Bedrock Geology and Mineral Potential of Mouse Mountain (NTS 093G/01), Central British Columbia

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KEYWORDS: Intermontane Belt, Quesnellia, alkaline copper-gold porphyry, monzonite intrusion, Valentine zone, chalcopyrite, malachite

INTRODUCTION

Mouse Mountain is situated 70 km northwest of Mount Polley and 200 km southeast of Mount Milligan, two alkaline, intrusive-related copper-gold porphyry deposits hosted within the Quesnel Terrane of central British Columbia. In this belt, the Quesnel Terrane is characterized by Triassic to Early Jurassic volcanic and sedimentary arc rocks and high-level, comagmatic alkaline intrusions. Complex, multiple intrusive centres define the axis of the arc and occur systematically every 13 km along its length. Mouse Mountain is interpreted to represent one of these Late Triassic intrusive centres.

On the eastern flank of Mouse Mountain is an area known as the Valentine zone, which shows classic alkalic porphyry attributes centred on a composite monzonite intrusion: potassium metasomatism enveloped by peripheral propylitic alteration and stockwork breccia copper-gold mineralization. The extent of mineralization within the monzonite-syenite intrusive complex has been a subject of debate for over 50 years. The current study is designed to test whether the mineralization/alteration at the Valentine zone represents the tail of an elephant or the body of a mouse.

This report describes the preliminary results of a detailed bedrock geology study conducted over the Mouse Mountain property. Exploration and mapping began on the May 20, 2006, and was carried out by the senior author and one assistant until the end of August 2006. The area mapped covers approximately 16 km^2 of generally subdued topography on the eastern margin of the low-lying Fraser Plateau. Previous bedrock maps of the area are based on reconnaissance-scale mapping carried out by Teck in 1992 and Sanguinetti in 1989. The bedrock geology map created in 2006 builds on these previous works and benefits from petrographic studies of the major rock units on the property.

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Background and History

Mouse Mountain is situated 9 km east-northeast of Quesnel in the Quesnel River area of central British Columbia at latitude 53º02'N, longitude 122º19'W, or UTM 545094E, 5876965N, in zone 10 (NAD 83). The Mouse Mountain property is wholly owned by Richfield Ventures Corporation (RVC), a private company with offices in Quesnel, BC.

Mineral exploration at Mouse Mountain has focused on copper-gold-porphyry-style mineralization, with the earliest work dating from the 1950s. At this time, 20 tonnes of hand-sorted ore grading 1.55 g/t Au, 15.5 g/t Ag and 5.6% Cu was produced from open pits and shipped to the Tacoma smelter (Sutherland Brown, 1957). In 1967, Euclid Mining Corporation tried to heap leach copper from the old workings, but abandoned the project without success. Subsurface exploration followed in the 1970s when Bethlehem Copper Corp. and DuPont of Canada Limited carried out preliminary percussion drilling programs. Soil geochemical and geophysical surveys were conducted over the property by a number of companies, but it was Placer Dome Inc. using a total field ground magnetic survey that recognized the large magnetic anomaly under Mouse Mountain. Teck Exploration Ltd. drilled several short diamond-drill holes in 1991 with the best intersection including 6.1 m of 0.31% Cu and 123 ppb Au. In 2003, Richfield Ventures Corp. acquired the Mouse Mountain property and began an extensive exploration program comprising soil sampling, induced polarization, geological mapping, prospecting and trenching.

REGIONAL GEOLOGICAL SETTING

The Quesnel Terrane, or Quesnellia, defines the eastern margin of the Intermontane Belt close to its tectonic boundary with the Omineca Belt (Fig 1, 2). Quesnellia extends from north-central BC to south of the United States border and comprises the Stuhini, Takla, Nicola and Rossland Groups, respectively. These Middle Triassic to Early Jurassic volcanic, sedimentary and plutonic assemblages formed in an island arc setting outboard or marginal to the ancestral North American continental margin (Bailey, 1988; Panteleyev *et al.*, 1996; Rees, 2005). Major porphyry copper deposits generated by Early Mesozoic, calcalkalic or alkalic island-arc magmatism within Quesnellia include: Highland Valley, Copper Mountain, Afton-Ajax, Mount Milligan and Mount Polley (Logan and Bath, 2005; Rees 2005).

At the latitude of the study area, Quesnellia is fault-bounded, juxtaposed on the west (fore-arc) with Paleozoic and Mesozoic rocks of the Cache Creek subduction-accretionary complex, and on the east by Paleozoic and older metasedimentary, metavolcanic and metaplutonic rocks of the pericratonic Kootenay Terrane. The western terrane boundary is marked by high-angle, strike-slip faults, which is probably the southern extension of the Pinchi fault system (Bailey, 1988). Along the eastern margin, rocks of the Quesnel belt are structurally coupled and tectonically emplaced by the Eureka thrust onto the Snowshoe Group of the Barkerville subterrane (Struik, 1983, 1988). Intensely deformed and variably metamorphosed Proterozoic and Paleozoic rocks of the Barkerville subterrane are characteristic components of the western limits of the Omineca Belt (Struik, 1986).

In the central Quesnel belt, Mesozoic strata of the Nicola Group consist of a basal unit of Middle Triassic argillite and fine clastic sedimentary rocks, and an overlying thick sequence of Late Triassic shoshonitic alkali volcanic and volcaniclastic rocks (Panteleyev *et al*., 1996; Rees, 2005). Toward the top of the sedimentary unit, mafic volcanic debris becomes common within the sedimentary rocks, suggesting that early mafic volcanism and late sedimentation were contemporaneous (Panteleyev *et al.*, 1996). Unconformably overlying the Late Triassic submarine to subaerial volcanic sequence are Early Jurassic sedimentary and epiclastic rocks.

Intrusive rocks in this part of Quesnellia record alkaline and calcalkaline arc episodes of magmatism during the Late Triassic and calcalkaline magmatism in the Early Jurassic, Middle Jurassic and mid-Cretaceous. Small isolated alkaline feeders to the widespread Tertiary continental volcanism record the youngest magmatic activity in the area (Logan *et al.*, 2007).

The structural geology and regional metamorphism of the central Quesnel Belt records the Middle Jurassic collision and amalgamation of Quesnellia arc rocks with rocks of the Omineca Belt to the east (Bailey, 1988; Panteleyev *et al*., 1996; Rees, 2005). Most faults are normal or strike-slip and trend either north or north-northwest (Rees, 2005). Complicating these arc-parallel structures are orthogonal, east and northeast-trending block faults related to a later period of crustal extension (Bailey, 1988). Regional metamorphism is low grade, typical of zeolite or lower greenschist facies. Contact metamorphic aureoles (biotite hornfels) are developed around several isolated plutons (Bailey, 1988).

The central Quesnel belt hosts a wide variety of mineral deposits, including surficial gold placers, precious and base metal veins and industrial minerals, but copper-gold porphyry comprises the most economically important exploration targets (Bailey, 1988; Panteleyev *et al*., 1996; Tempelman-Kluit, 2006). The Mount Polley open pit copper-gold mine is the largest alkaline porphyry system in this belt, with proven and probable reserves for the Wight, Bell, Springer and Southeast open pits totalling 40.9 million tonnes grading 0.448% copper and 0.31 g/t gold (Imperial Metals Corporation, 2006). However, almost all Late Triassic alkalic stocks intruding the volcanic rocks are mineralized. In the Swift River area, copper mineralization is known in stocks south of Benson Lake, at Cantin Creek and at Mouse Mountain (Bailey, 1988). Magnetite is also ubiquitous and magnetic patterns are important indicators of the presence of stocks in overburden-covered areas. Copper is invariably chalcopyrite with minor bornite and occasional chalcocite. Mineralization is coupled with hydrothermal alteration of the intrusive bodies and hostrocks (Panteleyev *et al*., 1996). The mineral showings consist of stockworks, veinlets and disseminations of copper minerals, associated with alteration minerals such as K-feldspar, magnetite, albite, actinolite, pyrite and sericite and surrounded by a propylitic halo containing chlorite, epidote and carbonate (Bailey, 1988; Panteleyev *et al*., 1996).

