusty pyritic hornfels	0.35	181.07	8.64	58.8	651	46.1	22.4	11.2	2.76	0.18	223.9	-5	13	8	11
06PSC-77	Rusty hornfels	4.9	152.45	4.04	10.9	1204	15.2	15.4	5.9	0.26	0.6	26.7	13	2121	-3	-2
06PSC-88	Pyritic siltstone	0.71	102.96	8.73	115.4	340	33.1	26	8.9	1.12	0.11	98.5	27	9	4	9
06PSC-99	Rusty fault rock	104.95	127.14	28.48	221.8	1234	45	14	7.7	14.94	0.14	29.2	34	77	9	14
06PSC-100-2	Quartz-pyrite-altered sandstone	1.3	108.65	3.74	36.3	316	14.6	13.8	3.9	4.18	0.16	215.3	-5	12	5	8
06PSC-174	Rusty pyritic rock in fault zone	4.07	79.88	9.15	169.5	306	26.1	15.5	17	3.85	0.07	63.6	117	9	7	9
06PSC-175	Rusty pyritic siltstone	15.58	97.15	8.36	65.7	188	33.3	16.6	4.3	1.65	0.07	59.5	24	4	-3	-2
06PSC-196	Rusty siltstone	2.71	132.19	3.89	93.1	161	17.2	14.9	9.8	0.58	0.17	90.1	40	4	7	13
06PSC-219	Pyritic sandstone	0.53	80.85	2.67	29.1	159	11.2	24	3.1	2.45	0.52	145.8	5	7	-3	-2
06PSC-282	Quartz vein; galena, pyrite	193.24	46.14	6449.6	7	2049	1.8	0.8	0.9	1.35	3.41	17.7	-5	10	-3	-2
06PSC-283	Quartz vein; galena, pyrite	887.73	29.23	2967.27	7.4	1143	3.7	2.4	0.2	0.7	2.46	249.3	10	4	-3	-2
06PSC-284	Quartz vein; galena, pyrite	50.9	12.87	1749.29	5	1320	2	0.6	0.4	0.22	4.38	10.5	6	4	4	4

Analysis of steel milled samples prepared by GSB

Abbreviations: ACM, Acme Analytical, Vancouver, BC; ARMS, aqua regia digestion with ICP-MS finish; FAIC, fire assay with ICP-ES finish

(1976) and Macdonald *et al.* (1995). The ore is hosted in quartz monzodiorite to granodiorite of the Boss Creek unit of the Takomkane batholith, but is related to a small mid-Cretaceous stock of monzogranite, the Boss Mountain Mine stock, that intrudes the batholith. Ore was mined from a system of sheeted quartz veins that forms a concentric zone centred on the southwestern margin of the stock, as well as from spatially associated subvertical breccia pipes. Soregaroli documented multiple episodes of alteration and mineralization associated with episodic diking, breccia formation, and fracture and vein development. He attributed the fracturing, brecciation, alteration and mineralization to multiple pulses of magmatic and hydrothermal pressure emanating from the Boss Mountain Mine stock. Three separate samples of hydrothermal biotite from the mine workings yielded K-Ar dates of 98 ±4, 104 ±4 and 105 ±4 Ma, respectively (White *et al*., 1968). These dates are inferred to represent the age of mineralization and of the Boss Mountain Mine stock (Soregaroli and Nelson, 1976). Similar mid-Cretaceous ages have been obtained from the main monzogranite phase of the Raft batholith (Schiarizza *et al*., 2002b), and from the Tintlhohtan Lake stock about 20 km to the south (Soregaroli, 1979). Both of these plutons also host molybdenum mineralization.

Copper Showings near Takomkane Mountain

Mineralized quartz veins and stockworks are known over a fairly large area within the Takomkane batholith near Takomkane Mountain, mainly west and northwest of the Boss Mountain molybdenum mine. The mineralization consists mainly of pyrite and chalcopyrite, and commonly yields significant Au and Ag values. Mineralization was discovered north of Takomkane Mountain prior to 1917, and was briefly described by Galloway (1918) and Reinecke (1920). Exeter Mines Ltd. staked claims around the known mineralization in 1969 and conducted an exploration program in 1970 that included geological mapping, soil sampling and a VLF-EM survey (Allen, 1970; Mark, 1970). Although no further assessment work was filed by Exeter, a cat trail from the Boss Mountain Mine road to the area of the main showings, old bulldozer trenches, and drillcore located at an old camp all show that some follow-up work was completed (Blann and Ridley, 2005a). The area of the main showings (Silverboss) was restaked by D. Ridley in 1993 and explored with small prospecting, mapping, and rock and soil geochemical programs in 1994, 1995 and 2000 (Ridley, 1994, 1995, 2000b). Additional geological and geochemical work was conducted during the 2004 field season, and the Silverboss claim group was optioned to Happy Creek Minerals Ltd. in December of that year (Blann and Ridley 2005a). Happy Creek Minerals Ltd. staked additional claims and carried out exploration programs on the Silverboss property in 2005 (Blann and Ridley, 2006) and 2006.

