Volcanic Facies, Deformation and Economic Mineralization in Paleozoic Strata of the Terrace–Kitimat Area, British Columbia (NTS 103I)

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Introduction

Recent regional mapping by the British Columbia Geological Survey (BCGS) has indicated that a package of Paleozoic volcanogenic strata, the Mount Attree volcanic complex, may host potential volcanic-hosted massive sulphide (VHMS) mineralization (McKeown et al., 2008; Nelson et al., 2008a). These Paleozoic strata are situated along the westernmost margin of Stikinia and intruded by Jurassic–Eocene plutons of the eastern Coast Plutonic Complex (CPC; Figure 1). Along strike to the north, Paleozoic and Mesozoic volcanic rocks similar to the Mount Attree volcanic-complex package host significant VHMS deposits, such as the Tulsequah Chief, Foremore, Eskay Creek, Granduc and Anyox deposits (Figure 1; Höy, 1991; McKeown et al., 2008). The recognition of this economic potential combined with new regional mapping, geophysical data from the recently completed QUEST-West survey and newly released BC regional geochemical survey (RGS) stream-sediment data from the Terrace–Kitimat area provides a solid foundation for additional studies of the area's economic potential.

This work focuses on the structural analysis, geochemical characterization, geochronology, and economic-mineral assessment of six targeted exposures of potential Paleozoic volcanogenic and marine sedimentary strata in the Terrace–Kitimat area. During the summer of 2009, detailed mapping and sample collection was completed in the six target areas outlined on Figure 2. Petrographic, structural, geochemical and geochronological analyses are in progress. These analyses will constrain the nature and timing of economic mineralization and deformation, establish a geochemical framework for volcanic and plutonic rocks in the area and assess the regional economic potential of these Paleozoic strata.

Keywords: *geochemistry, geochronology, Mount Attree volcanic complex, Zymoetz Group, Paleozoic, QUEST-West*

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Geological Setting

Economic mineralization in the Terrace–Kitimat area is concentrated along the intrusive boundary between the eastern margin of the CPC and supracrustal rocks of Stikinia (Figure 1). Devonian–Permian arc-volcanic rocks and platform carbonate rocks form the basement to Stikinia in the Terrace–Kitimat area, and are overlain by Triassic and Lower Jurassic marine sedimentary and volcanic-arc rocks. These supracrustal assemblages are intruded by Jurassic, Late Cretaceous and Eocene plutonic rocks of the CPC (Figure 2; Woodsworth et al., 1985; Gareau et al., 1997a, b).

Stratified units in the Terrace–Kitimat area include

- the newly defined Paleozoic Zymoetz Group consisting of a lower unit of andesitic and lesser rhyolitic flows, tuff and breccia named the Mount Attree volcanic complex (previously mapped as Jurassic Telkwa Formation) overlain by Lower Permian limestone of the Ambition Formation;
- Triassic (?), thinly bedded, radiolarian chert; and
- volcanic and volcaniclastic rocks of the lower Jurassic Telkwa Formation of the Hazelton Group (Nelson et al., 2006a; Nelson and Kennedy, 2007; Nelson et al., 2008a).

Plutonic rocks in the region are relatively poorly dated, and pluton ages are inferred from relationships with supracrustal rocks and petrological similarities to dated bodies northeast of Terrace (Nelson et al., 2008a). Early Jurassic intrusions, typified by the ca. 200 Ma Kleanza pluton, range from gabbro to granite and are compositionally and texturally heterogeneous and variably foliated (Figure 2; Gareau et al., 1997b; Nelson et al., 2008a). Cretaceous intrusions, which consist of ductilely deformed granodiorite and granite, are less voluminous (Nelson et al.,