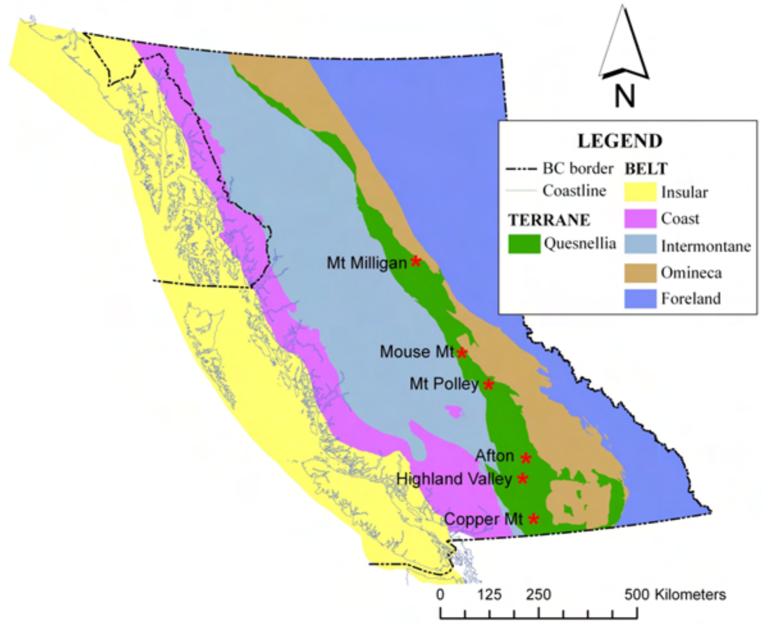

Figure 1. Map of British Columbia, showing the location of the study area in relation to other alkaline porphyry copper deposits in Quesnellia.

PROPERTY STRATIGRAPHY

Stratigraphy for the Mouse Mountain area follows the stratigraphic relationships established by Bailey (1988) for the Swift River area and Panteleyev *et al*. (1996) for the Quesnel River – Horsefly map area. Figure 3 shows these relationships schematically. Absolute ages for the rocks in the study area are unknown; however, correlative units at Mount Polley are intruded by plutons having Late Triassic crystallization ages (204.7 ±3 Ma; Mortensen *et al.*, 2005) using the time scale of Palfy *et al.* (2000). Physiographic features of the area and the distribution of rock types are shown on the property geology map (Fig 4).

Lower Sedimentary Rocks

SILTSTONE (UNIT 1)

Black siltstone outcrops in the far northeast portion of the property (Fig 5). It dips steeply to the southwest and may be traced as far south as Fallen Log Lake, where a small section of black siltstone was also found. Bedding surfaces or bases were not exposed, although the unit exceeds 7 m in thickness. The unit is dominated by dark to medium grey beds that are approximately 10 cm thick, with interbedded leucocratic laminations. Although the matrix is weakly calcareous, no fossils were observed. This unit correlates with the sedimentary package mapped by Bailey

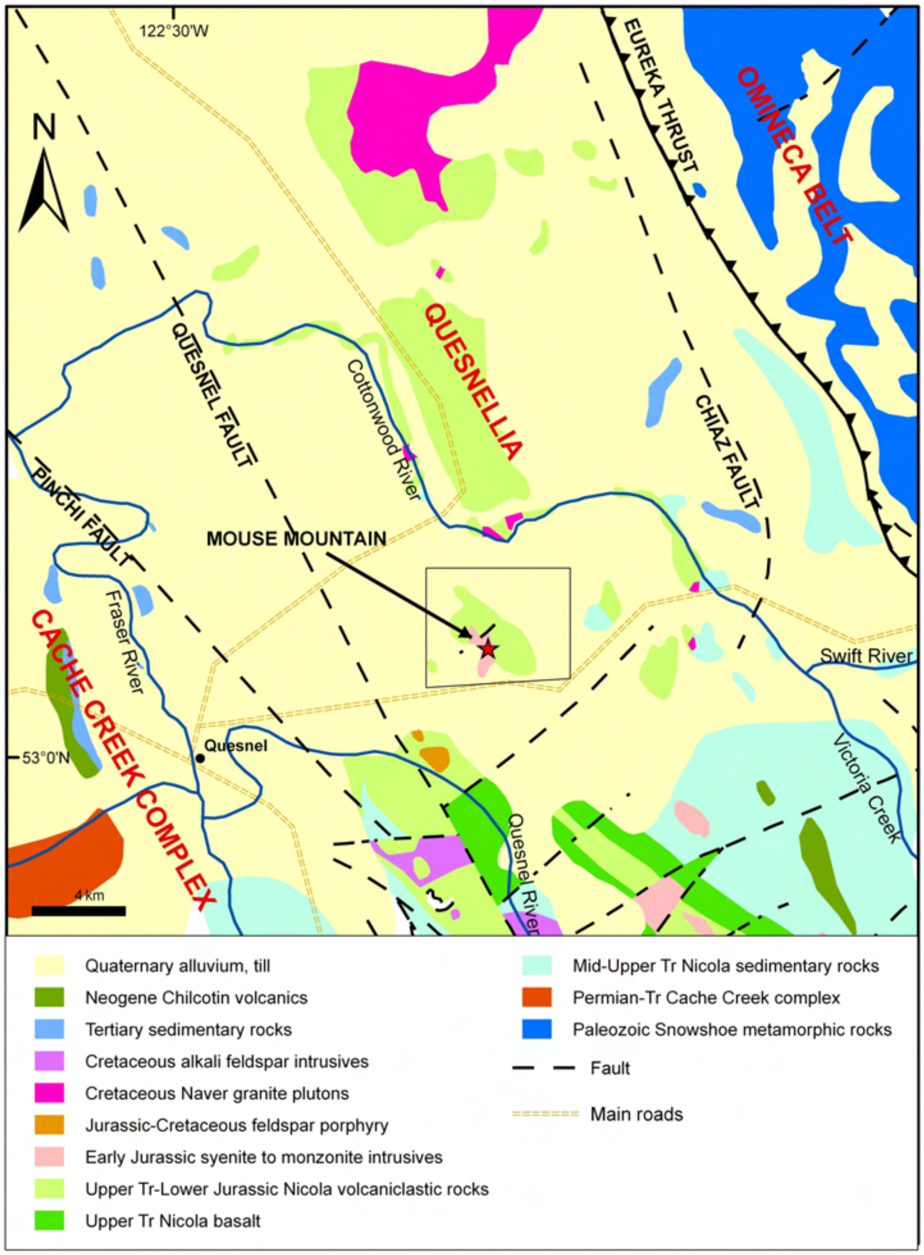

Figure 2. Regional geology map of the Quesnel belt around Mouse Mountain, showing the property outline. Compiled from www.mapplace.ca (BC Geological Survey, 2006) and Bailey (1988).

(1988) and dated as Carnian by Struik (1988) as the oldest recognized part of the Quesnel belt stratigraphy. Sediments of unit 1 probably underlie the volcanic succession seen on the property, although field relations are not directly evident.