The mineralization on the Silverboss property is hosted by the Boss Creek unit of the Takomkane batholith, which ranges in composition from hornblende-biotite quartz monzodiorite to monzodiorite and granodiorite. Much of the *in situ* mineralization occurs in a zone, a little more than 1.5 km long, that extends from the Silverboss showing in the north to the Horse Trail zone in the south (Fig 12). The zone of mineralization may continue at least 2 km farther to the southeast, based on mineralized float samples located during reconnaissance prospecting south of the Boss Mountain mine (Headwall and South Ridge zones of Blann and Ridley, 2005a). The mineralized veins on the Silverboss property commonly occur along fractures and faults that strike either northeast or northwest. The known veins appear to form a partial envelope bounding the Boss Mountain mine workings to the south, west and northwest. It is suspected that they are distal expressions of the same mineralizing system.

SILVERBOSS (MINFILE 093A 019)

The Silverboss showing is located about 600 m north of Takomkane Mountain. Mineralized quartz veins and lenses occur within a northeast-striking, steeply dipping shear zone, ranging from 1 to 10 m wide, that is exposed intermittently over a strike length of about 350 m (Allen, 1970; Ridley, 1994, 1995; Blann and Ridley, 2006). The mineralized structure is exposed mainly in old (mostly pre-1917) workings that include a water-filled shaft, a southwest-trending adit located 70 m northeast of the shaft, and numerous partially caved pits and trenches. The quartz veins are variably mineralized with pyrite and chalcopyrite, and locally contain arsenopyrite, pyrrhotite, galena, sphalerite, limonite, azurite and malachite (Galloway, 1918; Allen, 1970; Ridley, 1994). Individual veins range up to 30 cm in width and commonly contain vugs that are lined with quartz crystals, with or without sulphide minerals. The quartz monzodiorite within and adjacent to the shear zone is commonly altered with quartz, pyrite, chlorite, epidote and sericite. Chlorite-epidote-altered andesite dikes occur within and adjacent to the Silverboss shear zone, and locally have veins of vuggy quartz, sparsely mineralized with pyrite and chalcopyrite, along their margins (Ridley, 1995). Samples collected by Ridley (1994) show that mineralized material along the full length of the Silverboss structure contains significant concentrations of Au and Ag. The highest Au value came from a trench between the shaft and adit, where a grab sample from a well-mineralized quartz vein, 20 cm wide, contained 9.41 g/t Au, 514.8 g/t Ag and 1.34% Cu (Ridley, 1994, sample SB94-DR15). A 105 cm chip sample that included this vein, as well as sheared plutonic rock and several quartz stringers, returned 1.62 g/t Au, 63.2 g/t Ag and 1503 ppm Cu (sample SB94-DR13).

There are additional mineralized veins and shears documented in the vicinity of the Silverboss showing that are not within the main shear zone (Reinecke, 1920; Ridley, 1995, 2000a, b). One of these, referred to as the East Breccia zone (Ridley, 1995), is located on the east side of the ridge crest about 300 m east of the Silverboss shaft. There, an old blasted trench about 4 m wide forms a north-northwest-trending vertical slot in hornblende-biotite quartz monzodiorite. The east wall of the trench is coincident with the east margin of a zone of mineralized stockwork breccia that strikes 335° and dips about 80° to the east. The mineralized material is seen mainly as loose pieces on the floor of the trench, but some *in situ* mineralization remains along the east wall of the trench. The mineralization comprises a quartz stockwork that separates fragments of intensely chlorite-epidote-altered granitic rock, as well as some dark fragments that may have been derived from a mafic dike. The quartz is mineralized with pyrite, malachite-altered chalcopyrite and some specularite. A grab sample of mineralized breccia from the trench yielded 2.6% Cu, 42 ppm Ag and 1241 ppb Au (Ridley, 1995, sample TAK95-DR12).

