Geological Setting and Economic Potential of Gold Occurrences in the Kliyul Creek-Solo Lake Area, North-Central British Columbia

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INTRODUCTION

This report summarizes the results of lithogeochemical sampling completed in the Kliyul Creek-Solo Lake area of north central British Columbia. The study area is part of the larger Johanson Lake project (Fig. 1). The purpose of this work was to confirm the widespread distribution of gold in quartz veins as recognized by previous workers and to assess the potential for economically viable deposits in the area. Geochemical sampling and geologic mapping was done in early August from two strategically located fly camps one located at Divide Lake, the other near the headwaters of Mariposite Creek (Fig. 2). A total of 95 samples were collected and submitted to Acme Analytical Laboratories in Vancouver for multi-element inductively coupled plasma (ICP) analysis. Stations were established using a Garmin GPS unit and databases and maps were created using Manifold 6.0 GIS software.

The work discussed in this report was done as part of the Johanson Lake project. This project, which is now in its second year, is primarily a bedrock mapping program initiated by the Geological Survey Branch as part of the Toodoggone Targeted Geoscience Initiative (TGI). The project focuses on a belt of Mesozoic arc volcanic and plutonic rocks in the eastern part of the McConnell Creek (94D) map sheet. This area contains a number of gold, copper and molybdenum mineral occurrences and Regional Geochemical Survey sample sites that returned anomalously high values of gold and copper. The aim of the project is to improve the quality and detail of bedrock maps for the area and determine the setting and controls of mineral occurrences. This will help guide exploration strategies on known mineral occurrences and focus exploration for new occurrences. Operating funds were provided by the Toodoggone TGI and a private-public partnership agreement with Northgate Exploration Ltd. A more complete description of the project and the results of mapping completed in 2003 are provided in a previous report (Schiarizza, 2004). Results of work done in 2004 are contained in an accompanying report in this volume.

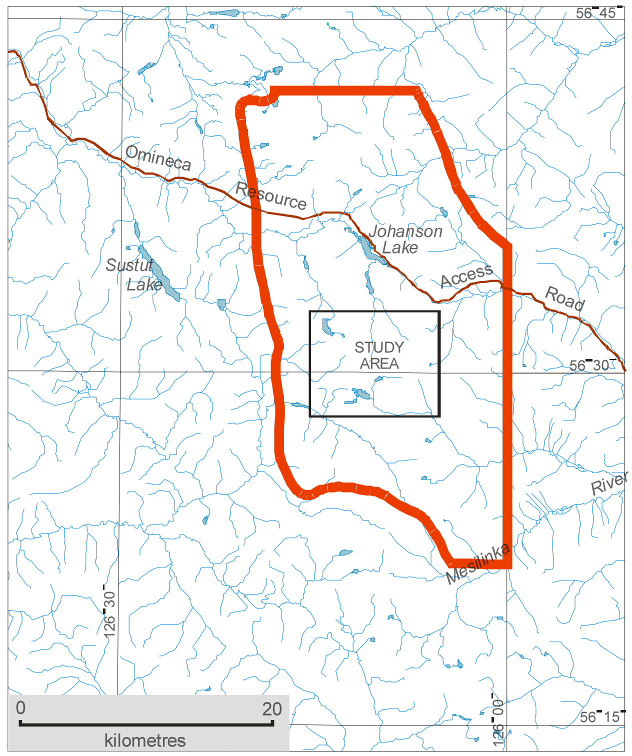

Figure 1. Location of the Johanson Lake project (thick line) and the current study area (rectangle).

PREVIOUS WORK

The history of geologic mapping and mineral exploration in the Johanson Lake project area is described in a previous report (Schiarizza, 2004). Table 1 is a summary of recorded mineral exploration in the study area. The earliest recorded exploration activity was in 1949 when Goldway Peak Mines Ltd. began working on prominent gold-quartz veins near Goldway Peak. Although a small amount of work was done intermittently over the next 20 years it was not until 1970 that Kennco Exploration discovered skarn mineralization near the headwaters of Lay Creek. Sumac Mines Ltd. optioned the Kliyul property from Kennco and completed 11 diamond-drill holes in 1973 and 1974 resulting in the discovery of additional gold-bearing skarn mineralization. Meanwhile, El Paso Mining continued to explore quartz veins at

Goldway Peak, San Jacinto Explorations Ltd. did regional exploration for skarn mineralization in the Lower Kliyul Creek area and BP Minerals explored a large quartz-sericite-pyrite alteration zone south of the Kliyul property (Bap property). Kennco Explorations resumed work on the Kliyul property in 1981 completing four NQ drillholes. BP minerals did more work on the Bap property in 1982 and in 1984 they mounted an aggressive exploration program that saw them work on a number of different properties in the area including the Kliyul property. At the same time various operators did work on showings in the Goldway Peak area. In 1990, Placer Dome optioned the Kliyul property and did some additional mapping and sampling. In 1992, Noranda Exploration acquired the property and in 1993 they drilled six reverse circulation percussion holes. They also did extensive lithogeochemical sampling in the Mariposite Creek area (Gill, 1994) which resulted in the discovery of a significant number of gold-bearing veins. Battle Mountain Canada (Hemlo Gold Mines Ltd.) subsequently completed two drillholes on this property (Gill, 1996) but the results were discouraging and no further work was done.

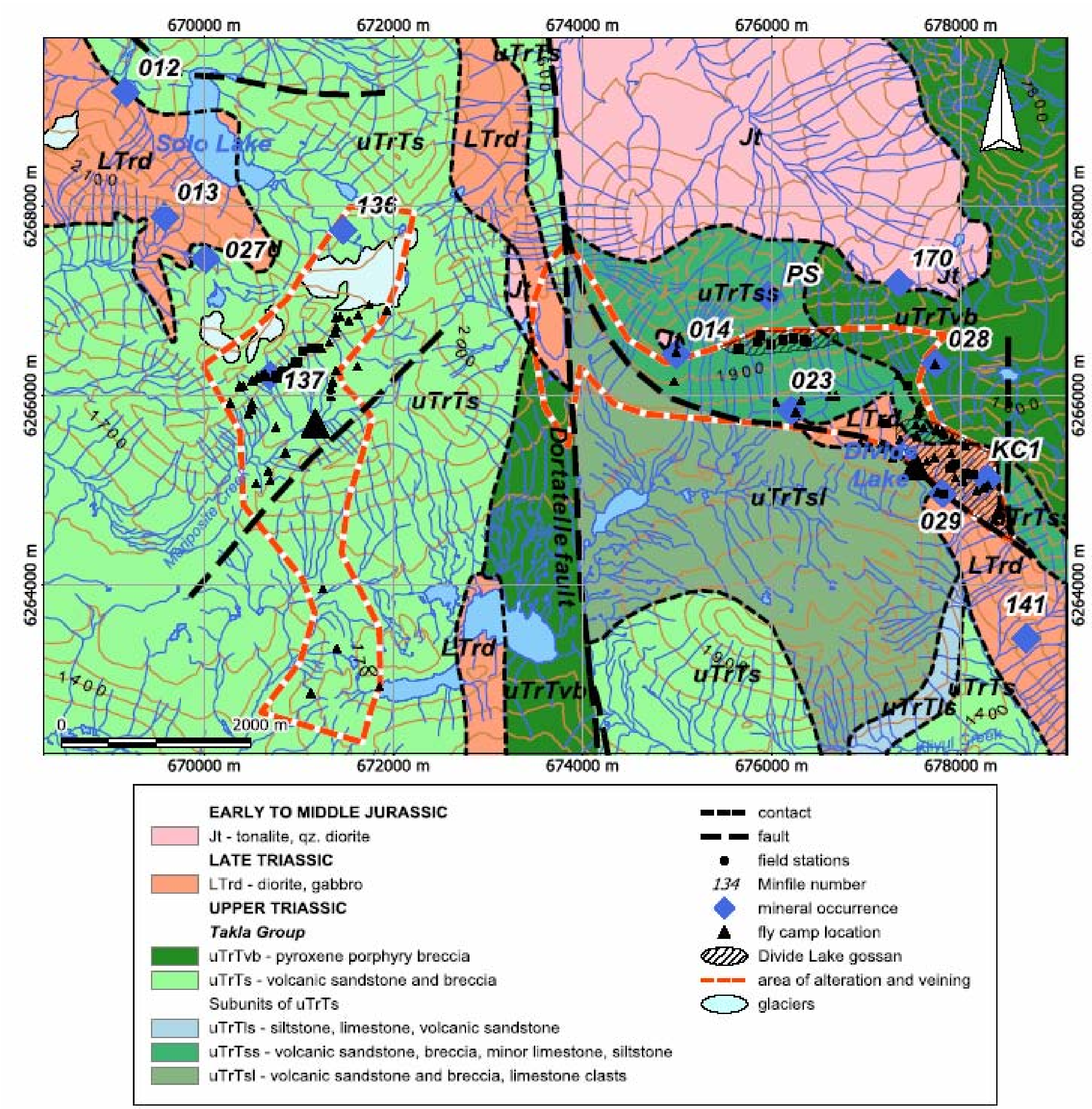

Figure 2. Geological map of the study area showing location of field stations, fly camps and mineral occurrences. Geology after Schiarizza (2004a).

TABLE 1. HISTORY OF EXPLORATION IN THE SOLO LAKE-KLIYUL CREEK AREA

Year	Operator	Area/Property	Work Done	Target	Result
1949	Goldway Peak Mines Ltd.	Goldway Peak	preliminary work	Au quartz veins	
1970-72	Kennco Explorations	Kliyul property	property staked; geochemical and geophysical surveys	zone of skarn mineralization	delineated 2.5X1.0 km IP chargeability anomaly and coincident but smaller Cu soil and magnetic anomalies
1971-72	El Paso Mining & Milling Co.	lower Kliyul Creek	prospecting	skarn mineralization	discovered skarn zones along sheared contact between ultramafics and volcanics
1973	Sumac Mines Ltd. (option from Kennco?)	Kliyul property	3 x-ray DDH	zone of skarn mineralization	unknown
1973	San Jacinto Explorations Ltd.	Goldway Peak	geochemical soil survey	Au quartz veins	unknown
1974	Sumac Mines Ltd. (option from Kennco?)	Kliyul property	6 BQ DDH	West & East zone Cu anomalies	
1974	Sumac Mines Ltd. (option from Kennco?)	Kliyul property	5 BQ DDH	magnetic high	intersected magnetite-Cu-Au mineralization in well fractured sericite, chlorite, epidote, carbonate, quartz, pyrite skarn hosted by calcareous andesite tuffs and agglomerates and lesser diorite. Estimated size of resource calculated to be 2.5 million tons grading 0.3% Cu and 0.03 opt Au
1974-75	BP Minerals Ltd.	Bap claims	geological mapping; geochemical and mag/JEM surveys	intensely sheared clay-sericite altered feldspar phyric volcanics/intrusives and Au quartz veins	
1976	BP Minerals Ltd.	Bap claims	Maxmin EM survey		
1981	Dupont of Canada Ltd.	AS 1 claim, Goldway Creek area	geological mapping and geochemical survey		
1981	Kennco Explorations and Vital Pacific Ltd.	Kliyul property	4 NQ DDH totaling 603 m all in southerly direction	central skarn zone	
1982	BP Minerals Ltd.	Bap claims	trace element study on previously collected samples	intensely sheared clay-sericite altered feldspar phyric volcanics/intrusives and Au quartz veins	
1982	Dermot Fahey and Laramie Mining Corp.	Goldway Peak	geochemical survey		
1983	Laramie Mining Corp	Goldway Peak	preparatory study to determine road access	Au quartz veins	
1984	BP Minerals Ltd.	Kliyul property	re-logged and sampled portions of core; geological mapping; geochemical sampling	skarn mineralization	
1984	Laramie Mining Corp	Goldway Peak	geological mapping; rock sampling and assaying; VLF geophysical survey	Au quartz veins	