Lower Volcanic and Volcaniclastic Rocks

AUGITE PORPHYRY FLOWS (UNIT 2)

Volcanic rocks of unit 2 (Fig 6) underlie the northeastern half of the map area in a continuous belt extending from the southeast corner of the property to the northwest corner. Augite porphyry also occupies areas to the west and southeast of the main showings, where it forms north to northwest-trending ridges. The areal distribution of the basalt is extensive at the property scale; however, the unit thickness is unknown.

The basalt is green-grey and maroon and forms monolithic tuff breccia and autobrecciated flows. Phenocrysts of augite comprise up to 10 to 35% and are approximately 2 to 3 mm in size. Less abundant phenocrysts of intermediate plagioclase are ubiquitous. The groundmass is aphanitic, grey-green, weakly hematite-stained and composed of fine-grained pyroxene and plagioclase. The unit appears to be mainly intact and unaltered, except for weak saussurite alteration. Accessory magnetite and pyrite were also noted. Quartz and calcite-filled amygdules are common in the northern outcrops of unit 2. These amygdules constitute approximately 10% of the mode and are approximately 1 cm

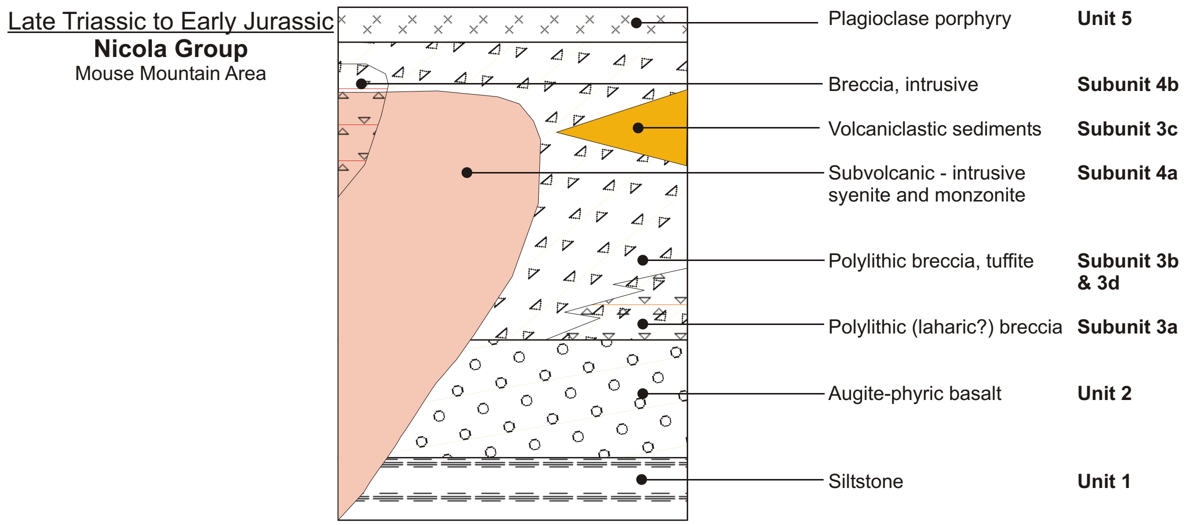

Figure 3. Schematic stratigraphy diagram for the Mouse Mountain area.

in size, spherical oblate and weakly flattened. In thin section, these basalts show well-developed trachytic flow textures.

Contact relationships are not obvious because Quaternary deposits mask large tracts of land on the Mouse Mountain property. However, unit 2 is believed to be equivalent to unit 2 in Bailey (1988) and is therefore the oldest and most widespread unit of volcanic rocks found in the Quesnel belt. The age of the unit is interpreted as early Norian (Late Triassic; Bailey, 1988).

Upper Clastic Volcanic Rocks

The majority of the property is underlain by a variety of massive, clastic volcanic rocks, which for the most part are heterolithic and show evidence of reworking. Clast compositions have been used to subdivide the rocks into

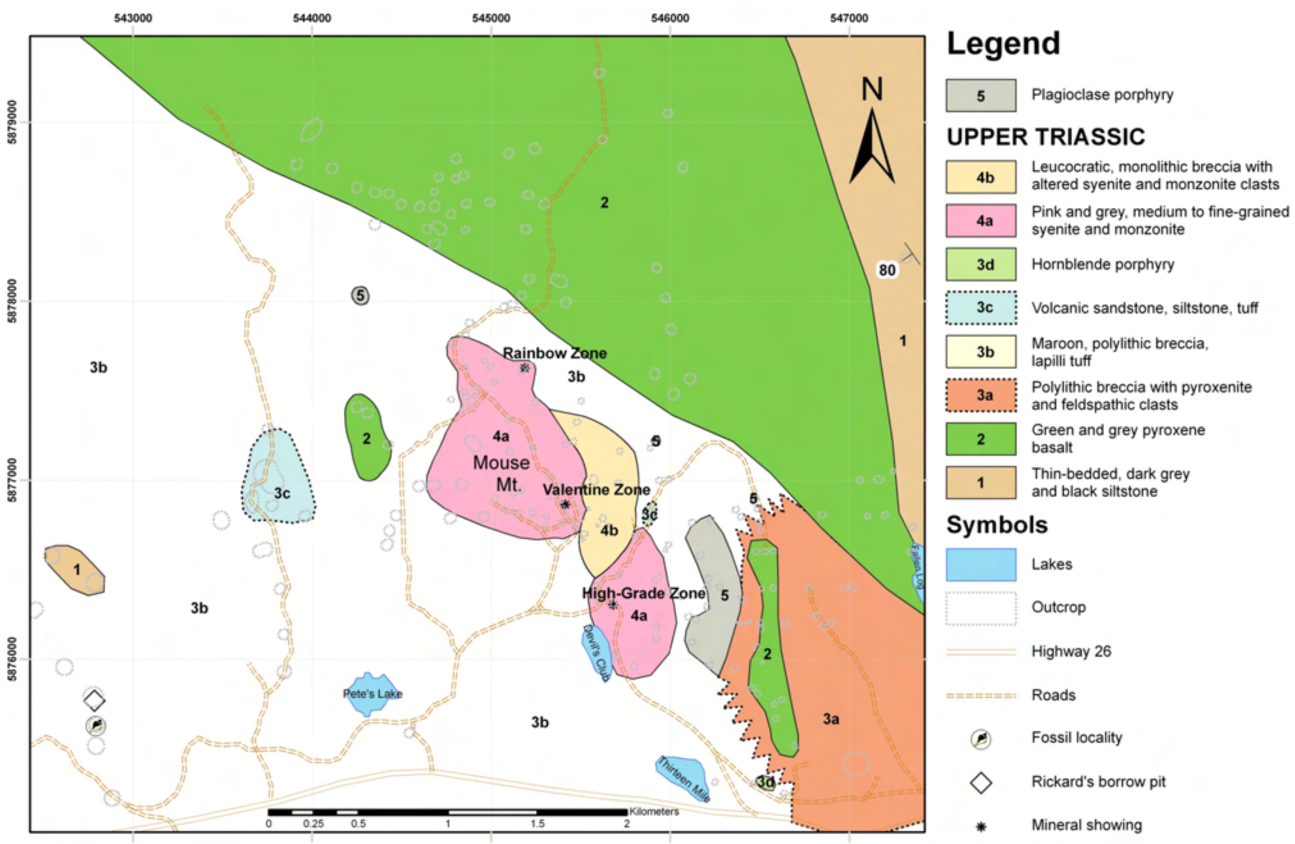

Figure 4. Mouse Mountain property geology map.

