Preliminary Geology of the Cariboo Lake Area, Central British Columbia (093A/11, 12, 13 AND 14)

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KEYWORDS: *Barkerville Terrane, Cariboo Terrane, Kootenay Terrane, Snowshoe Group, Keithley, Harveys Ridge, Agnes conglomerate, Goose Peak quartzite, Downey, Ramos, Frank Creek volcanics, Mount Barker volcanics, geochemistry, Unlikely, Frank Creek, Ace, volcanogenic massive sulphide, VMS, besshi, sedimentary exhalative, SEDEX.*

INTRODUCTION

This paper summarizes work in the second year of the Barkerville Mapping Project, a multi-year program examining the stratigraphic and structural setting of massive sulphide mineralization hosted by Snowshoe Group stratigraphy in the Cariboo Lake area. These relatively new sulphide occurrences are of volcanogenic or sedimentary exhalative origin and are best represented by the Ace Cu-Pb-Zn-Au-Ag (MINFILE 093A 142) and Frank Creek Cu-Pb-Zn-Au-Ag (MINFILE 093A 152) showings (Figure 1).

The main aims of this project are: 1) a better understanding of the geological setting of the Frank Creek and Ace mineral occurrences; 2) define the regional extent, nature and significance of metavolcanic rocks associated with the Frank Creek showing; 3) evaluate the nature and significance of metavolcanic rocks within the Downey succession, and, 4) test a model suggesting the inversion of Snowshoe stratigraphy (Höy and Ferri, 1998a). The objectives of the 2001 field program were to extend mapping northeastward toward Little River, northwestward across Cariboo Lake and onto the Snowshoe Plateau (Figure 2). This latter area is dominated by sub-amphibolite grade sections of Snowshoe stratigraphy and it was anticipated that it would provide an opportunity to recognize stratigraphic units delineated during the 2000 season.

Approximately 60 days were spent in the field from the beginning of June to the third week of August. A base was set up in Likely, which is the nearest source of supplies for the Cariboo Lake area. This small centre is reached by paved road from a turn-off some 20 kilometres south of Williams Lake on Highway 97 (Figure 2). Logging roads extend westward from Likely and cover a large portion of the sub-alpine regions of the map area. A very rough, 4-wheel drive quad road traverses the Snowshoe Plateau and connects the Keithley and Cunningham creek valleys.

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Two principal areas were mapped: 1) An area within the Goose Range which is bounded by Little River to the north, Ishkloo Creek to the west, Barkers Creek to the east and the headwaters of Grain Creek to the southwest; 2) a region that occupies the northwest side of Cariboo Lake and is bounded by Kangaroo and Spinks creeks to the southwest and Sixbee Creek to the northeast. The northwest boundary is within the Snowshoe Plateau, and roughly corresponds to a line between Roundtop Mountain, Yanks Peak and Coyote Hill (Figure 3a).

The Snowshoe Plateau and Goose Range represent the first large area of elevated terrain as one leaves the interior plateau and before entering the rugged Cariboo Mountains to the east. Relief is moderate with peaks reaching 2100 metres and alpine occurring at approximately 1700 metres. Many of the ridges within the Snowshoe Plateau occur just above timberline and allow easy travel.

This work builds on mapping south of Cariboo Lake by Ferri (2001a, b). A detailed account of previous work within the Barkerville - Wells area is given by Struik (1988). The present map area was covered at a regional scale by Campbell (1978) and at a more detailed level by Struik (1983a, b; 1988). Lang (1938, 1939) first mapped the area around Keithley Creek and the region between Yanks Peak and Roundtop Mountain. Holland (1954) re-examined this latter area in hopes of shedding new light on this economically important region. Panteleyev *et al*. (1996) mapped Quesnel Terrane rocks to the west and also gave a good account of regional geology. Rees (1987), as part of a Ph.D. dissertation, examined in considerable detail the boundary between the Quesnel and Barkerville terranes between Cariboo Lake and Mount Brew. Höy and Ferri (1998a, b) described Pb-Zn deposits of the Cariboo and Barkerville terranes, and Ferri *et al.* (1999) detailed the age, composition and tectonic significance of the western Quesnel Lake Gneiss.

REGIONAL SETTING

The Late Proterozoic to Paleozoic Snowshoe Group is a dominantly siliciclastic package of continental derivation that most likely represents the distal western edge of Ancestral North America. This fault-bounded sequence is stratigraphically distinct from other packages around it and as such has been called the Barkerville Subterrane, a subset of the Kootenay Terrane, with which it shares many similarities (Struik, 1986, 1988). East of the Snowshoe Group, across the westerly-verging Pleasant Valley thrust, are rocks

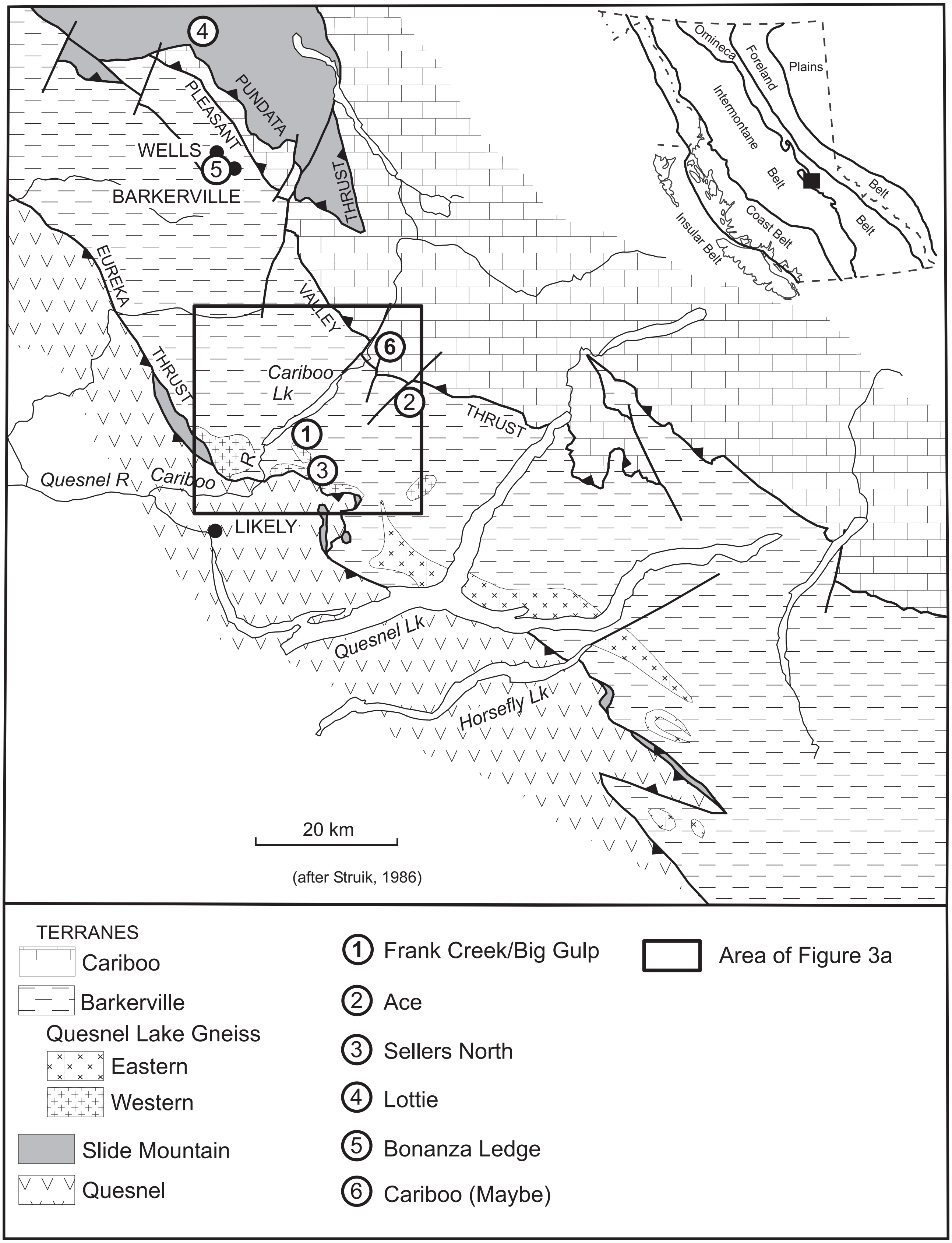


Figure 1. Generalized geological setting of the study area, together with some of the more significant mineral showings in the Barkerville and Cariboo terranes.

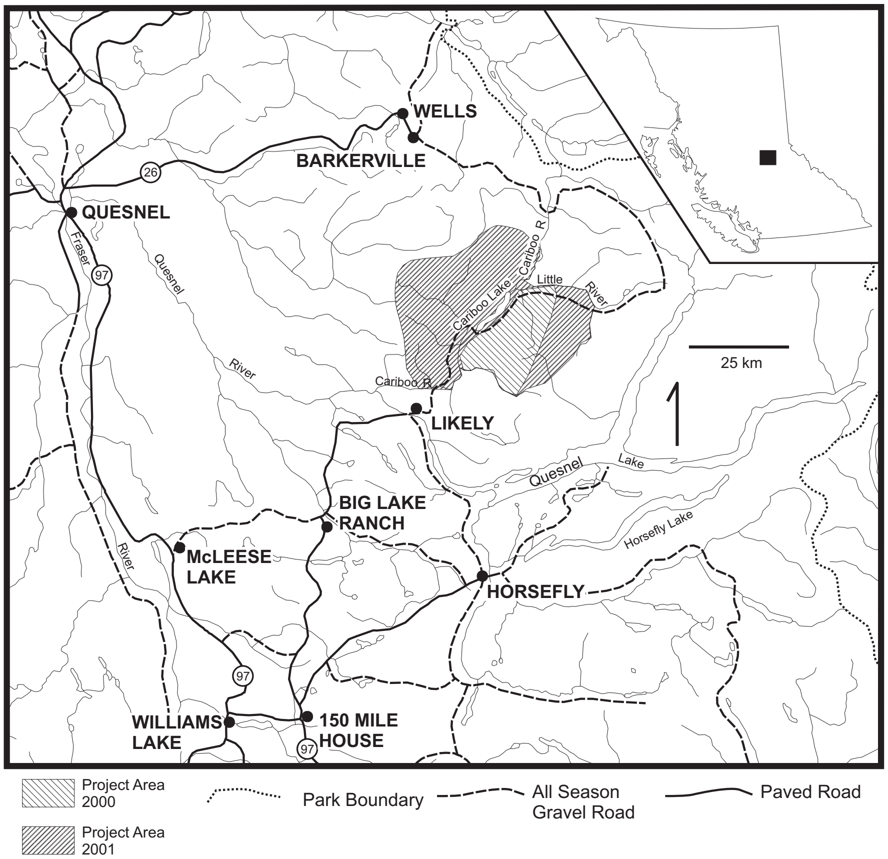


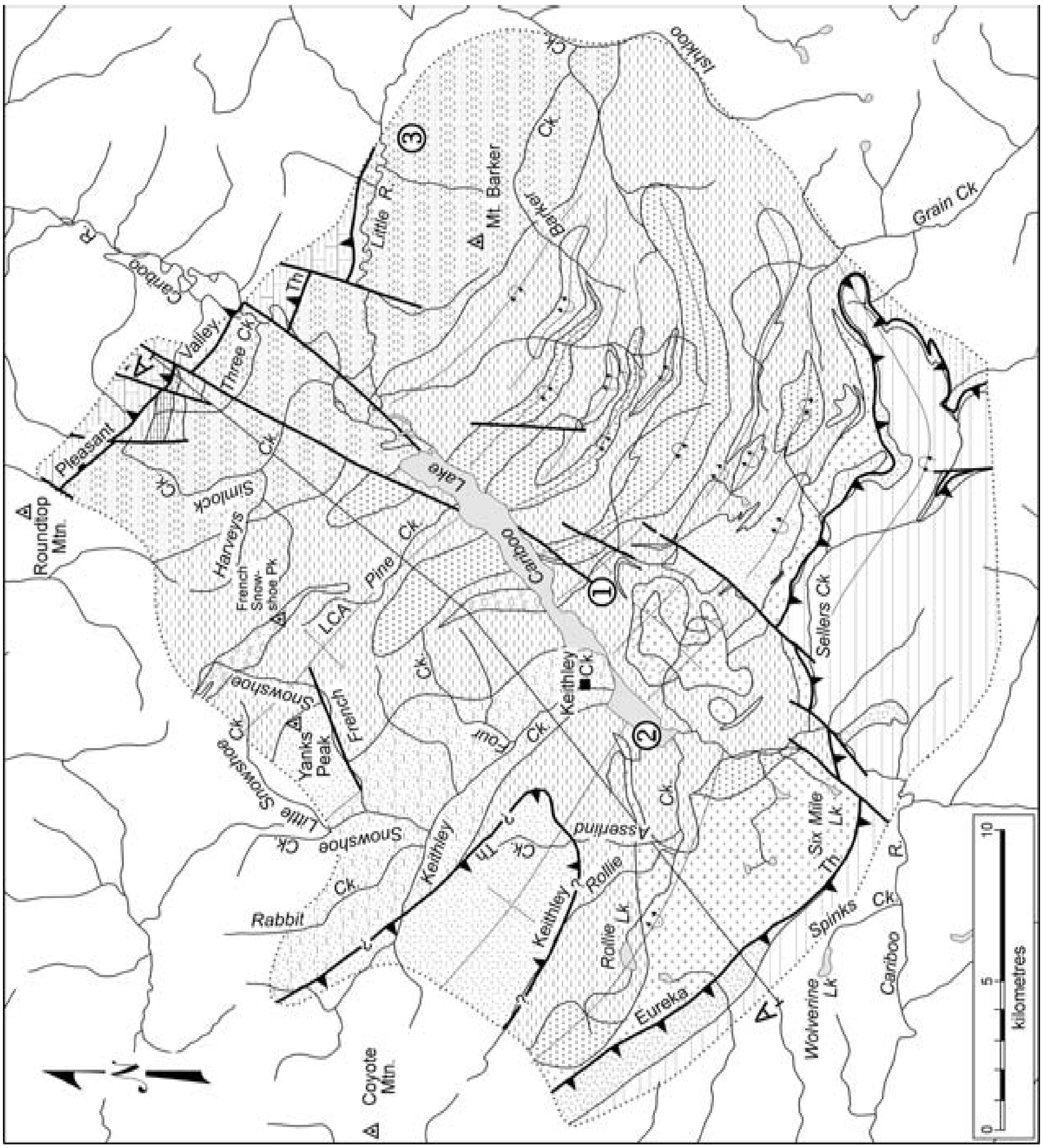
Figure 2. Location of the Cariboo Lake study area.

of the Kaza, Cariboo and Black Stuart groups, which also contain an abundance of siliciclastics, but with facies which suggest a more proximal continental shelf setting. Many of these units can be correlated with similar stratigraphy within Ancestral North American rocks. These rocks are placed within the Cariboo Subterrane, representing, like the Cassiar Terrane to which it belongs, a displaced piece of Ancestral North America (Struik, 1986, 1988). The west flank of the Snowshoe Group is occupied by the Quesnel Terrane, a composite volcanic-arc sequence dominated by Mesozoic mafic to intermediate volcanic rocks. It is separated from the Snowshoe Group by the easterly-directed Eureka thrust fault along which are slivers of mafic and ultramafic rocks assigned to the Crooked Amphibolite. This latter package has been correlated with rocks of the Slide Mountain Terrane, an assemblage of ocean floor volcanic and sedimentary rocks which structurally straddle the Barkerville and Cariboo terrane lithologies along the Pundata Thrust north of Wells (Figure 1).

