# Geology and Mineral Occurrences of the Timothy Lake Area, South-Central British Columbia (NTS 092P/14)

**by P. Schiarizza and J.S. Bligh**

*KEYWORDS*: Quesnel Terrane, Nicola Group, Takomkane batholith, Spout Lake pluton, Peach Lake stock, monzodiorite, monzonite, copper, gold, porphyry, skarn

## INTRODUCTION

The Takomkane Project is a multiyear bedrock mapping program initiated by the British Columbia Geological Survey in 2005. This program is focused on Mesozoic arc volcanic and plutonic rocks of the Quesnel Terrane in the vicinity of the Takomkane batholith, which crops out in the northern Bonaparte Lake (NTS 092P) and southern Quesnel Lake (NTS 093A) map sheets. Mapping during the 2005 and 2006 field seasons covered the Canim Lake and Hendrix Lake map areas, and is summarized by Schiarizza and Boulton (2006a, b) and Schiarizza and Macauley (2007a, b). Here, we present preliminary results from the third year of mapping for the Takomkane Project, which was carried out by a four-person crew from mid-June to the end of August, 2007. This work covers the 092P/14 NTS map sheet, comprising about 950 $km^2$ centred near Timothy Lake (Fig 1).

The Timothy Lake map area is located near the eastern edge of the Interior Plateau physiographic province, within the traditional territories of the Northern Secwepemc te Qelmucw and Esketemc First Nations. Topography is generally subdued, with elevations ranging from about 800 m along Bridge Creek to 1 655 m on Mount Timothy. The town of Lac La Hache, along Highway 97, is located in the southwestern part of the map area, and the village of Forest Grove and the west subdivision of the main Canim Lake Indian reserve are near the southeastern corner of the area. Access to most parts of the map area is easily achieved through extensive networks of public, logging and forest service roads.

The Takomkane Project builds on the geological framework established by the reconnaissance-scale mapping of Campbell and Tipper (1971) and Campbell (1978), as well as subsequent, more detailed studies by Panteleyev et al. (1996), Schiarizza and Israel (2001) and Schiarizza et al. (2002a, b, c). Our geological interpretation of the Timothy Lake map area also incorporates data found in assessment reports available through the BC Geological Survey's Assessment Report Indexing System (ARIS), and airborne geophysical data from a number of recent surveys funded by the Geological Survey of Canada, Geoscience BC and various industry partners (Carson et al., 2006a, b, c; Coyle et al., 2007; Dumont et al., 2007).

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## REGIONAL GEOLOGICAL SETTING

The Timothy Lake map area is underlain mainly by rocks of the Quesnel Terrane, which is characterized by a Late Triassic to Early Jurassic magmatic arc complex that formed along or near the western North American continental margin (Mortimer, 1987; Struik, 1988a, b; Unterschutz et al., 2002; Thompson et al., 2006). An assemblage of mid to Late Paleozoic oceanic basalts and cherts assigned to the Slide Mountain Terrane occurs directly east of the Quesnel belt, and is in turn juxtaposed against a wide belt of Proterozoic and Paleozoic siliciclastic, carbonate and volcanic rocks of the Kootenay Terrane. The Kootenay Terrane is commonly interpreted as an outboard facies of the ancestral North American miogeocline (Struik, 1988a; Colpron and Price, 1995), whereas the Slide Mountain Terrane is interpreted as the thrust-imbricated remnants of a Late Paleozoic marginal basin (Schiarizza, 1989; Ferri, 1997). To the west of the Quesnel Terrane are Late Paleozoic through mid-Mesozoic oceanic rocks of the Cache Creek Terrane, which are interpreted as part of the 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 basalt of Neogene and Quaternary age (Fig 1).

Prominent geological structures in the region include Permo-Triassic thrust faults that imbricate the Slide Mountain Terrane and separate it from the underlying Kootenay Terrane (Schiarizza, 1989; Schiarizza and Macauley, 2007a); Late Triassic or Early Jurassic, east-directed thrust faults that imbricate the Quesnel Terrane (Struik, 1988b; Bloodgood, 1990); and predominantly southwest-directed, synmetamorphic folds and thrust faults of Early to Middle Jurassic age that deform the rocks and mutual boundaries of the Kootenay, Slide Mountain and Quesnel terranes (Ross et al., 1985; Mortensen et al., 1987; Rees, 1987; Schiarizza and Preto, 1987). The structural geology of the Quesnel Terrane also includes faults that exerted controls on Triassic-Jurassic volcanic-sedimentary facies distributions and the localization of plutons and associated alteration and mineralization systems (Preto, 1977, 1979; Nelson and Bellefontaine, 1996; Logan and Mihalynuk, 2005b). Younger structures include prominent systems of Eocene dextral strike-slip and extensional faults (Ewing, 1980; Panteleyev et al., 1996; Schiarizza and Israel, 2001).

The Quesnel Terrane is an important metallogenic province, particularly for porphyry deposits containing copper, gold and molybdenum. The world-class Highland

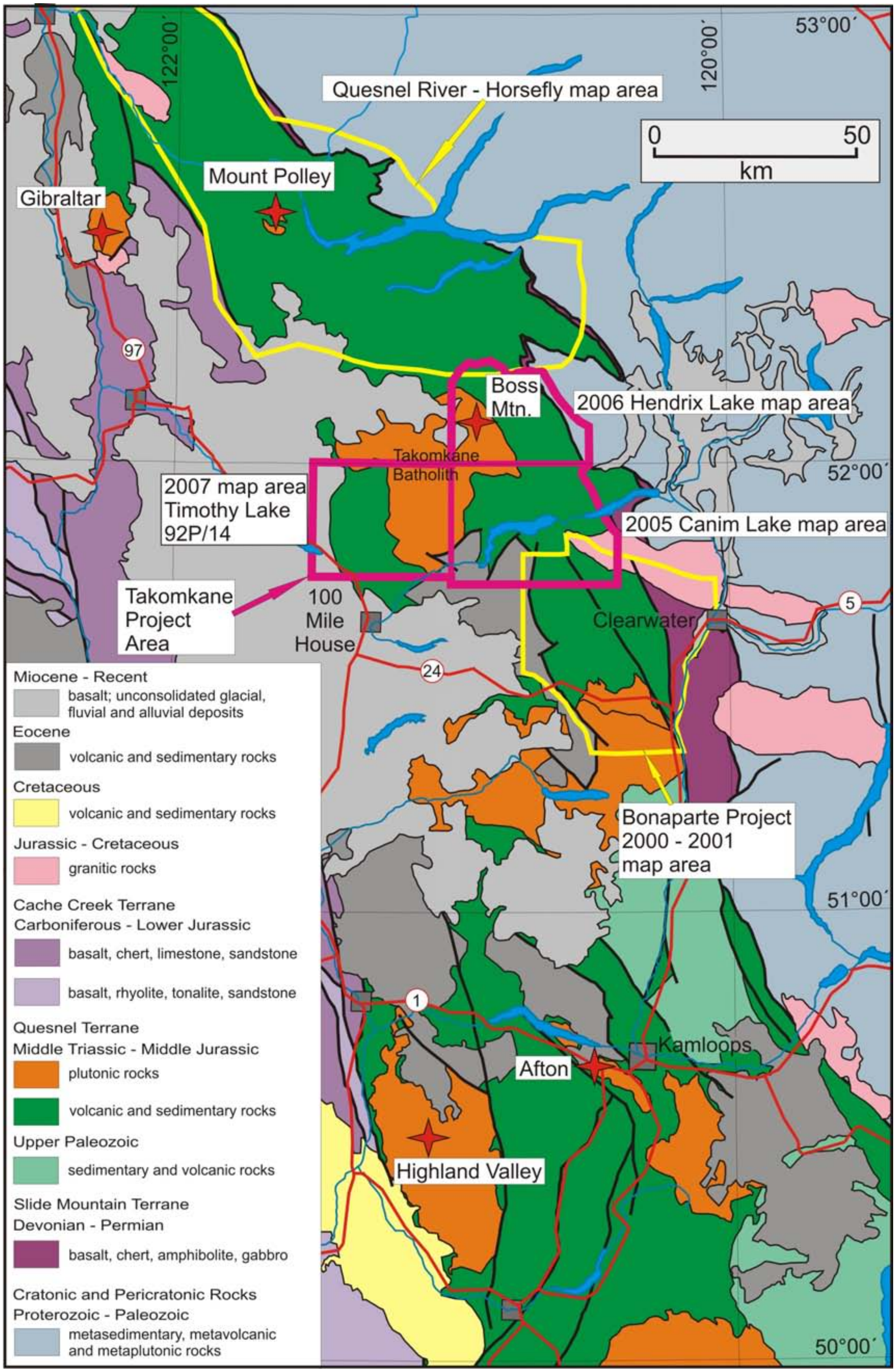



Figure 1. Regional geological setting of the Takomkane Project area, showing the areas mapped in 2005, 2006 and 2007, as well as the area mapped during the 2000–2001 Bonaparte Project, and the Quesnel River – Horsefly map area of Panteleyev et al. (1996). Stars denote locations of selected major mineral deposits.

Valley copper-molybdenum porphyry deposits are in calcalkaline plutonic rocks of the Late Triassic Guichon Creek batholith (Casselman et al., 1995), which is located in the western part of the Quesnel Terrane, about 150 km south of the Timothy Lake map area. Alkaline plutons, many of latest Triassic age, are scattered across much of the Quesnel Terrane, and host important copper-gold porphyry deposits. These include the Afton Mine and associated occurrences within the Iron Mask batholith, near Kamloops, and the Mount Polley Mine west of Quesnel Lake (Mortensen et al., 1995; Logan and Mihalynuk, 2005a, b). Porphyry and skarn occurrences containing molybdenum and tungsten are associated with Early Cretaceous calcalkaline plutons in the region, and Eocene volcanic rocks and structures locally host epithermal veins that contain gold and silver (Schiarizza et al., 2002a; Schiarizza and Boulton, 2006a; Schiarizza and Macauley, 2007a).

## LITHOLOGICAL UNITS

The distribution of the main lithological units within the Timothy Lake map area is shown on Fig 2. The Quesnel Terrane is represented mainly by sedimentary and volcanic rocks of the Upper Triassic Nicola Group and Early Jurassic granodiorite of the Takomkane batholith, but also includes suites of quartz-poor intrusions that crop out mainly in the area of Spout and Peach lakes. Volcanic rocks of the Eocene Skull Hill Formation also underlie significant portions of the map area, and are cut by small dioritic plugs east of Mount Timothy. Olivine-phyric basalt flows of the Miocene-Pliocene Chilcotin Group crop out locally in the southern, western and northern parts of the map area, and Quaternary (?) basalt flows containing lherzolite xenoliths occur on and adjacent to Mount Timothy.

### *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 Upper 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 Nicola Group in the eastern part of the Takomkane Project area includes two major subdivisions — the Lemieux Creek succession, comprising Middle and Upper Triassic sedimentary rocks that make up the eastern part of the group; and the volcaniclastic succession, an assemblage of volcaniclastic and volcanic rocks that crop out over a broad area to the west (Schiarizza and Boulton, 2006a, b; Schiarizza and Macauley, 2007a, b). Most rocks of the Nicola Group in the Timothy Lake map area are here assigned to the volcaniclastic succession. However, two additional units, not recognized to the east, have been mapped in the north-central part of the map area. These are referred to as the polylithic breccia unit and the red sandstone-conglomerate unit.