Figure 5. Finely laminated steeply dipping siltstone of unit 1, northeast of the Mouse Mountain peak.

four subunits. Definitive evidence for tuffaceous components (*i.e.*, pumice or fiamme) is lacking, although fresh pyroxene and plagioclase crystal-rich matrices to the breccia and conglomerate suggest limited reworking.

EPICLASTIC BRECCIA (SUBUNIT 3A)

Due east of Thirteen Mile Lake are metre-thick outcrops of laharic (?) breccia (Fig 4, 7). Subunit 3a is an unsorted, matrix-supported (locally clast-supported), polymictic breccia with coarse intrusive, feldspathic and lapilli-sized mafic volcanic clasts (hornblendite and pyroxenite). Hornblende-plagioclase-phyric lapilli fragments dominate the clast population. The variable-coloured, rounded and subangular clasts, some as large as 15 to 20 cm, occupy an aphanitic, hematite-stained, maroon matrix. The fine ash and crystal matrix consists of reworked plagioclase and hornblende crystals. Subunit 3a consists of mixed pyroclasts (?) and epiclasts, which are subangular and subrounded, respectively. In thin section, it is apparent that both the clasts and the matrix of subunit 3a are weakly potassium altered and sericitized. Soft sediment deformation features drape the breccia in places and possibly correspond to periods of quiescence in volcanic activity.

A late-stage plagioclase porphyry dike crosscuts subunit 3a on the western margin of the property. Subunit 3a is correlated with maroon heterolithic breccia mapped by Bailey (1988) and Panteleyev *et al*. (1996), to stratigraphically overlie mafic volcanic units similar to unit 2. Their work suggested this contact was an angular unconformity and interpreted the breccia to be Sinemurian in age (Lower Jurassic).

CRYSTAL-RICH LAPILLI VOLCANICLASTIC TUFFITE (SUBUNIT 3B)

Subunit 3b is the dominant lithology in the map area, occurring around the intrusive rocks of Mouse Mountain peak and to the west of the property (Fig 4). This heterolithic breccia (to crystal-lithic tuff) is provisionally distinguished by having volcanic components, particularly augite-phyric basalt clasts that reach up to 50 cm in size, and felsic hypabyssal clasts. Subunit 3b is generally green to grey, matrix-supported (but locally clast-supported), with subangular to subrounded clasts. This subunit is distinguished from subunit 3a on the basis of three observations: better sorting, better rounding and the lack of ultramafic clasts. The matrix, evident from thin section analysis, consists of mature crystals and reworked lapilli.

Stratigraphically, this breccia may be related to subunit 3a in the south, and grades laterally into finer-grained volcaniclastic rocks of subunits 3c and 3d. In general, subunit 3b is not altered or mineralized, although weak metamorphism of this unit has caused pervasive sericitization. Lithologically, this breccia correlates with subunit 3b mapped and characterized by Bailey (1988), to contain felsic rocks as well as basaltic debris derived from underlying units. Originally, this subunit was believed to be Sinemurian in age (Lower Jurassic), but isotopic dating by Mortensen *et al.* (1995) indicate these maroon volcaniclastic rocks are intruded by Late Triassic intrusive rocks at Mount Polley and therefore cannot be Jurassic in age.

A fossil-bearing horizon in granule conglomerate and reworked volcaniclastic rocks of subunit 3b was recognized in the southwest portion of the map area (Fig 4, 8b). The subunit is massive and bedding is not obvious, but a repetitive attitude of 270º/60º is assumed to indicate depositional layering. Macrofossil imprints and moulds of bivalves, gastropods and solitary corals are most common, although soft body fragments replaced by black calcite and pyritized nodules that are approximately 5 cm in diameter

Figure 6. Basaltic rock of unit 2, with megacrystic augite phenocrysts. The scale is in centimetres.

Figure 7. a) Laharic (?) breccia of subunit 3a, from the southeast part of the property, with a large ultramafic xenolith; b) breccia, with mixed clasts in soft sediment ‘slump’ structure.

were also observed. Samples have been collected for macrofossil and conodont analysis and sent to P. Smith of the Paleontology department of the University of British Columbia, Vancouver, and results are pending. The fossil assemblage was probably deposited in a high-energy beach environment.

VOLCANICLASTIC SEDIMENTS (SUBUNIT 3C)

Two small exposures of fine-grained, dark greyish-green, volcanic-derived siltstone and feldspathic sandstone occur on the east and west side of the Mouse Mountain peak (Fig 4, 9). This unit has gradational contacts and similar mineralogy to subunit 3b and is interpreted to be a finer-grained facies equivalent. Graded bedding and load structures (oriented at 165º/68º) indicate overturned bedding at one locale, which is interpreted to reflect soft sediment slumping rather than tectonic inversion. Thin section analysis of subunit 3c shows a few scattered broken plagioclase crystals in an otherwise aphanitic groundmass. These rocks are interpreted as distal deposits and probably represent reworked crystal tuff.

HORNBLENDE-PORPHYRY (SUBUNIT 3D)

Situated in the southeast portion of the map area, enveloped in subunit 3b, is a small outcrop of hornblende-plagioclase porphyry (Fig 4, 10). Hornblende phenocrysts are approximately 5 mm in size and constitute 30 to 40% of the mode; interstitial plagioclase crystals are 1 mm in length and occur in an aphanitic matrix that is abundant with blebby magnetite. With the exception of flow banding, this unit has extrusive flow features, such as monomictic autobrecciation textures on weathered surfaces and scattered centimetre-sized mafic rip-up clasts. Subunit 3d is either a small flow or ignimbrite unit. It may be related to the late-stage volcanic event that led to the formation of unit 5.

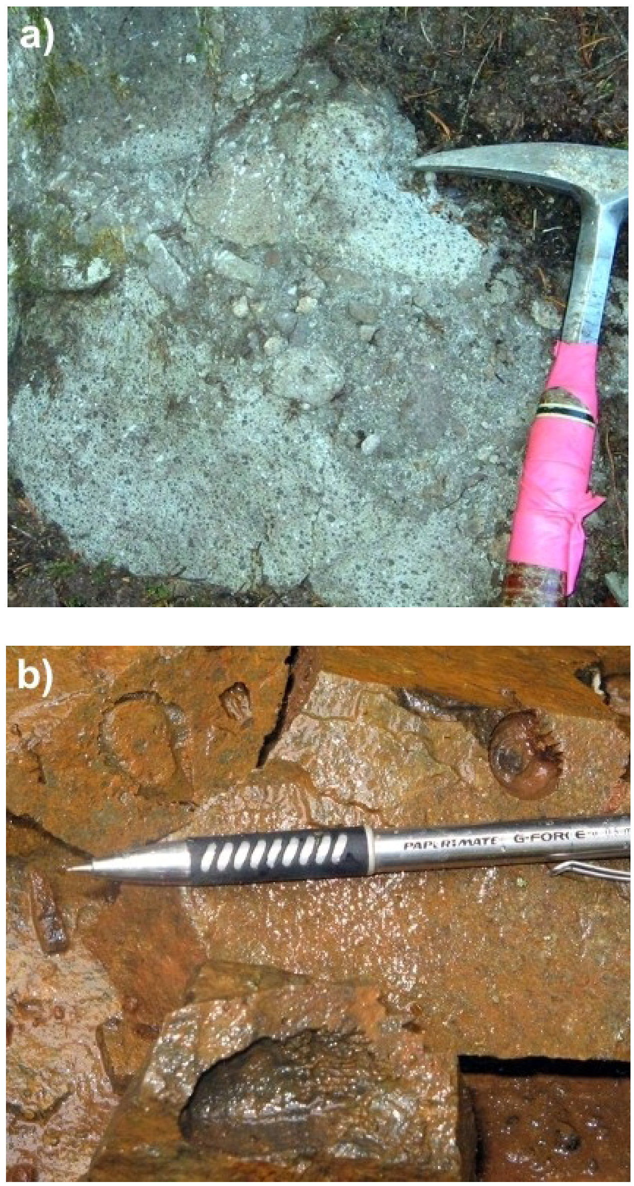

Figure 8. Variable texture of subunit 3b, that is a) dominated by augite-phyric clasts and b) fossiliferous.