TABLE 1 (CONTINUED)

1984	BP Minerals Ltd.	lower Kliyul Creek	geological mapping and geochemical survey		
1984	Golden Rule Resources Ltd.	KC 1 & 2	obtained claims; preliminary sampling and prospecting; further geological mapping, geochemical and magnetic surveys		
1985	BP Minerals Ltd.	Goldway Peak	geological mapping and geochemical survey	Au quartz veins	delineated Au quartz veins and fractures in quartz-carbonate-pyrite altered zone
1985	Golden Rule Resources Ltd.	KC 1 & 2	geological mapping, geochemical, magnetic and VLF surveys		
1985-1986	Laramie Mining Corp	Goldway Peak	prospecting, geological mapping, trenching and sampling	Au quartz veins	
1986	Lemming Mining Resources for BP Resources	Bap claims	soil geochemical survey	intensely sheared clay-sericite altered feldspar phyric volcanics/intrusives and Au quartz veins	
1986	Ritz Resources Ltd. For Golden Rule Resources Ltd.	KC 1 & 2	geological mapping, geochemical, magnetic and VLF surveys		
1990	Placer Dome	Kliyul property	line cutting, prospecting, magnetic, VLF-EM, soil and rock geochemical surveys	delineate magnetic anomalies similar to the known skarn zone, possible porphyry style mineralization and/or mineralized structures parallel to the large glacial valley	
1992	Noranda Exploration Company Ltd.	Kliyul property	1:5000 scale geological mapping, rock and minor soil sampling	alteration assemblages	
1993	Hemlo Gold Mines Inc.	Kliyul property	6 reverse circulation drill holes totaling 560 m	main skarn zone	gold bearing skarn intersected
1994	Hemlo Gold Mines Inc.	Kliyul property	10 diamond-drill holes; 1120 m	main skarn zone	gold-bearing skarn intersected
1995	gold bearing skarn intersected	Mariposite Creek property	Geochemical and geological surveys	extensive area of alteration and veining	
1996	Battle Mountain Canada	Mariposite Creek property	2 diamond-drill holes; 461 m; lithogeochemistry, 743 samples	quartz veins	drilling failed to intersect significant Au values; 70 of 743 rock samples contained >500 ppb Au

GEOLOGICAL SETTING

The geological setting of the study area is described in a previous report (Schiarizza, 2004). Only minor revisions and additional information are presented here. The geology of the study area, as mapped by Schiarizza (2004a) is shown on Figure 2. The reader should refer to an accompanying report in this volume for a current description of the regional stratigraphic units recognized in the project area.

The study area is underlain by Middle and Upper Triassic volcanic and sedimentary rocks of the Takla Group. These rocks, which are part of the Quesnel Terrane, are cut by economically important Late Triassic-Early Jurassic calc-alkaline and alkaline intrusive rocks.

The study area is situated within a belt of folded and faulted Takla Group rocks. The map pattern is strongly influenced by the development of prominent dextral strike-slip fault systems in Cretaceous and Early Tertiary time. These structures include the Finlay–Ingenika and

Pinchi faults located west and south of the study area. The north-trending Dortatelle fault, which transects the study area is believed to be related to this fault system.

Takla Group

Schiarizza (this volume) subdivides the Takla Group into a lower unit of volcanic sandstone and breccia (uTrTs) and an upper unit of predominantly pyroxene porphyry breccia (uTrTvb). The lower unit is further divided into subunits. These are

1. volcanic sandstone and breccia with local fragments, lenses and slump-blocks of limestone (TrTs)
2. volcanic sandstone and breccia with local intervals of thin-bedded limestone and siltstone (uTrTss)
3. siltstone, limestone and volcanic sandstone (uTrTls)
4. pyroxene-feldspar phyric basalt (does not occur in the study area).

For a more complete description of these lithologic units see Schiarizza (2004) and Schiarizza (this volume).

Mafic Intrusive Complexes West of the Dortatelle Fault

Gabbro, diorite and microdiorite, with minor amounts of quartz diorite and tonalite, form a narrow, northerly trending unit that has been traced for about 6 km within the volcanic sandstone and breccia unit of the Takla Group just west of the Dortatelle fault where it follows Darb Creek (Fig. 2). Similar rocks form a north-striking, sill-like body that marks the contact between the volcanic sandstone and volcanic breccia units a short distance to the south.

North Kliyul Creek Microdiorite

A separate body of mainly microdiorite, crops out in the southeast corner of the study area. These exposures are near the northern end of a northwest-trending body of diorite to gabbro that is exposed along the slopes east of the north branch of Kliyul Creek (Schiarizza, 2004). Near Divide Lake this intrusion is foliated and has pervasive quartz-sericite-pyrite alteration. Where it is less deformed and altered the rock is seen to be feldspar phyric with 40 to 60%, 1 to 2 mm feldspar phenocrysts. Numerous dikes of similar composition and trend cut Takla Group rocks west of this intrusion.

Solo Lake Stock

The Solo Lake stock intrudes the volcanic sandstone unit of the Takla Group in the northwest corner of the study area, along and southwest of Solo Lake (Fig. 2). The intrusion consists mainly of light to medium grey, medium-grained, equigranular hornblende quartz diorite to diorite. Melanocratic hornblende-rich diorite, locally grading to hornblendite, occurs locally, as do patches and dikes of mafic-poor tonalite. Dikes showing a similar range of composition are common within the Takla Group peripheral to the stock. A sample collected during the 2003 field season gave a U-Pb isotopic age of 223.6±0.8 Ma (Schiarizza, 2004a).

DARB CREEK PLUTON

A pluton of massive, light grey weathering, medium- to coarse-grained hornblende-biotite tonalite crops out on the slopes surrounding the prominent eastern tributary of Darb Creek (Fig. 2). Along its south margin the pluton cuts an east-dipping succession of the Takla Group; where observed this contact is sharp, although the tonalite contains abundant xenoliths of country rock for a few tens of metres along its outer margin. A small, presumably related pluton crops out near the Ginger B vein and shows similar abundance of xenoliths. The Darb Creek pluton is apparently truncated by the Dortatelle fault to the west. Preliminary U-Pb dating of the Darb Creek stock has given ages of 174+/-2.0 Ma and 177 Ma on titanite and zircon respectively (Schiarizza, 2004a).

Hornblende-Feldspar Phyric Dikes

A number of northwest trending, grey weathering hornblende-feldspar phyric dikes cut pervasively altered and sheared microdiorite southeast of Divide Lake. These dikes have weak chlorite-epidote alteration but for the most part appear to be post-mineral and post-deformation. A sample was collected from one of these dikes and has been submitted for whole rock Ar-Ar isotopic age dating.

STRUCTURE

The structure of the Johanson Lake project area has been discussed in a previous report (Schiarizza, 2004). Some of this information is repeated here as regional structures are deemed to play an important role in the localization of mineral occurrences.

The structure of most outcrops within the study area is characterized by brittle to brittle-ductile faults. A large proportion of these outcrop-scale faults strike northwest to north and dip steeply; some show evidence for dextral strike-slip displacement, consistent with the interpretation that these structures are related to Cretaceous-Tertiary dextral strike slip faults that are prominent regional structures (Zhang and Hynes, 1994). However, a significant number of northwest-striking, relatively ductile faults with sinistral displacement were also observed; these may relate to an earlier period of sinistral faulting that has not been well-documented in the region. Penetrative foliations are for the most part restricted to local high strain zones associated with faults. However, a weak slaty cleavage of more regional aspect is apparent locally, mainly in the southern part of the area. This cleavage is axial planar to local mesoscopic folds and, in the area west of the Dortatelle fault, is associated with larger folds with wavelengths of several hundred metres. The age of these structures is unknown; they may be related to the Cretaceous-Tertiary dextral strike slip faults that dominate the structure of much of the area (Zhang and Hynes, 1994), or might be vestiges of an older event, such as the late early Jurassic thrusting of the Quesnel Terrane over terranes to the east.

The Kliyul Creek–Johanson Lake map area is separated into two domains by the north-striking Dortatelle fault. The area east of the fault is broadly anticlinal in nature, with a poorly defined hinge occurring within the western part of the sandstone-carbonate unit (uTrTsl) of the Takla Group. Along its northeast margin interbedded volcanic sandstone and breccia with minor limestone and siltstone dips and faces to the northeast at moderate to gentle angles and is in turn overlain by a thick section belonging to the volcanic breccia unit. West of the Dortatelle fault the volcanic sandstone and breccia unit strikes mainly north and dips moderately to the east. Rocks exposed near the headwaters of Mariposite Creek have moderate to strong ductile deformation

Dextral Fault Systems

The structural geology of the Johanson Lake project area was studied by Zhang and Hynes (1991, 1992, 1994), who concluded that most of the deformation was related to dextral transcurrent movement on the Finlay–Ingenika fault system. They found that most faults were subvertical, and were either dextral strike-slip faults with northwest, north-northwest or north strikes, or sinistral strike-slip faults with east-northeast strikes. This suite of faults corresponds closely with the predicted orientations of structures that would form in a stress field resulting from dextral displacement along the Finlay–Ingenika fault (Tchalenko, 1970; Figure 18 of Zhang and Hynes, 1994). Zhang and Hynes also concluded, based on variations in the orientation of conjugate shear sets that formed early in the deformation history, that fault-bounded domains had rotated clockwise about subvertical axes in response to progressive displacement. Their analysis indicates rotations of up to 59 degrees adjacent to the Finlay–Ingenika fault, decreasing systematically to zero about 20 km away from the main fault. The suite of structures described by Zhang and Hynes (1994) was recognized during the 2003 mapping program (Schiarizza, 2004), but almost exclusively at the outcrop scale. With a few exceptions, such as the Dortatelle fault, individual faults could not be traced confidently beyond a single ridge or cirque basin.

The Dortatelle fault was mapped by Richards (1976), who shows it extending from the Ingenika fault northward about 40 km to just beyond Johanson Lake. Parts of the fault were studied in detail by Zhang and Hynes (1994), who demonstrated that it was a dextral strike-slip fault on the basis of the geometric relationships between S and C surfaces and associated folds. The fault is easily mapped on the basis of its prominent topographic expression and the apparent truncation of map units along it. Rocks adjacent to the fault, particularly on its west side, are commonly strongly foliated for several hundred metres beyond the fault trace. The foliation typically strikes north-northwest and dips steeply, consistent with the interpretation of dextral displacement along the fault.

Sinistral Faults

Faults with sinistral strike-slip displacement were documented by Schiarizza (2004) within the southeastern part of the Johanson Lake project area. Three of these strike east to northeast and are reasonably interpreted as conjugate riedel shears within a dextral fault system related to the Cretaceous-Tertiary Finlay–Ingenika fault (Zhang and Hynes, 1994). Most of the sinistral faults strike west-northwest to northwest, however, and probably represent a separate deformation event. Observations made during the current study suggest that a northwest- to west-trending sinistral strike slip fault follows the north arm of Kliyul Creek, passes just west of Divide Lake and extends westward under fluvial-glacial cover towards the Dortatelle fault. The sinistral sense of displacement along this fault is inferred from the angular relationship between the shear zone boundaries and the associated flattening foliation.

Schiarizza (2004) notes that sinistral shear zones are in general more ductile than many outcrop-scale faults observed in the area, and that in two areas the shear zones were localized along pyroxene porphyry dikes. It is suspected that sinistral faulting may have been broadly contemporaneous with the latter stages of mafic magmatism in the area.