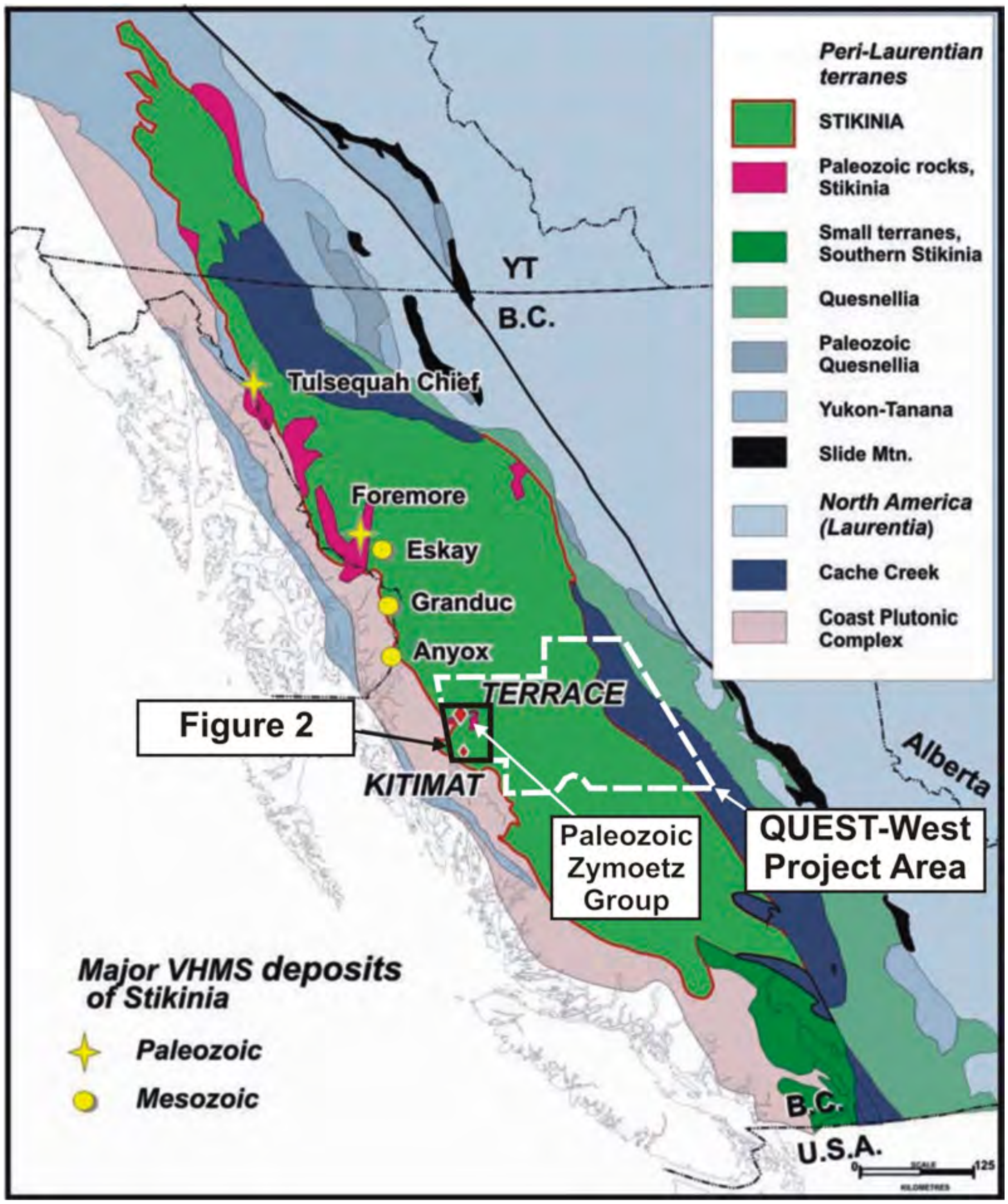

Figure 1. Terrane map of British Columbia, showing location of major volcanic-hosted massive sulphide (VHMS) deposits of Stikinia, location of study area (Figure 2 outline) and overlap of proposed project with QUEST-West Project (area outlined in white; modified from McKeown et al., 2008).

2008a). Eocene intrusions, such as the Carpenter Creek and Williams Creek plutons, consist of large, bulbous, nonfoliated granite and granodiorite units (Figure 2; Gareau et al., 1997b; Nelson et al., 2008a).

Paleozoic strata, such as the Zymoetz Group, are variably deformed but typically have a moderate to strong foliation parallel to bedding, particularly in the Mount Attree volcanic complex (Nelson et al., 2008a). The presence of overlying nonfoliated Jurassic strata indicates that a potentially important Late Paleozoic–Early Mesozoic deformational event involved strata with VHMS potential. Zymoetz Group and Telkwa Formation strata are folded on a regional scale into a northeasterly trending anticline that is oblique to the main structural grain in the region (Nelson et al., 2008b). The entire region has been affected by Cretaceous–Eocene extensional faulting, and probably occupies the hangingwall of a major low-angle structure associated with unroofing of the Central Gneiss Complex to the west (Heah, 1991; Nelson and Kennedy, 2007; Nelson et al., 2007; Nelson et al., 2008a, b).