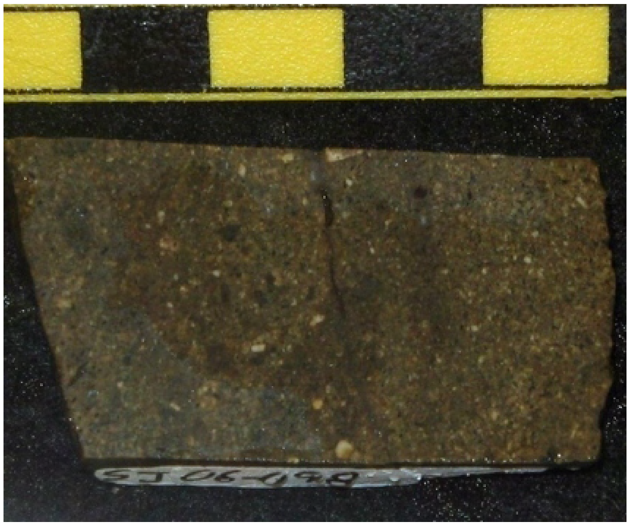

Figure 9. Volcanic sedimentary rock of subunit 3c, with white plagioclase crystals. The scale is in centimetres.

Intrusive Rocks

MONZONITE-SYENITE (SUBUNIT 4A)

Intrusive rocks underlie the main area of Mouse Mountain, encompassing an area of approximately 1.3 km^2 (Fig 4, 11). The intrusive rocks are felsic and typically weather off-white or a deep rusty brown where pyrite is present. When fresh, the rocks are creamy grey or pink in colour. In hand sample, the rocks are fine grained, microporphyritic and appear more like high-level subvolcanic bodies than plutons or stocks with well-developed equigranular texture. Subunit 4a varies compositionally and texturally from the top of Mouse Mountain toward the Valentine zone. At the peak of the mountain, the subunit is characterized by coarse potassium-feldspar megacrysts and a nepheline-normative syenite composition. Along the eastern margin of the intrusion at the Valentine zone, the monzonite is a microporphyry monzonite. Pyroxene and lesser biotite comprise the mafic minerals at both locales.

The monzonite of subunit 4a is flanked by and presumably intrudes maroon tuffite and volcaniclastic subunit 3b, although intrusive contacts were not recognized in the field. All known significant pyrite-chalcopyrite mineralization on the property is associated with monzonite bodies that occur within 1 or 2 km of the Mouse Mountain peak.

Figure 10. Hornblende porphyry of subunit 3d, east of Thirteen Mile Lake.

The monzonite stocks at Mouse Mountain correlate with subunit 7a of Bailey (1988). They are similar in composition, regional distribution and temporal relationships to the suite of Latest Triassic alkaline intrusive rocks that define the medial arc axis and magmatic centres at Mount Polley, the Quesnel River deposit (QR) and Cantin Creek, where they are associated with alteration and copper-gold mineralization. Most of subunit 4a probably represents subvolcanic dikes, sills and stocks, which have intruded the Triassic volcanic stratigraphy (Panteleyev *et al.*, 1996).

BRECCIA, INTRUSIVE (SUBUNIT 4B)

Separating the monzonite due east of the Mouse Mountain peak is a distinctive breccia subunit consisting primarily of pink-weathering (felsic) intrusive clasts in a white-creamy rock flour matrix (Fig 4, 12). subunit 4b is essentially monolithic with subangular potassic altered monzonite and syenite clasts (except for the occasional ma-

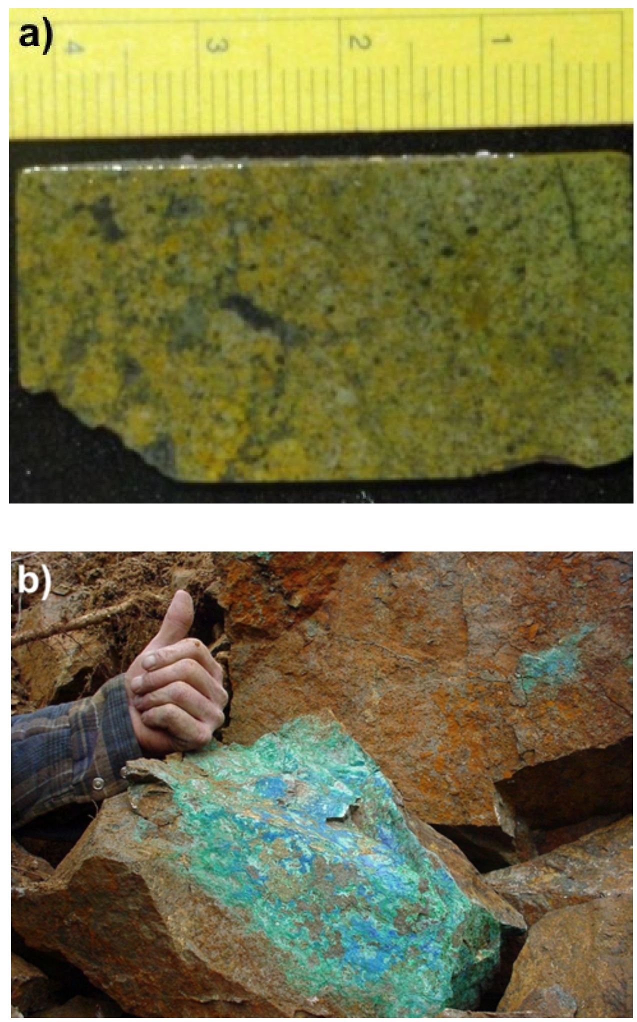

Figure 11. a) Nepheline syenite from the Mouse Mountain peak, subunit 4a, stained with Na-cobaltinitrate to distinguish potassium minerals; b) Altered and mineralized fine-grained monzonite from the Valentine zone.

Figure 12. Monolithic breccia of subunit 4b, with a) rock flour matrix and b) the occasional maroon volcanic clast.

roon volcanic clast) that range in size from 1 to 10 cm. The breccia is clast-supported (locally matrix-supported), massive and unsorted. Contact relationships between the monzonite and the maroon, heterolithic volcaniclastic unit are unknown. In addition, small isolated breccia zones are known to occur in the main monzonite stock to the west of the Valentine zone. Alteration is limited to the matrix of these breccia subunits and is characterized by magnetite and/or albite replacement.