MINERAL OCCURRENCES

The following description of mineral occurrences in the study area has been abridged from an earlier report by Schiarizza (2004). Many of the occurrences in the Solo Lake–Kliyul Creek area that were described in this earlier report were visited and sampled as part of the current study.

Mineral occurrences within the Kliyul Creek–Solo Lake study area are shown on Figure 2. Most contain copper and gold, and are spatially associated with mafic plutons and related dikes. These include pyrite-chalcopyrite in shear zones and veins within and peripheral to the plutonic rocks; magnetite-pyrite-chalcopyrite lodes in shear zones peripheral to the plutonic rocks, and magnetite-pyrite-chalcopyrite skarn and replacement bodies where calcareous units of the Takla Group are intruded by diorite dikes. Gold-bearing

TABLE 2. MINERAL OCCURRENCES IN THE KLIYUL CREEK–SOLO LAKE STUDY AREA.

MINFILE No.	Name	Easting	Northing	Status	Commodities	Deposit Type
012	Solo F-K veins	669170	6269201	Showing	Au Ag	Au-quartz vein
013	Bruce, A-vein	669582	6267886	Showing	Au Ag Pb	Au-quartz vein
014	Ginger B	674753	6266147	Showing	Au Ag Cu Pb	Au-quartz vein
023	Kliyul, Klisum, Kli, Kennco	676617	6266999	Developed Prospect	Au Cu Fe Ag	Skarn
027	Goldway, Mo, Ps, Solo	670011	6267439	Showing	Au Ag Pb	Au-quartz vein
028	Independence, FL, KC North, KC	677487	6266261	Showing	Au Ag Cu Pb	Au-quartz vein
029	Banjo, Bap, KC 1, KC 2	677739	6264755	Showing	Au Cu Ag Pb Zn	Au-quartz vein
136	Glacier, Joh	671470	6267746	Showing	Au	Au-quartz vein
137	Johan, Dort, Mariposite	670614	6265204	Showing	Au	Au-quartz vein
141	Mal, Cro 2	678396	6263389	Showing	Cu Au Ag	Porphyry Cu
170	Joh 9, Joh, Joh 3-10, Darb, Jo 3	677548	6267254	Showing	Au Cu	Skarn
--	KC1	678282	6265119	Showing	Au	Au-quartz vein
--	Pacific Sugar	675958	6267054	Showing	Au-Cu	Au Skarn

Note: Minfile numbers prefixed by 094D; UTM coordinates are NAD83, Zone 9

quartz veins occur within shear zones in the Solo Lake stock. Similar veins occur in the Divide Lake area and near the headwaters of Mariposite Creek. Schiarizza (2004) suggested these major alteration zones reflected the area's potential for large porphyry-style copper-gold mineralizing systems and thus, became the primary focus for the current study.

Gold Quartz Veins in the Divide Lake Area

A series of bright red and yellow outcrop bluffs and talus slopes define an irregular zone of quartz-pyrite ±sericite alteration that extends from the head of Darb Creek for about 5 km southeast, to the head of the north fork of Kliyul Creek (Photo 1). This conspicuous alteration attracted early prospectors in the area, who discovered the Ginger B (MINFILE 094D 014), Independence (094D 028) and Banjo (094D 029) gold-bearing quartz vein systems within and peripheral to the zone (White, 1948). The KC 1 occurrence, northeast of the Banjo, was discovered within the alteration zone at a later date (Fox, 1982).

Mineralization within the North Kliyul Creek Dioritic Stock

The dioritic stock that crops out on the slopes east of the north fork of Kliyul Creek hosts mineralization represented by the KC 2 (094D 140) and Mal (094D 141) MINFILE occurrences. The Cro 2 occurrence is along the southwest margin of the stock about 1 km south of the Mal. Mineralization at the KC 2 occurrence covers a broad area along the northeast margin of the stock and extends into the Takla country rocks. It includes quartz veins and silicified or quartz-carbonate-altered shear zones mineralized with magnetite, pyrite, chalcopyrite, malachite and azurite, and locally galena and sphalerite (Wilson, 1984; Cross, 1985). Shear zones trend northwest, north and northeast. Samples of mineralized material have yielded assay values of up to 5484 ppb Au and 14.5 ppm Ag (Cross, 1985). The Mal occurrence comprises variably oriented quartz-carbonate veins associated with fractures and shear zones that occur over several hundred metres along a major tributary to the north fork of Kliyul Creek. Some of the veins and shears are mineralized with pyrite, galena and malachite. A sample of one rusty quartz-carbonate vein containing disseminated pyrite yielded 16200 ppb Au and 3.10 ppm Ag (Wilson, 1984). At the Cro 2 occurrence, rocks of the Takla Group are cut by silicified, chloritized and pyritized shear zones for at least several tens of metres along the southwest margin of the diorite stock. The zone contains small quartz-pyrite veins, and a sample of one of these veins contained 294 ppb Au and 5.40 ppm Ag (Fox, 1991).

Magnetite-Pyrite-Chalcopyrite Skarn Occurrences

The Kliyul magnetite-pyrite-chalcopyrite occurrence (MINFILE 094D 023) is located in an area of poor bedrock exposure within the broad valley, bounded by gossanous bluffs and talus slopes, at the head of Kliyul Creek. Geology projected from the south and north suggests that the volcaniclastic rocks that host the mineralization are within the sandstone-carbonate unit of the Takla Group. The area was staked in 1970 and explored with silt, soil and geophysical surveys. Copper-gold mineralization associated with magnetite was discovered in 1974 by a drill program that tested a magnetic anomaly. Exploration by various companies subsequent to the initial discovery included diamond drilling in 1981 and reverse circulation drilling in 1993. The latter program extended the known skarn mineralization and suggested that the resource estimate of 2.5 million tons grading 0.3% Cu and 0.03 ounces per ton (oz/T) Au from the initial drilling could be increased (Gill, 1993). Two samples were collected from outcrop in Lay Creek which drains through the area of skarn mineralization.

The Pacific Sugar skarn showing, located about 1 km north of the Kliyul occurrence, was discovered in the mid 1990s. It is hosted by the volcanic sandstone unit of the Takla Group, which at this location includes an interval of calcareous siltstones and limestones. Exploration work to date has outlined a magnetite-pyrite-epidote-garnet skarn unit measuring 40 by 100 m and 3 to 6 m thick (Gill, 1995). Mineralization consists of massive magnetite and pyrite containing disseminations, impregnations and clots of pyrrhotite and chalcopyrite. Endoskarned diorite in the footwall of the unit is inferred to be the source of the skarn mineralization. The skarn was tested with 5 diamond-drill holes, with a cumulative length of 154.8 m, in 1996. Significant drill results include 2048 ppm Cu and 625 ppb Au over 3.97 m (Leriche and Harrington, 1996).

Gold Quartz Veins Associated with the Solo Lake Stock

Gold-bearing quartz veins within, and along the margins of, the Solo Lake stock are among the oldest documented mineral exploration targets within the study area. The Solo (MINFILE 094 D 012), Bruce (MINFILE 094D 013) and Goldway (MINFILE 094D 027) occurrences were explored in the mid 1940s and are described by White (1948). Exploration has continued intermittently to the present time, and new vein systems have been discovered, including the F vein (Pawliuk, 1985), the V3 occurrence (V1, V2 and V3 samples of von Rosen, 1986) and the Tar occurrence (MINFILE 094D 138; L veins of Richards, 1991).

The vein systems associated with the Solo Lake stock are well described by Richards (1991). Each occurrence comprises a number of veins, with individual veins ranging from several metres to several hundred metres in length, and from a few centimetres to several metres in width. Gold and silver ratios are commonly near one to one, and the precious metals are associated with pyrite, and locally galena and sphalerite. Visible gold has been reported from the A and C veins of the Bruce occurrence. The A vein has returned assay values up to 74.19 g/t Au over 29 cm (Phendler, 1984).

The geometry of the vein systems is most apparent at the Solo and Bruce occurrences, where individual veins are arranged en echelon within northwest-striking zones that approach 1 km in length. Individual veins strike more northerly than the overall system, and are inferred to occupy extensional fractures within dextral shear systems (Richards, 1991). Alteration related to the veins is minimal, and Richards (1991) suggests that the veins may be related to fault movements during the late stages of emplacement and cooling of the Solo Lake stock.

Gold Quartz Veins and Stockwork within the Mariposite Creek Alteration Zone

A zone of quartz-ankerite-pyrite alteration, marked in part by conspicuous orange-brown-weathered outcrops, extends north and south of upper Mariposite Creek for a total length of about 5 km (Fig. 2). Quartz veins are an integral part of this alteration, and exploration at the Glacier (MINFILE 094D 136) and Mariposite (MINFILE 094D 137) occurrences, where veins are particularly dense, has been directed towards evaluating the area's potential to host a bulk tonnage gold deposit. Gill (1996) reports that 743 rock samples

TABLE 3. LITHOGEOCHEMICAL SAMPLE DESCRIPTIONS.

Sample	Easting	Northing	Material sampled	Vein width	Mineralization	Alteration	Showing
DMA04-001	677640	6265306	quartz vein	5 cm			
DMA04-001A	677640	6265306	quartz vein	5 cm			
DMA04-002	677725	6265337	quartz vein	3-4 cm			
DMA04-002A	677725	6265337	quartz vein	3-4 cm			
DMA04-003	677897	6265392	microdiorite		trace pyrite	chlorite-epidote	
DMA04-005	678048	6265474	quartz vein				
DMA04-007	677801	6265625	microdiorite			chlorite-epidote	
DMA04-011	677942	6265130	sheared microdiorite		pyrite	oxidized	
DMA04-012	678029	6265090	microdiorite		pyrite	quartz-sericite	
DMA04-013	678168	6264990	microdiorite		pyrite	quartz-sericite	
DMA04-014	678243	6265023	microdiorite		pyrite	quartz-sericite	
DMA04-015	678289	6265051	quartz vein	up to 40 cm			
DMA04-017	678399	6264794	microdiorite		pyrite	quartz-sericite	
DMA04-019	678358	6264687	sheared microdiorite		malachite	chlorite-epidote	
DMA04-019A	678358	6264687	sheared microdiorite		malachite	chlorite-epidote	
DMA04-020	677564	6265276	sheared microdiorite		malachite, pyrite	chlorite-epidote	
DMA04-021	677281	6265343	quartz vein	40 cm	malachite, pyrite		
DMA04-021A	677281	6265343	quartz vein	40 cm			
DMA04-022	677165	6265432	quartz vein				
DMA04-023	677033	6265461	qz-carbonate vein			chlorite-epidote	
DMA04-026	676037	6265933	microdiorite		pyrite	quartz-sericite	
DMA04-027	674990	6266457	quartz vein	3-5 m			
DMA04-027A	674990	6266457	quartz vein	3-5 m	pyrite		Ginger B
DMA04-027B	674990	6266457	quartz vein	3-5 m	malachite, pyrite		Ginger B
DMA04-027C	674990	6266457	volcanic with qtz veinlets	3-5 m	pyrite	chlorite-epidote	Ginger B
DMA04-028	674967	6266149	quartz vein	30 cm			
DMA04-028A	674967	6266149	fd. phyric volcanic	30 cm	pyrite	chlorite-epidote	
DMA04-029	676315	6265951	skarn		pyrite	chlorite-epidote	Kliyul
DMA04-031	676679	6265998	quartz vein	1 m			
DMA04-032	677344	6266215	quartz vein	2-10 cm			
DMA04-033	677729	6266334	quartz vein	1 m	pyrite		Independence
DMA04-033A	677729	6266334	volcanic with qz veinlets	1 m		quartz-carbonate	Independence
DMA04-034	677572	6265887	quartz vein	2 m			
DMA04-038	677359	6265534	microdiorite		pyrite	quartz-sericite	
DMA04-040	677757	6264975	quartz vein				Banjo
DMA04-042	670734	6266198	quartz vein				
DMA04-044	670638	6266233	quartz vein	30 cm			
DMA04-045	670607	6266208	quartz vein				
DMA04-045A	670607	6266208	volcanic with qz veinlets				
DMA04-046	670559	6266192	quartz vein	10 m			
DMA04-047	670508	6266157	quartz vein	1.5 m			
DMA04-049	670373	6266096	quartz vein	2 cm			
DMA04-050	670274	6265918	quartz vein	5-7 m			
DMA04-051	670507	6265918	quartz vein	1 m			
DMA04-052	670500	6265856	volcanic with qz veinlets			quartz-carbonate	
DMA04-053	670464	6265811	quartz vein	80 cm			
DMA04-053A	670464	6265811	volcanic			quartz-carbonate	
DMA04-055	671743	6266956	quartz vein	.5-5 cm	pyrite		
DMA04-056	671627	6266846	quartz vein	10 cm	pyrite		
DMA04-057	671527	6266789	quartz vein				