#### VOLCANICLASTIC SUCCESSION

The volcaniclastic succession of the Nicola Group is widespread within the Timothy Lake map area (Fig 2), but for the most part is represented by small, sparsely scattered exposures that afford no opportunity to establish an internal stratigraphy. Relatively good sets of exposures occur on a series of ridges and hills that extends from Chub Lake northwestward to Greeny Lake, and within the central part of the belt that occurs between the polylithic breccia unit and the red sandstone-conglomerate unit north of Mount Timothy.

Most exposures within the volcaniclastic succession consist of massive, unstratified volcanic breccia containing fragments of mainly pyroxene-phyric and pyroxene-feldspar-phyric basalt. The breccia is typically dark green or grey-green and rusty brown to greenish-brown-weathered (Fig 3). Locally, such as in exposures south and southeast of Greeny Lake, the colour is mottled because the fragments occur in a variety of colours, including light to dark green, grey and maroon. The fragments commonly range from a few millimetres to more than 10 cm in size, but in some exposures the breccia is finer grained, with fragments up to only a few centimetres. Fragments are typically angular to subangular, poorly sorted and matrix-supported, although clast-supported varieties occur locally and some exposures include a substantial proportion of subrounded clasts. The matrix is composed mainly of feldspar, pyroxene and small mafic lithic grains, and locally is calcareous. In many exposures the compositional similarity between clasts and matrix obscures the fragmental texture of the rock.

A substantial proportion of the volcaniclastic succession consists of medium to coarse-grained, locally gritty, medium to dark green or grey-green sandstone that weathers to lighter shades of green or brownish-green. The sandstone occurs as poorly defined intervals within exposures dominated by volcanic breccia, and as individual outcrops or series of outcrops representing many tens of metres in stratigraphic thickness. Most sandstone units consist of feldspar, mafic mineral grains (mainly pyroxene), mafic lithic grains, and variable proportions of dark, fine-grained matrix material. Many sandstone units are massive, but bedding is locally defined by dark laminations or thin interbeds of fine-grained sandstone or laminated siltstone.

Dark green, brownish-weathered basalt forms rare exposures scattered throughout the volcaniclastic succession, and forms a substantial part of the succession south of Spout Lake, near the contact with the overlying polylithic breccia unit. Most basalt units consist of a fine-grained, chlorite-epidote-altered groundmass with sparse to abundant, 1 to 5 mm pyroxene and feldspar phenocrysts, and amygdules of mainly epidote and calcite. Similar pyroxene-feldspar porphyry also occurs as dikes cutting breccia, sandstone and basalt units of the volcaniclastic succession.

Light grey-weathered limestone forms a prominent, isolated ridge of outcrop near the southern boundary of the Timothy Lake map area, 10 km southeast of Lac La Hache. Contacts with adjacent rock units are not exposed, but outcrops of volcanic breccia to the west, northwest and north suggest that the limestone is within the volcaniclastic succession. The limestone displays a prominent platy to flaggy layering that dips gently to the north-northeast (Fig 4). The exposure has a strike length of about 600 m and a stratigraphic thickness of 30 to 40 m. In detail, most of the rock comprises irregular domains of very fine grained, pale brown dolomitic (?) limestone cut by abundant veins and patches of white crystalline calcite. Fossil fragments occur locally, and Campbell and Tipper (1971) report that a fossil

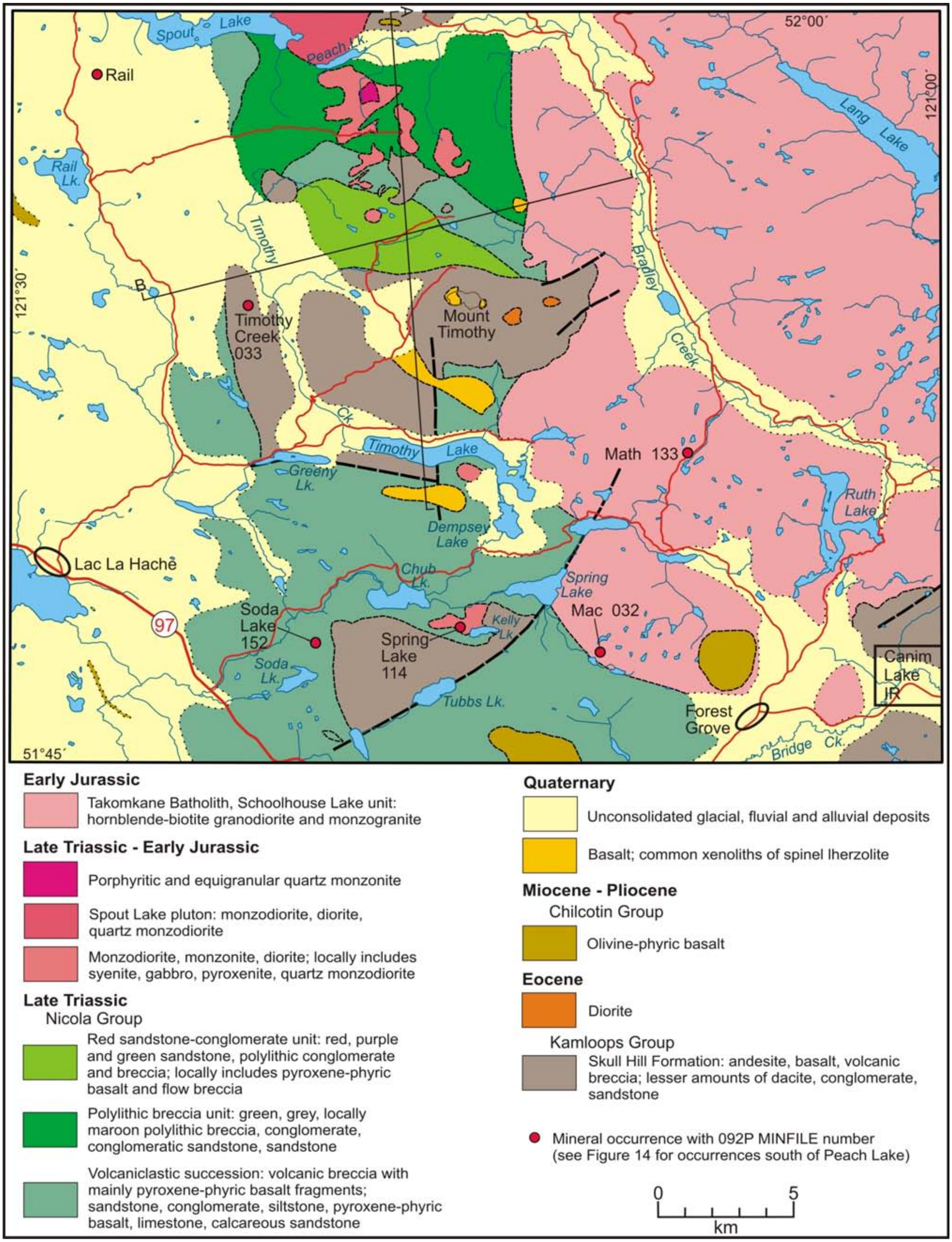



Figure 2. Generalized geology of the Timothy Lake map area, based mainly on 2007 fieldwork.

collection from this exposure indicates a Late Triassic, probably Norian age. This is the only fossil constraint on the age of the Nicola Group within the Timothy Lake map area.

### POLYLITHIC BRECCIA UNIT

The polylithic breccia unit of the Nicola Group crops out in the north-central part of the map area, in an area of relatively good exposure south of Peach Lake. This unit consists mainly of breccia and related conglomerate that contain a variety of clasts, including a significant proportion derived from intrusive rocks. This heterolithic clast population distinguishes the unit from the volcaniclastic succession, where breccia contains fragments of mainly or entirely pyroxene-feldspar-phyric basalt.

The breccia of the polylithic breccia unit has an overall medium to dark green or greenish-grey colour, and commonly weathers to light shades of brown, greenish-brown or beige. It is characteristically matrix-supported and poorly sorted, with angular to subrounded clasts ranging from a few millimetres to 15 cm in size (Fig 5). The clast population is commonly dominated by fine-grained, equigranular to weakly porphyritic feldspathic rocks ranging from diorite to monzonite in composition. Medium-grained gabbro/diorite, monzodiorite and monzonite fragments are also common, as are mafic to intermediate volcanic clasts containing variable proportions of feldspar, pyroxene and hornblende phenocrysts. Small clasts of pyroxenite, syenite and limestone were observed locally. The matrix consists mainly of feldspar with scattered mafic mineral grains. In many exposures it is difficult to distinguish the matrix from the feldspathic fragments that dominate the clast population.

Sandstone is a relatively minor component of the polylithic breccia unit, and occurs as thin bedded to massive intervals ranging from a few centimetres to several tens of metres in thickness (Fig 6). The sandstone intervals are generally dark grey-green in colour, and weather to lighter shades of rusty-brown or greenish-brown. They consist mainly of feldspar and dark, fine-grained matrix material, but locally include a significant proportion of mafic mineral grains (mainly pyroxene). Dark grey siltstone is intercalated with fine to coarse-grained sandstone in some thin bedded intervals, and thin lenses of impure limestone occur along the eastern edge of the belt at the Nemrud skarn occurrence (von Guttenberg, 1995).

Figure 3. Volcanic breccia of the Nicola volcaniclastic succession, Highway 97 near the south boundary of the map area.

Figure 5. Epidote-altered breccia of the Nicola polylithic breccia unit, 4 km east of Peach Lake.

Figure 4. Limestone of the Nicola volcaniclastic succession, 10 km southeast of Lac La Hache. View is to the west.

Figure 6. Thin sandstone units interbedded with conglomerate, Nicola polylithic breccia unit, 2 km southeast of Peach Lake.

Massive sandstone intervals are generally coarse-grained, commonly contain scattered rounded to subrounded pebbles, and locally grade into matrix-supported conglomerate. The clast population of the pebbly sandstone and conglomerate is typically dominated by fine to medium-grained intrusive rocks ranging from gabbro to monzonite in composition.

Volcanic rocks were not positively identified within the polylithic breccia unit, but it includes exposures of aphanitic to fine-grained feldspathic rock, locally with phenocrysts of feldspar and/or pyroxene, of uncertain origin. It is suspected that most of these are high level intrusions, at least in part related to the Spout Lake intrusive suite, but some could be volcanic flows.

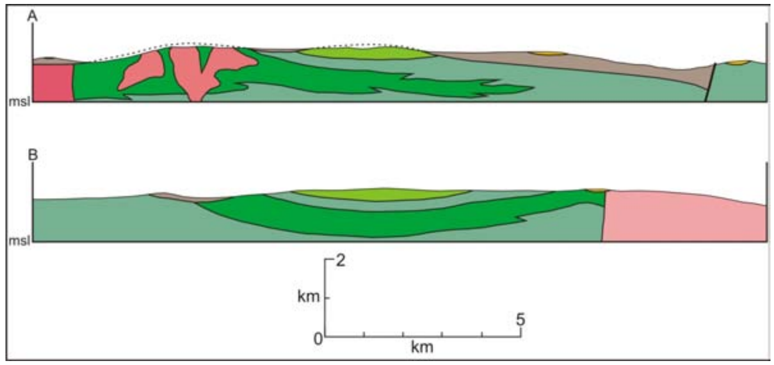


Figure 7. Schematic vertical cross sections along the lines shown in Figure 2.