DOGTOOTH ZONE

The Dogtooth zone (Blann and Ridley, 2006) is a northeast-striking mineralized shear zone located a short distance east of the Takomkane volcano, and about 950 m southeast of the Silverboss shaft. The shear zone is well exposed for about 35 m along an old (1917 vintage?) exploration trench, but is also recognized elsewhere, for a total known strike length of about 150 m (Blann and Ridley, 2006). The zone strikes about 050°, is more or less vertical, and ranges from 1 to 5 m wide. The shear zone comprises strongly fractured, variably silicified and chlorite-epidote-sericite-altered quartz monzodiorite containing quartz veins and lenses ranging up to 20 cm in width. The quartz commonly contains vugs lined with limonite-coated quartz crystals, and crystals elsewhere are oriented perpendicular to vein walls to define comb or dogtooth textures. Sulphide minerals are not abundant, but limonite-altered pyrite and some chalcopyrite are present in places. Blann and Ridley (2006) reported that a grab sample collected across 1 m of veined and silicified rock in a pit at the southwest end of the old exploration trench returned 10.06 g/t Au, 26.0 g/t Ag and 643 ppm Cu (sample 185364). An adjacent sample across 2 m of sheared wallrock, containing quartz veins 3 cm and 14 cm wide, returned 4.7 g/t Au, 35.0 g/t Ag and 198 ppm Cu (sample 151704).

HORSE TRAIL ZONE

The Horse Trail zone, discovered by D. Ridley in 2004, is a series of mineralized quartz veins located about 1.5 km south-southeast of the Silverboss shaft. The discovery vein, adjacent to the old horse trail that connected the Boss Mountain molybdenum deposit to Lac La Hache, is about 8 cm wide, dips about 30° to the northeast and contains patches of chlorite, epidote, pyrite and chalcopyrite. The host quartz monzodiorite is altered with chlorite, epidote and tourmaline for 2 to 3 cm adjacent to the vein margins. A grab sample from this vein returned 4238 ppm Cu, 27.9 ppm Ag and 2413 ppb Au (Blann and Ridley, 2005a, sample 151679). Several other mineralized quartz veins occur within an exposure about 100 m south of the discovery vein. These veins range from 6 to 30 cm in width and typically dip steeply to the northeast. They contain epidote, tourmaline, pyrite and chalcopyrite, and some include vugs containing quartz crystals and rusted-out sulphide minerals. A 20 cm chip sample across one of these veins returned 5642 ppm Cu, 43.7 ppm Ag and 791.7 ppb Au (Blann and Ridley, 2005a, sample 151677).

HEADWALL AND SOUTH RIDGE ZONES

The Headwall and South Ridge zones are represented by float samples of vein material from a part of the Silverboss property that has been prospected only at reconnaissance scale (Blann and Ridley, 2005a). At the Headwall zone, vuggy and dogtooth-textured quartz contains pyrite and chalcopyrite. A sample of this material returned 549 ppm Cu, 51.3 ppm Ag and 723 ppb Au, and was also anomalous in Pb, As, Bi and W (Blann and Ridley, 2005a, sample 151797). At the South Ridge zone, narrow parallel quartz veins, 1 to 3 cm wide, contain pyrite, chalcopyrite and traces of molybdenite. A sample of this material returned 1926 ppm Cu, 68 ppm Mo, 17.4 ppm Ag and 149 ppb Au (Blann and Ridley, 2005a, sample 151674). Both the Headwall and the South Ridge samples were collected along east-northeast-striking faults that were mapped by Soregaroli (1968). He mapped a parallel fault 900 m north of the Headwall zone, and two float samples of pyritic quartz collected along this structure, 350 m southeast of the Horse Trail zone, returned 1.91 and 5.55 g/t Au (Blann and Ridley, 2006, samples 185374 and 185375).

Showings North of the Hendrix Stock

The Hen claims were first staked by D. Ridley in 1992, following his discovery of mineralized float on the 6300 logging road. Subsequent exploration led to the discovery of *in situ* mineralization at the Hen and Dyke showings, and additional discoveries of gold-bearing float or subcrop to the north and east (Fig 12; Chick, Ledge and Southeast Skarn showings of Ridley, 1997b). These widespread indications of mineralization prompted staking of a large group of claims, the Hen, Ledge and DL claim groups, that extended from Hendrix Creek eastward to the DL showing near Deception Creek (Ridley, 1997b). This swath of claims covers a prominent system of topographic linears that was interpreted to represent a major east-southeast-striking fault system, and shear zones associated with mineralization at the Hen showing were interpreted as part of this structural zone. The Hendrix stock is also an important mineralizing agent, since the known occurrences (except the DL showing at the east end) are in hornfelsed and skarn-altered rocks on the northern margin of the stock.