DMA04-059	671391	6266823	quartz vein	2-5 cm		
DMA04-060	671399	6266718	quartz vein			
DMA04-060A	671399	6266718	quartz vein	10-20 cm		
DMA04-061	671383	6266669	quartz vein	1-5 cm		
DMA04-062	671321	6266559	quartz vein			
DMA04-064	671340	6265995	metased		pyrite	silicified
DMA04-064A	671340	6265995	quartz vein	1-2 cm		
DMA04-065	671338	6266079	quartz vein			
DMA04-065A	671338	6266079	metased		pyrite	quartz-carbonate
DMA04-065B	671338	6266079	metased with qz veinlets		pyrite	quartz-sericite
DMA04-066	671356	6266143	quartz vein	5-15 cm		
DMA04-067	671395	6266265	quartz vein			
DMA04-069	670858	6265396	quartz vein	30 cm		
DMA04-070	670678	6265201	quartz vein			
DMA04-071	670695	6265100	quartz vein	3-5 m		
DMA04-072	670550	6265072	quartz vein	2-3 m		
DMA04-073	670755	6265665	quartz vein	60-100 cm		
DMA04-074	671222	6265634	quartz vein			
DMA04-075	671255	6263961	quartz vein	7 cm		
DMA04-076	671402	6263325	volcanic with qz veinlets			quartz-carbonate
DMA04-078	671854	6262923	quartz vein	15-25 cm		
GPA04-001	677949	6265276	microdiorite		pyrite	quartz-sericite
GPA04-002	677890	6265230	microdiorite		pyrite	quartz-sericite
GPA04-004	678052	6265173	microdiorite		pyrite	quartz-sericite
GPA04-005	678140	6265170	microdiorite		pyrite	quartz-sericite
GPA04-007	675849	6266563	microdiorite		pyrite	chlorite-epidote
GPA04-008	675878	6266634	microdiorite		pyrite	chlorite-epidote
GPA04-009	675994	6266541	microdiorite		pyrite	quartz-sericite
GPA04-012	676234	6266594	microdiorite		pyrite	quartz-sericite
GPA04-014	676374	6266563	microdiorite		pyrite	quartz-sericite
GPA04-015	677440	6266098	quartz vein			
GPA04-015A	677440	6266098	quartz vein			
GPA04-016	677208	6265707	rhyolite dike		pyrite	
GPA04-017	677820	6264961	qz-fd porph. dike		pyrite, chalcopyrite	
GPA04-017A	677820	6264961	volcanic with qz veinlets			silicified
GPA04-018	670757	6266218	quartz-carbonate vein	up to 85 cm		
GPA04-020	670813	6266231	quartz vein	2-5 cm	pyrite	
GPA04-021	670819	6266249	quartz-carbonate vein	60 cm		
GPA04-022	670830	6266255	quartz-carbonate vein	up to 60 cm		
GPA04-026	670944	6266290	quartz vein	12 cm		
GPA04-029A	671041	6266472	metased			
GPA04-031	671217	6266497	quartz vein			

Note: UTM coordinates are zone 9, NAD83

TABLE 4. ANALYTICAL DATA.

Sample	Au ppb	Cu ppm	Ag ppm	Pb ppm	Zn ppm	As ppm	Mo ppm	Ni ppm	Co ppm	Cr ppm	Mn ppm	Ba ppm	Fe %	Ca %	Mg %	S %
DMA04-001	18.5	13.3	0.1	1.4	97	1	1.9	5.4	13.7	7.8	636	67	5.03	0.22	1.9	2.15
DMA04-001A	17.3	12.5	0.1	1.6	87	0.8	1.8	4.4	12.8	6.4	604	52	4.86	0.2	1.77	1.97
DMA04-002	0.6	5.1	0	0.8	24	1.6	0.2	7.4	6.2	35.6	544	3	1.48	0.81	0.67	0
DMA04-002A	8.9	21.7	0.1	1.5	30	1.6	0.2	7.1	15.4	4	252	32	5.06	0.24	1.4	4.52
DMA04-003	23	79.6	0.2	2.1	91	2.7	0.6	4.7	4.9	4.1	592	47	4.13	0.26	1.84	0.17
DMA04-005	32.4	10.9	0.6	0.8	62	0	0.2	2.9	2.6	4.3	325	6	0.64	0.07	0.01	0
DMA04-007	9.7	32	0.3	40.7	201	6.2	1	6.3	16.5	5.4	1638	45	4.07	0.56	1.8	1.75
DMA04-011	11.3	11.3	0.2	1.4	154	1.5	0.6	5.3	2.4	6.3	730	119	2.38	0.27	1.37	0.09
DMA04-012	11.1	14.9	0.1	3	63	2.8	1.3	4.9	8.7	5.6	356	32	4.43	0.18	1.22	2.97
DMA04-013	6.2	22	0.1	6.2	63	5.6	0.8	3.4	6.1	12.6	491	25	5.05	0.04	1.89	2.11
DMA04-014	33.1	11.4	0.6	16.2	22	3.9	0.8	2.5	7.4	1.3	114	38	3.66	0.01	0.35	2.58
DMA04-015	326.6	259.4	3.1	12.1	131	0.8	0.5	2.7	7.2	2.6	641	11	2.58	0.01	0.02	0
DMA04-017	10.7	21.2	0.2	0.9	57	3.8	0.5	4.8	5.3	4.6	832	36	2.64	0.5	1.23	1.22
DMA04-019	21.9	9246.9	0.3	1.6	120	0	0.2	5	15.3	18.9	795	142	3.38	2.03	1.5	0
DMA04-019A	9.5	3188.7	0.1	1.2	94	0	0.1	5.5	13.6	5.6	734	81	2.32	0.18	0.86	0
DMA04-020	286.4	3830.9	3.3	1.1	178	0	0.2	49.2	57.6	188.9	2273	2	6.99	1.57	4.2	0.06
DMA04-021	24.4	350.8	0.4	1.8	7	0	2	5.4	2.3	7.1	418	15	1.54	1.15	0.05	0.26
DMA04-021A	6.2	12.4	0.1	0.7	2	0	0.5	2.2	1	5.6	182	5	0.67	0.1	0.01	0.12
DMA04-022	38.5	10.7	0.3	1.5	13	0	0.9	2.8	3.2	3.5	472	15	1.43	0.08	0.02	0.13
DMA04-023	4	5.8	0	1.5	9	0.5	5.7	5.2	2.3	5.7	458	10	0.94	1.75	0.19	0
DMA04-026	39.6	225.9	0.3	8.9	295	4.5	1.3	12.2	8.5	17.7	688	72	2.12	0.72	1.61	0.73
DMA04-027	14.3	23.2	0.1	0.8	1	0	1.3	1.3	0.4	3.9	60	14	0.46	0.01	0	0
DMA04-027A	11360.8	21.9	18.1	5.7	11	0	59.4	3.8	3	12.1	538	4	1.74	0.1	0.42	0.35
DMA04-027B	9136.8	106.2	17.7	4.8	11	0	8	3	2.2	8.6	499	5	1.23	0.45	0.41	0.35
DMA04-027C	57	163.5	0.4	3.6	97	0.8	0.8	10.2	22	10.2	2004	58	4.27	2.26	2.17	1.48
DMA04-028	39	31.4	0.1	1.2	2	0	23.6	1.6	5.3	1.8	155	3	0.62	0.31	0.05	0.06
DMA04-028A	9.5	21.8	0	0.8	69	3.2	0.7	15.5	19.7	27.4	812	69	3.28	0.58	1.71	1.45
DMA04-029	1009.5	933.9	2.3	7.2	430	0	0.9	6.4	21.3	4.6	804	16	13.51	0.2	1.38	0.13
DMA04-031	51.4	11.8	0.2	2	23	0.8	0.7	3.3	6.5	3.7	283	20	1.64	0.39	0.08	0.51
DMA04-032	7.1	10	0	4.6	18	0.6	0.2	3	3.1	4.5	582	727	0.99	1.17	0.04	0.15
DMA04-033	1194.8	53.1	1.5	1.8	14	0	2.5	8.1	14.9	7	466	21	1.86	0.47	0.03	0.81
DMA04-033A	57.3	166.1	0.5	4.9	71	0	0.4	6.6	30.2	1.2	1278	97	4.3	4.58	1	1.11
DMA04-034	115.4	7.1	0.7	30.1	8	0	69.1	1.9	1.8	3.8	172	33	1.12	0.06	0.03	0.18
DMA04-038	13.4	26.1	0.1	2.3	34	0	0.9	3.1	6	4.1	264	15	4.82	0.33	1.62	3.24
DMA04-040	62.5	167.7	3.6	454.6	13	0.7	2.5	32	4.6	36.8	248	86	1.22	0.08	0.27	0.17
DMA04-042	194.7	101.7	1.3	8.4	29	14.3	0.8	2.2	7.2	2.7	917	24	1.77	4.47	0.05	0.25
DMA04-044	14	11.6	0.2	12.8	13	0.8	0.7	3.1	2.2	3.3	420	14	1.1	1.83	0.02	0
DMA04-045	265.2	7.5	1.5	111.8	25	3.7	4.7	11.6	1.4	7.8	699	7	0.73	4.62	0.04	0
DMA04-045A	183.8	67.8	0.6	11.6	77	0.9	2.4	14.8	24.1	7.9	1522	108	5.62	6.3	2.25	0.84
DMA04-046	30.4	15	0.4	2.4	8	0.7	1.4	1.8	1.5	4	101	3	0.62	0.04	0.01	0
DMA04-047	15.3	10.3	0.1	5	73	1.3	7.3	4.8	1.3	4.5	567	6	0.88	3.75	0.02	0
DMA04-049	7.2	11.5	0.1	23.6	14	1.1	0.6	3.4	3.1	4.7	1575	47	1.32	9.38	0.19	0.24
DMA04-050	6.9	5.6	0.1	0.7	2	0	0.4	1.7	0.8	7.1	140	3	0.82	0.08	0	0
DMA04-051	6	24.8	0.1	1.2	5	1.1	2.7	2.6	2.7	5.6	223	14	0.94	0.3	0.01	0
DMA04-052	58.9	441.9	1.6	2.5	6	4.6	0.2	3.7	5.6	2.5	1420	8	1.13	11.03	0.14	0.1
DMA04-053	21.5	26.9	0.4	4.7	21	0.9	3.1	1.9	1.5	5.2	140	12	0.78	0.11	0.02	0.06
DMA04-053A	24.5	65.9	0.3	2.7	78	0.8	0.7	14.4	22.5	20.4	969	33	5.24	3.65	1.73	0.31
DMA04-055	312.5	54.3	0.8	11.2	3	0	0.1	3.4	5.4	3.2	173	7	1.76	0.67	0.02	0.93
DMA04-056	904.8	21.5	0.3	0.7	2	6.9	0.2	3	5.6	4.4	183	8	1.23	0.29	0.01	0.18