Previous Work

Duffell and Souther (1964), Woodsworth et al. (1985) and Gareau et al. (1997a, b) produced regional geological maps and U-Pb geochronology results for the Terrace map area. The lack of regional maps at 1:50 000 scale for NTS 103I

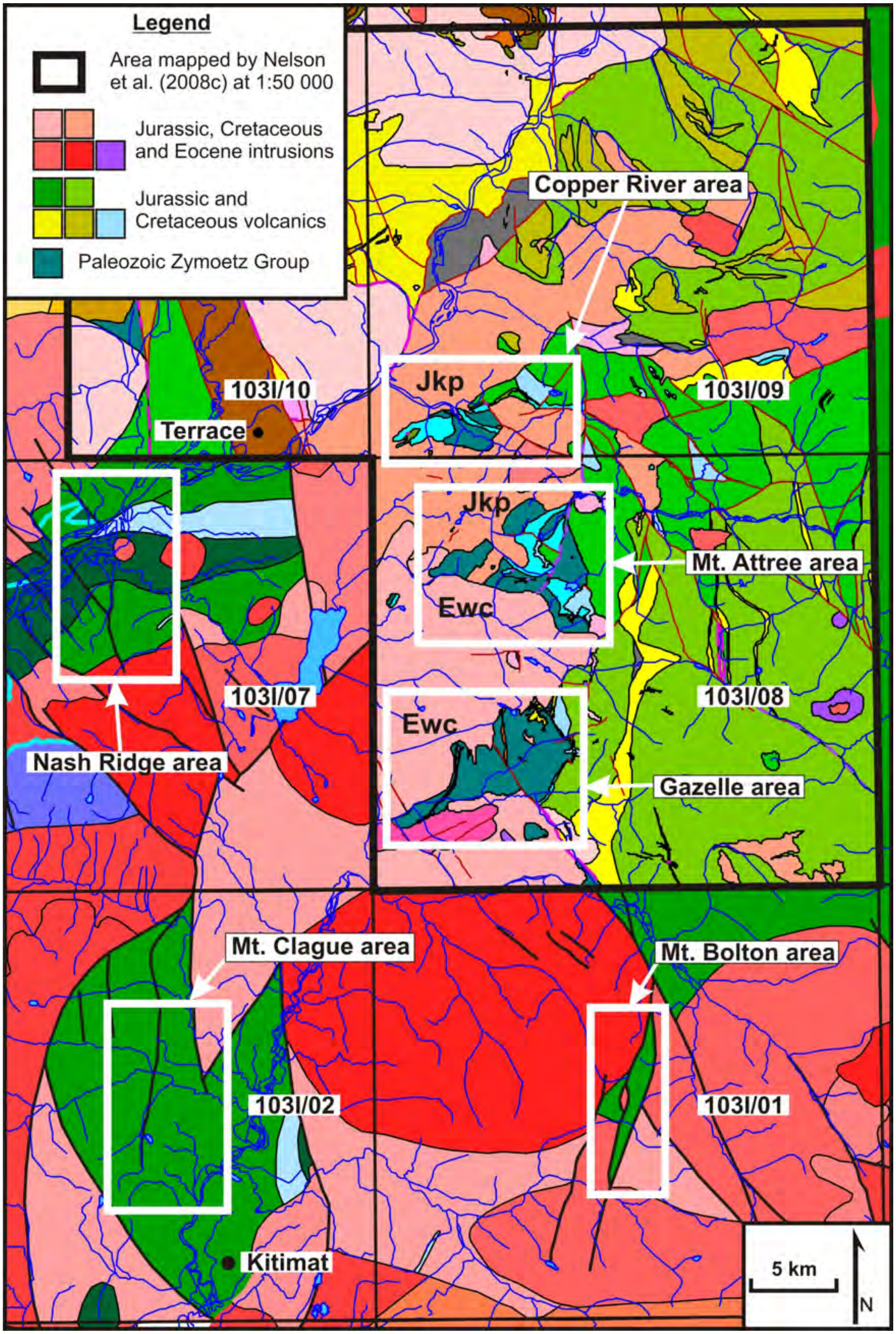

Figure 2. Geology of the Terrace–Kitimat area derived from BC MapPlace (British Columbia Geological Survey, 2008). New geological mapping by Nelson et al. (2008c) falls within the box with the heavy black outline; boxes with white outline highlight targeted exposures of Paleozoic Mount Attree volcanic rocks. Abbreviations: Jkp, Jurassic Kleanza pluton; Ewc, Eocene Williams Creek pluton.

and renewed interest in mineral exploration prompted the BCGS to initiate the Terrace Geological Mapping and Mineral Assessment Project, which was active from 2005–2008 under the direction of J.L. Nelson (Nelson et al., 2006a). This BCGS project has produced a series of reports and maps (Figure 2 outlines new mapping) that provide a modern geological framework for mineral exploration interest in the Terrace–Kitimat area (Nelson et al., 2006a, b; Nelson and Kennedy, 2007; Nelson el al., 2007; McKeown et al., 2008; Nelson et al., 2008a–c; Nelson, 2009).