In the area south of Spout Lake, the polylithic breccia unit is underlain by pyroxene-rich flows and breccia units of the volcaniclastic succession across an east-dipping contact. This contact appears to be one of mixed gradation, with pyroxene porphyry breccia intercalated with polylithic breccia over a stratigraphic interval of several hundred metres. However, the polylithic breccia unit is overlain by pyroxene-rich breccia, sandstone and volcanic rocks assigned to the volcaniclastic succession along its southern margin. It is therefore inferred that the polylithic breccia unit comprises a thick lens that is interleaved with the volcaniclastic succession in its upper part, as schematically shown on Figure 7. The polylithic breccia unit has not been directly dated, but it is older than the monzodioritic stocks and dikes of the Spout Lake intrusive suite that intrude it. One of these stocks has yielded a U-Pb titanite date of 203 ±4 Ma, and a nearby feldspar-phyric andesitic rock, interpreted to be a high level intrusion within the polylithic breccia unit, has yielded a similar U-Pb zircon date of 203.9 ±4.2 Ma (Whiteaker et al., 1998). These dates are Late Triassic according to the time scale of Pálfy et al. (2000). The polylithic breccia unit is therefore inferred to be Late Triassic, because it is within the upper part of the mainly Late Triassic volcaniclastic succession, and is cut by Late Triassic intrusive rocks. Similar breccia in the area of the Mount Polley mine (unit 3 of Panteleyev et al., 1996) is considered to be Early Jurassic because it passes stratigraphically upwards into sedimentary rocks that contain Early Jurassic fossils.

## RED SANDSTONE-CONGLOMERATE UNIT

The red sandstone-conglomerate unit crops out in the north-central part of the map area, north and northwest of Mount Timothy. It overlies the polylithic breccia unit and the intervening section of pyroxene-rich rocks assigned to the volcaniclastic succession, and therefore appears to be the highest stratigraphic element of the Nicola Group exposed within the map area. The top of the unit is not exposed. It is cut by a small porphyritic monzonite plug and is unconformably overlain by Eocene volcanic rock of the Skull Hill Formation. The red sandstone-conglomerate unit consists mainly of sandstone and heterolithic conglomerate and breccia, but also includes pyroxene-phyric volcanic flows and associated flow breccia. The conglomerate and breccia are similar in composition to those of the polylithic breccia unit, but the red sandstone-conglomerate unit is distinguished by a higher proportion of sandstone and its predominant red colour.

The sandstone within the unit is fine to coarse-grained, and consists mainly of feldspar, along with variably altered mafic grains (largely pyroxene) and very fine grained, dark matrix material. The clastic feldspar grains include plagioclase and K-feldspar, and can be subhedral, broken or weakly rounded. Bedding is evident as vague planar laminations (Fig 8), or as thin, planar to gently undulating beds defined mainly by contrasting grain size in adjacent beds. The sandstone is typically red on both weathered and fresh surfaces, but grey and green units are also present, and it is not uncommon for sandstone in a single outcrop to show irregular colour variations, mainly in shades of red and green.

Conglomerate and conglomeratic sandstone are a major component of the red sandstone-conglomerate unit, and locally dominate intervals 100 m or more in thickness. The conglomerate generally has an overall red or purple colour (Fig 9), but locally displays patchy colour variations in shades of red, purple, grey and green. It is matrix-supported and very poorly sorted, with clasts commonly ranging from a few millimetres to 20 cm in size, and locally ranging up to 60 cm across. The clasts are commonly subangular to subrounded, but in places are mainly angular to subangular. They are similar to those found in the polylithic breccia unit, consisting mainly of fine to medium-grained,


Figure 8. Laminated red sandstone of the Nicola red sandstone-conglomerate unit, 6 km northwest of Mount Timothy.

Figure 9. Conglomerate of the Nicola red sandstone-conglomerate unit, 5 km northwest of Mount Timothy.

equigranular to weakly porphyritic, feldspar-rich volcanic and plutonic rock types ranging from monzonite to diorite in composition. The medium to coarse-grained sandy matrix consists largely of feldspar, accompanied by mafic mineral grains and fine-grained matrix material. The fragmental texture is generally more conspicuous than in the polylithic breccia unit, because the matrix tends to be more friable and recessive-weathering.

Basalt flows and related flow breccia are a relatively minor component of the red sandstone-conglomerate unit, but were noted at several different localities within the unit. The flows are commonly mottled in shades of medium to dark purple, grey and green, and weather to lighter shades of these same colours. They include 1 to 3 mm pyroxene phenocrysts that comprise 10 to 20% of the rock, and fewer and smaller feldspar phenocrysts, within a very fine grained groundmass that contains tiny feldspar laths. Irregularly shaped vesicles, up to 1 cm in size, are commonly filled with calcite and chlorite.

The compositions of the various rock types within the red sandstone-conglomerate unit are similar to those of corresponding rock types within the underlying volcaniclastic succession and polylithic breccia unit. The main change is the predominant red to purple colour of all rock types, which may reflect a transition to more oxidizing conditions in a shallow marine or subaerial environment. The unit is undated, but is suspected to be Late Triassic and/or Early Jurassic.

## *Spout Lake Intrusive Suite*

Intrusive rocks of predominantly monzodioritic composition that crop out in the north-central part of the map area are referred to as the Spout Lake intrusive suite. These rocks intrude the polylithic breccia unit and adjacent rocks of the Nicola Group, and are associated with skarn and porphyry-style copper-gold occurrences. The largest intrusive body, here referred to as the Spout Lake pluton, crops out north of Peach Lake and extends beyond the northern limit of the Timothy Lake map area. Finer grained rocks of similar composition form several mappable stocks and numerous dikes that are common within an area of about 25 km$^2$ to the south and southeast of Peach Lake.

### SPOUT LAKE PLUTON

The Spout Lake pluton is represented by a series of good exposures near the northern boundary of the map area, east of Spout Lake and north of Peach Lake. The pluton apparently intrudes the polylithic breccia unit of the Nicola Group to the south, and is overlain by Eocene volcanic rocks to the east, but neither of these contacts is exposed. It extends northward beyond the limit of mapping in the current project for at least 7.5 km to the west end of Murphy Lake (unit TrJsd of Campbell, 1978).

The Spout Lake pluton is of fairly uniform composition where observed within and adjacent to the Timothy Lake map area. It comprises light grey-weathered, medium to coarse-grained, equigranular pyroxene-biotite monzodiorite, locally grading to diorite. Mafic minerals commonly form about 20% of the rock. Pyroxene is more abundant than biotite, but the latter mineral commonly forms larger, more conspicuous grains that partially enclose other minerals. Quartz may be present as a minor constituent, but does not generally form more than 1 or 2% of the rock. Narrow dikes of pink, fine to medium-grained monzonite and syenite are fairly common (Fig 10), and veins and patches of pegmatite, comprising K-feldspar with lesser amounts of plagioclase, quartz and hornblende, occur locally.

The Spout Lake pluton has not been dated, but a sample collected during the 2007 field season has been submitted to the geochronology laboratory at the University of British Columbia for U-Pb dating of zircons. It is suspected that it is of about the same age as the compositionally similar stocks south of Peach Lake, one of which has yielded a Late Triassic U-Pb titanite date (see following section).

### STOCKS AND DIKES SOUTH OF PEACH LAKE

In the area south of Peach Lake, the Spout Lake intrusive suite is represented by the Peach Lake stock, five smaller stocks and plugs, and numerous dikes. Most of the stocks consist of medium grey, light brownish to pinkish grey-weathered, fine to medium-grained, equigranular monzodiorite. The monzodiorite locally grades to diorite or monzonite, but K-feldspar-epidote alteration is ubiquitous, and commonly of such intensity that primary compositions

Figure 10. Diorite cut by a monzonite dike; Spout Lake pluton, northeast of Spout Lake.

are masked. Mafic minerals typically make up 15 to 25% of the rock, and consist of clinopyroxene with lesser amounts of biotite, although biotite locally forms larger, more conspicuous grains. Magnetite, titanite and apatite are common accessory minerals. Pink, equigranular to weakly K-feldspar-phyric monzonite occurs mainly as dikes cutting monzodiorite, but also forms a large part of the northern tip of the stock that crops out south of the main Peach Lake stock. Crowded feldspar porphyry of monzonitic composition also makes up the small circular plug that cuts the red sandstone-conglomerate unit 4.5 km northwest of Mount Timothy. A small patch of clinopyroxenite described by Whiteaker (1996) occurs along the east margin of the stock west of the Peach Lake stock, and pyroxenite also occurs locally as xenoliths within the stock.

A poorly exposed plug of porphyritic quartz monzonite occurs in the eastern part of the Peach Lake stock, where it apparently intrudes the enclosing monzodiorite. This plug was mapped by geologists working for Amax Exploration Inc. in the early 1970s (Leary and Godfrey, 1972) and its presence is confirmed by diamond drilling at the Ann North prospect (Callaghan, 2005). The single exposure of this plug located during the 2007 mapping program comprises K-feldspar phenocrysts set in a groundmass of plagioclase laths, with 10 to 15% quartz and rare mafic grains altered to chlorite, epidote and actinolite.

Most of the stocks south of Peach Lake have irregular, sinuous contacts. Mapping of these contacts is difficult because the stocks and country rocks are commonly heavily altered with K-feldspar and epidote, which makes differentiating the stocks from compositionally similar rocks of the polylithic breccia unit tenuous. Fragmental rocks along some contacts appear to be xenolith-rich marginal phases of the stocks. In other areas, fragmental rocks that have previously been described as intrusive breccia, such as along the south margin of the stock east of the main Peach Lake stock (Whiteaker, 1996), are here interpreted as altered country rock, comprising intrusive-clast breccia of the polylithic breccia unit.

A sample collected from the monzodiorite stock east of the main Peach Lake stock has yielded a U-Pb titanite date of 203 ±4 Ma (Whiteaker et al., 1998). This date was considered to be Early Jurassic by Whiteaker et al. (1998), but is Late Triassic according to the more recent time scale of Pálfy et al. (2000). Samples collected from two separate stocks during the 2007 field season have been submitted to the geochronology laboratory at the University of British Columbia for additional U-Pb dating.

A medium-grained quartz-hornblende-feldspar porphyry dike cuts the monzodiorite stock east of the main Peach Lake stock. The dike is not mineralized, but is spatially associated with areas of relatively gold-rich mineralization within the monzodiorite that it intrudes (Aurizon occurrence). The mineralogy of the dike suggests that it is not related to the Spout Lake intrusive suite. Whiteaker et al. (1998) report that zircons from a sample of this dike yielded a poorly-constrained upper intercept U-Pb date of 199 +23/–13 Ma.