Although the Snowshoe Group has an overall stratigraphic sequence distinct from that of the Cariboo Subterrane, there are similarities between the two, particularly with rocks of the Cariboo Group (Figure 4). This resulted in early workers taking stratigraphic terminology developed within the Snowshoe Plateau and extending it eastward into rocks of Cariboo Mountains (*see* Struik, 1988). This led to stratigraphic problems until Campbell *et al*. (1973) realized that the two sequences were quite distinct and required redefinition and new type sections. As a result, Struik (1988) formally reassigned rocks within the Snowshoe Plateau to the Snowshoe Group.

The present structural interleaving of the various terranes and dominant structural fabrics resulted from deformation which began in early Middle Jurassic time, although there may be earlier events of Permo-Triassic or Devono-Mississippian age. The latter is supported by the presence of the Early Mississippian Quesnel Lake Gneiss, possibly related to arc volcanism (Ferri *et al.*, 1999). Jurassic deformation resulted from the easterly thrusting of the Quesnel and Slide Mountain terranes on to the Snowshoe Group along Eureka and Pundata thrusts. There are three sets of penetrative cross-cutting structural features within the map area with metamorphism reaching amphibolite grade during the second period of deformation.

The Snowshoe Group has been subdivided into several informal units or successions by Struik (1988; Figure 4). It is dominated by siliciclastic rocks with lesser carbonate and volcanic sequences. Due to the penetrative fabric and lack of suitable lithologies for geochronology and preservation of fossils, there are few age constraints for this package. Regional correlations and scant fossil remains indicate a Late Proterozoic to Late Paleozoic age (Figure 4). The lower to middle Snowshoe Group is broadly correlative with the Kaza and lower to middle Cariboo Group (Figure 4, Struik,



Roundtop Mtn.
Pleasant
Valley
Three Ck
Cariboo R.
Little R.
Th
Mt. Barker
Barker
Ck
Isham
Grain Ck
Simlock
Ck
Harveys
French Snow-shoe Pk.
Pine Ck
Cariboo
Lake
LCA
Snowshoe
French
Yanks Peak
Little Snowshoe Ck
Snowshoe Ck
Keithley
Ck
Four
Ck
Sellers Ck
Six Mile Lk.
Th
Spinks Ck.
Cariboo R.
Wolverine Lk
Eureka
Rollie Lk
Rollie
Keithley
Th
Assenfind
Rabbit Ck
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N
A
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Figure 3a.

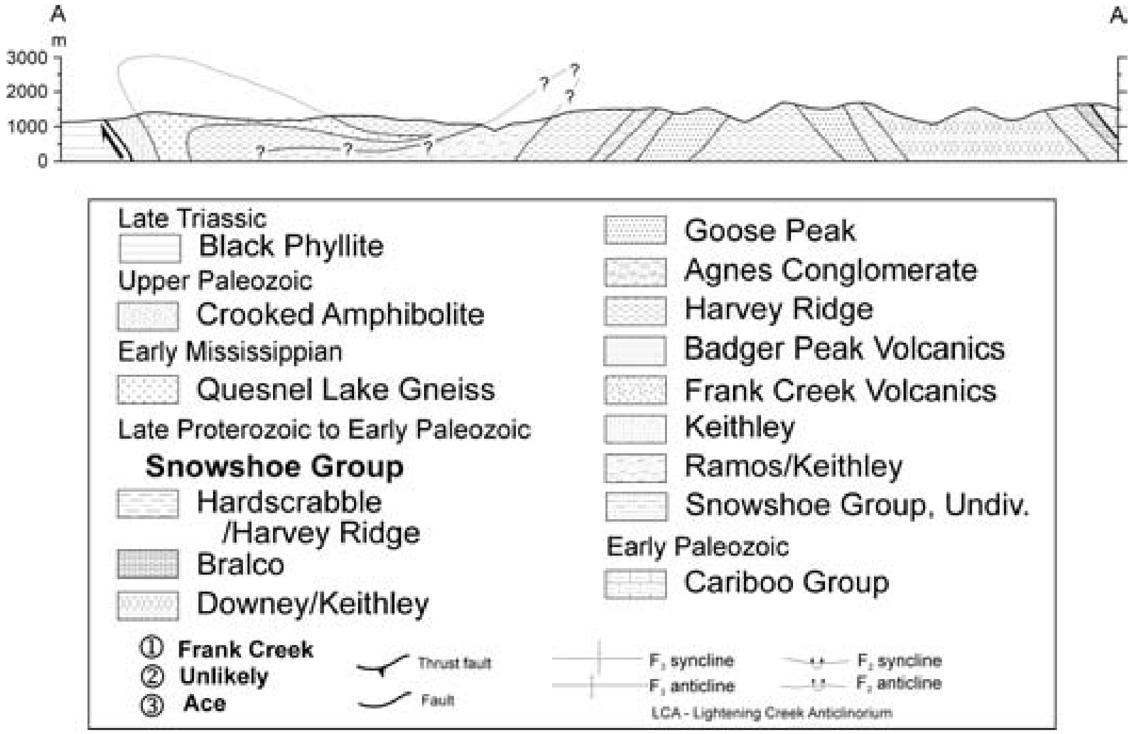

Figure 3. (a) Simplified preliminary geologic map of the Cariboo Lake area. (b) Simplified structural cross-sesction.

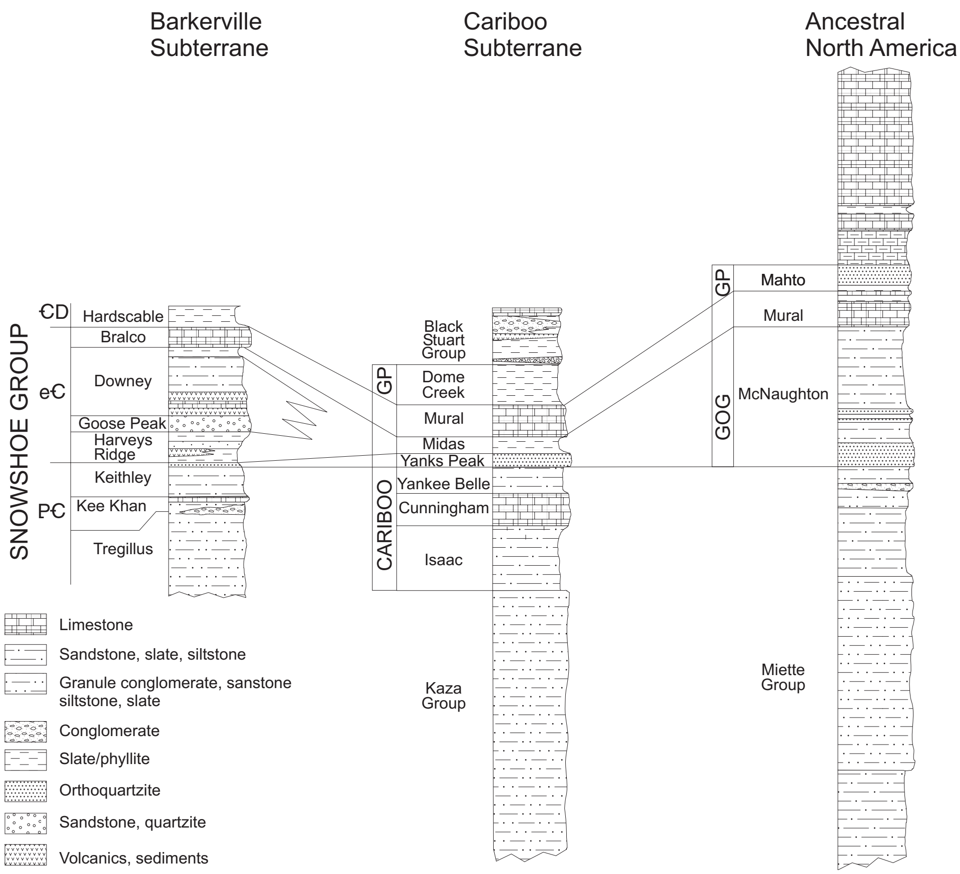

Figure 4. Generalized stratigraphic columns of the Barkerville and Cariboo subterranes and Ancestral North American rocks showing possible correlations of Snowshoe Group stratigraphy (modified from Struik, 1986).

1986). The coarse clastics of the Goose Peak quartzite, in conjunction with the volcanics of the Downey and inferred post-Early Cambrian age for the Bralco Limestone, have no direct correlatives within rocks of the Cariboo Subterrane. This would be resolved, in part, if the Bralco limestone (of the Snowshoe Group) correlates with the Mural Formation, a suggestion indirectly inferred by Struik (1988) who correlates the Bralco with the Archaeocyathid-bearing Tshinakin limestone of the Eagle Bay Formation (Schiarizza and Preto, 1987) implying it is age-equivalent to the Mural Formation.

LITHOLOGIC UNITS

Mapping this past summer encountered all units delineated during the 2000 field season (Ferri, 2001a, b). These include rocks of the Keithley, Harveys Ridge, and possibly Downey successions together with the Goose Peak quartzite and Agnes conglomerate. In addition, clastics, marble and minor igneous rocks along Keithley Creek that are assigned to the Ramos succession by Struik (1988, 1983a), may be all, or in part, equivalent to the Keithley succession. Early Mississippian foliated granite of the Quesnel Lake Gneiss intrudes Snowshoe rocks along the southwestern margin of the map area. Geologically, the southern part of the map area is structurally bounded by mafic to ultramafic rocks of the Crooked Amphibolite and dark grey phyllites and siltstones of Late Triassic age which belong to the basal Nicola Group (as per Panteleyev *et al*., 1996) and have been informally termed the "Black Phyllite" (Rees, 1987).

The light coloured, relatively thin and intermittent, orthoquartzite at the top of the Keithley succession was used as an excellent marker during the 2000 field season. Although sporadic and poorly exposed in sub-alpine areas, this unit can be used in conjunction with the contrasting lithologies of the Keithley schists and sandstones, and dark phyllites and sandstones of the Harveys Ridge, to establish overall map patterns. This was also the case during the 2001 field season, although the Keithley quartzite was only encountered in several areas, either due to limited outcrop or non-deposition.

BLACK PHYLLITE

The Black phyllite was only seen in sporadic outcrops in the Spinks Creek area and along the main logging road on the west side of the Quesnel River, south of Cariboo Lake. These rocks consist primarily of grey to rusty-weathering dark grey to blue grey or silvery phyllite. Thin horizons or bands of siltstone, with or without argillaceous partings, may be present. Some of the siltstone beds are up to 5 centimetres thick and locally grade into very fine-grained sandstone. A section of grey to dark grey quartz-feldspar-bearing schist to phyllite was encountered within an area assigned to this unit. It is an unusual lithology for this unit, but quartzose rocks are described from the base of the Black Phyllite south of the map area (Bloodgood, 1990). Phyllite and siltstone of this unit is usually quite friable in comparison to similar, denser and more indurated Harveys Ridge lithologies.

Black Phyllite rocks are believed to be Late Triassic in age (*see* Panteleyev *et al*., 1996) and form basement to the Nicola arc to the west. Western exposures of the Black phyllite contain sections of mafic tuffaceous sediments which interfinger with volcanic rocks typical of the Nicola Group (Panteleyev *et al., ibid.*)

CROOKED AMPHIBOLITE

Mafic and ultramafic rocks of the Crooked Amphibolite crop out immediately east of Wolverine Lake and extend, intermittently, northwestward onto the high ridge west of Rollie Lake. Mapping this past summer, in conjunction with work by Struik (1983a) and Rees (1987), suggests that the unit is approximately 1 kilometre thick in the north and thins southeastward and disappears in the vicinity of Six Mile Lake. The unit re-appears across the Cariboo River valley and shows the same thickness variations.

Much of the exposure west of Rollie Lake consists of grey to brown weathering, massive to strongly foliated and variably serpentinized ultramafite. Relict light brown weathering, dark green pyroxene crystals, up to 2 centimetres in size, are visible locally. These comprise up to 80 % of exposures in areas and may form a crude layering. Asbestos veining is present locally.