HEN

The Hen showing is within green to purplish grey hornfels on the north side of the 6300 logging road, about 1 km east of Hendrix Creek. The hornfels is derived mainly from volcanic sandstone of the Nicola volcaniclastic succession, although coarser volcanic breccia and mafic flow units occur locally. The northern contact of the Hendrix stock is inferred to be a short distance to the south, but is not exposed. The hornfels is cut by numerous east-striking fault and fracture systems that are commonly altered with quartz, actinolite, epidote, garnet, pyrite and pyrrhotite. The main Hen showing, discovered in 1994, is within a trench that exposes several tens of metres of sheared hornfels containing abundant pyrrhotite and veins of quartz and calcite. A zone containing pyrrhotite, arsenopyrite and abundant calcite veins returned 3.98 g/t Au over 2.1 m (Dunn and Ridley, 1994). Two diamond-drill holes angled to the south from north end of the trench intersected this mineralized zone at depth, and one of these holes intersected a separate zone of mineralization farther south, characterized by abundant calcite-quartz stringers, 5% pyrrhotite and up to 2% arsenopyrite. An 8 m core length of this zone averaged 0.86 g/t Au (Dunn and Ridley, 1994). A hole drilled in 1996 intersected gold mineralization that might represent the down-dip extension of the main mineralized zone discovered in 1994. This mineralization is more than 200 m below that exposed in the 1994 trench, and includes a 0.8 m length that returned 2.08 g/t Au (Ridley, 1997a).

DYKE

The Dyke showing is located on the north side of the 6300 logging road, about 1.3 km east-southeast of the Hen showing. It occurs within strongly hornfelsed rock about 30 m northeast of an exposure of biotite-hornblende tonalite that is inferred to form the north margin of the Hendrix stock. Most of the hornfels northeast of the tonalite comprises a medium grey, fine-grained mixture of quartz, biotite, amphibole and plagioclase, locally containing lenses and patches of calcsilicate rock that includes quartz, actinolite, epidote, garnet, biotite and pyrite. The Dyke showing comprises a 4.5 m zone of mainly rusty-weathered, grey-green silicified rock that contains 2 to 5% fine-grained disseminated sulphide minerals. The rusty zone includes some patches of grey nonsilicified hornfels, as well as two narrow tonalite dikes that dip steeply to the north-northeast. The Dyke showing was discovered in 1997 when a grab sample returned 2640 ppb Au and 2.0 ppm Ag (Ridley, 1997b, sample HEN97-DR29). It was partially exposed by hand trenching in 1998, and a 2 m chip sample across the zone returned 1270 ppb Au and 0.6 ppm Ag (Ridley, 1998, sample HEN98-DR15). A grab sample collected from the rusty zone during our 2006 fieldwork returned 2121 ppb Au and 1.2 ppm Ag (Table 1, sample 06PSC-77).

Fox

The Fox molybdenum-tungsten showing is located in the southeastern part of the Hendrix Lake map area, within the Snowshoe Group on the southern margin of the Deception stock. The area north of the showing was covered by a geological and geochemical exploration program in 1982, which was implemented to follow up a regional geochemical survey that identified anomalous tungsten concentrations in heavy mineral samples in the Deception Creek drainage system (Helson, 1982). The Deception stock, consisting of garnet-bearing two-mica granite, was recognized at this time but not mapped in detail, and soil samples from around the eastern and northern margins of the stock were found to be slightly anomalous in tungsten. D. and C. Ridley located the southern contact of the Deception stock and adjacent skarn alteration in 1997, while prospecting along the newly constructed 7200 logging road. Further prospecting in 1999 led to the discovery of molybdenum-bearing skarn and staking of the Fox mineral claims (Ridley, 2000a). Subsequent work included grid construction, soil geochemical surveys, a ground magnetometer and VLF-EM geophysical survey, and additional prospecting and claim staking. The property was optioned to Happy Creek Minerals Ltd. in December 2004, and an exploration program comprising grid layout, soil and rock geochemical sampling, prospecting and geological mapping was carried out in 2005. This program led to the discovery of the Nightcrawler tungsten zone, 1 km east of the Discovery molybdenum zone (Blann and Ridley, 2005b).