DMA04-057	2.8	2.3	0.1	21.2	15	0	0.1	2.6	1.3	2	3453	14	1	28.34	0.25	0.06
DMA04-059	4.4	8.6	0.1	0.9	3	1.4	0.1	2.8	2.5	3.9	261	9	1.1	0.2	0.01	0.06
DMA04-060	228.1	70.7	0.8	7.4	42	57.1	0.9	6.4	16	3.4	993	68	3.38	4.02	0.67	1.27
DMA04-060A	10.2	27.5	0.1	1.4	7	0.8	0.2	8	4.5	4.5	222	9	1.13	0.65	0.04	0.07
DMA04-061	30.3	20.8	0.2	7.3	13	5.2	2.9	4.5	5.4	3.8	2053	57	1.33	17.49	0.3	0.09
DMA04-062	227.6	9.5	1.2	21.5	16	1.3	3.8	8.5	4	6.3	1043	18	1.47	6.94	0.66	0.07
DMA04-064	72.8	96.2	0.8	5.5	97	23.9	1.1	46.3	22.9	71.1	1008	120	4.75	4.25	2.17	0.69
DMA04-064A	93.8	57.9	0.5	9.6	112	5.1	0.6	43.9	25.8	43.7	1150	95	5.06	4.13	1.61	0.5
DMA04-065	48.7	31.3	0.3	10.6	20	4.2	0.1	2.6	3.2	3.4	913	27	1.42	8.69	0.23	0.32
DMA04-065A	9.5	117.8	0.3	4.4	62	1.9	1.4	30.9	24.3	22.8	1232	39	5.24	5.01	2	0.93
DMA04-065B	826.3	173	1.3	9.7	107	173.4	1.3	69.6	24.7	15.2	1042	86	5.66	4.85	1.96	2.11
DMA04-066	27.1	9.2	0.3	59.8	16	5.4	0.2	2	1.9	4.6	291	15	1.22	3.13	0.08	0.19
DMA04-067	45.7	18.8	0.3	5.6	7	2.3	0.5	1.5	1.9	3.2	1342	30	1.08	10.49	0.08	0.11
DMA04-069	1.8	4.8	0	0.7	7	0.6	0.2	1.6	0.5	5.9	131	3	0.94	0.04	0	0
DMA04-070	5	4.2	0.1	1	3	0	0.2	2.1	0.7	6.2	136	2	0.53	0.21	0	0
DMA04-071	116.2	41.8	0.4	4	22	0.6	0.2	4.7	1.7	5.8	170	6	0.8	0.48	0.03	0
DMA04-072	338.5	5.9	1.4	1.5	266	0.8	0.2	2.6	1.2	5.1	163	1	0.56	0.48	0.02	0
DMA04-073	155.1	8.2	10.6	207.1	301	0.7	0.2	1.5	1.3	3.6	226	9	0.71	0.35	0.01	0
DMA04-074	4.3	4.8	0.3	13.5	23	0.6	0.2	1.3	0.6	4.6	128	10	0.67	0.12	0	0.09
DMA04-075	52.8	15.1	0.2	3.5	28	6.7	0.2	10	10	10	610	52	2.16	2.4	0.61	0.14
DMA04-076	378.6	25.8	0.3	2.1	24	10.9	0.2	4.2	8.5	3.2	792	30	2.49	3.64	0.9	0.36
DMA04-078	2.4	13.6	0.1	1	2	2.9	0.3	4.6	2.5	5.5	68	5	0.75	0.04	0.01	<.05
GPA04-001	19.6	110.5	0.2	3.5	103	0.5	1.4	4	7.7	2.7	636	30	3.67	0.23	1.73	1.07
GPA04-002	1	23.7	0	1.2	36	0.6	0.2	4	2.1	9.4	324	15	2.2	0.14	1.86	0.24
GPA04-004	17.7	22.3	0.2	2	44	0	0.7	2.6	1	3.2	494	29	3.49	0.25	1.38	0.07
GPA04-005	6.4	37.5	0.1	1.8	151	2.5	0.5	5.4	7.1	7.3	1466	25	3.34	0.44	1.99	0.49
GPA04-007	3.3	34	0.1	3.7	98	1.8	0.7	7.5	10.1	10.6	935	121	3.89	0.59	2.17	1.1
GPA04-008	6.9	38	0.1	1.3	44	2.5	1.2	4.4	8.8	2.8	440	52	3.58	0.16	0.63	1.81
GPA04-009	2.1	21.2	0.1	7	85	1.4	0.5	16.4	5.6	67.1	476	101	3.61	0.26	1.63	1.52
GPA04-012	4.6	16.7	0.1	2.1	15	0	0.6	4.7	2.3	13.2	234	42	3.28	0.03	0.88	0.61
GPA04-014	15.3	30.2	0.2	2.8	26	0.6	1.1	3.4	5.8	2.3	126	75	2.15	0.08	0.43	0.51
GPA04-015	102	6.9	1.3	4.4	11	0	1.7	25.9	7.7	5.7	618	10	1.53	0.06	0.02	0.14
GPA04-015A	399.9	150.8	13.1	13.5	88	5.3	0.3	330.4	43.3	115.2	3658	44	5.29	10.15	5.31	2.08
GPA04-016	9	9.1	1.3	30.5	31	2.5	0.1	1.1	1	1	149	4	0.49	0.02	0.01	0.08
GPA04-017	2.9	569.2	0.6	23.4	16	0	6.7	43.8	7.1	50.2	400	42	1.47	1.02	0.77	0.33
GPA04-017A	20.4	33.3	0.2	21.7	69	1.1	9.5	191.8	31.2	525.8	1099	327	3.81	5.38	4.15	0.54
GPA04-018	58.1	30.4	0.6	22	16	0.7	2.6	18.6	3.6	10.1	808	14	1.13	5.03	0.15	0
GPA04-020	689.7	8.8	1.1	1.8	6	5.8	1.3	3.5	2.8	6.8	444	57	1.15	2.29	0.1	0.17
GPA04-021	43.7	38.9	0.3	4	55	3.3	1.1	12	12	10.8	1115	37	3.6	6.46	0.93	0.18
GPA04-022	41.2	8.9	0.3	9.6	29	1.3	0.9	12.6	2.6	8.8	283	7	0.97	1.24	0.1	0
GPA04-026	100.1	5.1	0.1	5.1	27	1.2	0.2	2.4	1.3	6	122	6	0.76	0.07	0.01	0
GPA04-029A	34.1	90.1	0.5	17.9	35	6.5	0.5	15.8	18.4	7.9	1294	150	2.99	8.88	0.64	0.44
GPA04-031	229.5	6.2	1.9	74.4	34	1.3	14.9	26.8	2.8	16.5	340	16	1.13	1.37	0.33	0

Analytical done by Acme Analytical Laboratories, Vancouver B.C. Analytical method: ICP-MS, 30 gram sample, hot acid leach.

collected in the area of the Mariposite and Glacier occurrences included 70 samples (9%) that contained greater than or equal to 500 ppb Au. Two diamond-drill holes on the Mariposite occurrence intersected high density quartz-carbonate vein and stockwork intervals, but these contained only weak gold mineralization (Gill, 1996).

RESULTS OF THE CURRENT STUDY

The primary focus of the current study was to collect a suite of lithogeochemical samples from two areas of extensive alteration and veining that were identified as prospective during the 2003 field season. The first of these areas, referred to here as the Divide Lake area, ex-

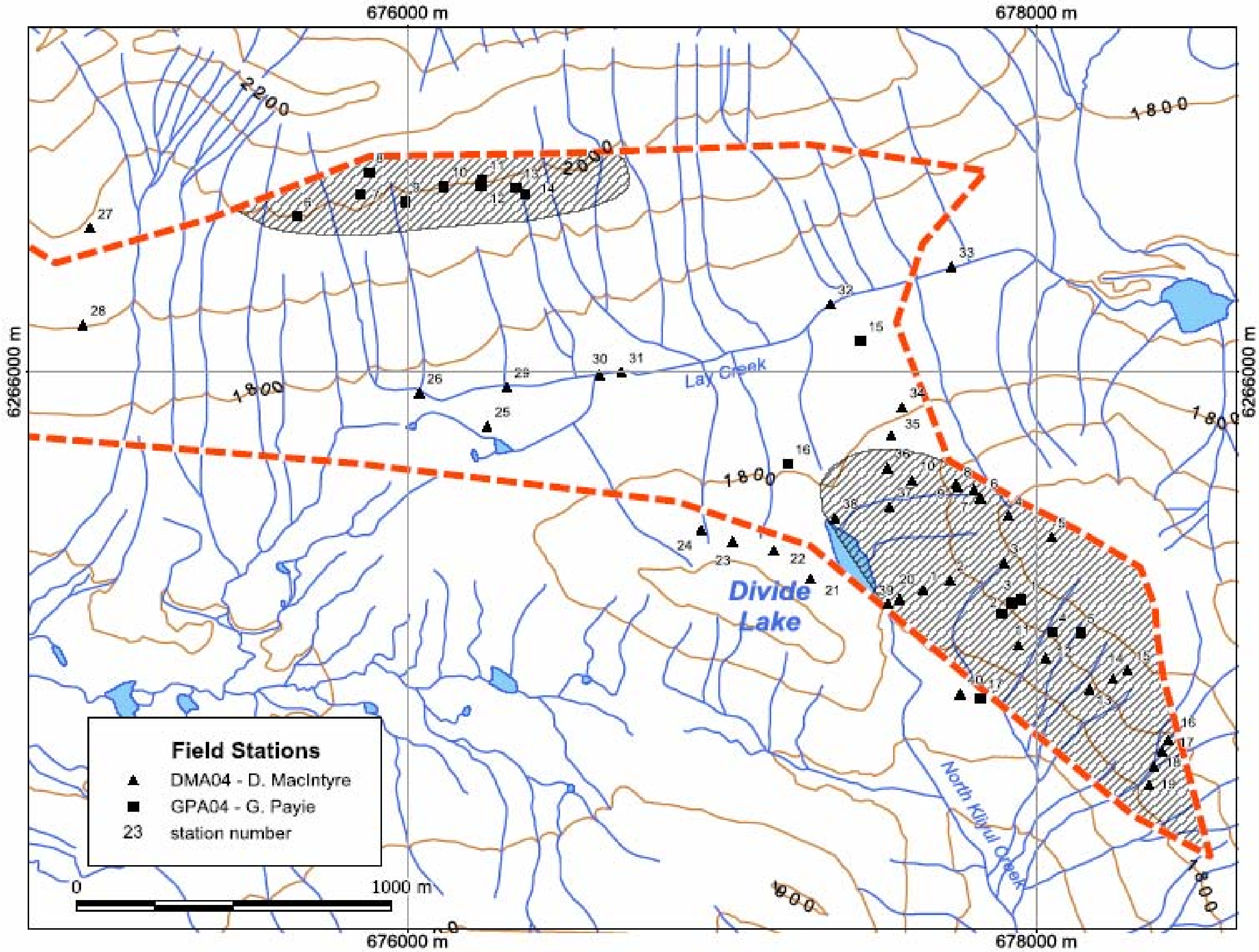

Figure 3. Field station locations, Divide Lake area.

tends from the headwaters of the north arm of Kliyul Creek westward to the Dortatelle fault (Fig. 2). At the southern end of this zone is a prominent gossan that is well exposed on steep southwest-facing slopes southeast of Divide Lake (Fig. 2). The second area, referred to here as the Mariposite Creek area, extends from the headwaters of Mariposite Creek southward toward Dortatelle Creek. Sampling done within these two areas was primarily of quartz veins and altered wall rocks. Sample descriptions are presented in Table 3 and analytical results are given in Tables 4 and 5.