Southeast of this ridge, the Crooked Amphibolite consists of chlorite schist together with talc and iron carbonate altered gabbro and pyroxenite. Relict breccia textures (intrusive?) within gabbro can be observed locally. The Crooked Amphibolite displays a strong fabric (mylonitic) at its contact with the Quesnel Lake Gneiss. This is particularly well developed in exposures immediately north of Wolverine Lake. In this area, the western-most part of the Quesnel Lake Gneiss contains fine to medium-grained, chlorite-hornblende?-plagioclase gneiss in sections up to tens of metres thick. These are roughly on strike with Crooked Amphibolite lithologies and may be part of this unit. Similar mafic gneiss lithologies occur within the main part of the Quesnel Lake Gneiss and can be traced into less deformed sections and appear to have originally been gabbroic dikes. However, on the west side of the Quesnel Lake Gneiss, mafic gneiss of possible Crooked Amphibolite affinities appear to be intruded by the former unit casting doubt on the correlation of all mafic gneisses with the Crooked Amphibolite.

QUESNEL LAKE GNEISS

The large body of Quesnel Lake Gneiss, north of the Cariboo River, is a northern continuation of two similar units to the southwest. This felsic intrusion is actually a folded sill to transgressive sill-like body (Figure 3a, b). In the southwest, the unit is only preserved on the limbs of a large F_2 fold. This structure plunges northwest and is well outlined by the trace of the Quesnel Lake Gneiss (Figure 3a).

This unit is fairly uniform in composition consisting of a coarsely crystalline foliated potassium feldspar megacrystic granite to granodiorite. It is locally highly deformed, commonly at its contact with the Crooked Amphibolite, and appears gneissic in composition, displaying layers or lenses of quartz, feldspar and possibly mica. Potassium feldspar megacrysts are up to 8 centimetres in length and can comprise up to 30 % of the unit. These are invariably aligned, resulting in a well defined mineral lineation. Quartz may be flattened to form ribbons up to several centimetres in length. Biotite and muscovite are accessory minerals, with the former commonly altered to chlorite. At the western margin of this body, a mica poor, felsic-looking, finer grained variety of foliated granite intrudes typical lithologies of the Quesnel Lake Gneiss.

This body of foliated granite is the northern terminus of a series of Early Mississippian intrusions, collectively termed the Quesnel Lake Gneiss. These are subdivided into two informal suites based on composition and rough geographic position: the peraluminous Western Quesnel Lake Gneiss and the meta-aluminous Eastern Quesnel Lake Gneiss (Ferri *et al.*, 1999). The significance of the Quesnel Lake Gneiss has been the subject of much debate and Ferri *et al.*, (1999) suggested that these bodies are related to Late Devonian to Early Mississippian arc volcanism, whereas others (Montgomery and Ross, 1989) proposed that the alkaline geochemistry found within parts of the Eastern Quesnel Lake Gneiss may imply intrusion in an extensional regime.

SNOWSHOE GROUP

One of the aims of the 2000 field season was to test a model, first put forth by Höy and Ferri (1998a), that suggested much of the Snowshoe stratigraphy is inverted. Although mapping could not demonstrate this, it indicated that parts of the stratigraphic succession are overturned. Examination of Snowshoe stratigraphy during the 2000 field season indicated that rocks presently assigned to the Downey succession may be equivalent to the Keithley succession (Ferri, 2001a, b). Evidence gathered during the 2001 field season is consistent with this hypothesis. South of Harveys Creek, facing directions, together with the presence of a Keithley-like quartzite at the contact between the Harveys Ridge succession and lithologies currently assigned to the Downey succession, re-enforce this assumption. This would then imply that the dark siliciclastic rocks of the Hardscrabble Mountain succession, which are now interpreted to sit stratigraphically above the Downey succession, are in fact equivalent to Harveys Ridge rocks. This is confirmed at the outcrop scale as lithologies of Harveys Ridge and Hardscrabble Mountain successions are indistinguishable, an observation also noted by Struik (1988). Struik (*ibid*.) suggested that to make the two units equivalent would require large southwest verging fold structures, the presence of which have been demonstrated within the map area (Ferri, 2001a, b; Rees, 1987).

Furthermore, rocks presently included within the Ramos Creek succession along the Keithley Creek valley may be part of the Keithley succession. This is based on tracing Keithley rocks southeastward from Yanks Peak, in conjunction with the facing direction of lithologies on either side of Keithley Creek. This also suggests that carbonate, siliciclastics and deformed mafic igneous rocks west of Yanks Peak are also part of the Keithley succession. Struik (1988) noted that parts of the Ramos may be equivalent to sections of the Keithley succession.

North of Sellers Creek, limestone and stratigraphically underlying clastics at the base of the Keithley succession have recently been tentatively assigned to the Kee Khan marble and Tregillus sediments by Ferri (2001b). Limestone at Sellers Creek is associated with overlying chloritic-rich, Cu-bearing sediments of possible volcanic origin. These rocks are very similar to Cu-bearing meta-volcanic-limestone associations along Harveys Creek (presently assigned to the Downly succession), suggesting they are equivalent. If the limestone and underlying clastics are part of the Keithley succession, the overall sequence would have similarities to Downey rocks to the north, suggesting the two packages are equivalent.

This re-interpretation of Snowshoe stratigraphy suggests that, within the map area, the number of stratigraphic units making up the Snowshoe Group can be reduced by 50 %. A similar condensation of Snowshoe stratigraphy can be achieved in the Wells-Barkerville area, although there are more units defined in this region (Tom, Tregillus, Eaglesnest, Island Mountain) that are not encountered in the Cariboo Lake area. This re-definition of Snowshoe stratigraphy suggests the presence of large southwesterly directed fold structures between the study area and the Wells-Barkerville region, an inference compatible with the structural style present within the map area.

It is interesting to note that Holland (1954) first subdivided present day Snowshoe rocks in the Yanks Peak area and used the terms Yankee Belle, Yanks Peak and Midas to describe key sections. Yankee Belle and Midas were derived from mineral claims in the Yanks Peak vicinity which were primarily underlain by the respective rock types (Holland, *ibid.*). Holland's Yankee Belle Formation and Yanks Peak quartzite correspond to the present Keithley succession and Keithley quartzite respectively, and the Midas formation represented the Harveys Ridge succession. The higher Harveys Ridge coarse clastics and Agnes conglomerate were part of his Snowshoe Formation.

Holland (1954) traced these units eastward to the Cariboo Mountains and later workers (Sutherland Brown, 1957, 1963; Campbell *et al*., 1973) applied this terminology to lithologies typical of these rocks west of the Pleasant Valley Thrust (*see* Struik, 1988). Campbell *et al*. (1973) first suggested that Yankee Belle, Yanks Peak and Midas rocks in the informal type area may have very little in common with similarly named stratigraphy throughout the bulk of the Cariboo Mountains. This, together with the plethora of formation terminology in the Wells-Barkerville area led to the re-definition of Snowshoe rocks by Struik (1988). As a result of this long history of formation definition, the original type areas for the Yankee Belle, Yanks Peak and Midas formations are now part of the Snowshoe Group and may or may not correlate with the with definitions of these units.

Keithley Succession

Keithley rocks are located on the west flank of Yanks Peak and east of Grain Creek. Upper greenschist to lower amphibolite schist along the ridge west of Keithley Creek are also tentatively grouped with this unit. Rocks presently assigned to the Ramos and Downey successions in the map area by Struik (1988, 1983a) may be part of the Keithley succession and will be described in later sections.

In the Yanks Peak area the Keithley succession is characterized by thinly interlayered rusty brown to grey weathering, grey to grey green or green shale, siltstone to very fine sandstone. Locally, sandstone layers approach a metre in thickness and occur as a coarse, granule conglomerate. This sandstone is feldspathic and contains blue-grey to dark grey vitreous quartz grains. These horizons are commonly graded and may be interbedded with quartzo-feldspathic wackes.

On the ridge west of Keithley Creek are poorly exposed sections of thinly interlayered rusty brown weathering, grey garnet?-biotite-muscovite schist and quartz schist. These can be traced to the southern end of this ridge where they contain large porphyroblasts of andalusite? and appear to sit structurally above Harveys Ridge and Goose Peak lithologies. Several hundred metres of garnet-bearing chlorite-actinolite schist and gneiss occur on the east flank of this ridge and occupy an area between these Keithley schists and underlying Harveys Ridge or Ramos lithologies. These mafic schists locally contain felsdspar segregations and can be traced into lithologies which suggest they may be, in part, metagabbro or metadiorite. The gneissocity is highly contorted and the intense fabric indicates the rocks are highly strained. One outcrop of rusty brown weathering, dark green magnetic, pyroxene phyric schist is located at the north end of this belt.

Southeast of Grain Creek the Keithley succession is characterized by 5 to 100-centimetre-thick beds of grey to beige, impure quartzite to micaceous quartzite separated by 0.1 to 10 centimetre sections of garnet-biotite-muscovite quartz schist. These latter beds contain between 10 and 70 % mica. The Keithley is considerably more quartzose in the Grain Creek area than in the region around Yanks Peak.

Up to 100 metres of Keithley quartzite outcrops along the top of Yanks Peak where it is repeated by folding or thrusting. This quartzite can be traced to the southwest where it is inferred to be cut by a late normal fault along the French Snowshoe Creek valley. The quartzite was not encountered southeastward along strike within the Keithley Creek valley and disappears before the Little Snowshoe Creek valley (Struik, 1988; 1983a). Southeast of Grain Creek it is only 5 metres thick.

Keithley quartzite is light grey, white to beige and commonly has a purplish colour. It is relatively pure and commonly approaches an orthoquartzite in composition. Bedding is thick or massive and occasionally there are thin to film-like phyllitic partings. On Yanks Peak, thin grey phyllite, siltstone to fine sandstone is interbedded with the quartzite. These sections locally show grading and cross-stratification. Where present, and in conjunction with the overlying Harveys Ridge black clastics, this unit forms an excellent marker.

The thickness of the Keithley succession is dependent on the interpretation of its basal sequence. If carbonate and clastics in the Sellers Creek area are part of the Kee Khan marble and Tregillus clastics, respectively, this unit is probably over 500 metres in thickness. If these units are part of the Keithley, then it is in excess of 1000 metres. Struik (1988) suggested it is no more than 300 metres, although current work indicates this is probably a minimum.

Harveys Ridge Succession

The Harveys Ridge succession is characterized by black clastics and minor dark grey carbonate and metavolcanics. The most common lithology is a dark grey to black carbonaceous phyllite to siltstone, the latter commonly characterized by very thin, discontinuous laminae of white quartz (Photo 1). This lithology is well exposed east of Yanks Peak and along ridges within the Snowshoe Plateau. These rocks are metamorphosed to amphibolite grade in the Grain Creek area where they contain porphyroblasts of garnet and biotite, although the bulk of the rock barely attains a schistose texture, possibly due to the carbonaceous content. The unit is also characterized by dark grey to black quartzite or quartz sandstone containing black vitreous quartz grains.

Along the Snowshoe Plateau, the unit commonly contains thin to thick horizons of quartz-feldspar wackes and quartz grains are commonly blue-grey to dark grey or black. Towards the east, sections of grey to beige fine to coarse quartz sandstone are found interbedded with these wackes. These are sometimes feldspathic and the entire sequence appears very similar to the transitional section of the Harveys Ridge, immediately below the coarse sandstones of the Goose Peak quartzite (Ferri, 2001). This influx of coarser clastics in the upper part of the Harveys Ridge sequence can be seen northeast of Keithley Creek, on the north side of Cariboo Lake.

The thickness of this unit is quite variable. Carbonaceous phyllite to siltstone varies from 50 to several hundred

Photo 1. Typical dark grey to black, carbonaceous siltstones and phyllites of the Harveys Ridge succession.

metres, whereas the coarser wacke and quartzite are probably in excess of 300 metres. The transitional section of Harveys Ridge clastics varies between 100 and greater than 500 metres and probably occupies a large portion of the Snowshoe Plateau. In some areas, no mappable section of carbonaceous phyllite was encountered and only lithologies of the transitional sequence were observed.

Several sections of mafic volcanics were seen within the Harveys Ridge section and may be equivalent to similar volcanics observed in the Frank Creek area. These occur along the ridge immediately north of the community of Keithley Creek and along road side exposures on the southwest side of Cariboo Lake. Volcanics north of Keithley Creek are only a few metres thick and consist of dark green carbonate altered chlorite schist, which locally is less deformed and includes relict feldspar and pyroxene crystals. On the north shore of Cariboo Lake 1 to 5-metre sections of brown weathering, iron-carbonate altered metavolcanics are interbedded with typical Harveys Ridge lithologies. These sections have smears or porphyroblasts of green mica suggesting a volcanic origin prior to alteration. Initial trace element chemical analysis of these two groups of volcanics indicate a mafic alkaline chemistry compatible with the mafic Frank Creek volcanics to the southwest (*see* below, Ferri, 2001a).

Outcrops of highly deformed greenish grey, actinolite-chlorite schist or phyllite similar in appearance to the intermediate Frank Creek metavolcanics occur in the vicinity of the Peacock showing (Minfile 093A 133) northwest of southern Cariboo Lake. These are associated with Goose Peak and possibly transitional Harveys Ridge lithologies and appear to contain relict volcanic clasts.

Several outcrops of grey to light grey weathering, light to dark grey finely laminated limestone with thin dark grey phyllitic partings occur south of Four Creek. Limestone is typically finely recrystallized, although locally it is a coarse marble.

Agnes Conglomerate

The Agnes conglomerate is a distinctive quartzite cobble conglomerate within the upper part of the Harveys Ridge succession, either stratigraphically near the beginning of the transitional part of the Harveys Ridge or just below the Goose Peak quartzite. It crops out in two main linear belts within the map area, occurring on either side of the Lightning Creek Anticlinorium (Figure 3a). It extends from the Cariboo Lake area, northwestward and thins out south of the headwaters of Four Creek reappearing along strike in the Yanks Peak region. The second area of good exposure is along the Snowshoe Plateau where it outcrops along the top of French Snowshoe Peak and can be traced north and south for approximately 10 kilometres. On the southwest side of French Snowshoe Creek, quartzite originally placed within the Keithley succession contains quartzite cobbles and is tentatively assigned to the Agnes conglomerate.