Newly discovered VHMS-style mineralization in the Paleozoic Mount Attree volcanic complex, discovered during the regional mapping project, is believed to be analogous to that of other VHMS deposits found in Stikinia, such as the Tulsequah Chief deposit (Figure 1; McKeown et al., 2008) This mineralization is characterized by massive sulphide lenses, disseminated sulphide minerals and syngenetic alteration of felsic volcanic rocks to quartz-sericite schist (Höy, 1991; McKeown et al., 2008). Deformed and metamorphosed Mount Attree volcanic-complex rocks and their mineral potential were previously described by Hooper (1984, 1985) when he discovered the Gazelle showing. Mount Attree volcanic-complex rocks in and around the Gazelle showing exhibit intense sericitization and silicification, lenses of chalcopyrite and sphalerite parallel to bedding, disseminated chalcopyrite±galena and massive barite (Figure 2; Hooper, 1984, 1985; McKeown et al., 2008). McKeown et al. (2008) suggested other known and suspected Zymoetz Group exposures may have VHMS potential (shown in boxes on Figure 2).

In addition, mapping identified Mo±Cu±Au–porphyry deposits, polymetallic veins (Ag, Pb, Zn, Au), variably mineralized skarns and shear-zone–hosted polymetallic veins (Ag, Pb, Zn, Au) associated with CPC intrusions, including the Jurassic Kleanza pluton and Eocene Carpenter Creek and Williams Creek plutons (Figure 2; Nelson et al., 2008a). Timing of mineralization with respect to volcanism, magmatism and deformation remains poorly constrained for these deposits (J. Nelson, pers. comm., 2008).

Summary of Targeted Areas

Targeted areas consist primarily of exposures of the Mount Attree volcanic complex and were selected based on previous work that identified or suggested VHMS potential. Analysis of RGS stream sediment data identified an additional target of opportunity near Mount Bolton (Figure 2). Rock types, volcanic facies, alteration, deformation and mineralization vary considerably between the targeted areas, which are described separately. Within each area, samples were collected for geochemical, assay, petrographic and microstructural analyses, and geochronology to help fully characterize the relationships between volcanism, deformation and mineralization. Samples of other representative units associated with or intruding the targeted Mount Attree volcanic complex were also collected. These samples are being used to assist in timing of deformation and mineralization studies and to provide a basic geochemical framework for future and ongoing study in the Terrace–Kitimat area, including the recent QUEST-West geophysical survey and RGS stream-sediment survey reanalysis (described in Kowalczyk [2009] and Jackaman [2009], respectively). The nature of the rock types, deformation, alteration and mineralization observed in the six targeted areas during summer 2009 fieldwork is summarized below.

Copper River

The Copper (Zymoetz) River area has several large exposures of Mount Attree volcanic rocks (Figure 2). The exposures north of the Copper River are strongly dominated by medium- to coarse-grained nonwelded tuff and upright, generally northwest-striking and moderately north-dipping epiclastic volcanic rocks. There is a general trend of increasing clast size in the volcaniclastic rocks from south to north. Northern exposures consist of coarse-grained fragmental andesitic volcanic rocks and very coarse grained epiclastic units consisting primarily of rounded andesitic volcanic clasts (Figure 3). Northern exposures also contain lesser litharenite to feldspathic litharenite and siltstone interbeds, aphanitic andesite flows and/or sills and conglomerate. In a few localities, channels cut epiclastic volcanic rocks, which consist of fining-upward sequences of polymictic pebble conglomerate to feldspathic litharenite. Samples of these volcanogenic sedimentary sequences were collected for detrital zircon analyses to constrain the age of the Mount Attree volcanic complex. Aphanitic to porphyritic andesite dikes (hornblende) are observed throughout the area.