Divide Lake Area

As described in an earlier section, mineral occurrences in the Divide Lake area can be categorized into 3 main groups – gold quartz veins such as the Banjo, Independence, Ginger B and KC1, shear-hosted copper mineralization such as the Mal and magnetite-pyrite-chalcopyrite skarn such as the Kliyul and Pacific Sugar (Table 2). In addition an extensive gossanous zone of foliated microdiorite and Takla volcanic rocks with per-

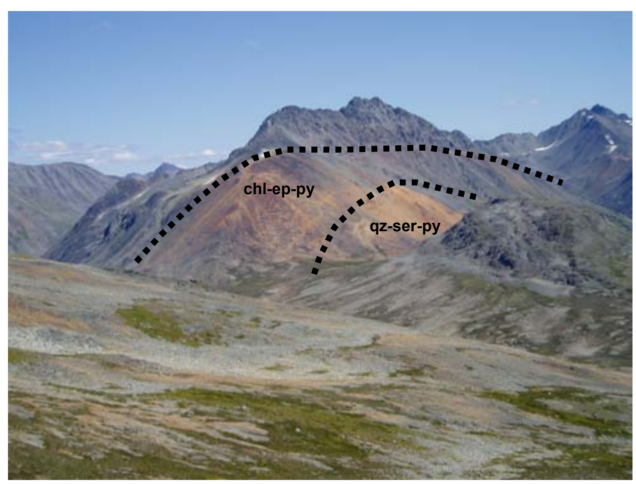

Photo 1. View southeast toward the Divide Lake gossan showing approximate boundaries of chlorite-epidote-pyrite and quartz-sericite-pyrite alteration zones. Altered rocks are mainly micodiorite. Divide Lake is located in the pass near the base of the gossan. The headwaters of Lay Creek are in the foreground. The prominent ridge east of the gossan is composed of resistant, east-dipping volcanic breccias of the Takla Group (unit uTrTvb).

vasive quartz-sericite-pyrite and chlorite-epidote-pyrite alteration crops out on the steep southwest-facing slope southeast of Divide Lake (Photo 1). This zone is referred to here as the Divide Lake gossan. As shown on Figure 3, the majority of field stations in the Divide Lake area were located within this zone of alteration and mineralization.

GOLD QUARTZ VEINS

The gold-quartz veins at the Ginger B, Independence, Banjo and KC1 showings, which are on the order of 1 to 5 m in width, typically occur within massive volcaniclastic or dioritic intrusive rocks that locally show evidence of shearing. The veins are steeply dipping to vertical and strike northwest, northeast and east (Fig. 4). Although sulphide content is generally low, sulphides do sometimes occur as bands near the outer margins of the veins with various combinations of pyrite, chalcopyrite and rare galena (Photo 2). Significant gold and silver values have been reported from all of the occurrences (White, 1948; Fox, 1982; Christopher, 1986). A sample collected from a pyrite-chalcopyrite–bearing quartz vein on the Banjo showing during the 2003 mapping program contains 2251 ppb Au and more than 100 ppm Ag (Schiarizza, 2004a: sample 03PSC-93). Samples collected as part of the current project (Table 3, Fig. 3) confirm anomalous gold values at all of these showings (Table 4, Fig. 5). Copper values, on the other hand, are generally low to weakly anomalous for quartz veins but higher in sheared microdiorite along the trend of the North Kliyul Creek fault (Table 4, Fig. 6).

All major quartz veins in the Divide Lake area were re-examined as part of the current study. The best results came from two samples of the Ginger B quartz vein (DMA04-027A, DMA04-027B) which were assayed and gave values of 10.38 and 9.12 g/t Au respectively (Table 5). Both of these grab samples contained pyrite and one contained malachite. A third sample of barren quartz from the centre of the vein (DMA04-027) contained low Au, Cu and Ag values. This suggests that the Au values in the Ginger B vein are associated with the occurrence of pyrite.

Another major quartz vein in the area, the Independence vein, is exposed in a trench along the south bank of Lay Creek (Photo 3). A sample from this vein (DMA04-033), which contained minor amounts of pyrite, was assayed and gave a value of 1.25 g/t Au (Table 5). However, a sample of quartz-carbonate-pyrite altered wall rock (DMA04-033A) contained low Au and slightly anomalous copper values.

Although good gold values have been reported for the Banjo vein (Schiarizza, 2004), a sample collected as part of this study only contained slightly anomalous gold and copper and 454 ppm lead. Such variation in values from the same vein reflects the notorious “nugget effect” which makes sampling and evaluation of quartz veins very difficult.

Photo 2. View southwest toward the Ginger B gold-quartz vein. Rock hammer for scale. Note banding and Fe oxide staining near vein contact. A sample collected from this material assayed 10.38 g/t Au.

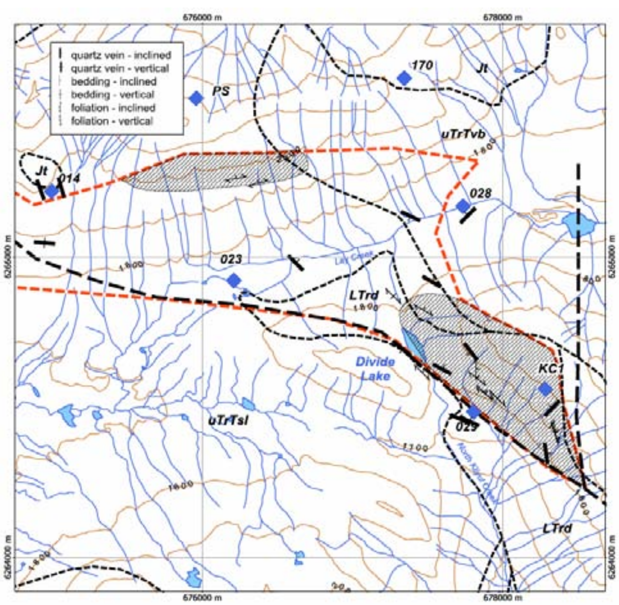

Figure 4. Structural trends of gold-quartz veins, bedding and foliation in the Divide Lake area. See Figure 2 for legend.

A prominent quartz vein, up to 40 cm in width, has been exposed by trenching near the top of the ridge east of Divide Lake. This vein occurs within an area of pervasive chlorite-epidote alteration and is thought to be

TABLE 5. FIRE ASSAY RESULTS.

Sample	Showing	g/t Au
DMA04-027A	Ginger B quartz vein	10.38
DMA04-027B	Ginger B quartz vein	9.12
DMA04-029	Kliyul skarn	1.04
DMA04-033	Independence quartz vein	1.25

Assays done at Acme Analytical Laboratories, Vancouver, British Columbia; fire assay, analysis by ICP-ES.

Photo 3. View southwest across a trench on the Independence vein. The vein (under Gary Payie's right foot) is about a metre wide and is mainly massive, white quartz. Brown to orange weathering volcanic rocks exposed on the walls of the trench have strong quartz-carbonate-pyrite alteration, typical of alteration associated with quartz veins in the study area.

the KC1 showing. A chip sample across the vein (DMA04-15) gave slightly anomalous Au and Cu values.

A number of other quartz veins crop out along the northeast facing slope of the ridge west of Divide Lake (DMA04-021-024). Although these veins locally contain sulphides, samples submitted for analyses did not return any significant gold values (Table 4).

GOLD SKARN OCCURRENCES

The Kliyul magnetite-pyrite-chalcopyrite occurrence (MINFILE 094D 023) is located in an area of poor bedrock exposure within the broad valley, bounded by gossanous bluffs and talus slopes, at the head of Lay Creek. An historical resource estimate of 2.5 million tons grading 0.3% Cu and 0.03 oz/T Au has been calculated for the deposit and could potentially be increased (Gill, 1993).

As shown in Photo 4, outcrop is very limited in the vicinity of the Kliyul skarn deposit with most of the area

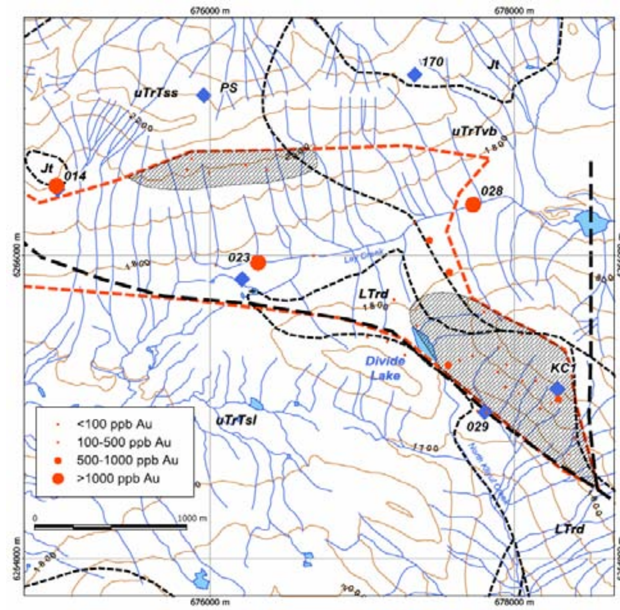

Figure 5. Gold values for samples collected in the Divide Lake area as part of the current study. See Figure 2 for legend.

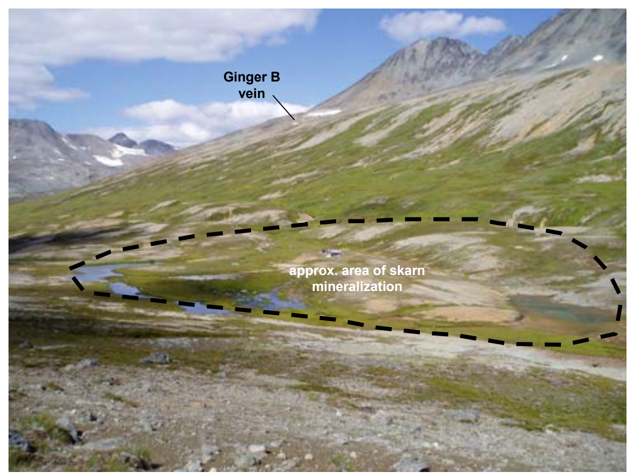

Photo 4. View northwest across the Kliyul skarn deposit. The building in the middle of the area of skarn mineralization is the remains of an old exploration camp. Also shown is the location of the Ginger B gold-quartz vein on the ridge northwest of the camp..

covered by mounds of glacial transported material. However, two samples were collected from outcrop in Lay Creek. The first of these was from quartz-sericite-pyrite altered microdiorite that crops out northwest of the area of skarn mineralization. This sample (DMA04-026) contained low Au and only slightly elevated Cu and Zn values. The second sample is from chlorite-epidote-magnetite skarn that crops out along the south bank of Lay Creek, northeast of the old camp. This sample (DMA04-029) contained 1.04 g/t Au (Table 5), 933 ppm Cu and 430 ppm Zn (Table 4).

Another skarn showing, the Pacific Sugar (labeled PS on Fig. 4, 5 and 6) is located about 1 km north of the

Kliyul occurrence. The skarn was tested with 5 diamond-drill holes, with a cumulative length of 154.8 m, in 1996. Significant drill results include 2048 ppm Cu and 625 ppb Au over 3.97 m (Leriche and Harrington, 1996). This showing was not visited as part of the current study.