### Kelly Lake Stock

The Kelly Lake stock is represented by a few scattered exposures of monzodiorite to diorite that extend from the shore of Kelly Lake northward about 800 m to 111 Mile Creek, between Spring and Chub lakes. The stock is inferred to extend about 1.5 km west of Kelly Lake on the basis of diamond-drill holes cored during mineral exploration of the Spring Lake copper occurrence (Blann, 1995b). The stock intrudes breccia and sandstone of the Nicola volcaniclastic succession, although the contact is not exposed on surface, and is overlain to the east by volcanic rocks of the Skull Hill Formation.

The exposures of the Kelly Lake stock located during the present study consist mainly of grey, grey-brown-weathered, fine to medium-grained, equigranular monzodiorite and diorite. Mafic minerals make up 15 to 30% of the rock and consist mainly of clinopyroxene and biotite. Minor amounts of quartz are present locally, and titanite and apatite are conspicuous in thin section. The main phases of the stock are variably altered with K-feldspar, epidote and chlorite, and are locally cut by narrow dikes of monzodiorite to syenite. The Kelly Lake stock has not been dated, but is suspected to be of about the same age as the compositionally similar Peach Lake stocks.

### Intrusive Rocks South of Timothy Lake

An intrusive body is inferred to underlie the area south of the east end of Timothy Lake, based on extensive angular rubble located in a recent logging cut 1 km northwest of the narrows between Timothy and Dempsey lakes. The rubble comprises red, fine to medium-grained syenite to monzonite with chlorite-epidote alteration along joint and fracture surfaces. Eighteen hundred metres to the southeast, on the northeast side of Dempsey Lake, a 60 m percussion-drill hole intersected diorite that might be part of the same intrusive system (PDH TY2-82-1; Gamble, 1983b). The presence of these intrusive rocks is noteworthy because of their compositional similarity to the economically-significant Spout Lake intrusive suite.

### Takomkane Batholith

The Takomkane batholith is a large Late Triassic–Early Jurassic granitic pluton more than 40 km wide (Fig 1). The southwestern part of the batholith underlies much of the eastern part of the Timothy Lake map area, where it intrudes the Late Triassic Nicola Group to the west, and is locally overlain by volcanic rocks of Eocene, Miocene-Pliocene and Quaternary (?) ages. To the east, in the Canim Lake map area, the batholith has been subdivided into two units, referred to as the Boss Creek unit and the Schoolhouse Lake unit (Schiarizza and Boulton, 2006a). The entire exposure belt within the Timothy Lake map area is correlated with the Schoolhouse Lake unit.

The Schoolhouse Lake unit is very homogeneous throughout its extent in the Timothy Lake map area. It consists of light grey to pinkish grey, coarse to medium-grained, hornblende-biotite granodiorite, locally grading to monzogranite. Tonalite occurs locally along the western margin of the batholith, northeast of Mount Timothy. Mafic minerals commonly make up 10 to 20% of the granodiorite, with hornblende predominating over biotite. The texture is typically porphyritic, with K-feldspar crystals up to several centimetres in size and, locally, quartz grains and aggregates up to 1 cm in size (Fig 11). Pegmatite and aplite dikes are a widespread but relatively minor component of the unit. Grey to pink quartz porphyry and quartz-feldspar porphyry dikes that locally cut the batholith and the adjacent Nicola Group may also be broadly related.

Figure 11. Granodiorite with K-feldspar phenocrysts; Takomkane batholith, northwest of Lang Lake.

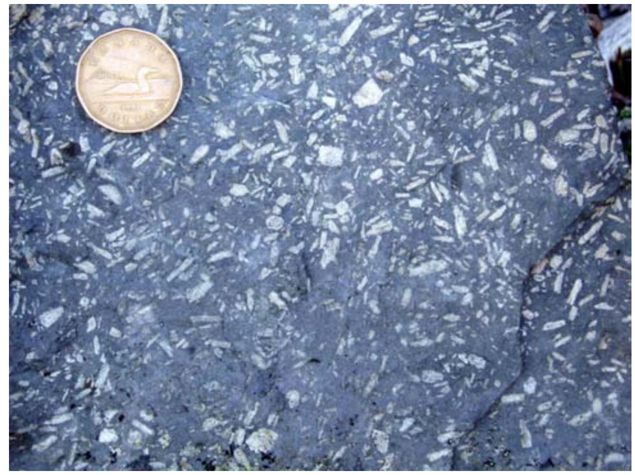


Figure 12. Plagioclase-phyric andesite of the Skull Hill Formation, south flank of Mount Timothy.

The Takomkane batholith within the Timothy Lake map area has yielded a U-Pb zircon date of 193.5 ±0.6 Ma from a sample collected at Ruth Lake (Whiteaker et al., 1998). This Early Jurassic age for the Schoolhouse Lake unit is confirmed by a U-Pb zircon date of 195.0 ±0.4 Ma from a sample collected a short distance east of Lang Lake (Schiarizza and Macauley, 2007a).

### Skull Hill Formation

Campbell and Tipper (1971) assigned Eocene volcanic rocks in the Bonaparte Lake map sheet to the Skull Hill Formation of the Kamloops Group. The most extensive exposures in the Timothy Lake map area are on and around Mount Timothy, but the formation also crops out in several areas to the south and north of the mountain, as well as in the southeast corner of the map area. The latter exposures comprise the north end of a continuous belt of Eocene rocks that Campbell and Tipper (1971) traced 70 km south to Bonaparte Lake. They recognized that Eocene rocks were also present farther to the northwest, but mapping during the current project shows that the Skull Hill Formation is much more extensive than portrayed by Campbell and Tipper (1971). Numerous small outliers of the formation in the north-central part of the map area suggest that the belt that encompasses Mount Timothy once formed a continuous blanket that extended to beyond the northern boundary of the map area.

The Skull Hill Formation unconformably overlies a number of different Mesozoic rock units within the Timothy Lake map area, including various units of the Nicola Group, the Takomkane batholith, the Spout Lake pluton, and the Kelly Lake stock. The southern boundaries of the Mount Timothy belt and the belt to the south are inferred to be controlled by east to northeast-striking faults. The formation consists mainly of andesitic to basaltic flows and associated flow breccia, but also includes dacitic flows, volcanic breccia, and rare exposures of arkosic wacke. The most common rocks are grey to brown, purplish brown-weathered andesitic flows characterized by abundant coarse plagioclase phenocrysts, and less conspicuous pyroxene and/or hornblende phenocrysts (Fig 12). Dark grey basaltic flows are also fairly common, and contain pyroxene and plagioclase phenocrysts. The andesitic and basaltic flows are commonly vesicular, and vesicles are typically filled with chalcedonic quartz or calcite. Pale grey dacitic flows are relatively rare, and were observed only in the southeastern corner of the map area, north of Bridge Creek, and in the Eocene section that crops out along the north-central boundary of the map area.

Volcanic breccia is most common on the top and south flank of Mount Timothy. It comprises purple, green and grey volcanic fragments, from less than 1 cm to more than 10 cm in size, within a friable matrix that is rich in feldspar grains. The volcanic fragments commonly contain various combinations and proportions of feldspar, pyroxene and hornblende phenocrysts. Locally, the breccia includes narrow intervals of thin-bedded sandstone to small pebble conglomerate containing volcanic-lithic grains and crystals of feldspar and mafic minerals. The breccia locally resembles that of the Nicola Group, but it shows considerably less chlorite-epidote alteration, and is clearly interbedded with the feldspar-phyric flows that characterize the Skull Hill Formation. Coarser breccia, comprising poorly sorted fragments up to 1.5 m across, within a friable, pale grey-green, feldspar-rich matrix, crops out on an isolated ridge in the southeast corner of the map area, south of Bridge Creek. External contacts were not observed, but this coarse breccia is within an area dominated by andesitic to basaltic flows that are typical of the Skull Hill Formation.

### Eocene or Younger Diorite

Grey, fine to medium-grained, equigranular diorite makes up two small plugs that intrude volcanic flows and breccia of the Skull Hill Formation on the east flank of Mount Timothy. The dioritic rocks consist of plagioclase, locally with traces of K-feldspar, along with 25 to 35% mafic minerals that include hornblende, clinopyroxene and biotite. These diorite bodies have not been dated, but are inferred to be Eocene or younger because they cut rocks assigned to the Eocene Skull Hill Formation.

### Chilcotin Group

The Chilcotin Group comprises flat-lying basalt flows and related rocks that cover much of the Interior Plateau of south-central British Columbia. The group ranges from

Early Miocene to Early Pleistocene in age, and is contemporaneous with the more voluminous Columbia River flood basalts of Oregon and Washington states (Mathews, 1989). The Chilcotin Group is currently the focus of a major research program at the University of British Columbia, aimed at better understanding the volcanic lithofacies and thickness variations within the group (Andrews and Russell, 2007).

The Chilcotin Group within the Timothy Lake map area is represented by two outliers near Forest Grove in the southern part of the area, by a very small outlier northeast of Peach Lake near the northern boundary of the map area, by a few exposures along the railway tracks south of Lac La Hache, and by an exposure west of Rail Lake. The latter two areas, near the western edge of the map area, are apparently part of a very extensive blanket of Chilcotin basalt flows that stretches far to the west and south. Our mapping, combined with data from exploration drillholes northeast of Rail Lake, shows that this blanket does not extend as far into the Timothy Lake area as indicated on the reconnaissance-scale map of Campbell and Tipper (1971).

The Chilcotin Group within the Timothy Lake map area consists of dark grey to blue-grey, brownish-weathered, very fine grained basalt that is variably vesicular and commonly contains pale green olivine phenocrysts 1 to 3 mm in size. The greatest thickness occurs in the outlier west of Forest Grove, where close to 100 m of basalt is exposed. The outlier north-northwest of Forest Grove has yielded a Middle to Late Miocene K-Ar whole rock date of 11.8 ±0.5 Ma (Mathews, 1989).

### *Mount Timothy Basalt*

Flat-lying basalt containing peridotite xenoliths occurs as five separate outliers within a north-south belt, 11 km long, which encompasses Mount Timothy (Fig 2). The basalt is grey, locally maroon, very fine grained and weakly to moderately vesicular. Red, scoriaceous basalt breccia was noted at the base of the western outlier on Mount Timothy, and also near the base of the northernmost outlier. Peridotite xenoliths, mainly spinel lherzolite, are common in all five outliers of the Mount Timothy basalt and commonly range up to 20 cm in size (Fig 13). These are locally accompanied by smaller and less common crustal xenoliths consisting mainly of medium-grained dioritic rock.

Figure 13. Basalt with lherzolite xenoliths, south flank of Mount Timothy.

The Mount Timothy basalt, including the lherzolite xenoliths, is very similar to xenolith-bearing basalt that caps Takomkane Mountain, 30 km northeast of Mount Timothy (Schiarizza and Macauley, 2007a). The basalt on Takomkane Mountain is inferred to be Pleistocene because it rests on a glaciated surface but has been sculpted by subsequent glacial action (Sutherland Brown, 1958). We suspect that the Mount Timothy basalt is of similar age.

## STRUCTURE

Outcrop scale structures within the Timothy Lake map area consist mainly of brittle faults and fractures that are more common in Mesozoic rocks than in Eocene rocks of the Skull Hill Formation. Folds of bedding were observed only rarely within the Nicola Group, and penetrative foliations occur in only a few exposures of hornfelsed and skarn-altered rocks of the Nicola Group along the margin of the Takomkane batholith.