The breccia contains occasional potassium-altered clasts (orthoclase, magnetite and biotite) and clasts of copper (malachite and/or pyrite) mineralization. These clasts represent primary hypogene mineralization and suggest that brecciation may have accompanied or postdated early potassium-copper mineralization. Albite, epidote and late chlorite alteration of the rock flour matrix represents the waning stages of the hydrothermal system. Multistage breccia events are common in high-level hydrothermal systems and particularly so in the alkaline systems of BC (Copper Mountain, Iron Mask, Mount Polley and Galore Creek). This subunit may represent a hydrothermal breccia or eruptive diatreme located near the top of the intrusive pile. Equivalent units elsewhere in the Quesnel belt have been used successfully in regional exploration to outline eruptive volcanic centres (Fox, 1975) that are underlain by high-level intrusive bodies (Panteleyev *et al*., 1996).

Volcanic Rocks

PLAGIOCLASE PORPHYRY (UNIT 5)

Plagioclase-dominated porphyry crops out in the southeast corner of the map, east of Devils Club Lake. Here, plagioclase-porphyritic volcanic rocks and subvolcanic intrusions, possibly feeders to the flows, underlie a broad crescent around the east-southeast limits of Mouse Mountain, encompassing an area of approximately 0.25 km^2 (Fig 4, 13). The unit is grey-greenish with off-white (locally crowded) plagioclase laths in an aphanitic dark grey groundmass. The plagioclase phenocrysts are euhedral, up to 1 cm, form 20 to 30% of the mode and typically do not show any flow alignment. Subordinate hornblende occurs as minor phenocrysts or in the groundmass. Unit 5 is generally fresh and unaltered, andesitic in composition and contains minor amounts of hydrous minerals (hornblende and lesser biotite). The plagioclase porphyry is considered to be late, crosscutting and overlying the augite porphyry and volcaniclastic units.

SURFICIAL GEOLOGY

The Mouse Mountain property lies in a region affected by extensive glacial erosion and deposition. Unconsolidated Pleistocene glacial, glaciofluvial, till and organic material covers much of the map area. In low-lying areas, swamps, bogs and glaciolacustrine deposits are common, whereas till and glaciofluvial deposits occupy the elevated slopes and ridges. A thin veneer of till typically drapes the underlying bedrock, but in river valleys south of the property, thicknesses of greater than 150 m are attained. Glacial striations and the trend of bedrock ridges are commonly between 330 and 350°, which reflect the major direction of glacial transport (Bailey, 1988).

STRUCTURE

The structural geology of the Mouse Mountain property is poorly constrained due to limited exposure and the

Figure 13. Plagioclase porphyry of unit 5; Mouse Mountain, central BC.

massive nature of the volcanic units. In general, contacts and structures trend northwesterly parallel to the dominant regional tectonic grain. The few faults, fractures and slickensides that were observed are disorderly and unrelated. Bedding in the northeast corner of the map area dips and faces southwesterly, consistent with the eastern flank of the Quesnel belt (Panteleyev *et al.*, 1996).

A major east-striking fault zone oriented 280º/78ºN crops out approximately 3 km west of Mouse Mountain in Rickard's borrow pit. This 2.5 m wide zone of crushed rock, fault gauge and sandy infill corresponds to a splay of the Chiaz fault (Bailey, 1988). The fault is shown to transect the monzonite at Mouse Mountain (Fig 2); however, evidence for the structure or displacement of the monzonite could not be substantiated in outcrop.

METAMORPHISM

The metamorphic grade of the rocks of the Mouse Mountain property is for the most part sub-greenschist facies. Primary textures and fabrics are preserved, except where the rocks have been affected by faulting or hydrothermal alteration. The metavolcanic rocks of unit 2 and unit 3 occur within the chlorite metamorphic isograd, with the characteristic metamorphic minerals being chlorite+ epidote±clinozoisite. In unit 3, the saussuritization of plagioclase varies from slight to complete replacement by fine-grained epidote, calcite and sericite. The dark green to dark grey pyroxene basalts of unit 2 contain mafic crystals with only slightly chloritized rims, although the plagioclase is universally turbid and saussuritized. Amygdules within the vesicular portion of the flows contain calcite and lesser quartz. Locally, zones of more intense replacement of the greenschist assemblage are interpreted to be products of propylitic alteration related to the nearby intrusion.

ALTERATION AND MINERALIZATION

Three separate zones of copper-gold mineralization and associated alteration occur in the vicinity of the Mouse Mountain peak (Fig 14). These zones are aligned and distributed along a north-northwest-trending strike length of 3 km. They include, from north to south: the Rainbow, Valentine and High-grade zones.

Geochemistry

Table 1 presents the results of geochemical analyses of rock samples collected from the Rainbow, Valentine and High-grade zones. The samples prefaced with SJ06 were collected and analyzed for Au, Pd and Pt by fire assay and for 28 elements by ICP-MS, by Eco-Tech Laboratories Limited in Kamloops, BC. The remaining samples prefaced with 06JLO were steel milled at the BC Geological Survey Laboratory in Victoria. Splits were shipped for analyses to ACME Analytical Laboratories Ltd., Vancouver, for trace-element analyses using inductively coupled plasma emission spectrometry (ICP-ES) and Activation Laboratories Ltd., Ancaster, Ontario for Au analyses using instrumental neutron activation (INAA).

Rainbow Zone

The Rainbow zone is a small, poorly exposed area of altered monzonite situated at the northwest end of the mineralized corridor approximately 1 km north-northwest of the Valentine zone. The intrusive rocks in this area are generally fine-grained, pink-orange-yellow in colour and silicified. This zone is characterized by pervasive, texturally destructive quartz-carbonate and fuchsite-mariposite alteration. In thin section, ankerite is the dominant carbonate mineral present, with calcite occurring only in late-stage crosscutting veinlets. Chalcedonic quartz, characterized by numerous fluid inclusions, occurs in veins and blebs. Where the carbonate alteration is strongest, sulphides and copper carbonates have been leached out of the rock. Locally, however, unaltered monzonite has fresh biotite phenocrysts.

Mineralization at the Rainbow zone occurs as disseminations and microveins of pyrite, chalcopyrite, malachite and azurite. Negligible amounts of fluorite, sphalerite and bornite were also observed. Chalcopyrite mineralization estimated at 0.5% occupies the core of the Rainbow zone and is enveloped by a pyrite-only mineralized margin. A couple of grab samples of chalcopyrite mineralization returned low copper (~0.25%) and gold (100 ppb) values (SJ06-051, 196; *see* Table 1).

Valentine Zone

The Valentine zone is located due east of the Mouse Mountain peak. It occupies an east-facing hillslope that was stripped in 1987 and comprises a well-exposed 100 m by 100 m outcrop area of variably altered and mineralized microporphyritic monzonite. Mineralization, alteration and structure of the Valentine zone are the focus of ongoing studies by the senior author. The following summarizes preliminary work to date.

The Valentine zone is developed close to the eastern margin of the Mouse Mountain monzonite, which at the Valentine zone is a nepheline-normative micromonzonite. This zone exhibits classic alkalic porphyry-style alteration zonation comprising propylitic-phyllic-potassic with limited supergene enrichment, from the fringe to the core. In the outer margins of the study area and in the surrounding country rock, a mineral assemblage of chlorite+epidote+carbonate defines the propylitic alteration zone. Stockworks of sericite, quartz and pyrite are common on the periphery of the Valentine zone, delineating a phyllic halo. In the potassic core, an assemblage of potassium feldspar+magnetite+biotite+chlorite+diopside±actinolite hosts disseminations and stockworks of pyrite and chalcopyrite. Discrete zones of pervasive iron-carbonate alteration overprint the alkalic alteration assemblage. These zones are structurally controlled (north and east-trending), texturally destructive and can dilute copper-gold grades of the monzonite-related mineralization. An assemblage of dolomite, pyrite, calcite, quartz and sericite characterizes this late-stage event. Zones of iron-carbonate alteration are characterized by elevated arsenic, antimony and molybdenum values (SJ06-196, 06JLO8-86, SJ06-104; *see* Table 1). At the top of the deposit, supergene processes have leached sulphides from the cap rock and precipitated iron oxide, malachite and azurite on fracture surfaces; this is the most noticeable evidence of the copper mineralization.