The Mount Attree volcanic rocks in the Copper River area typically show pervasive chlorite-epidote alteration. Minor quartz veining is observed locally but veins are barren and

Figure 3. Coarse-grained epiclastic volcanogenic rocks from the Copper River area, British Columbia. Clasts are predominantly porphyritic andesite and dacite.

typically undeformed, and do not show a preferred orientation. Intensity and orientation of foliation in this package of volcanic rocks varies spatially. Foliation is often associated with thrust faults, which imbricate the Paleozoic Mount Attree volcanic complex atop a sequence of thin-bedded chert, silt and sand units interpreted to be Triassic (Nelson et al., 2006a, b). Thrusts and subsidiary shear zones in the area strike southwest, dip to the north and give consistent top-to-the-south sense of shear. Slightly folded aphanitic andesite dikes cut the Mount Attree volcanic rocks and Triassic sedimentary units, which suggests that deformation of the sequence is post-Triassic. Economic-mineral potential in the Mount Attree volcanic rocks in this area is limited. Most mineralization noted in the area is associated with the Jurassic Kleanza pluton, which intrudes the volcanic rocks (Figure 2), and is localized around xenoliths of volcanic rocks near the pluton margin, where it consists of disseminated pyrite, chalcopyrite, and rarely disseminated and vein malachite.

Mount Attree

The Mount Attree area is the type locality for the Mount Attree volcanic complex. Volcanic rocks in this area include a western unit that is dominated by aphanitic andesitic flows, sills and small stocks and crosscutting porphyritic andesite dikes. This transitions abruptly to an eastern unit characterized by fine- to medium-grained fragmental volcaniclastic andesite with minor aphanitic andesite flows and sills, and porphyritic andesite dikes. A structural contact between Mount Attree volcanic units and Ambition Formation limestone is exposed in several localities in the Mt. Attree area. Nelson et al. (2006a, b) argued that the Mount Attree volcanic complex and Ambition Formation limestone are conformable, based on interfingering of the volcanic units and limestone. Eastern exposures of volcanic rocks in the Mount Attree area contain lenses of coarse crystalline marble whose protolith is possibly Ambition Formation limestone. Thus, observed structural contacts could be sheared depositional contacts. In other localities in the Terrace–Kitimat area, exposure was poor and it remains unclear whether contact is everywhere a structural contact.

Intruding the package of volcanic rocks in the west is a medium-grained, foliated hornblende-biotite granodiorite, interpreted by Nelson et al. (2008a, b) to be part of the Jurassic Kleanza pluton. Samples of this body were collected for geochemical analysis and comparison to other Kleanza samples. Small stocks of granodiorite and quartz monzonite intrude eastern volcanic and marble units; these smaller intrusions are interpreted to be part of the same Kleanza system and the bodies responsible for metamorphism of the marble observed in the area. Granodiorite dikes that intrude marbles are characterized by slight folding, which likely occurred during the emplacement of the Kleanza pluton and deformation of the marble units.

Foliation in the Mount Attree volcanic package varies spatially in orientation and intensity and often occurs near small shear zones in the package. Where observed, foliation is typically northeast striking and steeply dipping. The Kleanza pluton is variably deformed and exhibits a subsolidus foliation defined by aligned hornblende and elongate plagioclase that strikes generally east- and dips moderately to the north. Alteration of the volcanic package is characterized by a pervasive chlorite-epidote overprint and locally by chlorite-epidote veining. Unlike most exposures of Mount Attree volcanic rocks, chlorite-epidote veining in this area has a consistent, roughly north-striking and steeply dipping orientation. Mineral potential in the type locality is limited. The only mineralization observed consists of a few small (10–50 m) gossans several kilometres east of Mount Attree along the contact between the Kleanza pluton and fine-grained andesitic fragmental units containing disseminated pyrite and minor chalcopyrite. These gossans are interpreted to be related to the intrusion of the Kleanza pluton.

Gazelle

The Gazelle area is a primary target because of previously recognized potential for economic mineralization (e.g., MINFILE 103I 185; MINFILE, 2009) and the interpretation of VHMS-style mineralization in the area (Hooper, 1984, 1985; McKeown et al., 2008). Numerous geochemical, assay and geochronological samples were collected from this area to help assess mineral potential and determine genetic and timing relationships. Most mineralization in the Gazelle area occurs in its central region, where the predominantly felsic volcanic rocks are more intensely deformed and metamorphosed, and contain more gossans than surrounding volcanic rocks in the Gazelle area and all exposures of Mount Attree volcanic rocks east of Terrace (Figure 4a).