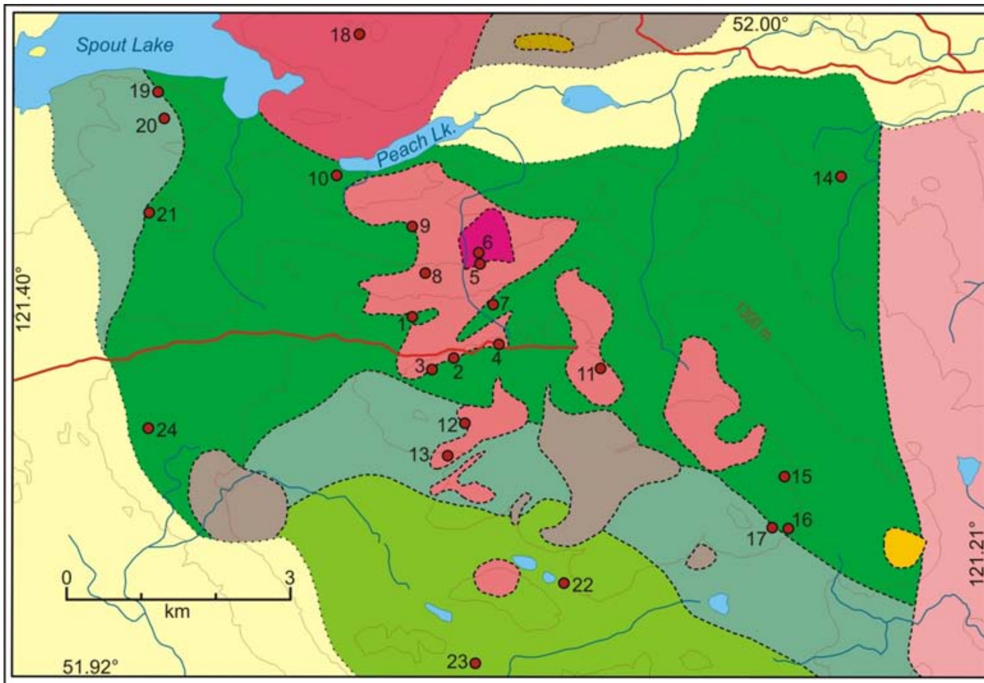
The macroscopic structure of the Nicola Group within most of the map area is very poorly understood due to poor exposure, a lack of marker units, and the predominance of apparently non-stratified rocks. An exception is the area north of Mount Timothy, where the three mappable units of the Nicola Group outline a broad syncline with a poorly defined axial trace (Fig 7). Rocks in the core of the syncline are more or less horizontal. Those on the west limb generally dip eastward at gentle to moderate angles, although sandstone near the base of the polylithic breccia unit south of Spout Lake is nearly vertical. Rocks on the east limb dip gently westward, but are folded through an anticlinal hinge a short distance west of the Takomkane batholith and generally dip eastward at the batholith contact.

Most of the faults mapped within the Timothy Lake area strike east to northeast and partially control the distribution of Eocene rocks. The largest of these, the Greeny Lake and Spring Lake faults, juxtapose Eocene rocks on their north side against Triassic rocks to the south, so are inferred to have a component of Eocene or younger north-side-down displacement. The Spring Lake fault may also have component of dextral strike slip, based on the apparent offset of the Takomkane batholith. Although they are faulted, Eocene rocks are essentially horizontal wherever bedding orientations were observed.

Although Eocene or younger faults are clearly present, many of the outcrop scale faults observed within Mesozoic rocks are inferred to be pre-Eocene because these structures are much more prevalent in the older rocks. Steeply dipping faults with northwest, north and northeast strikes are most common. Topographic lineaments with these orientations are also common but, with the exception of the mapped Eocene or younger faults, none have been proven to be controlled by major faults. In the Peach Lake area, northwest, northeast and east-striking structures control some of the alteration and mineralization associated with the Spout Lake intrusive suite.

## MINERAL OCCURRENCES

The metallic mineral occurrences known within the Timothy Lake map area (MINFILE, 2007) are concentrated in the area south of Peach Lake, and are summarized on Fig-




| Map Label | Name | MINFILE # | Map Label | Name | MINFILE # |
|---|---|---|---|---|---|
| 1 | Peach 1 | 092P 001 | 13 | Miracle-Central | 092P 124 |
| 2 | Peach 2 | 092P 034 | 14 | Nemrud | 092P 003 |
| 3 | Jody | 092P 034 | 15 | Tim #1 | 092P 122 |
| 4 | Peach 3 | 092P 035 | 16 | Tim #2 | 092P 122 |
| 5 | Peach 5 | 092P 115 | 17 | Tim #3 | 092P 122 |
| 6 | Ann North | 092P 002 | 18 | SS | 092P 004 |
| 7 | NK | na | 19 | WC - North | 092P 120 |
| 8 | Harvey | na | 20 | WC - South | 092P 120 |
| 9 | Northeast-mag | na | 21 | Red | na |
| 10 | Peach-Melba | 092P 108 | 22 | Cyan - NE | 092P 121 |
| 11 | Aurizon | 092P 153 | 23 | Cyan - SW | 092P 121 |
| 12 | Miracle-Discovery | 092P 124 | 24 | Club | na |

Figure 14. Geology and mineral occurrences in the Peach Lake area. See Figure 2 for legend.

ure 14. Most of these are copper-gold porphyry and skarn occurrences associated with stocks of the Spout Lake intrusive suite. Mineral occurrences scattered through other parts of the Timothy Lake map area are shown on Figure 2. These include porphyry-style copper-gold mineralization associated with the Kelly Lake stock, disseminated chalcopyrite within the Nicola Group north of Soda Lake, molybdenum-copper showings within the Takomkane batholith, and structurally controlled polymetallic veins within the Kamloops Group west of Timothy Creek.

## *Occurrences in the Peach Lake area*

### PEACH 1 (MINFILE 092P 001)

The Peach 1 showing is located 2 km south of Peach Lake. It is the first mineral occurrence discovered in the Peach Lake area, and was explored with trenches and some short diamond-drill holes by Coranex Ltd. and Amax Exploration Ltd. between 1967 and 1972 (Janes, 1967; Sutherland Brown, 1969; Leary and Godfrey, 1972). In 1991, the trenches were remapped and sampled by Asarco Exploration Company of Canada Ltd., and an area south of the trenches was tested with 2 short percussion-drill holes (Gale, 1991).

Mineralization at the Peach 1 showing is hosted by the polylithic breccia unit within a narrow embayment in the southern part of the Peach Lake stock. Chalcopyrite is the main sulphide mineral. Pyrite is present in minor quantities, as are malachite, azurite and native copper. The chalcopyrite occurs along fractures and locally as disseminations within several northeast-trending zones (Janes, 1967). Associated alteration assemblages include K-feldspar, magnetite, tourmaline and biotite. Sutherland Brown (1969) notes that the stockwork pattern within the mineralized zones is partly random, but is dominated by northward dipping fractures that strike east-northeast or west-northwest. A 12 m section sampled by Coranex Ltd. in 1967 returned 0.33% Cu and 0.576 g/t Au (Janes, 1967).

### PEACH 2 (MINFILE 092P 034), JODY, AND PEACH 3 (MINFILE 092P 035)

The Peach 2 showing is located about 700 m southeast of the Peach 1 occurrence, along a northeast-trending contact zone that forms part of the southern margin of the Peach Lake stock. The mineralization was evaluated with trenches and percussion-drill holes by Amax Exploration Inc. in 1972 and by Asarco Exploration Company of Canada Ltd. in 1991 (Leary and Godfrey, 1972; Gale, 1991).

Subsequent exploration by GWR Resources Inc. included two diamond-drill holes in 1999 (Blann, 2001a), and two additional diamond-drill holes and a major trenching program in 2004 (Callaghan, 2005).

Mineralization consisting of pyrite, chalcopyrite and minor bornite occurs sporadically throughout the 150 m by 45 m area that was exposed by the recent GWR Resources Inc. trenches. Hostrocks include potassic-altered monzodiorite as well as altered breccia and related rocks of the polylithic breccia unit. The mineralization occurs in shears, fractures and narrow veins of variable orientation, and is associated with alteration assemblages that contain K-feldspar, epidote, magnetite and locally biotite. A 28 m trench sample collected by GWR Resources Inc. in 2004 returned 0.07% Cu and 0.22 g/t Au. The highest grades encountered came from a 2 m sample that contained 0.34% Cu and 2.25 g/t Au (Callaghan, 2005).

Mineralization is also known to occur about 300 m southwest of the Peach 2 occurrence, in an area known as the Jody zone, which was explored with two trenches and five percussion-drill holes in 1991. Mineralization is within the polylithic breccia unit a few tens of metres from the contact with the Peach Lake stock. Chalcopyrite is associated with K-feldspar-magnetite-chlorite alteration along north, northwest and west-striking fractures and faults. A sequence of six 5 m chip samples from one of the trenches returned a combined grade of 0.17% Cu and 93 ppb Au (Gale, 1991, samples 061470–061475).

The Peach 3 showing is 500 m east-northeast of the Peach 2 occurrence, where several recent trenches and scraped areas expose monzodiorite, sparsely mineralized with chalcopyrite and malachite, along the main exploration/logging road (Telegraph Corner area of Callaghan, 2005). The monzodiorite is variably altered with K-feldspar and epidote. Chalcopyrite occurs mainly as disseminated grains associated with magnetite, chlorite and pyrite along variably oriented fractures with K-feldspar haloes. The mineralization was tested with one diamond-drill hole in 1995 (von Guttenberg, 1996, hole A95-04) and two diamond-drill holes in 2004 (Callaghan, 2005, holes 04-31 and 04-32). None of these holes intersected significant mineralization — the best intersections from hole A95-04 were 0.13% Cu and 0.06 g/t Au over 4.6 m, and 1.31% Cu and 0.07 g/t Au over 1.0 m. The latter intersection includes a 30 cm thick quartz-calcite vein that contains specularite, chalcopyrite and bornite (von Guttenberg, 1996).

## PEACH 5 (MINFILE 092P 115) AND ANN NORTH (MINFILE 092P 002)

The Peach 5 and Ann North occurrences are 1 500 to 1 700 m south-southeast of Peach Lake, and are associated with a small porphyritic quartz monzonite plug or dike swarm that is within the Peach Lake monzodiorite stock. The plug is very poorly exposed on surface, but was identified during exploration by Amax Exploration Inc. in 1972. The Peach 5 showing was also discovered at this time, in a trench along or near the southern margin of the stock where porphyritic quartz monzonite cuts monzodiorite. The mineralization is described as chalcopyrite in veined monzodiorite, minor disseminated chalcopyrite in the porphyritic quartz monzonite, and minor but widespread malachite along the trench (Leary and Godfrey, 1972). A small patch of subcrop at or near the remnant of this trench was located during the present field program, and comprises K-feldspar-epidote-altered porphyritic quartz monzonite stained with malachite.