There are three main fault sets that crosscut the Valentine zone. These trend 040º, 220º and 310º and all dip moderately to steeply. Hypogene mineralization consists of early pyrite replaced by magnetite and chalcopyrite. Miner-

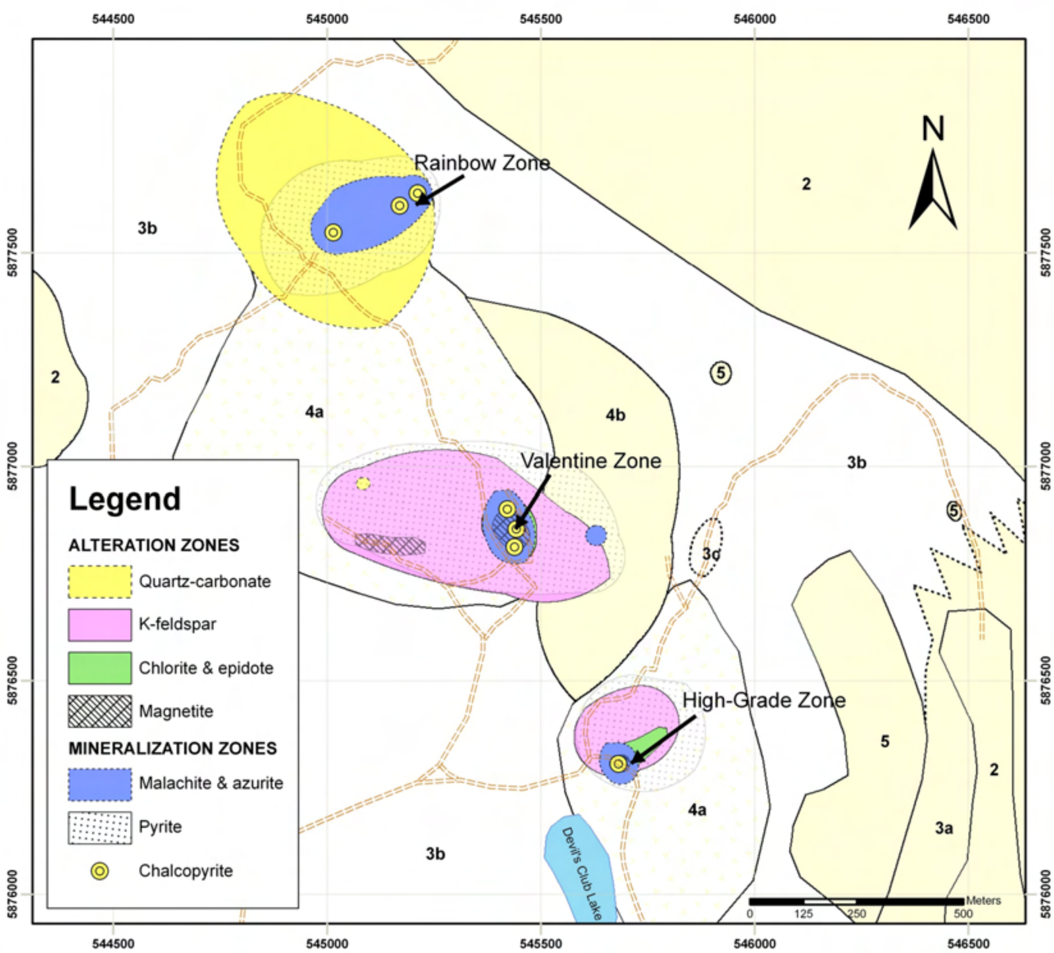

Figure 14. Alteration and mineralization zones on the Mouse Mountain property..

alization occupies anastomosing and coalescing series of fractures and breccia that appear to postdate some of the potassium alteration. The highest assay results from grab samples collected on the Valentine zone returned 0.6056% Cu and 455 ppb Au. Palladium shows slightly elevated values in sulphide-rich samples from the Valentine and High-grade zones (SJ06-133 and 149).

High-Grade Zone

Two hundred metres north of Devils Club Lake and 750 m south of the Valentine zone is a small mineralized outcrop known as the High-grade zone. The entire zone is approximately 3 m by 2 m and is exposed in the wall of a flooded pit, presumably the source of early production. The hostrock to the mineralization is fine to medium grained, grey-pink in colour and resembles monzonite from the Valentine zone. Compositionally, however, monzonite from the High-grade zone is distinct on two accounts: clinopyroxene is more abundant (~25% of the mode) and nepheline is not present. Alteration is similar to that at the Valentine zone: fine-grained magnetite and potassium alteration flood the monzonite replacing the matrix and altering the clinopyroxene to biotite, epidote and chlorite assemblages. Younger potassium alteration occurs in veins with coarse crystalline magnetite. Cockscomb calcite occupies open fractures. Copper mineralization consists of copper carbonates and chalcopyrite. The highest assay results from grab samples collected at the High-grade zone returned 1.38% Cu and 1.23 g/t Au (SJ06-149; *see* Table 1).

CONCLUSION

The 2006 summer mapping program has successfully mapped and described a variety of lithological units on the Mouse Mountain property, and for the first time applied thin section analyses to validate these descriptions. Nicola Group rocks underlie the Mouse Mountain property and can be correlated along strike with volcaniclastic units and porphyritic subvolcanic monzonite intrusions, which are spatially and temporally associated with mineralization at Mount Polley. Heterolithic, maroon volcaniclastic rocks that are Late Triassic or Early Jurassic (?) in age, underlie the majority of the Mouse Mountain property. In general, the volcanic succession consists of subaqueous pyroxene-phyric basalt flows and breccia, an overlying sequence of pyroclastic and epiclastic volcanic deposits, and shallow-water sedimentary rocks that overlap and flank the volcanic accumulations. Late Triassic alkaline intrusions intrude the volcaniclastic succession, producing high-level breccia by steam-blasted disintegration. At Mouse Mountain, there are multiple events of hydrothermal alteration, brecciation

TABLE 1. ICP-ES AND FIRE ASSAY RESULTS FROM SELECTED MINERALIZED SAMPLES, MOUSE MOUNTAIN.