Western and southern exposures of Mount Attree volcanic rocks are dominated by andesitic fragmental units that grade into dacitic to rhyolitic tuff to the east. Andesitic units are typically fine- to coarse-grained nonwelded lapilli tuff with minor aphanitic andesite flows and/or sills. These units are metamorphosed to greenschist facies and cut by numerous aphanitic and porphyritic andesite dikes, some of which are folded (Figure 5). Foliation within the andesitic units is consistent, strikes north-northwest and dips moderately to steeply east. The central region of the Gazelle area is characterized by dacitic to rhyolitic tuff protoliths, which have been metamorphosed to upper-greenschist facies or higher and exhibit much more intense deformation (i.e., well-developed foliation everywhere) than observed elsewhere in both the Gazelle and other targeted areas. There is a mix of quartz-sericite schist, biotite schist and fine-grained, quartz-dominated schist found in the central region.

Figure 4. a) Gossan rich in disseminated pyrite, chalcopyrite, arsenopyrite and small undeformed veinlets or stringers of chalcocite from the central region of the Gazelle area, British Columbia. **b)** Magnetite skarn found along contact between Mount Attree volcanic rocks and an Eocene (?) intrusion.

Figure 5. Folded andesite dike cutting nonwelded andesitic fragmental volcanic rocks in the southern part of the Gazelle area, British Columbia.

In the western region an undated granodiorite pluton intrudes the western margin of the Mount Attree volcanic rocks. This coarse-grained biotite-granodiorite pluton is texturally identical to the granite found in the Nash Ridge area (described below) and contains 40–45% quartz in large (~1 cm), slightly elongate blebs. The foliation in this Cretaceous (?) granite is parallel to that observed consistently in the rest of the Gazelle area. This pluton is interpreted to constrain the maximum age of the deformation that resulted in the area's foliation, which is likely related to the occurrence of a regional east-west contraction during, and shortly after, crystallization of the granodiorite pluton. The Eocene Williams Creek pluton (or equivalent) to the west shows no evidence of magmatic or subsolidus foliation development.

The Gazelle area is also characterized by numerous large gossans hosted in the central region (Figure 4a). Mineralization observed in the central domain is typically disseminated and undeformed pyrite, arsenopyrite and locally chalcopyrite and chalcocite. In several localities vein pyrite, chalcopyrite, galena and chalcocite stringers are undeformed and crosscut foliation in quartz-sericite schist, which suggests that development of at least some of the mineralization in the Gazelle area is a post-foliation event, possibly associated with nearby CPC intrusions. A new discovery of sphalerite±magnetite pods up to 1 m in size was made in a layered Jurassic (?) intrusion west of the main exposure of Mount Attree volcanic rocks. Large xenoliths of dacitic to rhyolitic tuff occur near sphalerite pods. One pod showed evidence for previous prospect activity but this occurrence is not in the MINFILE database. Samples were collected from the sphalerite pod for assay and from the plutonic units for geochemistry. Additional mineralization in the Gazelle area, typically magnetite skarn, was observed along the western contact of volcanic units with the Eocene Williams Creek pluton and other undated (Cretaceous?) plutons (Figure 4b).

Mount Bolton

The Mount Bolton area was not mapped during the most recent BCGS regional mapping campaign in the Terrace–Kitimat area. It was selected as a target because it is along and across strike of other mapped exposures of Mount Attree volcanic rocks and contains proximal RGS Cu, Mo and Au anomalies (Nelson, 2009). This north-trending, elongate body of volcanic rock was previously mapped as possible Lower Jurassic Telkwa Formation by Woodsworth et al. (1985). The northern half of the target area was mapped and sampled for petrographic, geochemical and geochronological analyses.

The northern tip is an intrusive complex characterized by a 50:50 mix of volcaniclastic units intruded by dikes and stocks. Volcaniclastic rocks consist of dacitic to rhyolitic welded and nonwelded tuffs with round quartz eyes, plagioclase phenocrysts (<1 cm) and minor euhedral biotite. Minor occurrences of volcanogenic siltstone and sandstone, hypabyssal rhyolite sills and crosscutting andesite dikes were also observed. These are intruded by Eocene (?) fine- to medium-grained hornblende-biotite granodiorite, which contains ubiquitous euhedral honey-brown titanite. Often, volcanic units are found as decametre-scale xenoliths and/or rafts within the plutonic rocks near contacts with larger plutons to the north and east. South of the intrusive complex, dacitic to rhyolitic crystal-lithic welded and nonwelded tuffs dominate (Figure 6). Bedding generally strikes west-northwest and dips moderately to the north. Plagioclase and hornblende-phyric andesite dikes, locally folded, cut the package of volcaniclastic rocks.