The most distinctive lithology of this unit is a grey to beige matrix to clast-supported granule to boulder quartzite conglomerate (Photo 2). Orange-weathering, grey carbonate clasts are present locally. The matrix to this conglomerate is a quartz sandstone to quartzite similar in composition to the clasts. Locally, conglomerate consists of light grey siltstone clasts floating in a dark grey phyllitic matrix. Conglomerate is commonly associated with beige to light brown, fine to coarse grained, thick to massively bedded quartz sandstone, and light greenish grey phyllite to siltstone. These light coloured sandstones and phyllites can be the most common lithology within the Agnes conglomerate sequence and sit immediately above black carbonaceous phyllite and siltstone of the Harveys Ridge succession along the Snowshoe Plateau. Quartz wackes and sandstones more akin to the transitional Harveys Ridge succession occur stratigraphically above the Agnes conglomerate.

On the north side of Pine Creek, dark grey to cream orthoquartzite horizons, up to 3 metres thick, occur within the Agnes conglomerate section. The light coloured quartzite appears very similar to Keithley quartzite whereas the dark grey variety is characterized by black vitreous quartz grains as per quartzites in the Harveys Ridge succession.

Goose Peak Quartzite

The extent of coarse feldspathic quartzite assigned to the Goose Peak is fairly limited within the present study area in comparison to the area south of Cariboo Lake. Two belts of exposure were seen on either side of Pine Creek and scattered outcrops of this unit were observed in the poorly exposed region around the large body of Quesnel Lake Gneiss.

The Goose Peak is characterized by thick to massive bedded, grey, poorly sorted coarse grained feldspathic impure quartzite to granule conglomerate. The micaceous and feldspar content of these rocks is usually less than 10 %, combined. Thin to moderately bedded dark grey to grey phyllite to siltstone partings are subordinate, although they increase in abundance towards the base of the unit. Relatively pure, well sorted grey to beige quartzite to micaceous quartzite is also present within sections assigned to this unit and bear a strong similarity with Keithley sandstones.

Photo 2. Stretched quartzite cobble to boulder conglomerate of the Agnes conglomerate.

Downey or Keithley Succession

It is suggested that rocks presently assigned to the Downey succession in the Harveys Creek area may be part of the Keithley succession (*see* also Ferri; 2001a, b) This is based on several lines of evidence. First, facing and structural evidence suggest that the eastern edge of Harveys Ridge rocks, south of Harveys Creek, occur on the southwesterly overturned limb of an F_2 anticlinal fold. Second, the contact between Harveys Ridge rocks and the presently named Downey sequence is marked by a grey to beige, impure to relatively pure quartzite similar to that at the upper contact of the Keithley succession.

The most common lithology consists of grey-green to green phyllite to siltstone, containing thin interbeds of grey to green sandstone to impure quartzite. Less common is grey to brown weathering, mottled to lustrous grey to dark grey phyllite, siltstone and wacke. These rocks are more highly metamorphosed southeast of Mount Barker and consist of grey to light grey garnet-biotite schist and quartz schist.

This succession also contains sections of chlorite schist of metavolcanic origin (alkaline composition; *see* section below). There are no relict tuffaceous textures within sections of mafic schist in the present study area, except for 0.5 to 1 centimetre ovoid smears of dark green chlorite observed within chlorite schist between Simlock and Harveys Creek. Chlorite schist is 100 to 200 metres thick in the Cariboo River area and thins northwestward. This mafic schist is commonly associated with sections of thinly interlayered, grey to dark grey limestone and phyllite up to several hundred metres thick. The limestone is commonly bleached to a white marble and may be orange to brown weathering. At the headwaters of Simlock Creek, and near the Cariboo Hudson Mine, these limestone horizons contain sections of limestone clast conglomerate (with a calcarenite matrix) or clastic carbonate (calcarenite) up to 15 metres thick. These carbonate horizons, especially the orange to brown weathering variety, are quite distinct from Bralco limestone.

South of Cariboo River the Downey/Keithley succession is locally coarser grained and contains sections of coarse feldspathic sandstone to granule conglomerate, which superficially resemble lithologies within the Goose Peak quartzite. North of Ishkloo Creek, dark grey to black garnet and biotite bearing phyllite to schist of the Harveys Ridge succession sit on dark green-grey garnet-biotite schist which contain sections of chlorite schist. There is no orthoquartzite present at the contact, but subangular beige orthoquartzite boulders up to 1 metre thick occur at this contact.

Parts of this sequence contain sills of metadiorite up to several hundred metres thick. These are abundant along the ridge including Mount Barker, where they form several mappable bodies, and they also occur north of the Cariboo River. The spatial association of these metadioritic bodies and metavolcanics suggests they are co-magmatic[3], although the volcanics are alkaline in composition whereas the meta-diorite display calc-alkaline signatures.

One of the few fossil localities within the Snowshoe Group occurs within rocks tentatively assigned to the Downey succession (Struik, 1988). Ostracod and bryozoa fragments were recovered from rocks very near the Pleasant Valley thrust fault north of Wells. There is some uncertainty as to the assignment of these rocks to the Downey succession (Struik, 1988).

Ramos or Keithley Succession

Exposures of brown weathering, grey to dark grey or green-grey phyllite with thin to thick beds of grey to greenish grey siltstone to fine sandstone occur along the lower Keithley Creek valley. Interbedded with these lithologies is moderately to thickly bedded grey feldspathic sandstone to wacke. These lithologies can be traced northward, beyond the mouth of Little Snowshoe Creek, where they are subordinate to greenish chloritic phyllite and schist. West of Rabbit Creek, a section of thinly interbedded dark grey weathering grey limestone and grey schist occurs with these schists and sandstone. This limestone sequence locally sits structurally above mafic volcanics and diorite.

Southwest of Keithley Creek, limestone is structurally succeeded by sheared mafic schist and banded gneiss. A thin band of dark grey to black phyllite and siltstone, similar to that within the Harveys Ridge succession, occurs between the two.

Struik (1988) placed these rocks within the Ramos succession and interpreted them as one of the oldest sequences within the Snowshoe Group, sitting below the Kee Khan marble and Keithley succession. Based on facing directions, structural attitudes and stratigraphic makeup, these may alternately be part of the Keithley succession. Keithley rocks from the top and west flank of Yanks Peak can be traced southward to French Snowshoe Creek and appear offset by a late, northeast trending normal fault. Quartzite on the south side of the creek was originally mapped as the upper part of the Keithley succession by Holland (1954) and Struik (1988). However, examination of this identified quartzite conglomerate horizons suggesting it is part of the Agnes conglomerate. Furthermore, this quartzite and conglomerate traces southeastward into Harveys Ridge lithologies and is on strike with Agnes conglomerate south of Four Creek.

Keithley quartzite is not encountered south of French Snowshoe Creek. The present interpretation of the southward extension of Keithley lithologies places them along the ridge tops northeast of Keithley Creek (Struik, 1988). The structural attitude of bedding and foliation in the Keithley Creek area together with tops being consistently overturned to the northeast, as seen on Yanks Peak, suggest these rocks sit stratigraphically below the Harveys Ridge succession. It is suggested here that the rocks along the Keithley Creek valley may be part of the Keithley succession. The presence of limestone and mafic metavolcanics along the northward extension of these rocks is similar to the sequence of limestone and chloritic schist north of Sellers Creek and to rocks along Harveys Creek, both of which are thought to be part of the Keithley succession.

If the above correlations are correct, this would require facies changes within the Keithley succession to account for the different lithologies. The rapid disappearance of the thick Keithley quartzite north of Yanks Peak is consistent with this.

Bralco Limestone

Several hundred metres of thin to thickly or massively bedded, grey weathering, grey to dark grey finely recrystallized limestone are found at the headwaters of Three Creek. Locally it is slightly dolomitized and beige weathering and may be coarsely recrystallized to a white marble. Bedding can be well developed and the unit breaks into thin sheets or has platy to flaggy partings. Limestone is locally argillaceous and thin grey phyllitic partings are sometimes present. A primary limestone breccia may be associated with these argillaceous regions. Locally ovoid or circular features up to 5 millimetres in diametre are found in 1 to 3 centimetre thick horizons and may be oolitic or pisolitic in origin. These appear silicified and have calcite cores. Discontinuous layers, up to 1 metre thick, of white to beige quartzite or recrystallized chert occur in two localities. This limestone can be traced to the southwest where it thins and occurs in the footwall of the Pleasant Valley Thrust, and consists of dark grey, platy argillaceous limestone to recrystallized limestone. The unit does not appear to extend north of Simlock Creek and could be cut by a late northeast-trending normal fault.

Dark grey to black phyllites and siltstones of the Hardscrabble/Harveys Ridge lie above the limestone. Although no exposure was identified structurally below the limestone, scattered rubble of dark grey to black siltstone and phyllite, not unlike that of the Harveys Ridge, extends over an area of 500 metres.

Struik (1988), from trace fossil information, indicated that the Bralco limestone may be younger than Cambrian, possibly Siluro-Devonian. This age or stratigraphic position would create some problems with the argument posed in this report equating Downey with Keithley stratigraphy. Alternatively, the dark grey to black fine siliciclastics on either side of the limestone may be part of the Harveys Ridge succession suggesting the Bralco Limestone overlies this unit and is found in the core of an F_2 synclinal fold. The assignment of Downey rocks to the Keithley requires the presence of Harveys Ridge lithologies above the Keithley succession. Furthermore, no Bralco limestone exists in the upper part of the Harveys Ridge succession west of Three Creek. There are only scattered occurrences of grey to dark grey limestone to the west of here suggesting that, if this stratigraphic re-interpretation is correct, the limestone has either not been deposited or has been removed and replaced by coarse clastics of the transitional Harveys Ridge or Goose Peak.

Another possibility is that the Bralco limestone is actually in the hanging wall of the Pleasant Valley Thrust and may be equivalent to the Mural limestone. Initially, Struik (1981, 1982) equated this carbonate with either the Cunningham or Mural formations. The associated lithologies and lack of a thick interbedded shale-limestone sequence, typical for the base of the Cunningham limestone, suggest it could be equated with the Mural Formation.

Hardscrabble Mountain/Harveys Ridge Successions

Dark grey to black phyllite and siltstone overlie the Bralco limestone along the ridge northwest of Three Creek. Siltstone contains thin, discontinuous layers of light grey to white quartz 0.5 to 2 centimetres apart. Minor lithologies include thin beds of black sandstone and altered mafic metavolcanic rocks. Rubble of the same material outcrops below the limestone over a length of about 500 metres.

These rocks have been assigned to the Hardscrabble Mountain succession by Struik (1988). Superficially these rocks are identical to basal Harveys Ridge lithologies and it is suggested here that these be placed with the Harveys Ridge succession. The repetition of these rocks around the Bralco limestone is explained by the presence of an F_2 fold. This is supported by the presence of green-grey to grey siltstones and phyllites further up the ridge which are identical to lithologies to the west within rocks presently assigned to the Downey succession.

To the northwest, near Hardscrabble Mountain, the Early Permian Sugar limestone sits stratigraphically above clastics of the Hardscabble Mountain succession (Struik, 1988). Struik (*ibid.*) suggests that the Sugar limestone sits uncomfortably above the Hardscrabble, with the latter being possibly Devono-Mississippian in age and equivalent to the Black Stuart Group of the Cariboo Terrane. The correlations suggested in this paper would indicate that the unconformity at the base of the Sugar limestone would be quite profound, placing Permian upon Cambrian lithologies.

MAFIC SILLS AND DIKES

Several parts of the map area contain abundant alkaline to subalkaline mafic intrusions. There are two areas where these are concentrated: in the region between Keithley and Rollie creeks and along the ridge containing Mount Barker and extending northwestward into the vicinity of Simlock Creek. Many of these are sills or dikes are up to 5 metres in thickness, although in the Mount Barker area they form large, mappable bodies several hundred metres in thickness. These are fine to coarse-grained diorite with between 40 and 60 % pyroxene and/or hornblende with the remaining being composed of plagioclase feldspar. The larger sill-like bodies north of Mount Barker may contain up to 5 % biotite and traces of quartz.

Most of the diorite bodies contain a foliation of varying intensity, which is parallel to the main foliation within surrounding meta-sediments. Some have an intense, to almost mylonitic, fabric, whereas others are essentially undeformed. Diorite between Keithley and Rollie creeks has similar geochemical characteristics as the Frank Creek or Mount Badger volcanics[4]. *See* section on Geochemistry below.

CARIBOO GROUP

Rocks belonging to the Cariboo Group were examined in a cursory manor along the northeastern edge of the map area. Lithologies belonging to the Yankee Belle, Yanks Peak, Midas and Mural formations occur between the confluence of Little and Cariboo rivers and Roundtop Mountain. Yankee Belle rocks consist of interlayered light grey to greenish grey siltstone and thin interbeds of fine-grained grey sandstone. Yanks Peak Formation is dominated by beige to white or light grey, thick to massively bedded, fine to coarse grained orthoquartzite to impure quartzite. Orthoquartzite forms sections up to 50 metres thick producing resistive exposures and forming an excellent marker horizon. Immediately above the orthoquartzite are several massive, metres-thick sections of black to dark grey quartzite containing fine to coarse grains of black vitreous quartz, presumably belonging to the Midas Formation. Stratigraphically above this are sections of grey to greenish grey siltstone with horizons of purplish grey sandstone (up to 1 metre thick) or dark grey sandstone and grey slate. Limestone of the Mural Formation was only seen in one locality and consists of massive looking, light grey to white (mottled) finely recrystallized limestone. Very few bedding surfaces were discerned and these were questionable. Locally, parts of the limestone are orange weathering and slightly dolomitic.

It is generally very difficult, at the outcrop level, to distinguish Yankee Belle from Midas rocks (this study and Struik, 1988). Generally, the Midas Formation forms a fining upwards sequence whereas the Yankee Belle is a coarsening upwards succession and contains limestone in its lower part. Lacking any fossils, it is also very easy to confuse Cunningham and Mural limestones in outcrop. The base of the Cunningham consists of a 100 metre thick section of interlayered limestone and calcareous phyllite or slate like that of the underlying Isaac Formation. The transition from Mural to Midas formations is relatively sharp and occurs over a few metres (Struik, 1988).