The Ann North prospect was discovered during a diamond drill program by GWR Resources Inc. in 2000, when eight of thirteen holes drilled to the north and northeast of the Peach 5 showing intersected significant mineralization. This included a 125 m intersection in hole 00-15 that returned 0.20% Cu and 0.3 g/t Au, including a 44 m interval containing 0.31% Cu and 0.41 g/t Au (Blann, 2001a). The mineralized area was further evaluated with a 13 hole, 3 536 m diamond drill program carried out by GWR Resources Inc. in 2004 and 2005. Significant mineralized zones were intersected in seven of the holes, including a 107.3 m interval in hole 04-19 that assayed 0.29% Cu and 0.33 g/t Au (Callaghan, 2005).

The main area of mineralization outlined by drilling at the Ann North prospect is centred about 150 m north of the Peach 5 showing. Mineralization is hosted mainly by potassic-altered quartz monzonite and porphyritic quartz monzonite, and occurs as a series of northeast-trending, steeply northwest-dipping lenses with widths up to 35 m and a combined strike length of more than 200 m (Callaghan, 2005). Mineralization consists of chalcopyrite and pyrite, locally with bornite, tennantite, chalcocite and native copper. Copper minerals occur as patches, disseminations, and vein and fracture-fillings, and are associated with vein and alteration assemblages that include K-feldspar, quartz, magnetite, carbonate and tourmaline.

## NK ZONE

The NK zone, located about 2 200 m south of Peach Lake, is hosted in altered breccia of the polylithic breccia unit along the southeast margin of the Peach Lake stock. The mineralization was discovered by diamond drilling carried out by GWR Resources Inc. in 1999 and 2000 (Blann, 2001a). Chalcopyrite, bornite and pyrite occur as disseminations and along fractures with variable orientations. Fracture-controlled malachite, native copper and chalcocite occur in the upper parts of drillholes. Alteration assemblages include magnetite, biotite, chlorite, epidote, albite and K-feldspar. Mineralized drill intersections are interpreted as three sub-parallel north-northeast-trending zones, 15 to 50 m wide and 100 m long, that remain open (Blann, 2001a). Notable intercepts include 89.3 m grading 0.186% Cu and 0.23 g/t Au, and 13.5 m grading 0.391% Cu and 0.24 g/t Au (Blann, 2001a).

## HARVEY AND NORTHEAST-MAG ZONES

GWR Resources Inc. explored an 800 m by 500 m area in the western part of the Peach Lake stock with 2 782 m of diamond drilling in 19 holes between June 2002 and February 2004 (Barker, 2002, 2003; Callaghan, 2005). Barker (2002, 2003) referred to the southern part of this area as the Harvey zone, and called the northern part the Northeast-mag zone. Copper-gold mineralization was encountered in a number of the holes, and consists of pyrite and chalcopyrite as disseminations and fracture and vein fillings, associated with alteration minerals that include K-feldspar, epidote, magnetite and tourmaline. The host rock is mainly fine-grained K-feldspar-epidote-altered monzodiorite. Significant drill intersections include 85.2 m containing 0.25% Cu, 0.12 g/t Au and 0.77 g/t Ag from the Harvey zone (Barker, 2002), and 9 m grading 0.47% Cu and 0.46 g/t Au from the Northeast-mag zone (Barker, 2003).

About 1 km west of the Harvey zone are natural and recently trenched exposures that display chalcopyrite-malachite mineralization within both the Peach Lake stock and adjacent breccia and sandstone of the polylithic breccia unit. Mineralization in both units is concentrated along steeply dipping, west-striking faults. Chalcopyrite mineralization within the polylithic breccia unit is associated mainly with patches of calcite and tourmaline that are enclosed by zones of strong K-feldspar-epidote alteration. The mineralization hosted by monzodiorite of the adjacent Peach Lake stock comprises chalcopyrite and magnetite within structurally controlled zones of intense K-feldspar-epidote alteration.

### PEACH-MELBA (MINFILE 092P 108)

The Peach-Melba prospect is located about 100 m southwest of the west end of Peach Lake. It is hosted by the polylithic breccia unit of the Nicola Group a short distance south of the Spout Lake pluton and northwest of the Peach Lake stock. The occurrence is associated with a large, northwest-trending induced polarization anomaly that was tested with several drill programs by different companies between 1972 and 1994. The Peach-Melba zone was discovered when GWR Resources Inc. drilled a hole on the northeast flank of the anomaly in the spring of 1995, which yielded an intersection of 77.4 m containing 0.23% Cu and 0.23 g/t Au (Blann, 1995a, hole PL95-2). Hole PM95-01, cored later that same year, yielded a 112 m intersection grading 0.20% Cu and 0.13 g/t Au (von Guttenberg, 1996). Additional drilling within and adjacent to the zone was carried out in 1997, 2002, 2003 and 2005 (Callaghan, 2005).

The main mineralized zone at the Peach-Melba prospect trends northwest, dips steeply, and has a true width of about 80 m (von Guttenberg, 1996). Mineralization consists of disseminated and fracture controlled pyrite-chalcopyrite associated with alteration assemblages that include K-feldspar, biotite, epidote, magnetite and hematite. Host rocks include breccia and finer grained rocks of the Nicola Group as well as monzonite and syenite dikes. Pyroxene-garnet skarn, sparsely mineralized with magnetite and chalcopyrite, was intersected in drillholes east of the main mineralized zone (von Guttenberg, 1996).

### AURIZON (MINFILE 092P 153)

The Aurizon occurrence is within a monzodiorite stock that crops out to the east and southeast of the Peach Lake stock. The mineralization was discovered by GWR Resources Inc. in 1994 when two diamond-drill holes were cored to test coincident induced polarization and copper in soils anomalies. One of these holes intersected copper-gold mineralization in 5 separate intervals. The best intersections, 3.8 m grading 11.41 g/t Au and 0.22% Cu, and 2.4 m grading 3.56 g/t Au and 0.47% Cu, were in quartz-calcite-chalcopyrite-veined monzodiorite along both margins of a quartz-hornblende-feldspar porphyry dike (Blann, 1995c). Three additional holes were drilled in 1995 to test for mineralization along the margins of the dike, but returned generally low and erratic gold values (von Guttenberg, 1996). More recent work by GWR Resources Inc., including part of the 2007 drill program, is targeting other portions of the Aurizon stock, which displays copper mineralization in many of the exposures examined during our 2007 field program. This mineralization consists of weakly to heavily disseminated chalcopyrite and magnetite, locally with malachite and native copper, along variably oriented fracture surfaces within monzodiorite that is strongly altered with K-feldspar and epidote. The highest grade mineralization observed comprises clots and disseminations of chalcopyrite within a steeply dipping, northeast-striking zone of highly fractured monzodiorite veined with calcite and epidote. A grab sample from this mineralized zone, taken 1 km north of the Aurizon showing, returned 3 634 ppb Au and greater than 1% Cu.

### MIRACLE (MINFILE 092P 124)

The Miracle prospect, 4 km south of Peach Lake, comprises porphyry-style Cu-Au mineralization associated with a small stock that crops out south of the Peach Lake stock. Mineralization was discovered by local prospectors in 1986, along a newly constructed logging road, and staked as the Miracle claims. The claims were optioned to GWR Resources Inc. and explored with geological mapping, trenching, geophysical and geochemical surveys and thirteen diamond-drill holes in 1987 through 1992 (White, 1987; Dunn, 1992). This work showed that Cu-Au mineralization is widespread, but did not outline any major zones with demonstrable continuity. A 2 691 m diamond drilling program in 1994 focused on an induced polarization anomaly that was outlined by a 1993 survey to the south and west of the area of previous drilling. This program outlined a northeast-trending zone of mineralization that was referred to as the Central zone (Blann, 1995d). Two additional holes were drilled on the south side of the induced polarization anomaly in 1995, but did not intersect any significant mineralization (von Guttenberg, 1996).

The Discovery showing of the Miracle prospect, currently marked by a partially caved trench, comprises altered, grey-green hornfels cut by dikes of monzodiorite and several heavily limonite-altered fault zones up to 1.5 m wide. The fault zones strike northwest and are more or less vertical, as are many of the dikes. Zones of strong K-feldspar-epidote±hematite alteration have multiple orientations, but are most common along steeply dipping, northwest to north-northwest-striking fractures and dike contacts (Fig 15). Most primary minerals have been leached from the gossanous fault zones, but traces of specularite, pyrite and chalcopyrite occur locally. Malachite occurs along fractures in the fault zones and in some

Figure 15. Potassium-feldspar-epidote-hematite alteration in a monzodiorite dike and adjacent hornfels; Discovery showing of the Miracle prospect.

of the monzodiorite dikes. A diamond-drill hole directed under the trench in 1988 included an 18 m intersection grading 0.23% Cu and 0.17 g/t Au (Blann, 1995d).

The Central zone of the Miracle prospect is several hundred metres south of the Discovery zone. It comprises mineralized drill intersections in a northeast-trending corridor about 650 m long within the southwest lobe of the stock. The mineralization is hosted by K-feldspar-altered monzodiorite, and consists of pyrite and chalcopyrite, with minor amounts of bornite and tetrahedrite, as disseminations and fracture and vein stockworks (Blann, 1995d). The best intersection is near the southwest end of the zone, where hole M94-1 cut 72 m grading 0.17% Cu and 0.21 g/t Au (Blann, 1995d).

### NEMRUD (MINFILE 092P 003)

The Nemrud skarn prospect is hosted in the polylithic breccia unit of the Nicola Group near its contact with the Takomkane batholith, about 5 km east of Peach Lake. Mineralized skarn was noted in this area by geologists working for Coranex Ltd. in the 1960s, when it was referred to as the Tim #1 showing (Janes, 1967). The main exploration work was conducted from 1993 through 1995, when the occurrence was covered by the Riley 1 claim and explored by Strathcona Mineral Services Ltd. for the Lac La Hache Joint Venture of Regional Resources Ltd. and GWR Resources Inc. The first phase of this exploration program included geological mapping, prospecting, soil, silt and rock sampling, and induced polarization and magnetometer geophysical surveys (von Guttenberg, 1994). This was followed by a program of diamond drilling that included 1 018 m in fourteen holes on the skarn occurrence, as well as 567 m in six holes to test nearby induced polarization anomalies (von Guttenberg, 1995).The results of this work, and follow-up drilling of 392 m in two holes, did not encourage further exploration of the Nemrud occurrence at that time (von Guttenberg, 1996), and no additional work has been recorded.

Outcrops of mineralized skarn on the Nemrud prospect are scattered over an area 600 m long and up to 250 m wide, along and adjacent to a north-south ridge about 400 m west of the Takomkane batholith. Mineralization comprises blebs of bornite, and rarely chalcopyrite, pyrite, native copper and malachite, within skarn-altered rock that includes garnet, diopside and epidote. Grab samples of mineralized material have returned values of up to 3.57% Cu, 82.1 ppm Ag and 1 257 ppb Au (von Guttenberg, 1994, sample 93-RCS-027). Diamond drilling indicates that mineralization is mainly within a zone that is 20 to 25 m thick, comprising intercalated lenses of skarn, impure marble, volcanic sandstone or tuff, siltstone, and possible mafic to intermediate volcanic flows (von Guttenberg, 1995). This zone is gently undulating but dips mainly to the east at shallow angles. The enclosing rocks are variably hornfelsed and skarn-altered breccia, conglomerate, sandstone and siltstone of the Nicola polylithic breccia unit, locally cut by diorite and granodiorite dikes.