Overall, the volcaniclastic units observed in the Mount Bolton area appear significantly less metamorphosed and altered than those found in the other target areas. Metamorphic grade appears to be lower-greenschist facies at most, with local exceptions in the intrusive complex. The pervasive chlorite-epidote alteration observed elsewhere in the Mount Attree volcanic complex is absent in this area (Figure 6), except for some local epidote veining and replacement. Epidote replacement appears to be the result of hydrothermal fluid flow in channels or pipes through the volcanic rocks, probably during pluton emplacement. The volcanic units in this area likely belong to the Jurassic Telkwa Formation based on their lower grade of metamorphism and lack of alteration. A sample of quartz-phyric rhyolitic welded tuff was collected for dating. Mineralization is lacking in this area, with one exception consisting of minor disseminated pyrite and vein pyrite observed in one rhyolite tuff.

Nash Ridge

Distinctly different volcanic lithofacies are observed in the Nash Ridge area (and Mount Clague below), which is located ~10 km due west of type exposures of Mount Attree volcanic rocks (Figure 2). The area consists of a southern region dominated by mixed volcanic units and a northern region (north of the Skeena River) that consists primarily of deformed plutonic rocks. Unique to volcanic units found in the Nash Ridge and Mount Clague areas are spectacular lavender quartz eyes, which distinguish them from all other units to the east (Figure 7).

The southern region consists of rhyolitic to dacitic crystal-lithic tuff, porphyritic dacite flows, aphanitic and porphyritic (plagioclase) andesite flows and/or sills, dacitic to andesitic flows containing rhyolite clasts and medium- to coarse-grained nonwelded andesitic fragmental tuff. Rhyolitic to dacitic units typically contain abundant lavender quartz eyes, but all rock types and most exposures contained some lavender quartz eyes (Figure7). Intercalated within the volcanic rocks are lenses of coarse-grained, strongly foliated biotite schist. The entire package of volcanic rocks is metamorphosed to upper-greenschist facies. Foliation strikes consistently east-northeast and dips steeply. Aphanitic andesite dikes (variably porphyritic with plagioclase and hornblende phenocrysts) are present throughout the volcanic package and are typically undeformed. A small stock of nonfoliated medium-grained gabbro intrudes the volcanic units. A high-temperature ductile shear zone (<1 m wide), with plastically deformed feldspar and oriented parallel to foliation in the volcanic rocks, cuts the gabbro.

Figure 6. Welded rhyolite tuff with flattened fiamme found in the Mount Bolton area, British Columbia.

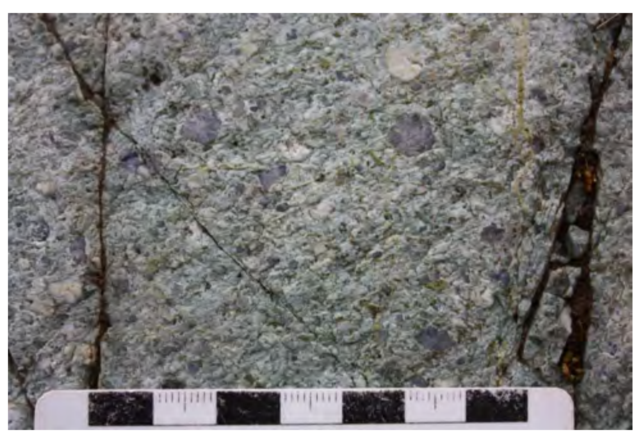

Figure 7. Rhyolite tuff with distinctive lavender quartz eyes characteristic of most units found in the Nash Ridge area and some units in the Mount Clague area, British Columbia.

A Cretaceous (?) coarse-grained biotite granodiorite intrudes the volcanic package to the south. It contains 40–45% quartz, which occurs as large, slightly elongate blebs. This pluton is deformed in the solid state and has a consistent foliation defined by the elongate quartz, which is parallel to the foliation found in the volcanic rocks. A sample of the deformed pluton has been collected for dating, which should provide a maximum on the age of deformation in the Nash Ridge area. Late, steep, brittle faults dissect the area and show consistently subhorizontal slickensides indicating strike-slip movement. Undeformed chlorite-epidote veins are noted infrequently in this area and their lack of specific orientation is evidence of late- or post- deformational emplacement Minor mineral occurrences were found throughout the entire area and typically occur in dacitic to rhyolitic rock types but were also observed in nonwelded andesitic tuff, schist lenses, crosscutting andesite dikes and gabbro. Mineralization consists of pyrite, chalcopyrite, pyrrhotite, arsenopyrite and minor bornite. It is expected that microstructural analyses carried out in the Nash Ridge area will help confirm that mineralization was a syn- or postdeformation event because disseminated pyrite and arsenopyrite crystals are euhedral and appear to overprint foliation.