REGIONAL CORRELATIONS

Struik (1986, 1988) correlated parts of the Snowshoe stratigraphy with sections of the Eagle Bay Assemblage (Figure 5). Höy and Ferri (1998a) and Ferri (2001a) suggested that the Bralco limestone is equivalent to the Early Cambrian Tshinakin and equivalent limestones (Badshot, Mural). Höy and Ferri (1998a) also indicated that the sequence may be inverted and that the Downey sits above the Bralco limestone.

Work this past summer suggests that the Downey is stratigraphically below the Bralco limestone and may in fact lie underneath the Harveys Ridge succession. The stratigraphic sequence proposed for the map area, based on the revised structural interpretation, is shown in Figure 6. Rocks of the Downey would be equivalent to the Keithley succession and rocks of the Hardscrabble Mountain succession would simply be a repetition of Harveys Ridge rocks.

Parts of this new stratigraphic sequence correlate well with massive sulphide-bearing Eagle Bay Assemblage rocks in the Adams Plateau region. The similarity in lithologies, their relative sequence and similar style of mineralized occurrences lends further strength to the newly proposed stratigraphic column for the Cariboo Lake area.

Höy (1999) recently described several Pb-Zn-Cu volcanogenic massive sulphide occurrences in unit EBG of the Eagle Bay Assemblage in the Adams Plateau area (Figure 7). The Mosquito King, Spar, Lucky Coon, Elsie and King Tut occurrences and their relative position within the stratigraphic sequence, is shown in Figure 7. If one assumes Mount Barker volcanics sit below the Keithley quartzite, the

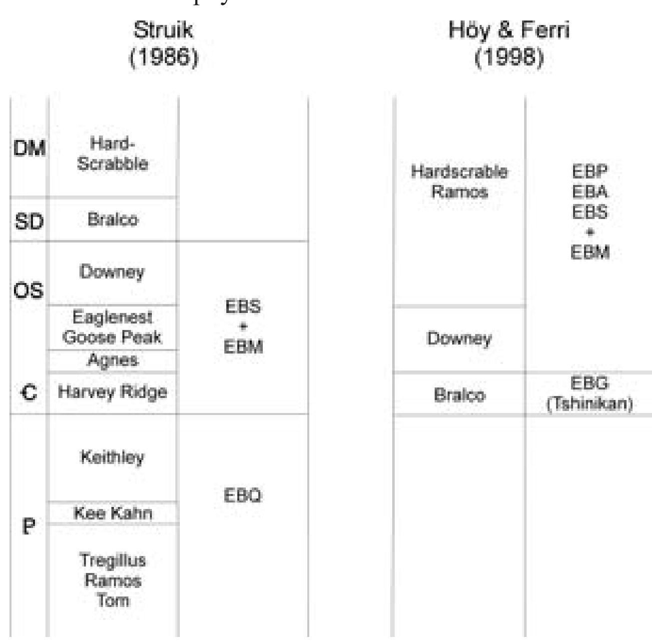

Figure 5. Generalized stratigraphic correlations of parts of the Snowshoe Group and Eagle Bay Assemblage, from Struik (1986) and Höy and Ferri (1998).

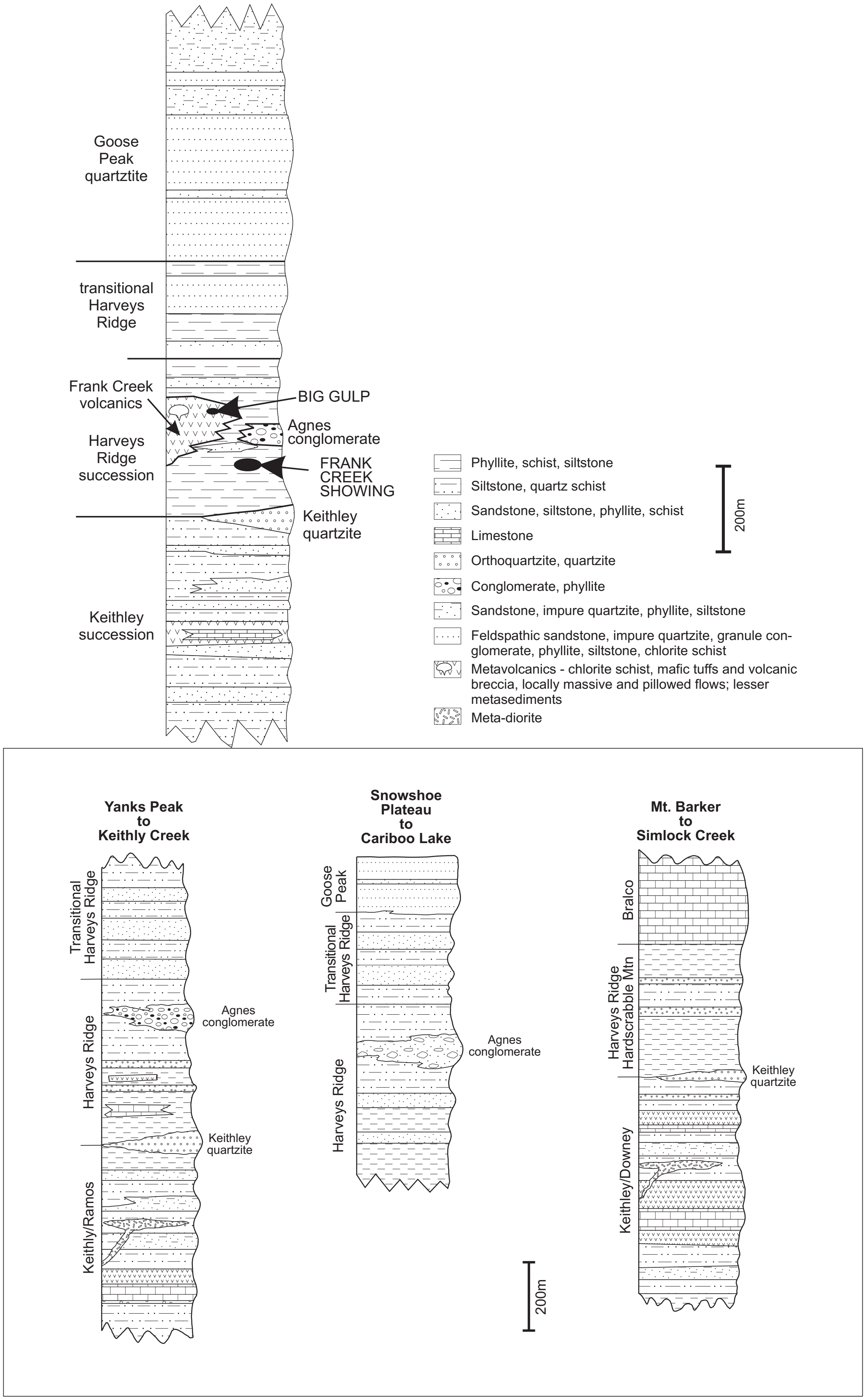

Figure 6. (a) Simplified stratigraphic column for sub-Downey/Keithley stratigraphy southeast of Cariboo Lake (from Ferri, 2001). (b) Generalized and composite stratigraphic columns from three different parts of the Snowshoe Group showing proposed stratigraphic order.

general stratigraphic sequence within each area are approximately correlative. Unit EBG_1 would equate with the Mount Barker volcanics, unit EBG_2 with the Keithley quartzite and the carbonaceous sediments and volcanics of units EBG_3 to EBG_6 being equivalent to the Harveys Ridge succession (including the Frank Creek volcanics). Chemically, the volcanics of unit EBG_1 display the same signature as those of the Mount Barker area. The quartzite of unit EBG_2 is relatively pure and displays the same thickness variations as the Keithley quartzite.

In general, the carbonaceous character of units EBG_3, EBG_5 and EBG_6, together with the volcanic sequence of unit EBG_4, has an overall similarity to that of the Harveys Ridge succession. Sporadic limestone occurrences are found in the Harveys Ridge succession, particularly north of Keithley Creek. Metavolcanics of unit EBG_4 are correlated with the Frank Creek or Badger Peak volcanics, although they sit below Lucky Coon mineralization. The EBG_3 to EBG_6 section is much more calcareous than the sequence in the Cariboo Lake area and may reflect lateral facies variations.

One of the other similarities between the two sections is the relative position of massive sulphide mineralization (Figure 7). Copper-rich occurrences within unit EBG_1 are similar to Ace and sporadic Cu mineralization within the Mount Barker volcanics. The mineralogy of Lucky Coon and related occurrences, as well as the host sequence of black carbonaceous sediments above a relatively pure quartzite horizon (EBG_2), are analogous to the Frank Creek and Unlikely showings.

PRELIMINARY GEOCHEMISTRY OF MAFIC IGNEOUS ROCKS

Although small mafic, post-tectonic plugs and dikes are found cross-cutting the Snowshoe Group, the bulk of mafic rocks are pre-tectonic and metavolcanic rocks are found intercalated within these sediments. Mafic metavolcanics and intrusive rocks are found within the Harveys Ridge, Ramos/Keithley and Downey/Keithley successions. They have been subdivided into the following groups: Mount Barker volcanics, Mount Barker metadiorite, Harveys Ridge volcanics, metadiorite between Keithley and Rollie creeks and sheared metavolcanics? and metadiorite southwest of Keithley Creek (Figure 8). Select samples of these rocks were analyzed to better understand their composition and tectonic setting (Table 1).

Many of the mafic igneous rocks within the map area have undergone upper greenschist to lower amphibolite grade metamorphism and have been multiply deformed. As a consequence, the analyses of these rocks using major oxides is suspect considering the mobility of these elements at these conditions. Since trace elements are less mobile during regional metamorphism, all the diagrams presented in the next section make use of these chemical components.

Utilizing the Zr/TiO_2 versus Nb/Y trace element rock classification diagram derived by Winchester and Floyd (1977), all of the mafic volcanic rocks range from alkaline to subalkaline basalts, although SiO_2 values range as high as basaltic andesites or andesites (Table 1, Figure 8). Dioritic bodies intruding Snowshoe rocks between Keithley and Rollie creeks form two clusters with one group having alka-

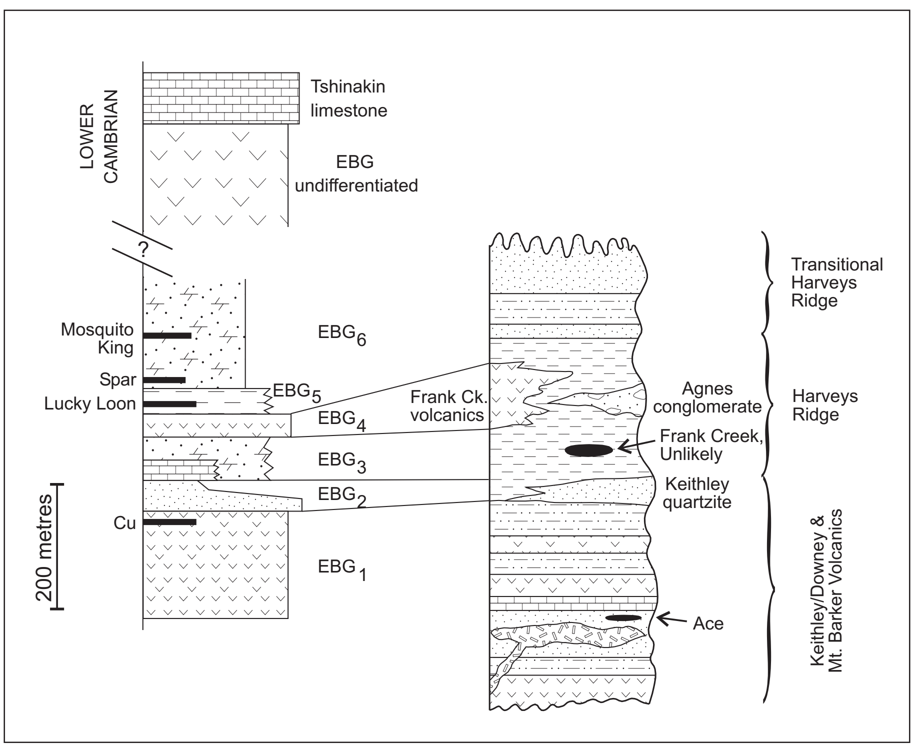

Figure 7. Correlation of EBG stratigraphy associated with Lucky Coon and Mosquito King mineralization on the Adams Plateau (Höy, 1999) and proposed stratigraphy and associated mineralization within the Cariboo Lake map area.

TABLE 1
WHOLE ROCK AND TRACE ELEMENT GEOCHEMISTRY OF SELECT IGNEOUS ROCKS WITHIN THE SNOWSHOE GROUP.