The mineralized skarn zone outlined by the initial phase of drilling on the Nemrud prospect was traced to within about 350 m of the contact with the Takomkane batholith. It has a typical average grade of 0.1% Cu, 0.03 g/t Au and 1 g/t Ag, but includes sections, 2 to 3 m long, that may carry up to 0.4% Cu, 0.1 g/t Au and 5 g/t Ag (von Guttenberg, 1995). Follow-up drilling included a 214 m hole to test the down-dip extension of the mineralized zone closer to the Takomkane batholith, which was suspected to be the source of the skarn alteration and mineralization. This hole showed an eastward increase in the amount of massive skarn, but a marked decrease in copper mineralization (von Guttenberg, 1996). Subsequent determination of the lead isotope composition of a sulphide sample from the Nemrud prospect suggests that the mineralization may be related to the Spout Lake intrusive suite, represented locally by rare dioritic dikes, rather than the Takomkane batholith (Whiteaker et al., 1998).

### TIM (MINFILE 092P 122)

The Tim showings comprise several occurrences of chalcopyrite-pyrite-bornite mineralization located 3.5 to 4.5 km north of Timothy Mountain. Mineralization is hosted in the volcaniclastic and red sandstone-conglomerate units of the Nicola Group, and is associated with a series of monzodiorite dikes that are part of the Spout Lake intrusive suite. Three main showings, referred to as the Tim 1, Tim 2 and Tim 3 showings, were discovered during a geological mapping program by Amax Exploration Inc. in 1972 (Leary and Allan, 1972). The area was restaked by Stallion Resources Ltd. in 1979, and explored with a program that included six short diamond-drill holes on the Tim 1 showing in 1983 (Butler, 1984). The claims were subsequently optioned by Liberty Gold Corp. and explored with VLF-EM, magnetometer, induced polarization and soil geochemical surveys in 1988 and 1989 (White, 1988; Seywerd, 1990). These surveys were followed by a 1990 program that included geological mapping, a detailed induced polarization survey, 736 m of percussion drilling in seven holes and 1 245 m of diamond drilling in twelve holes (Reynolds, 2006), although none of this work was filed for assessment credit. The claims were allowed to lapse, but the known mineral showings and anomalies were staked by P. Reynolds in 1997 as the Tam and Mat claims. These claims were optioned to GWR Resources Inc. in 2001, and explored with a program of geological mapping, soil and rock sampling and diamond drilling (Blann, 2001b). They were then optioned by Tatmar Ventures Inc., and evaluated with induced polarization, magnetometer and soil geochemical surveys in 2004 through 2006 (Reynolds, 2006).

Much of the exploration work on the Tim occurrence has been focused on the Tim 1 showing, located about 500 m southeast of the easternmost monzodiorite stock. Mineralization is associated with a monzodiorite dike that dips steeply to the northwest, and occurs within the dike itself and the country rock along its northwest margin. Mineralization consists of disseminations and fracture and vein stockworks containing pyrite, chalcopyrite and minor bornite, associated with epidote and K-feldspar (Leary and Allan, 1972). Diamond drilling carried out in 1983, 1990 and 2001 indicates that mineralization occurs in several sub-parallel, northeast-striking zones, 2 to 10 m thick, that have been traced for a strike length of 50 m and remain open (Blann, 2001b). Intercepts from the 2001 drilling program include 0.61% Cu, 0.18 g/t Au and 6.0 g/t Ag over 17.4 m in hole TAM01-1, and 0.50% Cu, 0.11 g/t Au and 3.0 g/t Ag over 5.6 m in hole TAM01-2 (Blann, 2001b).

The Tim 2 showing is located about 800 m south of the Tim 1 showing. It comprises K-feldspar-epidote-calcite-magnetite stockworks containing chalcopyrite and pyrite. This mineralization has been traced intermittently over more than 200 m within sheared rock along the southwest margin of a northwest-striking monzodiorite dike. (Leary and Allan, 1972). The Tim 3 showing is located several hundred metres east of the Tim 2 showing. Here, chalcopyrite, pyrite and malachite are associated with epidote, K-feldspar and magnetite in fracture and vein stockworks, within and adjacent to a north to northeast-striking monzodiorite dike (Leary and Allan, 1972).

Additional scattered occurrences of chalcopyrite, malachite and native copper have been reported between and west of the main Tim showings (Leary and Allan, 1972; Blann, 2001b). Some of these occur in trenches that were excavated to test a strong IP chargeability anomaly outlined by Liberty Gold Corp in 1989, and centred about 900 m southwest of the Tim 1 showing (Seywerd, 1990). This chargeability anomaly was also tested with percussion and diamond-drill holes in 1990. According to Reynolds (2006), the drilling revealed extensive areas of pyrite, with minor chalcopyrite, bornite, native copper, molybdenite and copper oxides, within propylitic and potassic-altered Nicola breccia.

### SS (MINFILE 092P 004)

The SS showings are located near the northern boundary of the map area, about 1 km northeast of the east tip of Spout Lake. They are hosted in monzodiorite of the Spout Lake pluton, and are described as shears containing bornite, chalcopyrite, magnetite, pyrite and malachite (Allen, 1968). They were covered by the SS claims in the late 1960s, which were held by Monte Cristo Mines Ltd., and explored with a soil geochemical survey (Allen, 1968) and a ground magnetometer survey (Mitchell, 1969). The showings have apparently received little attention since that time.

### WC (MINFILE 092P 120)

The WC occurrence is a chalcopyrite-magnetite skarn located on the south side of Spout Lake, 2 km west of the east end of the lake. The mineralization was discovered in 1971 by Amax Exploration Inc. and covered by the WC claim group (Hodgson and DePaoli, 1972). Subsequent exploration included percussion and diamond drill programs by Amax Exploration Inc. in 1972 and 1973, and diamond drilling by Craigmont Mines Ltd. in 1974 (Rowan, 1990). During this period, the mineralization was also the focus of a study carried out at the University of Western Ontario (Winfield, 1975). The WC occurrence has received intermittent attention since the mid-1970s, including several diamond drill programs that were carried out between 1992 and 1995 (Blann, 1995a). The most recent work recorded on the occurrence was a 1 784 m, 8 hole diamond drill program carried out by GWR Resources Inc. in 2005 (Callaghan, 2005).

The WC prospect is hosted by volcanic and clastic rocks within the transition zone between the volcaniclastic succession and the polylithic breccia unit of the Nicola Group. The host succession is dominated by volcanic and polylithic breccia and mafic flows, but also includes intervals of massive to thin-bedded sandstone, siltstone and calcareous siltstone. These rocks are along the south margin of the Spout Lake pluton, and are cut by narrow dikes ranging from diorite to monzonite in composition. Skarn assemblages include the minerals garnet, epidote, calcite, K-feldspar, magnetite, tourmaline, clinopyroxene, actinolite, sphene and scapolite. Sulphide mineralization, comprising chalcopyrite and pyrite with subordinate bornite and covellite, occurs as stratiform lenses and fracture-controlled zones associated with magnetite-rich skarn (Winfield, 1975; Callaghan, 2005).

Mineralization at the WC prospect occurs mainly in two zones, referred to as the North zone and the South zone. Copper-magnetite mineralization in the North zone occurs in narrow, discontinuous lenses that are roughly concordant to the northwest-striking, steeply dipping hostrock. The main zone of mineralization has been traced over a strike length of more than 400 m, and is 5 to 55 m wide. Mineralization within the zone is discontinuous, however, and copper and gold assay values tend to be low and erratic (Callaghan, 2005). Notable (oblique) intersections from the 2005 drill program include 18.4 m grading 0.60% Cu and 0.12 g/t Au, and 81.9 m grading 0.40% Cu and 0.01 g/t Au (Callaghan, 2005, hole SPL-05-01). The South zone, 150 to 200 m south of the North zone, comprises patchy skarn alteration and mineralization that has been interpreted to occur within a single gently dipping lens (Blann, 1995b) or along two narrow, parallel, north-northwest-trending fault systems (Callaghan, 2005). Notable intersections from the 2005 drill program include 32.7 m grading 0.24% Cu and 0.06 g/t Au in hole SPL-05-02, and 11.7 m grading 0.40% Cu and 0.28 g/t Au in hole SPL-05-07 (Callaghan, 2005).

### RED

The Red showing, located about 2 km south of Spout Lake, comprises fracture-controlled chalcopyrite-pyrite-magnetite-malachite mineralization adjacent to a northeast-striking fault. The mineralization occurs in a small outcrop that was discovered during an exploration program on the Red property in 2005 (Blann, 2006). It is hosted by breccia that forms part of the contact zone between the Nicola volcaniclastic succession and the polylithic breccia unit. A 1 m chip sample across the mineralized zone returned 2.54% Cu, 20.8 ppb Au and 12.8 ppm Ag (Blann, 2006, sample 151717).

### CYAN (MINFILE 092P 121)

The Cyan showing, hosted by the red sandstone-conglomerate unit of the Nicola Group about 4 km northwest of Mount Timothy, comprises scattered occurrences of native copper, malachite and chalcopyrite. The area was staked as the Bear claim group in 1994, following the release of encouraging exploration results from the nearby Miracle showing (MINFILE 092P 124), and copper mineralization was discovered during a short program of reconnaissance geological mapping (Newman, 1994). It was further evaluated with geological mapping and limited soil and silt geochemistry in 1998 (Blann, 1998), but has received little attention since then.

The copper mineralization at the Cyan showing occurs as several isolated occurrences within two areas about 1 600 m apart. The northeastern area is within a series of pyroxene-phyric flows and flow breccias in the lower part of the red sandstone-conglomerate unit. It includes an exposure containing native copper as narrow fracture fillings and disseminations, an exposure of fractured malachite-stained rock 500 m to the northeast, and a narrow shear zone containing malachite, limonite and chalcopyrite 900 m northwest of the native copper exposure (Newman, 1994). A grab sample from the shear zone returned 1.67% Cu and 15 ppb Au, and a sample of the malachite-stained rock to the east returned 4 518 ppm Cu and 12 ppb Au (Blann, 1998). The second area of mineralization, 1 600 m to the southwest, is within an area dominated by polylithic breccia and conglomerate with local sandstone, shale and amygdaloidal flows. The main area of mineralization comprises native copper, associated with chalcedonic quartz and specularite, as vesicle fillings within an amygdaloidal flow. A grab sample of this copper mineralization returned 0.13% Cu and less than 0.03 ppm Au (Newman, 1994). A separate copper occurrence, comprising malachite-stained breccia, is located about 400 m to the north of the native copper showing (Newman, 1994).

#### CLUB

The Club showing is located 5 km south of Spout Lake. It comprises 10 m of intermittent malachite that was exposed in a trench excavated by Tide Resources Ltd. in 1988, during an exploration program on the Club mineral claims (White, 1989). The trench was cut through K-feldspar-epidote-altered breccia and sandstone that are here assigned to the Nicola polylithic breccia unit. The zone of malachite was sampled in two 5 m intervals. One yielded 1 110 ppm Cu, 2.3 ppm Ag and 3 ppb Au, and the adjacent section returned 2 579 ppm Cu, 5.6 ppm Ag and 1 ppb Au (White, 1989).