DIVIDE LAKE GOSSAN

A prominent gossan has developed on the steep southwest-facing slope of the ridge southeast of Divide Lake (Photo 1). This gossan is over a kilometre long and extends from the 1700 m level to the top of the ridge. Several days were spent examining and sampling this area with a total of 29 stations recorded within the gossan zone (Fig. 3). The strongest gossan coincides with a lower zone of pervasive quartz-sericite-pyrite alteration in foliated microdiorite. Up slope this alteration grades into chlorite-epidote alteration with a corresponding decrease in disseminated pyrite. Quartz veining is rare within the alteration zone and those that were sampled did not carry any appreciable gold values. The only mineralization of note occurs along the southwest margin of the gossan where chlorite-epidote altered diorite is cut by northwest-trending shear zones containing malachite and chalcopyrite. Two samples (DMA04-019, 019A) collected at station DMA04-019 (Fig. 3) near the southeast end of the gossan returned Cu values of 9247 and 3831 ppm respectively but had low Au values. Another sample (DMA04-020) collected from similarly sheared, propylitically altered microdiorite that crops out near the Divide Lake fly camp contained 3831 ppm Cu and slightly anomalous Au (286 ppb). These copper-bearing shear zones are close to a major northwest-trending fault (Fig. 6) that swings westward toward the Dortatelle fault. The alignment of occurrences along this trend as shown by the orientation of anomalous copper samples in Figure 6 suggests this may be the most prospective part of the Divide Lake gossan.

Photo 5. View southeast across the Divide Lake gossan. Orange weathering rocks have pervasive quartz-sericite-pyrite alteration that grades up slope into a zone of propylitic alteration.

A number of samples of quartz-sericite-pyrite and chlorite-epidote altered microdiorite were collected within the Divide Lake gossan (Table 3). None of these samples contained significant concentrations of precious or base metals with most values at background or, at the most, slightly anomalous (Table 4, Fig. 5 and 6).

LAY CREEK GOSSAN

A smaller, less pronounced gossan, located up slope from the Kliyul skarn deposit, was also sampled during the current study (Fig. 3). This gossan is mainly due to the presence of disseminated pyrite in propylitically altered feldspar phyric volcanic or intrusive rocks. Locally, these rocks have strong quartz-sericite-pyrite alteration possibly associated with the development of shear zones. None of the samples of microdiorite collected from this zone contained anomalous Au or Cu.

Mariposite Creek Area

Rocks exposed on the steep southeast- and northwest-facing slopes that straddle the headwaters of Mariposite Creek weather a conspicuous orange-brown colour due to extensive zones of quartz-ankerite-pyrite alteration associated with numerous quartz veins. The size of the area of alteration and the density of quartz veining attracted companies like BP Resources (Meyers and Smit, 1985) and Hemlo Gold Mines (Gill, 1996) to test the area for possible bulk tonnage Cu-Au deposits. This area was targeted for follow-up work as part of the current project after regional mapping in 2003 confirmed the extensive nature of alteration and veining (Schiarizza, 2004).

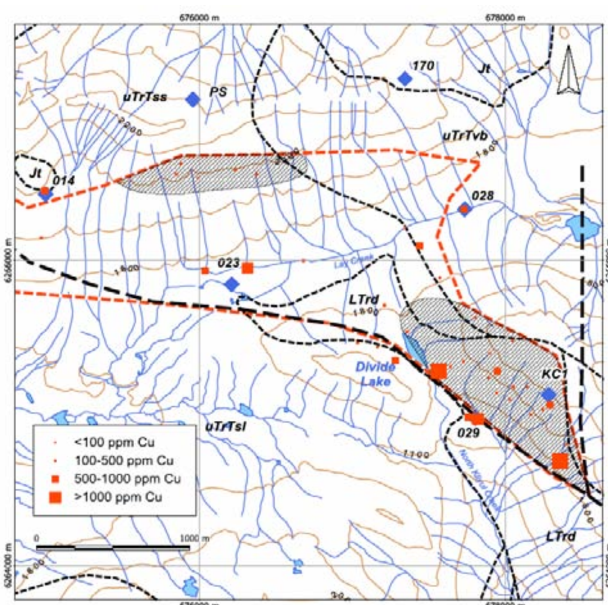

Figure 6. Copper values for samples collected in the Divide Lake area as part of the current study. See Figure 2 for legend.

Photo 6. View northwest toward the Lay Creek gossan (dotted outline). Rocks in the foreground are pervasively altered and foliated microdiorite that crops out near the northern end of the Divide Lake gossan..

Photo 7. View northwest toward the Mariposite quartz veins and lenses (white areas in the middle of the slope) that are well-exposed on the southwest-facing slope of the ridge northwest of the headwaters of Mariposite Creek. Hemlo Gold Mines drilled two holes into these veins in 1996. Note orange-brown weathering due to oxidation of quartz-ankerite alteration zones associated with the veins. Dark to medium grey weathering outcrops are relatively unaltered Takla volcanic rocks.

As part of the current study, a suite of samples were collected from quartz veins exposed on the steep slopes above the headwaters of Mariposite Creek (Table 3, Fig. 7). This is the area of strongest alteration and highest abundance of veins. Scattered areas of quartz-ankerite alteration and narrow, discontinuous quartz veins do occur further south and several of these were sampled as well (Fig. 7).

Quartz veins in the Mariposite Creek area range from a few centimetres to several metres in width with some, like those at the Mariposite showing occurring as large irregular lenses (Photo 7). However, most veins are tabular, steeply dipping (Photo 8) and strike predominantly to the northwest (Fig. 8). Some veins can be traced for several hundred metres; others only a few metres before they pinch out. Overall, the veins, which vary from pure quartz to mixed quartz and carbonate, contain no or only very minor amounts of sulphide minerals. Alteration envelopes are also variable. Some envelops extend several metres out from the vein contact, others only a few centimetres and some veins appear not to have any alteration associated with them at all. From a

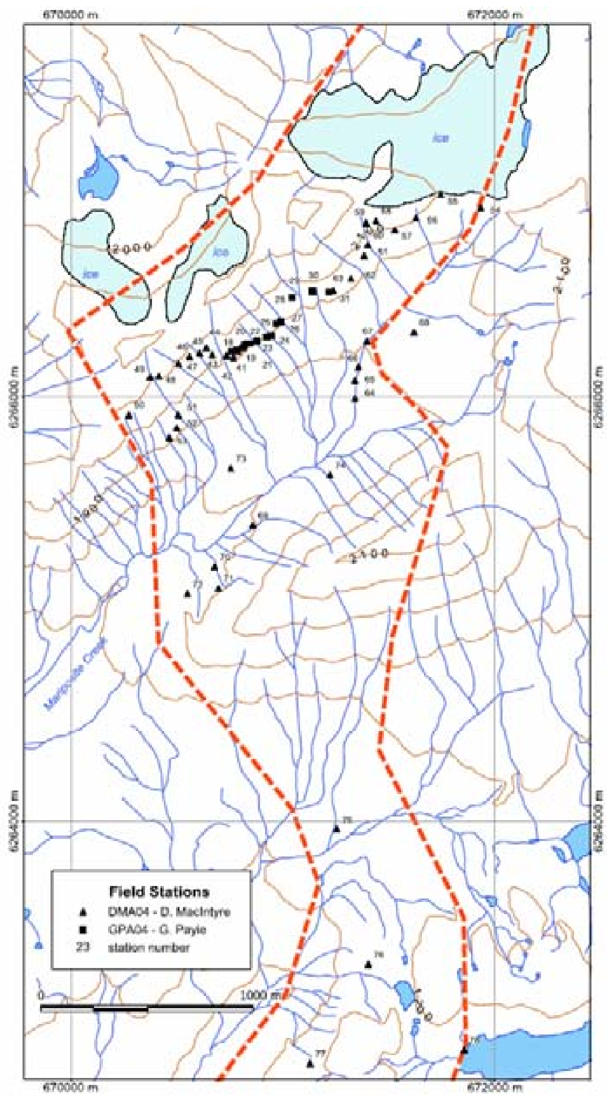

Figure 7. Station locations in the Mariposite Creek area.

distance, the extent of alteration is misleading as much of the colour anomaly is due to altered talus sitting on relatively unaltered rocks. The writers estimate that less than 20% of the rock exposed on the slope north of Mariposite Creek, is actually altered. The rest is relatively unaltered Takla volcanics and metasediments.

A number of samples collected in the Mariposite Creek area contained anomalous gold concentrations (Table 4, Fig. 9) but many others only contained background. These results are not dissimilar from those report by Gill (1996) where of 743 samples collected in the area, 70 (9%) contained greater than 500 ppb Au. The location of Gill's samples is also shown on Figure 9 for comparison. Although the number of samples containing anomalous gold is encouraging, the erratic distribution and grade is a concern. In part, this reflects the difficulty of determining gold concentrations using grab and chip samples. Bulk sampling is required to effectively determine the overall concentration and distribution of gold, especially in some of the larger veins.

Some of the strongest, most continuous wallrock alteration occurs in metasedimentary rocks that crop out along the upper, northernmost branch of Mariposite Creek (Photo 9). Although most of the alteration is quartz-ankerite, locally there is also strong quartz-sericite-pyrite alteration especially where quartz vein stockworks have developed. A sample collected from one of these zones

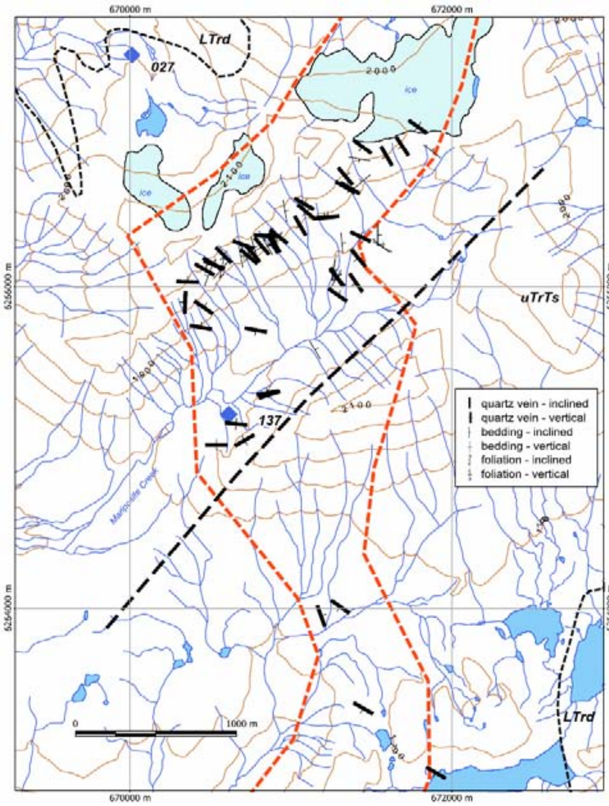

Figure 8. Structural trends of gold-quartz veins, bedding and foliation in the Mariposite Creek area. See Figure 2 for legend.

Photo 8. Typical steeply dipping quartz veins in the Mariposite Creek area. This vein was sampled (DMA04-053) but contained low concentrations of gold as did a sample of the quartz-ankerite altered wallrock (DMA04-053A).