	01BO-06-03a	01BO-06-03b	01BO-06-06	01BO-11-01	01BO-15-07a	01BO-18-01	01BO-18-03a	01BO-18-05	01BO-21-06	01BO-21-07	01BO-29-05	01BO-31-05	01BO-33-03a	01BO-04-06	01FFE-03-01	01FFE-03-01A	01FFE-03-07	01FFE-06-09	01FFE-07-02	01FFE-07-05	01FFE-07-15	01FFE-08-07	01FFE-08-08
Unit	KR-D	KR-D	KR-D	KR-D	MB-V	MB-D	MB-D	MB-V	MB-V	MB-V	MB-V	MB-V	MB-V	KR-D	KR-D	KR-D	KR-D	KR-D	KR-D	KR-D	KR-D	HR-V	HR-V
Easting	602007	602007	603109	603382	613981	624228	624336	625052	623878	623987	614366	614857	626161	601826	597750	597750	59744	602549	602901	602729	603506	608792	608950
Northing	5844432	5844432	5845654	5848436	5857068	5850777	5849846	5850070	5846831	5846861	5863133	5862407	5849138	5848997	5845225	5845225	5846775	5845117	5846038	5846792	5847252	5849779	5849809
SiO2	52.4	53.47	43.38	50.54	45.04	50.29	48.5	47.18	62.2	57.9	41.33	49.75	48.61	50.9	50.56	47.24	46.18	44.13	54.02	44.83	49.27	47.54	44.29
TiO2	0.93	1.13	1.87	0.87	2.44	1.04	1.1	1.35	0.99	0.99	0.76	1.07	1	1.25	1.17	2.57	1.75	1.73	0.68	3.79	1.4	2.51	1.75
Al2O3	15.6	14.97	13.35	16.45	14.15	14.56	16.9	17.85	19.03	19.1	9.69	12.65	17.27	15.77	15.55	15.09	18.15	12.43	14.59	13.19	15.27	15.21	14.22
Fe2O3	10.14	10.35	13.65	8.26	12.4	14.22	11.1	11.18	7.44	10.65	10.09	11.52	13.89	9.65	10.65	14.06	10.8	12.9	9.25	13.73	11.15	12.56	11.43
MnO	0.15	0.15	0.2	0.15	0.09	0.23	0.2	0.17	0.07	0.1	0.1	0.11	0.18	0.14	0.17	0.21	0.12	0.18	0.15	0.18	0.17	0.14	0.14
MgO	6.01	5.42	7.76	5.65	8.18	3.49	3.3	2.06	1.61	2.34	9.27	10.78	4.36	6.71	6.26	6.34	6	13.1	7.44	8.47	6.55	5.76	7.46
CaO	8.8	8.44	12.43	14.07	6.11	6.21	5.9	5.26	0.34	0.43	5.32	5.42	7.07	9.09	10.36	9.1	9.43	9.93	9.36	9.44	11.06	7.3	5.84
Na2O	3.54	2.73	1.87	0.85	2.94	2.74	5.1	6.32	0.83	0.79	2.44	3.91	3.1	3.42	2.44	3.06	3.09	0.37	2.23	1.95	2.23	3.96	4.32
K2O	0.4	0.73	0.69	0.15	0.01	0.56	0.5	0.82	3.2	3.71	0.87	0.1	0.69	0.31	0.18	0.56	1.41	0.5	0.25	0.82	0.25	0.07	0.01
P2O5	0.07	0.1	0.46	0.07	0.27	0.3	0.4	0.55	0.12	0.1	0.07	0.11	0.25	0.09	0.07	0.33	0.18	0.4	0.03	0.66	0.1	0.25	0.27
LOI	1.27	1.75	3.83	2.14	8.06	6	6.57	6.75	3.6	3.52	19.34	3.97	2.92	2.24	2.21	0.95	2.36	3.61	1.4	2.54	2.07	4.32	9.97
SUM	99.32	99.29	99.56	99.21	99.7	99.66	99.54	99.53	99.5	99.7	99.32	99.4	99.35	99.58	99.63	99.54	99.67	99.35	99.42	99.69	99.54	99.63	99.71
Zr	66	77	139	66	154	106	122	123	155	144	60	73	87	73	73	166	126	142	58	305	77	158	120
Y	22	27	18	17	22	25	27	25	20	24	7	10	20	22	26	27	19	19	18	24	26	23	19
Sr	213	218	242	281	223	625	577	481	261	111	255	112	816	154	130	450	550	122	98	386	166	246	335
Nb	9	12	22	11	20	12	11	14	27	17	14	15	13	12	12	24	21	26	12	24	12	22	20
V	274	279	233	210	319	347	277	166	129	139	166	213	283	273	277	299	203	223	247	226	294	289	224
La	5	<5	13	<5	<5	26	24	33	34	42	16	19	24	5	9	18	14	16	12	5	10	<5	8
Ce	8	21	56	35	52	81	64	109	110	93	30	41	56	14	25	89	<5	40	20	55	12	56	59
Ba	63	487	706	50	70	156	89	444	748	715	398	94	137	98	128	285	1982	722	185	915	161	110	107
Rb	23	32	21	14	11	41	30	25	111	133	24	<3	34	18	11	12	35	22	17	37	14	8	8

	01FFE-09-02a	01FFE-09-04a	01FFE-09-04b	01FFE-11-04	01FFE-11-08	01FFE-11-09	01FFE-11-07a	01FFE-11-07b	01FFE-13-04	01FFE-17-01	01FFE-17-02	01FFe-24-07	01FFe-28-06	01FFe-35-02	01FFe-38-05	01FFe-39-01	01FFe-39-02	01FFe-40-07a	01FFe-40-07b	01FFe-41-01a	01FFe-41-01b
Unit	HR-V	HR-V	HR-V	KR-D	KC	KC	KC	KC	KR-D	MB-V	MB-V	MB-V	MB-V	HR-V	MB-D	MB-D	MB-D	KR-D	KR-D	KC	KC
Easting	605096	605812	605812	603458	601192	600110	601064	601064	602071	613099	613025	619060	627324	615548	627262	625052	624956	602880	602880	596524	596524
Northing	5844003	5845055	5845055	5849443	5849676	5849997	5850147	5850147	5852299	5858123	5858272	5852850	5845314	5860691	5848373	5850254	5850418	5846012	5846012	5856980	5856980
SiO2	35.33	43.65	31.15	53.7	42.38	36.63	43.52	45.13	51.38	50.56	44.38	50.58	56.81	34.15	47.08	47.45	46.52	55.13	54.18	47.86	44.72
TiO2	0.87	2.25	1.59	1.44	2.54	0.58	2.02	2.74	0.92	2.86	2.67	1.15	1.39	0.67	0.56	0.55	1.04	0.76	0.68	1.58	1.19
Al2O3	9.76	14.42	14.09	14.96	14.71	5.94	13.57	14.94	14.21	16.86	14.82	16.05	19.13	10.13	14.97	15.02	15.06	14.57	14.52	14.52	16.39
Fe2O3	9.38	12.5	17.15	11.31	13.15	17.59	12.73	12.39	9.89	15.13	12.47	11.1	11.47	11.78	9.39	9.48	10.43	9.61	9.48	11.17	11.03
MnO	0.14	0.14	0.18	0.17	0.15	0.2	0.18	0.15	0.17	0.07	0.12	0.2	0.05	0.14	0.15	0.17	0.17	0.15	0.15	0.15	0.15
MgO	12.39	9.81	23.84	4.51	8.64	28.19	13.11	9.09	7.71	3.64	5.59	4.61	1.66	14.48	7.78	8.6	3.42	6.28	7.21	8.31	9.13
CaO	5.69	9.22	1.94	7.78	12.02	2.52	9.4	9.73	11.18	1.38	6.92	4.61	0.5	9.1	11.06	9.13	8.31	9.36	9.28	8.55	8.81
Na2O	0.05	0.95	0.01	3.31	1.82	0.02	1	2.75	1.48	0.86	3.94	4.51	1.61	0.01	2.85	3.11	3.38	2.25	2.08	3.02	2.24
K2O	2.47	2.16	0.01	0.46	0.75	0.01	0.83	0.47	0.23	3.64	0.15	0.18	3.85	0.01	0.4	0.56	1.14	0.15	0.28	0.81	1.21
P2O5	0.11	0.31	0.23	0.15	0.4	0.05	0.2	0.5	0.07	0.43	0.34	0.27	0.15	0.05	0.11	0.1	0.28	0.05	0.05	0.2	0.23
LOI	22.87	3.83	9.68	1.73	2.93	7.23	2.85	1.65	2.34	4.21	8.28	6.57	3.04	18.79	4.55	5.15	9.56	1	1.48	3.07	3.2
SUM	99.13	99.56	99.88	99.53	99.53	98.97	99.51	99.57	99.59	99.77	99.69	99.84	99.74	99.32	98.92	99.35	99.34	99.32	99.41	99.62	99.12
Zr	77	158	85	115	177	37	114	158	67	193	183	118	258	48	60	52	90	56	53	113	98
Y	15	17	11	34	17	6	13	21	23	18	25	26	41	11	11	16	23	24	22	29	19
Sr	149	338	13	226	512	53	117	451	230	74	313	234	113	242	924	717	653	111	103	322	323
Nb	19	28	19	12	30	10	23	27	12	26	23	15	28	10	11	9	12	11	10	14	15
V	140	294	186	280	204	92	227	263	252	237	270	293	211	140	216	224	277	292	263	297	223
La	7	17	21	<5	12	10	19	16	9	12	16	27	42	18	16	26	18	13	9	<5	13
Ce	44	<5	47	19	58	20	40	83	31	43	98	82	97	33	42	22	53	23	9	<5	<5
Ba	667	3232	33	137	381	56	1015	286	83	1251	121	107	829	16	244	296	270	111	163	3763	8246
Rb	93	57	8	28	23	5	19	17	23	83	11	11	135	5	16	26	48	10	13	18	31

KR-D: Diorite between Keithley and Rollie creeks; HR-V: Harveys Ridge volcanics; KC: sheared metavolcanics and diorite southwest of Keithley Creek;
MB-V: Mount Barker volcanics; MB-G: Mount Barker diorite.
Major oxides in per cent; trace elements in ppm; Steel mill grinding at GSB; major oxides by Fused Disc - X-ray fluorescence; trace elements pressed pellet - X-ray fluorescence
Analysis performed at Cominco Research Laboratory, Vancouver, B.C. SUM = Sum of oxides

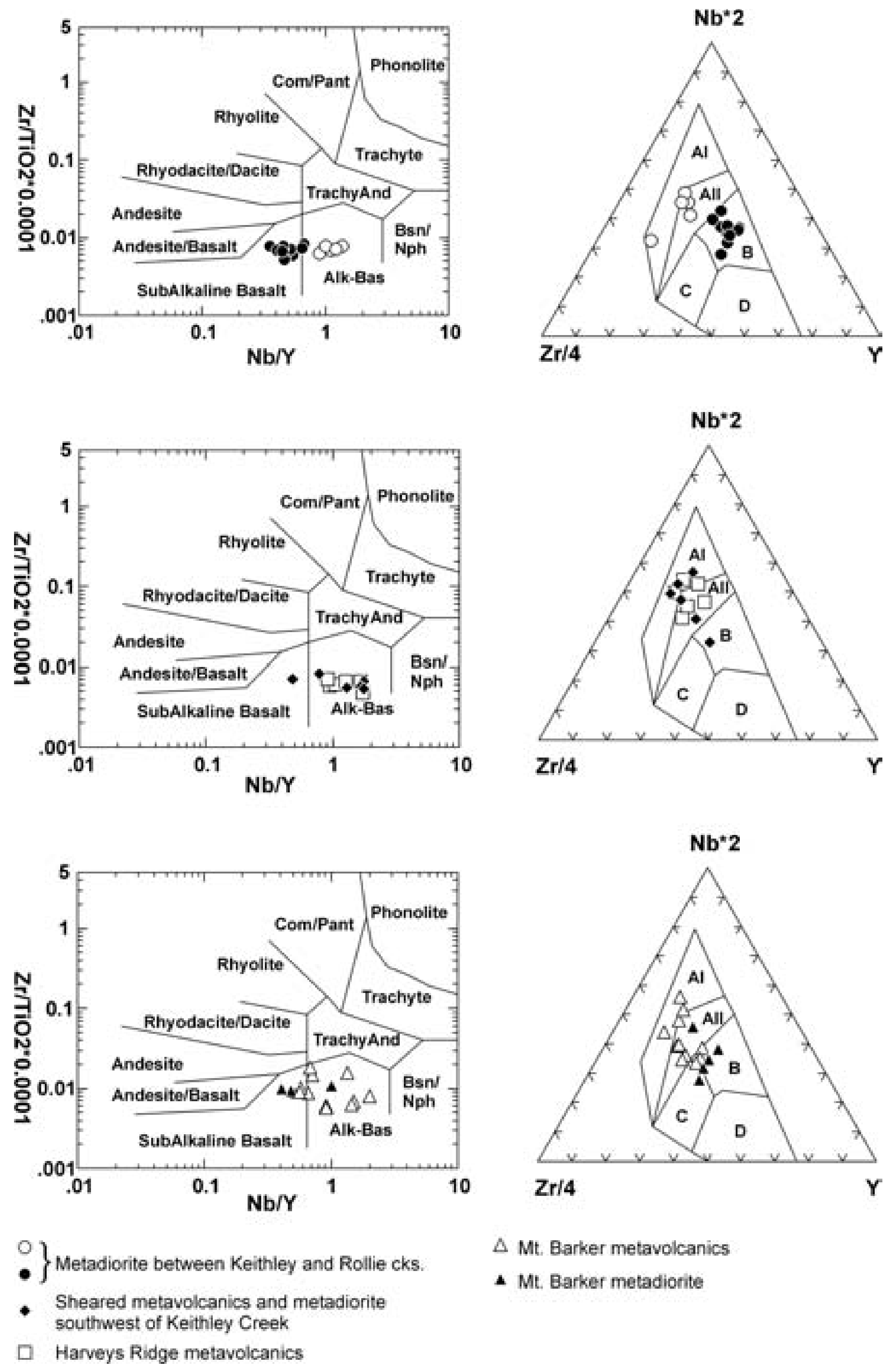

Figure 8. (a) Nb/Y versus Zr/TiO_2*0.0001of diorite sills and dikes within Snowshoe rocks between Keithley and Rollie creeks. (b) Nb*2-Zr/4-Y for diorite sills and dikes within Snowshoe rocks between Keithley and Rollie creeks. (c) Nb/Y versus Zr/TiO_2*0.0001 for sheared metavolcanics and diorite southwest of Keithley Creek and Harveys Ridge volcanics. (d) Nb*2-Zr/4-Y for sheared metavolcanics and diorite southwest of Keithley Creek and Harveys Ridge volcanics. (e) Nb/Y versus Zr/TiO_2*0.0001 for diorite and metavolcanics within the Mount Barker volcanics. (f) Nb*2-Zr/4-Y for diorite and metavolcanics within the Mount Barker volcanics. AI - within-plate alkali basalts; AII - within-plate alkali basalts and within-plate tholeiites; B - E-type MORB (mid-ocean ridge basalt); C - within-plate tholeiites and volcanic-arc basalts; D - N-type MORB and volcanic-arc basalts. Alk-bas - alkali-basalt; bsn - basinite; com - comendite; nph - nephelinite; pant - pantellerite; trachyand - trachyandesite.

line, within-plate signatures and the other having subalkaline compositions and suggesting a MORB setting (Figure 8). A very similar trend is exhibited for samples taken from the body of sheared mafic metavolcanic and dioritic rocks southwest of Keithley Creek (Figure 8). Harveys Ridge metavolcanics are entirely of alkaline composition and have a within-plate signature.