### *Occurrences elsewhere in the Timothy Lake map area*

#### SPRING LAKE (MINFILE 092P 114)

The Spring Lake occurrence, located in the south-central part of the map area, consists of disseminated and fracture-controlled copper mineralization within and adjacent to the Kelly Lake stock. This area was first covered by the SL claims, which were staked by Royal Canadian Ventures Ltd. in 1968 to cover a magnetic high outlined by an aeromagnetic survey (Geological Survey of Canada, 1968). The SL claims were explored with a soil geochemical survey, a ground magnetometer survey, a VLF-EM survey, and limited geological mapping in 1968 (Vollo, 1969); a mercury vapour soil geochemical survey in 1970 (Vollo, 1970), and one 67 m diamond-drill hole in 1971 (British Columbia Mineralogical Branch, 1972). The area was restaked as the Ty 1 claim by Guichon Explorco Ltd. in 1981, and covered by a soil geochemical survey (Owsiacki and Gamble, 1982) and two induced polarization surveys (Gamble, 1983a). It was again restaked in 1994, as the Spring claims of GWR Resources Inc., and explored by geological mapping, a soil geochemical survey, induced polarization and magnetometer geophysical surveys, and 1 549 m of diamond drilling in twelve holes (Blann, 1995b). Erwin Resources Ltd. conducted soil, rock and silt geochemical surveys over the area in 2003 (Thompson, 2003).

Bedrock is very poorly exposed in the area of the Spring Lake occurrence, but diamond drilling, together with some natural exposures, shows that copper mineralization is widespread, although discontinuous and generally low grade, over an area extending for about 1.5 km to both the north and west of the west end of Kelly Lake (Blann, 1995b). The mineralization occurs within the Kelly Lake stock, and in related dikes and enclosing breccia and sandstone of the Nicola volcaniclastic succession north of the stock. It consists of pyrite, chalcopyrite and bornite, and locally native copper and malachite, which occur along fractures, in narrow veins and as disseminations. Associated alteration assemblages consist mainly of K-feldspar, epidote, chlorite and magnetite, but areas of quartz-sericite-pyrite alteration are also reported, and mineralized garnet-epidote-diopside skarn occurs within breccia north of Kelly Lake (Blann, 1995b). Diamond-drill hole S95-3, located 400 m west of Kelly Lake, cut the Kelly Lake stock and included a 21 m intersection grading 0.184% Cu, 0.03 g/t Au and 1 g/t Ag (Blann, 1995b). Diamond-drill hole S94-4, within volcanic breccia 1 500 m to the north, included a 15 m intersection that graded 0.151% Cu, 0.08 g/t Au and 1.16 g/t Ag (Blann, 1995b).

#### SODA LAKE (MINFILE 092P 152)

The Soda Lake occurrence is located in the southwestern part of the map area, about 1 km north of Soda Lake, and is hosted by volcanic breccia here assigned to the Nicola volcaniclastic succession. The first assessment work recorded in this area was an induced polarization survey conducted by Anaconda American Brass Ltd. in 1970 over the Whitehorse and Soda claim groups (Macrae and Cont, 1970). Most of these claims had lapsed by 1981, when R.M. Durfeld staked the Bridget 1 mineral claim to cover an area of mineralized float that he discovered while prospecting along the power transmission line (Durfeld, 1982). Subsequent prospecting, geological mapping and soil geochemical surveys led to the discovery of minor *in situ* mineralization, which Durfeld (1983) describes as pyrite and chalcopyrite, as veins and disseminations, in propylitically altered andesitic volcanics and breccias. Additional prospecting, along with soil and rock geochemical analyses, was carried out in 1996, when the area was covered by the Soda 4 claim group of Guardian Enterprises Ltd. (McCrossan, 1996b). Soil and rock samples (angular float mineralized with pyrite) returned anomalous copper values, but no subsequent work has been recorded in the area of the occurrence.

#### RAIL

The Rail occurrence, located about 3 km north of Rail Lake, comprises mineralization intersected in a diamond-drill hole cored to test an elongate, northwest-trending aeromagnetic anomaly in an area with no bedrock exposure. The anomaly was first staked by M.S. Morrison in 1991, and the area was surveyed with ground magnetometer surveys from 1992 to 1995, a percussion drilling program in 1996, and a VLF-EM survey in 1999 (Morrison, 1999). The percussion drilling program showed that the anomaly is underlain by a magnetite-rich microgabbro. The original claims were allowed to lapse, but the area was restaked by M.S. Morrison in 2003, and three diamond-drill holes were cored in 1995 to test a northeast-trending magnetic low, interpreted as a fault zone that offset the anomaly. The three holes intersected gabbro that is weakly mineralized with chalcopyrite and bornite in zones of potassic alteration. The best intersections returned 0.67% Cu across 25 cm and 0.27% Cu across 2 m (Morrison, 2006).

#### MAC (MINFILE 092P 032)

The Mac showing is located within the Takomkane batholith near its southwest margin, about 2.5 km southeast of Spring Lake. Canway Explorations Ltd. explored the area with a soil geochemical survey, two induced polarization surveys, trenching and percussion drilling from 1969 to 1974. This was followed by a small rock and soil geochemical survey carried out by Guardian Enterprises Ltd. in 1996. The known mineralization is apparently very minor, and is described as disseminations and fracture-fillings of fine-grained pyrite, chalcopyrite and molybdenite (McCrossan, 1996a).

### MATH (MINFILE 092P 133)

The Math showings are located in the Takomkane batholith, about 6 km east of Timothy Lake. The area was staked by Pickands Mather and Co. in 1972 to cover an area of anomalous molybdenum values obtained in a lake sediment geochemical survey. An exploration program carried out in 1973 included geological mapping, soil and mercury vapour geochemical surveys, a magnetometer survey, and the blasting of 9 test pits. Molybdenum mineralization was exposed in two adjacent test pits. It comprises pyrite and molybdenite within a random network of quartz veinlets, hosted by intensely silicified and locally brecciated granitic rock. A 14 kg sample of mineralized material returned 0.024% Mo (Leonard and Wahl, 1973). Subsequent exploration apparently included an induced polarization survey and some drilling, but none of this work was filed for assessment purposes.

Additional exploration work in the area of the Math showing was carried out by Denison Mines Ltd. in 1980, Herb Wahl and Associates Ltd. in 1984, and Guardian Enterprises Ltd. in 1996. The 1984 exploration program outlined a zone of strong quartz-sericite-kaolin-pyrite alteration, 350 m by 400 m in size, about 1 700 m northeast of the original Math molybdenum occurrence. Anomalous Mo values of 29 to 240 ppm were obtained from propylitically altered rocks collected adjacent to this altered zone (Wahl, 1984). This peripheral zone includes an exposure of slightly silicified and chloritized granodiorite with disseminated chalcopyrite and malachite. A sample of this material returned 1 420 ppm Cu and 242 ppm Mo (Wahl, 1984).

### TIMOTHY CREEK (MINFILE 092P 033)

The Timothy Creek occurrence is located on the west side of Timothy Creek, 12 km northeast of Lac La Hache. It comprises polymetallic veins within a shear zone that cuts andesitic flows and breccia of the Skull Hill Formation. The Yep claims were staked over the veins in 1972, and the claims were explored with a soil geochemical survey and rock sampling program in 1974. The highest assay from eight samples of mineralized material collected during this program was 0.30% Cu, 3.51% Pb, 6.05% Zn, 159.4 g/t Ag and 1.3 g/t Au (Fox, 1974). The mineralized structure was mapped in more detail by Reinertson (1978) after the showing had been acquired by Noranda Exploration Company Ltd. According to Reinertson the shear zone strikes 015°, dips steeply west, is up to 90 m wide, and was traced over a strike length of 725 m. Individual veins are less than 15 cm thick and vary in composition from pure galena to variable proportions of galena, chalcopyrite, sphalerite, quartz and calcite. Noranda Exploration Company Ltd. tested the vein system at depth with two angled diamond-drill holes in 1979. Although quartz-carbonate veins were intersected beneath the surface showing, they are narrow and only sparsely mineralized with disseminated galena, chalcopyrite, sphalerite and pyrite (Lewis, 1979).

## SUMMARY OF MAIN CONCLUSIONS

- The Timothy Lake map area is underlain mainly by Mesozoic volcanic, sedimentary and plutonic rocks of the Quesnel Terrane, but also includes substantial areas of Eocene volcanic rocks, small outliers of Miocene-Pliocene basalt, and several patches of Quaternary (?) basalt containing lherzolite xenoliths. Eocene volcanic rocks are much more extensive than shown on previous maps, whereas Miocene-Pliocene basalt of the Chilcotin Group is considerably less extensive.
- The Quesnel Terrane is represented mainly by the Upper Triassic Nicola Group and Early Jurassic granodiorite of the Takomkane batholith (Schoolhouse Lake unit), but also includes quartz-poor intrusive rocks of mainly monzodioritic composition. The latter intrusions are particularly abundant in the north-central part of the map area, where they are assigned to the Spout Lake intrusive suite, represented by the southern part of the Spout Lake pluton and several stocks and plugs south of Peach Lake.
- The Nicola Group in the southern part of the map area consists mainly of green pyroxene porphyry breccia and pyroxene-feldspar sandstone, which are assigned to the volcaniclastic succession and correlated with Nicola rocks previously mapped to the east and southeast. Two additional units, not recognized to the east, have been mapped in the north-central part of the map area, where they interfinger with and overlie the volcaniclastic succession. These are referred to as the polylithic breccia unit and the red sandstone-conglomerate unit. The unique features of these units include the presence of abundant fine to medium-grained plutonic fragments (monzonite, monzodiorite, diorite, gabbro) in the conglomerate and breccia, and a predominant red colour of the sandstone and conglomerate in the upper part of the succession. These units probably correlate with unit 3 of Panteleyev et al. (1996) within the Quesnel River – Horsefly map area to the north.
- Cu-Au mineralization is concentrated in an area of 60 to 70 km$^2$ in the north-central part of the Timothy Lake map area, near Peach Lake. Mineralization occurs mostly as porphyry-style fracture and vein stockworks within and adjacent to stocks of the Spout Lake intrusive suite, but also includes several skarn occurrences. The porphyry-style mineralization comprises chalcopyrite, pyrite and locally bornite, and is associated with magnetite and K-feldspar, and locally biotite, hematite, tourmaline, chlorite and calcite, within areas of widespread K-feldspar-epidote alteration. Malachite and native copper are common throughout the mineralized belt. One of the mineralized stocks has yielded a U-Pb titanite date of 203 ±4 Ma (Whiteaker et al., 1998), demonstrating a temporal relationship with other alkalic Cu-Au porphyry systems within central and southern Quesnel Terrane, such as Mount Polley, Afton-Ajax and Copper Mountain (Mortensen et al., 1995).
- The mineralized stocks south of Peach Lake are hosted by the polylithic breccia unit of the Nicola Group, which is overlain by the red sandstone-conglomerate unit to the south. The spatial relationship of mineralized stocks, breccia and conglomerate units containing plutonic clasts, and red breccia and sandstone implying emergent conditions, suggests that this area is part of a relatively long-lived volcanic-plutonic centre within the Nicola arc.

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