		Element	Ag	Al	As	Au	Ba	Bi	Ca	Cd	Ce	Co	Cr	Cu	Fe	Hf	K	La	Li	Mg	Mn	Mo
		Units	ppm	%	ppm	ppb	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	%	ppm	ppm	%	ppm	ppm
		Method	TICP	TICP	TICP	FA	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP
Station Number	Easting	Northing																				
Rainbow Zone																						
SJ06-051	544960	5877660	<0.2	0.66	5	10	180	<5	2.78	<1	-	18	22	92	4.31	-	-	<10	-	1.14	1354	<1
SJ06-198	545016	5877544	0.2	0.35	985	100	190	<5	1.7	6	-	23	41	2510	1.92	-	-	<10	-	0.38	405	10
Valentine Zone																						
06JLO2-12	545433	5876857	0.5	8.62	14	325	1092	0.2	3.04	0.1	18	14.6	68.5	2944	5.63	1.1	3.65	8.4	25.7	1.49	748	2.5
06JLO8-86	545476	5876810	0.9	8.47	434	9	1077	0.2	3.28	0.1	16	15.1	34.5	3269	5.86	0.6	4.66	6.8	1.8	0.13	825	7.5
06JLO9-85	545453	5876847	0.5	8.53	12	356	1248	0.1	2.93	0.1	18	18.5	68.3	2059	6.06	1.2	3.32	8.1	20.1	1.47	818	7.3
06JLO9-87	545453	5876856	0.7	8.5	14	307	1007	0.1	3.49	0.1	19	16.9	71.6	2275	5.86	1	4.48	8.2	27.9	1.69	873	3.4
06JLO9-88	545311	5876796	<.1	9.21	21	253	1288	<.1	3.33	0.1	12	8.8	23.8	30.9	3.72	2	4.15	5.6	18	0.93	714	1.8
SJ06-104	545402	5876896	0.2	0.19	215	165	935	<5	6.1	<1	-	15	56	1305	4.09	-	-	<10	-	1	1160	5
SJ06-109	545453	5876840	1.3	0.92	35	455	270	<5	1.34	<1	-	32	40	6056	6.8	-	-	<10	-	1.23	848	9
SJ06-131	545423	5876862	<0.2	0.25	50	40	250	<5	4.47	<1	-	12	33	341	4.64	-	-	<10	-	0.61	750	14
SJ06-132	545457	5876870	0.5	1.04	10	255	35	<5	1.2	<1	-	26	49	2658	7.76	-	-	<10	-	1.64	870	7
SJ06-133	545477	5876809	0.7	0.23	110	460	140	<5	5.97	<1	-	28	17	3543	5.14	-	-	<10	-	1.88	1084	8
SJ06-134	545438	5876818	<0.2	1.41	5	15	60	<5	3.73	<1	-	24	<1	202	7.33	-	-	<10	-	2.04	2302	2
High-Grade Zone																						
06JLO2-11	545685	5876296	0.3	8.82	11	277	1100	0.6	5.99	<.1	22	29.6	57.3	5466	7.9	1.2	2.91	12.6	43.3	2.9	1142	2.6
SJ06-149	545682	5876305	1.3	2.1	20	>1000	65	<5	5.76	<1	-	34	60	>10000	8.23	-	-	<10	-	0.38	405	10
Std CANMET WPR1			0.6	1.55	-1	45	19	0.1	1.61	0.2	5	174	2370.6	1692	10.96	0.5	0.09	1.9	4.6	18.57	1352	0.3
Recommended			0.7	1.64	1.4	42.2	22	0.19	1.43	0.43	6	180	3300	1640	9.93	0.61	0.165	2.2	4.2	18.69	1549	0.9
% Difference			3.8	1.4	300.0	1.3	3.7	15.5	3.0	18.3	4.5	0.8	8.2	0.8	2.5	5.0	14.7	3.7	2.3	0.2	3.4	25.0

		Element	Na	Nb	Ni	P	Pb	Pd	Rb	S	Sb	Sc	Sn	Sr	Th	Ti	U	V	W	Y	Zn	Zr
		Units	%	ppm	ppm	%	ppm	ppb	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
		Method	TICP	TICP	TICP	TICP	TICP	FA	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP	TICP
Station Number	Easting	Northing	0.001		0.1	0.001	0.01			0.02	0.02	0.1		0.5	0.2	0.001	0.5	2	1		0.1	
Rainbow Zone																						
SJ06-051	544960	5877660	0.04	-	11	1770	6	<5	-	-	<5	-	<20	138	-	0.05	<10	119	<10	18	44	-
SJ06-198	545016	5877544	0.07	-	8	1590	6	<5	-	-	10	-	<20	71	-	<0.01	<10	41	<10	10	31	-
Valentine Zone																						
06JLO2-12	545433	5876857	3.777	2.6	18.9	0.105	4.1	16	55.8	0.2	1.1	12	1.5	596	1.5	0.299	1	206	0.4	13.1	33	30.2
06JLO8-86	545476	5876810	3.233	2.4	14.7	0.132	6	<2	62.7	0.1	26.6	10	1.5	337	1.2	0.297	0.9	250	2.2	9.7	48	16.6
06JLO9-85	545453	5876847	2.819	3	16.9	0.117	4.9	22	43.6	0.2	0.7	14	1.7	661	1.6	0.316	1.1	246	0.6	16	40	31.6
06JLO9-87	545453	5876856	2.751	2.6	19	0.11	5	42	63.1	0.2	0.7	13	1.5	407	1.5	0.298	1	219	0.4	14.7	38	26.9
06JLO9-88	545311	5876796	3.908	2.8	3.2	0.125	4.7	10	61.6	<.1	1.1	7	0.7	686	1.5	0.317	1.4	192	0.8	15.2	36	62.2
SJ06-104	545402	5876896	<0.01	-	9	1020	14	15	-	-	335	-	<20	165	-	<0.01	<10	58	<10	6	38	-
SJ06-109	545453	5876840	0.02	-	25	1150	24	25	-	-	<5	-	<20	40	-	0.09	<10	216	<10	13	48	-
SJ06-131	545423	5876862	0.01	-	11	1060	8	<5	-	-	30	-	<20	75	-	<0.01	<10	72	<10	9	25	-
SJ06-132	545457	5876870	0.02	-	22	1010	20	15	-	-	<5	-	<20	28	-	0.15	<10	249	<10	6	42	-
SJ06-133	545477	5876809	0.01	-	18	1030	14	60	-	-	<5	-	<20	103	-	<0.01	<10	134	<10	18	35	-
SJ06-134	545438	5876818	0.02	-	21	2160	18	<5	-	-	<5	-	<20	39	-	0.03	<10	256	<10	20	77	-
High-Grade Zone																						
06JLO2-11	545685	5876296	2.644	2.1	14.7	0.284	3.7	53	61.1	0.3	0.6	25	1.2	968	1.1	0.444	1	358	0.6	19	47	26.7
SJ06-149	545682	5876305	0.03	-	22	3660	62	70	-	-	<5	-	<20	158	-	0.17	30	308	<10	17	70	-
Std CANMET WPR1			0.017	1.8	3151	0.018	5.7	277	3.8	0.8	0.7	11	0.7	6	0.3	0.204	0.1	72	0.1	4.3	94	14.2
Recommended				2.4	2900	0.013	6	285	5	0.9	0.9	12	1.1	7	0.4	0.179	0.2	65			95	18
% Difference			50.0	7.1	2.1	8.1	1.3	0.7	6.8	2.9	6.3	2.2	11.1	3.8	7.1	3.3	16.7	2.6	50.0	50.0	0.3	5.9

06JLO: TICP= Four acid digestion - inductively coupled plasma emission/mass spectrometry analysis. FA - Lead collection fire assay - ICPES Finish. Acme Analytical, Vancouver

SJ06: TICP = Aqua regia digestion - inductively coupled plasma emission/mass spectrometry analysis, FA= fire assay. Eco Tech Laboratory, Kamloops and mineralization associated with the invasion of stocks and sills into the country rock.

Limited rock geochemical sampling and analyses indicates a Triassic mineral assemblage of copper-gold-palladium associated with alkaline magmatism and a younger, possibly Middle Jurassic or Cretaceous metal assemblage of molybdenum-arsenic-antimony associated with iron-carbonate-silica alteration. Ongoing studies of the mineralization, alteration and intrusive paragenesis at the Valentine zone is designed to understand the processes contributing to mineral deposition within an alkaline magmatic centre and permit assessment of other potential magmatic centres in the Quesnel belt.

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