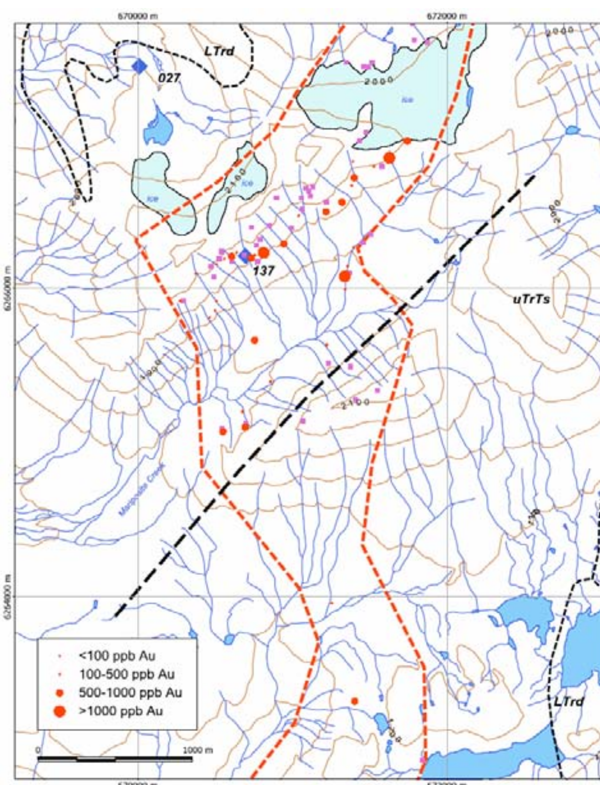

Figure 9. Gold values for samples collected in the Mariposite Creek area as part of the current study. See Figure 2 for legend. Purple squares show samples collected by Gill (1994) that had >500 ppb Au.

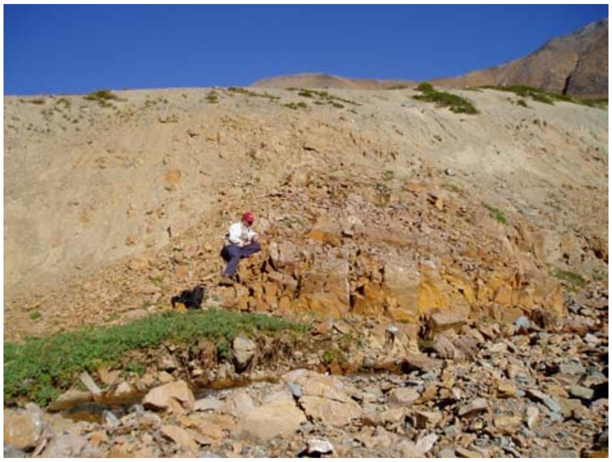

Photo 9. View northwest toward an outcrop of pervasive quartz-ankerite-pyrite altered metasediments exposed on the west bank of Mariposite Creek near station DMA04-064

Photo 10. Quartz vein stockwork in pervasive quartz-ankerite altered metasediments. These rocks crop out in Mariposite Creek near station DMA04-065A where a sample with similar veining contained 826 ppb Au.

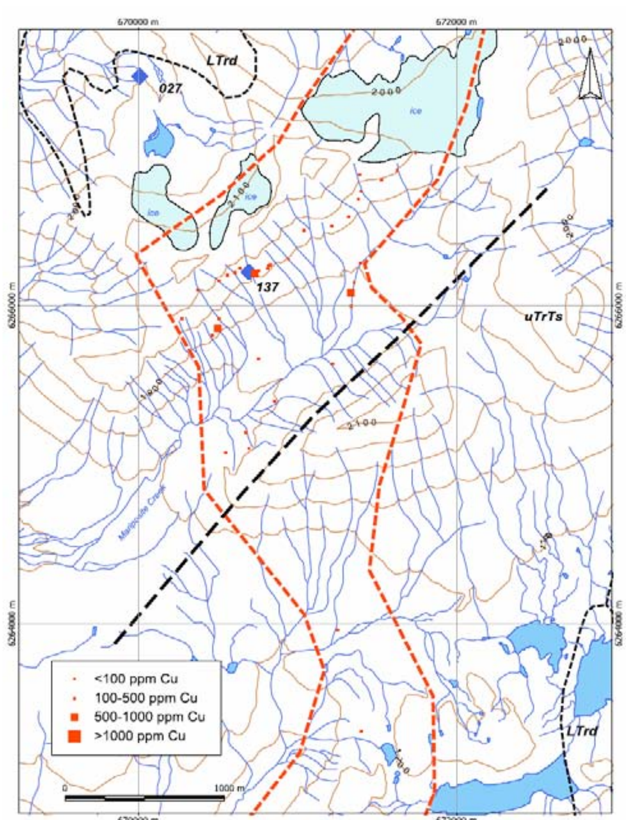

Figure 10. Copper values for samples collected in the Mariposite Creek area as part of the current study. See Figure 2 for legend.

(DMA04-065B) contained 826 ppb Au and slightly anomalous Cu (173 ppm). This was the highest Cu value determined for the samples from the Mariposite Creek area (Table 4; Fig. 10).

CONCLUSIONS

Based on the results of this study and previous exploration work, the main exploration targets in the area are gold-quartz veins, gold-bearing skarn and copper associated with shear zones near Divide Lake. Gold-quartz veins are most abundant near the headwaters of Mariposite Creek where hundreds of predominantly northwest-trending, steeply dipping veins crop out over a distance of 1.5 km. Although these veins locally contain significant gold concentrations, the distribution of gold is erratic and evaluation of the veins is difficult without bulk sampling. Better gold values appear to be associated with the presence of pyrite and/or galena. Previous drilling of the Mariposite showing produced disappointing results but dioritic to monzonitic intrusive rocks with associated stockwork veining were intersected at depth... In the writers' opinion, the best target in this area is not the massive quartz-carbonate lenses at the Mariposite showing but rather strongly altered and veined metasedimentary rocks exposed in Mariposite Creek itself. The alteration here is more pervasive, locally grades into strong quartz-sericite-pyrite alteration and in places quartz vein stockworks with anomalous gold concentrations have developed (Photo 10). An intrusive body similar to that intersected in drilling up slope at the Mariposite showing may be present at depth.

Although rocks in the Mariposite area are locally sheared and ductily deformed, quartz veins show no sign of deformation and appear to have crystallized within open fractures, possibly tension gashes (Richards, 1991). Most of these fractures trend northwest, while others are lensoidal structures with a northeast orientation. Formation of tension gashes and northwest-trending fractures may be related to extension in a southwest-northeast direction, possibly related to strike-slip movement on the nearby Dortatelle fault. Northwest-trending shear zones may also be related to this period of faulting, which is believed to be Late Cretaceous or Early Tertiary. If formation of quartz veins is indeed related to this fault movement then these veins are unrelated to the older Late Triassic and Early Jurassic intrusive bodies in the study area. However, there may be younger intrusive bodies, not yet recognized or dated that have a genetic association with formation of the quartz veins. Alternatively quartz vein formation is related to hydrothermal activity that accompanied strike-slip faulting.

The Divide Lake gossan is related to an extensive zone of pervasive quartz-sericite-pyrite and chlorite-epidote alteration. Samples collected from this alteration zone contained only background or slightly elevated precious and base metal concentrations. However, the extent and style of alteration is typical of phyllic and propylitic alterations assemblages found peripheral to porphyry copper deposits and the possibility that such a deposit exists at depth should be considered. The occurrence of hornblende-feldspar phyric dikes cutting the alteration zones may be further evidence of an intrusive body at depth. Copper mineralization in shear zones along the southwest edge of the gossan may also be related to a porphyry system.

Although gold occurs sporadically in many of the quartz veins in the area, to date, the best target for a bulk tonnage deposit remains the Kliyul gold skarn. Although results of exploration to date have been encouraging, much additional exploration will be needed to determine more precisely the ultimate size and economic potential of this deposit.

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REFERENCES

Cross, D.B. (1985): Geological, geophysical and geochemical report, KC 1 and 2 claims, Omineca Mining Division, British Columbia, N.T.S. 94D/8E, 9E; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 14416, 18 pages.

Gill, D.G. (1993): Drilling assessment report on the Kliyul property, N.T.S. 94D/8, 9; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 23033, 12 pages.

Gill, D.G. (1994): Geological and geochemical assessment report on the Joh property, N.T.S. map sheet 94D/9; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 23543, 15 pages.

Gill, D.G. (1994), Assessment report on the Joh, Darb, Croydon, Mariposite & Kliyul Properties, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 23379.

Gill, D.G. (1995): Geological assessment report on the Joh 3 group of claims, N.T.S. map sheet 94D/9; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 23842, 16 pages.

Gill, D.G. (1996): Drilling report on the Mariposite property, N.T.S. 94D/8, 9; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 24778, 23 pages.

Fox, M. (1982): Geological and geochemical report, KC 1 and 2 mineral claims, N.T.S. 94D/8E and 9E, Omineca Mining Division, British Columbia; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 10346, 14 pages.

Fox, M. (1991): Geological and geochemical exploration report, Jo 1-8 and Cro 1-5 mineral claims, N.T.S. 94D/8E and 9E, Omineca Mining Division, British Columbia; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 21502, 18 pages.

Leriche, P.D. and Harrington, E. (1996): Diamond drilling report on the Joh property, Johanson Lake area, Omineca Mining Division, British Columbia; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 25099, 22 pages.

Meyers, R.E. and Smit, H.Q. (1985): 1984 assessment report of the geological and geochemical exploration program on the Goldway 1-8 claims, Omineca Mining Division, NTS 94D/8, 9; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 13697, 83 pages.

Pawliuk, D.J. (1985): Report on assessment work on the Goldway Peak property, Omineca Mining Division, Johanson Lake, British Columbia; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 14105, 17 pages.

Phendler, R.W. (1984): Report on assessment work (sampling and assaying) on Vi 1 and Vi 2 (Record Nos. 1948 and 1949), Johanson Lake area, Omineca Mining Division, British Columbia; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 13175, 9 pages.

Richards, T.A. (1976): Geology, McConnell Creek map-area (94D/E); *Geological Survey of Canada*, Open File 342, scale 1:250 000.

Schiarizza, P. (2004): Geology and Mineral Occurrences of Quesnel Terrane, Kliyul Creek to Johanson Lake (94D/8,9) in Geological Fieldwork 2003, *B.C. Ministry of Energy and Mines*, Paper 2004-1, pages 83-100.

Schiarizza, P. (2004a): Geology of the Kliyul Creek-Johanson Lake area, Parts of NTS 94D/8 and 9, *B.C. Ministry of Energy and Mines*, Open File Map 2004-5, scale 1:50,000.

Tchalenko, J.S. (1970): Similarities between shear zones of different magnitudes; *Geological Society of America*, Bulletin, Volume 81, pages 1625-1640.

von Rosen, G. (1986): Assessment geological report on mapping, sampling and bulk sampling program on the Good (4155) - Prospects (4147) - Much (4149) - Pro (4150) - Fit (4151) - Dar (4154) mineral claims (Gold group), Goldway Peak - Johanson Lake area, Omineca Mining Division; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 15313, 35 pages.

Wilson, G.L. (1984): Geological, geochemical and geophysical report, KC 1 and 2 mineral claims, N.T.S. 94D/8E and 9E, Omineca Mining Division, British Columbia; *B.C. Ministry of Energy, Mines and Petroleum Resources*, Assessment Report 13580, 17 pages.

Zhang, G. and Hynes, A. (1991): Structure of the Takla Group east of the Finlay-Ingenika fault, McConnell Creek area, north-central B.C. (94D/8, 9); *in* Geological Fieldwork 1990, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1991-1, pages 121-129.

Zhang, G. and Hynes, A. (1992): Structures along Finlay-Ingenika fault, McConnell Creek area, north-central British Columbia (94C/5; 94D/8, 9); *in* Geological Fieldwork 1991, *B.C. Ministry of Energy, Mines and Petroleum Resources*, Paper 1992-1, pages 147-154.

Zhang, G. and Hynes, A. (1994): Fabrics and kinematic indicators associated with the local structures along Finlay-Ingenika fault, McConnell Creek area, northcentral British Columbia; *Canadian Journal of Earth Sciences*, Volume 31, pages 1687-1699.

White, W.H. (1948): Sustut-Aiken-McConnell Lake area; *in* Annual Report of the Minister of Mines for 1947, *B.C. Department of Mines*, pages A100-A111.