The very sparse bedrock exposure in the vicinity of the Fox showing includes skarn, calcsilicate gneiss, quartz-biotite schist and quartzite, locally cut by aplitic, pegmatitic and granitic dikes. Layering and schistosity show gentle to moderate dips to the southwest. At the Discovery molybdenum zone, subcrop of garnet-epidote-pyroxene skarn, locally with distinct vesuvianite crystals, contains patches, fracture-fillings and disseminations of molybdenite. The Nightcrawler tungsten zone, about 1 km to the east, comprises some subcrop and outcrop, along with many large angular blocks, of scheelite-bearing skarn. Fine to coarse-grained scheelite, as fracture fillings and disseminations, is accompanied locally by traces of chalcopyrite, sphalerite and molybdenite (Blann and Ridley, 2005b). Samples from the Discovery zone have returned up to 4.9% Mo, while those from the Nightcrawler zone contain up the 3.16% W (Blann and Ridley, 2005b). The broad area that encompasses the two zones, more than 1 km long by several hundred metres wide, contains abundant mineralized float and several zones of anomalous tungsten and/or molybdenum in soils.

SUMMARY OF MAIN CONCLUSIONS

The Hendrix Lake map area is underlain mainly by Proterozoic-Paleozoic siliciclastic metasedimentary rocks of the Kootenay Terrane, Late Paleozoic mafic schist of the Slide Mountain Terrane and Middle Triassic to Early Jurassic sedimentary, volcanic and plutonic rocks of the Quesnel Terrane. Younger rocks include a small hornblende granodiorite stock of suspected Jurassic age, several granitic stocks of mid-Cretaceous age and minor amounts of Quaternary basalt

The main stratigraphic assemblages in the area, representing the Kootenay, Slide Mountain and Quesnel terranes, form a west-southwest-facing homocline that constitutes part of the west limb of the Boss Mountain anticline, a significant map-scale fold that formed during the late stages of a regional structural-metamorphic event of mainly Early to Middle Jurassic age. Studies elsewhere in the region show that the Slide Mountain Terrane, represented by the Crooked amphibolite, was thrust eastward over the Kootenay Terrane, represented by the Snowshoe Group, prior to folding. The Quesnel Terrane, represented mainly by the Nicola Group, may have been deposited stratigraphically above the Slide Mountain Terrane, either before or after east-directed thrusting, but the contact has been the locus of shearing during subsequent structural events.

The Nicola Group in the Hendrix Lake map area includes two major subdivisions. The Lemieux Creek succession forms the eastern part of the group and consists mainly of dark grey phyllite, slate and siltstone. It is assigned a Middle to Late Triassic age based on correlation with dated rocks to the south and north. The volcaniclastic succession forms a wide outcrop belt to the west and consists of massive to well-bedded volcanic sandstone, siltstone and conglomerate, intercalated with pyroxene-rich volcanic breccia units and some mafic flows. It is Late Triassic and/or older because the upper part of the succession is cut by latest Triassic quartz monzodiorite of the Takomkane batholith. Fossils from correlative rocks to the north and south are mainly Late Triassic, but include some Middle Triassic forms near Quesnel Lake.

Intrusive rocks assigned to the Quesnel Terrane include the Takomkane batholith and the Hendrix Lake ultramafic-mafic plutonic complex. The Takomkane batholith comprises the Late Triassic Boss Creek unit of mainly quartz monzodiorite composition (U-Pb zircon age of 202.5 ±0.5 Ma), undated diorite to quartz diorite of the Buster Lake unit, and Early Jurassic granodiorite to monzogranite of the Schoolhouse Lake unit (U-Pb zircon age of 195.0 ±0.4 Ma). The poorly exposed Hendrix Lake ultramafic-mafic complex includes pyroxenite, gabbro, diorite and intrusion breccia. It is thought to be Early Jurassic, based on correlation with the lithologically similar Iron Lake and Aqua Creek complexes in the Canim Lake area (hornblende Ar/Ar plateau ages of 187.7 ±1.1 Ma and 183.0 ±1.1 Ma, respectively).

Quartz veins mineralized with galena and pyrite in the northeastern part of the area probably formed during Early to Middle Jurassic deformation and metamorphism. Many other mineral occurrences within the Hendrix Lake map area are associated with granitic stocks of mid-Cretaceous age. These include the past-producing Boss Mountain porphyry molybdenum deposit, molybdenum-tungsten skarn showings along the southern margin of the Deception stock, and gold showings within hornfelsed rocks along the northern margin of the Hendrix stock. Precious-metal-bearing veins and stockworks near Takomkane Mountain, mineralized mainly with pyrite and chalcopyrite, might be distal expressions of the system that generated mineralization at the Boss Mountain mine.

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