Mount Barker volcanics and metadiorite are part of the Downey/Keithley succession and plot within the alkaline and subalkaline fields, respectively (Figure 8). Furthermore, the values of Nb-Y and Zr also show within-plate and MORB tectonic signatures on the discrimination diagram proposed by Meschede (1986). It is interesting to note that several of the metadiorite sample points fall within the volcanic arc basalt field (C).

In summary, preliminary geochemistry of mafic igneous rocks within the Snowshoe Group indicate alkaline to subalkaline compositions and generally suggest an extensional tectonic setting.

STRUCTURE AND METAMORPHISM

Sedimentary and igneous rocks record at least three phases of penetrative deformation at the outcrop scale (Figure 9). The first consists of a layer-parallel fabric defined by the alignment of phyllosilicates and, in higher strain areas, the flattening of silicate minerals. The second phase of deformation was quite ductile and of such intensity that first phase foliation and bedding are approximately parallel to sub-parallel to second phase foliations along second phase fold limbs. It is only in the core of second phase fold structures that one can observe the layer parallel first phase foliation being crenulated. The last phase of ductile deformation is seen as a sub-vertical crenulation cleavage axial planar to open folds. These crenulations are not ubiquitous throughout the map area, being more evident in the upper greenschist to amphibolite grade regions. Locally, especially near northeast trending fault structures, northeast trending crenulations are developed across second phase foliations. The relationship of these to third phase crenulations is unclear.

No first phase folds or other large-scale structures were observed outside of the large shear zone at the contact between the Crooked Amphibolite and Quesnel Lake Gneiss. This shear zone is believed to be a first phase structure and resulted from the emplacement of Slide Mountain and Quesnel rocks overtop of the Snowshoe Group (Rees, 1987; Struik, 1988). Surprisingly, no large scale folds or faults have been recognized within Snowshoe stratigraphy that are unequivocally related to this convergence.

The geological pattern southeast of Cariboo Lake and in the region between Barker and Ishkloo creeks is dominated by second and third phase fold structures. The area between Barker and Ishkloo creeks, as with the area mapped during the 2000 field season, contains southeast to northwest trending second phase foliations which dip shallowly or moderately to the north and outline large-scale southwesterly verging fold structures (Ferri, 2001a, b). These general attitudes have been modified north of Cariboo Lake by upright third phase folding producing the large Lightening Creek Anticlinorium and related structures to the southwest. Large third phase folds similar to these were delineated in the region between Frank and Sellers creeks (Ferri, 2001a, b). There is a profound change in structural style north and south of Cariboo Lake. To the north of the lake, third phase structures, like the Lightening Creek Anticlinorium, are the dominant structures and control the map pattern. Second phase structures may be present here, but may have been refolded by these third phase structures.

Near Grain Creek, the Keithley quartzite outcrops on a ridge in the very southeastern part of the map area. Its disappearance to the south is interpreted to result from a second phase fold closure. To the northeast, poor exposure and the lack of a suitable marker within the large expanse of rocks tentatively assigned to the upper transitional Harveys Ridge made delineation of structures tentative, at best.

North of Cariboo Lake, the northeast trending axis of the Lightening Creek Anticlinorium can be traced from the eastern side of Yanks Peak down to Cariboo Lake. Second and first phase foliations are also broadly warped to the west of this structure (Figure 3a) suggesting the presence of similar structures. One of these is well outlined by the long, northeastward tongue of Quesnel Lake Gneiss which extends almost to the mouth of Keithley Creek (Figure 3a, b). The core of the Lightening Creek Anticlinorium occurs within the broad expanse of Harveys Ridge lithologies. The Agnes conglomerate is also repeated on either side of the axis. The steep dip of first and second foliations on either side of the axis, particularly to the northeast, further accentuates this large fold.

The stratigraphy on Yanks Peak poses some structural challenges. This overturned panel of Keithley stratigraphy, together with rocks tentatively assigned to the Keithley succession immediately to the southwest and Agnes and Harveys Ridge stratigraphy in the core of the Lightening Creek Anticlinorium, suggests the presence of a northeast verging fold or faulted fold structure which is tentatively shown in Figure 3b. The orientation of this fold is inconsistent with a third phase structure (*i.*e. parasitic fold to the Lightening Creek Anticlinorium) and, if correct, is most likely related to second phase deformation. Struik (1988) outlines similar structures in the Wells-Barkerville map sheet. If this interpretation is accurate, this second phase vergence reversal or confrontation zone would suggest the presence of box fold-like geometry similar to the west flank of the Porcupine Creek Anticlinorium (Likorish, 1993). Second phase fold structures and the relationship between second phase foliation and bedding between Yanks Peak and Keithley Creek, are consistent with a northeast-verging fold structure inferred in Figure 3b.

Highly deformed meta-volcanic and igneous rocks along the southwest side of Keithley Creek suggest the presence of a large ductile shear zone. No kinematic indicators could be discerned within these deformed rocks and the vergence of the fault zone is not known. This fault roughly coincides with the northeasterly directed Keithley Thrust first delineated by Struik (1983a; 1988). The southward extension of this fault is not known. It cannot be traced south-

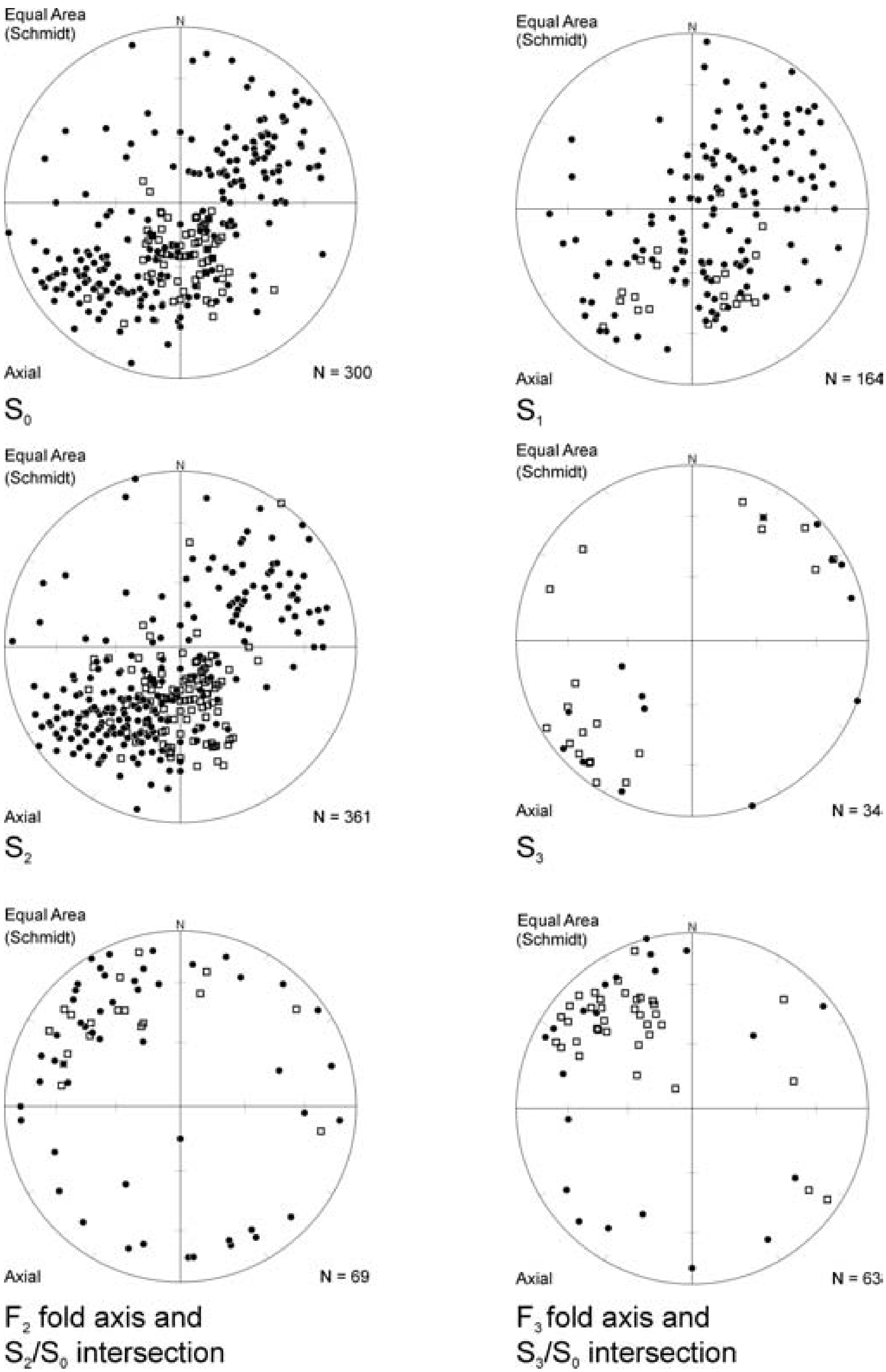

Figure 9. Equal area plots of structural data collected within the map area. Symbols refer to areas mapped during 2001 field season. These areas are shown in Figure 2.

eastward towards Cariboo Lake suggesting that it may trace an arcuate path along the headwaters of Asserlind Creek, following the general trend of foliation, and then swing around and up along Rollie Creek.

Higher grade metamorphic rocks were encountered in two areas: between Barker and Ishkloo creeks and in the area west of Keithley Creek. The area between Barker and Ishkloo creeks occurs within the garnet isograd and staurolite was observed locally. Metamorphic mineral assemblages suggest lower amphibolite conditions. Southwest of Keithley Creek garnet-biotite-muscovite schist and garnet-hornblende and actinolite bearing mafic metavolcanics occur, indicating upper greenschists to lower amphibolite environments. Outcrop is sporadic in this area and mapping of metamorphic isograds was not possible. Biotite-bearing schist can be traced up to the Crooked Amphibolite in the southwest, although the few outcrops of the Late Triassic Black phyllite seen further west are relatively unmetamorphosed.

Metamorphic rocks southwest of Keithley Creek are also characterized by the presence of large (up to 3 centimetres) idioblastic crystals of andalusite. The orientation of these crystals appears random or semi-random and this mineral suggests low pressure metamorphic conditions.

In general, peak metamorphic conditions, as shown by the growth of metamorphic index minerals, occurred during the latter parts of the second phase of deformation. The presence of muscovite and chlorite along third phase crenulations indicates that this period of deformation occurred during the waning stages of this metamorphic event. First phase deformation is believed to have begun in the late Early Jurassic (approximately 190 to 185 Ma; Rees, 1987). Metamorphic sphene in parts of the Quesnel Lake Gneiss suggest that second phase deformation occurred at approximately 175 Ma (Mortensen *et al*., 1987). Arguments put forth by Rees (1987) suggest that there was little or no break between second and third phase deformation, with the latter continuing to about 160 Ma. Thus the main ductile elements present within the map area occurred over a relatively short time period.

MINERAL OCCURRENCES

One of the main objectives of this mapping project was to examine the geologic setting of recently discovered massive sulphide mineralization in the Snowshoe Group. During the course of mapping, a new semi-massive sulphide occurrence was discovered within rocks of the Harveys Ridge succession and is here named the Unlikely showing. This, together with other indicators of mineralization within this unit and the more important Frank Creek occurrence, suggests this horizon has above average potential for hosting additional massive sulphide mineralization. It will also be argued later in this section that the revised stratigraphic sequence for the Snowshoe Group correlates well with Eagle Bay sections containing significant massive sulphide occurrences in the Adams Plateau region (Lucky Coon) and that this metallogenic horizon or time line extends northward into the Barkerville area.

In addition to massive sulphide mineralization, there are numerous other mineral occurrences within the map area. These include the abundant Ag-Au veins in the region around Yanks Peak (Holland, 1954), the Cariboo-Hudson gold mine and associated showings, numerous placer operations on Keithley, Pine and Harveys creeks and other minor vein occurrences. Mapping this summer also encountered several minor Cu-bearing veins and disseminations within volcanics of the Downey/Keithley succession. The following discussion focuses on the Ace and Frank Creek occurrences and the reader is directed towards the Minfile database for information on the other showings.

UNLIKELY

Mapping during the 2001 field season led to the discovery of the Unlikely Cu-bearing semi-massive sulphide occurrence (Photo 3). It is located along the main road on the north shore of Cariboo Lake, approximately 2.25 kilometres southwest of the small community of Keithley Creek. Mineralogy, overall characteristics and association with mafic metavolcanics suggest this may represent stratiform besshi-style sulphide mineralization similar to that at Frank Creek, immediately to the southeast.

Host rocks are grey to dark grey or black phyllites and siltstones of the Harveys Ridge succession. Locally, immediately adjacent to the sulphides, is a "stripped" sequence of alternating light grey to white and dark grey siltstone from 0.5 to 1 centimetre thick. Green-mica bearing, ankerite altered and silicified? horizons up to several metres thick occur structurally above the showing. Chemical analyses suggests these are highly altered mafic volcanic sequences originally of alkaline composition.

The showing is about 1.5 metres wide at its thickest point and gossanous sediments and sulphide can be traced for approximately 10 to 15 metres. The strike of the sulphide horizon is parallel to schistosity or cleavage presumably of second phase origin. Bedding is tightly folded locally, but is essentially parallel to the main schistosity. The mineralized zone is highly siliceous and appears to be silicified Harveys Ridge lithologies. The southwest part of the mineralized zone contains the highest concentrations of sulphides, with

Photo 3. The Unlikely mineral occurrence (outlined by the white line).