The northern domain consists primarily of variably foliated and lineated diorite to quartz diorite, minor tonalite and nonwelded andesitic fragmental tuff. Plutonic units here are heterogeneous, containing abundant (50–60%) volcanic, schist, diorite and hornfels xenoliths. In addition, there is strong textural variability in the intrusive units from very fine to coarse-grained, in particular in the roadside outcrops observed along Highway 16, west of Terrace. Fine-grained biotite granodiorite dikes, typically <1 m wide, intrude the diorite package. Andesitic fragmental volcanic rocks, observed locally, show pervasive chlorite-epidote alteration and are interpreted to be xenoliths in the intrusive package. The variable foliation intensity and orientation observed in northern domain intrusions can also be interpreted to be a result of local deformation concentrated around the volcanic xenoliths. Very little mineralization was observed in this northern domain compared to the south, with infrequent occurrences of minor disseminated pyrite hosted by diorite.

Mount Clague

The exposures of Mount Attree volcanic rocks in the Mount Clague area are somewhat similar in character to those found in the Nash Ridge area. Particularly interesting is the presence of lavender quartz eyes in both volcanic and plutonic units found in this area. Volcanic rocks are exposed in the central portion of the outlined target area in Figure 2 and are nearly completely surrounded by a heterogeneous intermediate to mafic intrusive complex. Dominant volcanic rock types include quartz-phyric rhyolitic to dacitic tuff, where quartz phenocrysts are both of the lavender and clear variety, with the presence of minor occurrences of lithic dacitic tuff and andesitic nonwelded tuff with lavender quartz eyes (xenocrysts?) also noted in the matrix. Most of the Mount Clague area consists of tonalite, diorite and microdiorite intrusions with minor occurrences of granite and gabbro. Felsic plutonic units, in particular granitic intrusions, often contain lavender quartz phenocrysts/xenocrysts (?).

Foliation, typically found in plutonic rocks, is variable in orientation and intensity. A somewhat consistent southwest strike and moderate dip to the north characterize the plutons. Alteration observed in the volcanic units and many of the plutonic units is typically pervasive chlorite-epidote alteration with local chlorite-epidote veining. Veins of radiating actinolite were also observed locally in dacitic tuff; vein orientations are inconsistent throughout the area. The VHMS-style mineralization reported by Nelson (2009) was not observed during summer 2009 fieldwork; however, the presence of disseminated and vein pyrite was noted in rhyolitic volcanic rocks.

Summary

Detailed mapping within the six targeted exposures of Paleozoic Mount Attree volcanic rocks has shown that there are observable volcanogenic lithofacies trends that can help focus exploration studies. One significant trend within the Mount Attree volcanic sequence is the distinct difference between volcanic lithofacies in the areas west of Terrace compared to the eastern areas. In general, western areas are more felsic, contain more intrusive material, are generally higher metamorphic grade and contain ubiquitous lavender quartz eyes, which are completely absent in the eastern Mount Attree volcanic complex exposures, in both volcanic and plutonic rocks. Lithofacies trends have also been noted within the individual targeted exposures and are being examined further through petrographic and geochemical analyses.

The Gazelle area has shown the most economic-mineral potential. Previous work around the Gazelle showing has described the mineralization as VHMS in origin (Hooper, 1984, 1985; McKeown et al., 2008); however, at least some of the mineralization observed in the Gazelle area occurred during or after foliation development, as indicated by crosscutting vein pyrite, chalcopyrite, galena and chalcocite. Furthermore, much of the disseminated mineralization appears to be postdeformational because pyrite is typically euhedral and overprints foliation. This mineralization could be a result of intrusion of CPC plutons or have been remobilized by them. Foliation patterns in Mount Attree volcanic complex exposures in the Gazelle and Nash Ridge areas are parallel to foliations developed in undated

(Cretaceous?) plutons. Geochronological sample preparation is in progress and will help evaluate this possibility.

Ongoing petrographic, geochemical and geochronological work will help constrain the ages of the volcanic packages, their genesis and the timing of mineralization with respect to deposition and deformation. These data, when combined with the results of targeted mapping completed during summer 2009, recent regional mapping, QUEST-West geophysical data and reanalyzed RGS stream data, will provide a more complete geological and mineral potential framework for the Terrace–Kitimat area.

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