TABLE 2
GEOCHEMISTRY OF SEVERAL MINERALIZED HORIZONS AND OCCURRENCES WITHIN THE SNOWSHOE GROUP

	Easting	Northing	Mo 0.01	Cu 0.01	Pb 0.01	Zn 0.1	Ag 2	Ni 0.1	Co 0.1	Mn 1	Fe 0.01	As 0.1	U 0.1	Au 1	Th 0.1	Sr 0.5	Cd 0.01	Sb 0.02	Bi 0.02
01FFE-09-03	605535	5844523	4.27	2217.3	22.31	52.7	724	337.4	214.6	692	27.65	2875.4	1.1	12.4	0.6	12.6	0.06	1.71	33.36
01FFe-32-6	607045	5859165	18.14	114.86	16.58	513.6	295	62	6	364	10.88	67.2	3	1.2	1.4	11	0.63	8.52	0.17
01FFe-32-6a	607045	5859165	1.54	63.3	3.1	161.2	156	26.3	3.4	34	4.64	6.3	1.1	1.3	2	2.3	0.17	0.81	0.02
UNLIKELY 1	605535	5844523	4.84	1489.8	10.32	37.5	403	285.2	213.9	636	29.01	2901.2	1.4	8.1	0.7	7.6	0.11	1.94	16.13
UNLIKELY 2	605535	5844523	4.92	894.75	12.25	40.3	330	59.8	37.5	533	28.21	175.5	1.9	6	1	12.6	0.08	0.29	17.4
UNLIKELY 3	605535	5844523	3.49	3323.2	31.66	46	963	216.3	197.7	744	24.07	32.7	0.9	15.7	0.5	15	0.16	0.25	53.34
UNLIKELY 4	605535	5844523	2.58	518.58	13.95	162	146	64.6	72.7	1059	12.14	43.4	2.7	4.5	2.7	13	0.2	0.06	20.79
UNLIKELY 5	605535	5844523	2.08	1131.2	12.25	92.7	306	84.2	82.2	970	12.31	16.2	1.7	4.9	1.8	42.6	0.19	0.1	15.11
01FFE-9-2A	605096	5844003	0.84	172.84	4.38	61.4	119	257.4	56.4	964	6.9	187.5	0.3	1.9	1	123.7	0.18	0.32	2.57
01FFE-6-2	605096	5844003	2.83	46.36	1.08	28.2	31	6.2	14.1	571	4.11	0.1	0.4	1.3	3.2	69.2	0.01	0.07	0.28
01FFE-11-7	601064	5850147	1.42	37.9	0.74	51.5	11	3.7	11.6	354	3.45	0.3	0.7	0.5	3.8	34.4	0.06	0.02	< .02
01FFE-22-1	613924	5887034	0.09	15637	2.13	134.5	6211	23.8	50.3	1177	7.1	1.2	0.1	361.2	2.3	37.4	0.09	0.06	4.63
01FFE-22-2	613827	5858245	0.51	492.72	11.95	28.1	1277	104.1	49.2	3854	29.97	4.9	0.9	769.7	2.9	134.5	0.04	0.18	2.17

	V 2	Ca 0.01	P 0.001	La 0.5	Cr 0.5	Mg 0.01	Ba 0.5	Ti 0.001	B 1	Al 0.01	Na 0.001	K 0.01	W 0.2	Sc	Tl 0.02	S 0.02	Hg 5	Se 0.1	Te 0.02	Ga 0.02
01FFE-09-03	35	0.45	0.043	1.8	73.1	1.3	28.2	0.005	< 1	0.99	0.01	0.03	1.8	2.5	0.13	14.24	12	16.6	0.11	5.9
01FFe-32-6	53	0.01	0.077	3.2	100.3	0.03	124.5	0.001	4	0.57	0.003	0.14	0.5	1.6	0.05	0.12	24	6.8	0.14	1.9
01FFe-32-6a	22	0.01	0.046	9.3	68.1	0.01	132.4	0.003	1	0.48	0.021	0.09	< .2	1.7	0.04	0.07	6	1.6	0.05	0.9
UNLIKELY 1	3	0.26	0.01	1	43.6	0.36	19.4	0.003	< 1	0.13	0.013	0.03	1.7	0.6	0.2	16.07	20	16.5	0.15	0.8
UNLIKELY 2	13	0.17	0.023	1.5	40.3	0.16	59.9	0.01	< 1	0.29	0.017	0.04	1	1.1	0.03	2.34	5	6.7	0.05	1.9
UNLIKELY 3	6	0.72	0.006	0.8	51.1	0.27	19.9	0.002	< 1	0.18	0.016	0.02	2.1	0.9	0.02	15.93	< 5	25.3	0.1	1.6
UNLIKELY 4	44	0.31	0.08	1.8	84.3	1.26	53.7	0.004	1	0.99	0.044	0.04	0.4	2.9	0.02	2.86	< 5	6.2	0.03	5
UNLIKELY 5	21	1.73	0.037	1.3	67.4	1.04	64.6	< .001	< 1	0.55	0.022	0.06	0.4	1.6	0.03	5.41	< 5	9	0.05	2.5
01FFE-9-2A	14	3.72	0.067	3.3	63.3	5.25	84.6	0.012	< 1	0.42	0.012	0.17	< .2	6.6	0.07	1.22	< 5	1.7	0.02	1
01FFE-6-2	15	1.41	0.535	32.3	2.1	0.9	248.8	0.061	< 1	1.69	0.034	0.37	0.4	0.7	0.18	0.57	< 5	0.8	< .02	4.4
01FFE-11-7	16	1.42	0.454	21.6	1.4	0.68	81.6	0.069	1	1.55	0.045	0.12	< .2	0.8	0.02	0.15	< 5	0.2	< .02	4.1
01FFE-22-1	162	1.38	0.233	14	4.1	3.12	6.6	0.028	< 1	4.28	0.011	< .01	< .2	10	< .02	0.06	1159	3.5	0.05	19.1
01FFE-22-2	< 2	7.21	0.02	11.2	4.3	0.42	24.9	0.003	< 1	0.56	0.003	0.01	2.5	0.4	0.02	10.97	44	1.4	0.17	2.3

NOTES: Steel mill grinding at GSB; analysis by Aqua regia digestion (1 g sample)-mass spectroscopy at ACME Analytical Laboratory, Vancouver, B.C.; all results in ppm except Fe, Ca, P, Mg, Ti, Al, Na, K and S which are in per cent and Au in ppb

01FFe-09-03: grab sample of sulphides at the Unlikely showing (Harveys Ridge succession)

01FFe-32-6: grab sample of ferricrete on Harveys Ridge siltstone and phyllite

01FFe-32-6a: grab sample of pyritiferous Harveys Ridge siltstones and phyllites

UNLIKELY 1: grab sample of high grade zone (Harveys Ridge succession)

UNLIKELY 2: semi-continuous chip sample (1.5 metres) across the main mineralized zone. (Harveys Ridge succession)

UNLIKELY 3: grab sample from the middle of the main silicified zone. (Harveys Ridge succession)

UNLIKELY 4: grab sample of thinnly interlayered light and dark grey siltstone with minor sulphides. Approximately 5 m northeast of the main zone. (Harveys Ridge succession)

UNLIKELY 5: grab sample of spalled piece of siliceous Harveys Ridge with disseminated sulphides. (Harveys Ridge succession)

01FFe-9-2A: grab sample of altered volcanics within the Harveys Ridge succession.

01FFe-6-2: grab sample of 2 m wide gossanous siltstone and sandstone of Harveys Ridge succession. Up to 20 per cent pyrite.

01FFe-22-1: grab sample of chalcopyrite-bearing quartz-carbonate vein within Mount Barker volcanics.

01FFe-22-2: grab sample of pyrite-rich zone within limestone adjacent to Mount Barker volcanics (Downey/Keithley succession). Garnet? and diopside? Associated with this suggesting skarn-type mineralization one 1.5 by 3 metre area containing zones over 50 % sulphide, and averaging between 25 and 50 %. Sulphide content decreases to the northeast and disappears into the "stripped" Harveys Ridge lithology described above.

Sulphides consist of pyrite, pyrrhotite, arsenopyrite and chalcopyrite. Cu content varies from 0.05 to 0.3 % and some of the higher Cu values are associated with anomalous Au (Table 2). Sulphides commonly appear finely disseminated and have a dull lustre, although they are locally recrystallized into coarser masses. Sulphides also form more concentrated horizons or discontinuous lenses parallel to the main schistosity.

ACE

The Ace property is located south of the Little River, 35 kilometres northeast of Likely and is easily reached from the Wells-Barkerville road. A detailed description of the property history can be obtained from Höy and Ferri (1998a). The Little River valley, within which the Ace property occurs, contains extensive glacio-fluvial deposits and as such the only exposures are limited to the river valley, the ridge containing Mount Barker and some road cuts. Extensive trenching within the property was carried out in the mid-1990s but has either been subsequently back filled and/or slumped in or flooded. The lithologies exposed in the trenches were described in Höy and Ferri (1998a) and these rock types are entirely consistent with other sequences of the Downey/Keithley succession encountered northwest and southeast of the Ace property. Sulphide mineralization is semi-massive within quartzo-feldspathic schist and phyllite, and consists primarily of pyrite and pyrrhotite with lesser amounts of chalcopyrite, sphalerite and galena. As Höy and Ferri (1998a) point out, Cu/Pb and Zn/Pb ratios, together with the mixed mafic meta-volcanic and sedimentary sequence suggest a besshi-type setting for this occurrence.

Barker Minerals Ltd. drilled 7 holes on the property during the 1998 field season (Payne, 1999). The thickest, composite section of sulphide encountered was approximately 0.5 metres and was elevated in Au, Ag, Cu and Zn. Barker Minerals Ltd. suggest that sulphide mineralization sits above a felsic unit which is from 4 to 82 metres in thickness. This rock outcrops near the main road and Höy and Ferri (1998a) theorized that it may represent highly deformed intrusive rock. This unit was sampled during the 2000 field season for U-Pb geochronology. Recovered zircons had a morphology indicating they were detrital and subsequent analysis confirms this (Richard Freidman, Personal Communication, 2001). These results cast doubt on the felsic volcanic or intrusive origin of this unit.

Mafic volcanics and intrusive rocks associated with the meta-sedimentary sequence hosting the Ace property can be traced northwestward across the Cariboo River and to Harveys Creek. Bornite-bearing quartz veins were observed within metavolcanic rocks on the south side of Harveys Creek and are found in metamorphosed rocks in the Pennys Creek area northwest of the Cariboo-Hudson Mine. Malachite stained metadiorite or metavolcanics were also observed southwest and south of the Ace occurrence, within the Mount Barker volcanic sequence. Metavolcanic rocks disappear to the northwest and only a narrow section of chlorite schist is associated with limestone at Downey Pass, near Wells. These volcanics can be traced southeastward (Struik, 1983b) and it is argued that they form part of the stratigraphic sequence in the Adams Plateau area (Eagle Bay Assemblage).

MASSIVE SULPHIDE POTENTIAL IN THE HARVEYS RIDGE SUCCESSION

The presence of the Frank Creek and Unlikely besshi-style volcanogenic massive sulphide occurrences within the Harveys Ridge succession clearly shows that within Snowshoe stratigraphy, this unit has above average potential for hosting significant syngenetic mineralization. Mapping along the Snowshoe Plateau also encountered several sections of ferricrete incrusted sections of Harveys Ridge sediments. Sampling of one northeast of Yanks Peak returned elevated levels of Zn, although the levels of other elements are relatively low (Table 2). The presence of these ferricrete deposits indicates that the host rocks either have a high iron background level or contain zones of high iron concentration that are being leached by ground waters percolating along permeable layers, most likely a fault zone.

The Frank Creek showing is hosted by black to dark grey carbonaceous shales and siltstones which commonly lie immediately below the Agnes conglomerate. This is especially true on the Snowshoe Plateau where fine black clastics also contain ferricrete deposits. Conglomeratic rocks of the Agnes occur roughly at the same stratigraphic level as the Frank Creek volcanics (*see* Ferri, 2001b) and occur immediately above the Frank Creek occurrence. These two rock types suggest increased tectonic activity subsequent to the deposition of the fine black clastics. Furthermore, the deposition of alkalic volcanic rocks points to increased heat flow and extensional tectonics during this time. The presence of massive sulphide mineralization within the black clastics of the Harveys Ridge succession may also indicate that this horizon was experiencing precursor effects registered in immediately overlying lithologies. These fine, carbonaceous, black clastics indicate anoxic conditions which would have been an ideal environment for the deposition of sulphides from expelled metal-rich brines. Although this scenario is analogous to sedimentary exhalative-type massive sulphide mineralization (SEDEX) found elsewhere in the Cordillera (*i.e.* Kechika Trough) the elevated levels of Cu and pyrrhotite suggests higher temperatures and input from igneous sources, and is more akin to sediment-volcanic or besshi-type mineralization.

Correlation southward of the Harveys Ridge succession with massive sulphide-bearing stratigraphy of the Eagle Bay Assemblage in the Adams Plateau region suggests that this horizon represents a significant metallogenic period within the western part of the Kootenay Terrane. In the Adams Plateau area similar stratigraphy hosts several significant massive sulphide deposits (Lucky Coon, King Tut; Höy, 1999). These occurrences consist of Pb-Zn deposits with elevated levels of Cu and Au. Höy (1999) demonstrated that thickness and facies changes within local stratigraphy reflect the presence of growth faults which may have been channel ways for metalliferous brines that produced the deposits. There is not enough stratigraphic control in the present study area to suggest a similar scenario, although the nature of the deposits implies that some type of fault system may have been involved with their formation.

CONCLUSIONS

- A new Cu-rich massive sulphide showing named the Unlikely was discovered within rocks of the Harveys Ridge succession.
- The stratigraphic sequence hosting the Frank Creek and Unlikely occurrences is similar to Eagle Bay stratigraphy in the vicinity of the Lucky Coon and related showings within the Adams Plateau.
- Mapping suggests that rocks of the Downey and Ramos may be equivalent to the Keithley succession and that Hardscrabble Mountain and Harveys lithologies may also be time equivalent.

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[4] A subalkaline sill southwest of Keithley Creek was samples and dated by U-Pb geochronology resulting in a preliminary age of 281 ± 12 Ma (R. Friedman, Personal Communication, 2001), very similar in age to meta-diorite along Mount Barker.

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