

GEOLOGY AND GEOCHEMISTRY
OF THE

PENMAN PROPERTY
Idaho County, Idaho

for

QUARTZ CREEK GOLD MINES (B.C.) LTD.

August 6, 1985.

P. VAN ANGEREN, P. GEOL.
W.G.T. CONSULTANTS LTD.

GEOLOGY/MINERALIZATION

The oldest rocks in the Elk City area comprise thick series of gneisses, schists, quartzites, and limestones which are metamorphic equivalents of sediments laid down for the most part in fairly shallow water.

In his report of March 26, 1984, L. Sookochoff, P. Eng. states:

Regional:

The Mesozoic Idaho batholith consisting of quartz monzonite to alaskite to migmatite in the general area. The major portion of the batholith occurs in the south with sporadic stocks in association with pre-Cambrian rocks northward to and beyond the Penman property area. The pre-Cambrian sequence is indicated as probable Belt supergroup rocks or equivalent. In the property area the supergroup consists of white quartzite and augen and biotite gneiss of the Ravali Group (pEqz) with biotite gneiss with quartzite and mica schist (pEbg) of possibly the Prichard Formation.

Local:

The local geology is described in Circular 9 USGS as follows:

"The prevailing wall rock at the Homestake mine is a hybrid type of granitic rock that is probably best termed "granodiorite". Quartzite and quartzitic schist and gneiss crop out a few hundred feet east of the mine. The granodiorite is prevailing coarse-grained, and much of it is a pegmatitic texture. Pegmatite and andesite dikes cut it at the line, and a well-exposed dike of porphyritic dacite cuts the granodiorite along the road a short distance northwest of the mine. Inclusions of quartzite and quartzitic schists are numerous in the granodiorite, and many of them are exposed in the underground workings.

The prominent quartz veins cross the property, striking S75 to 80 degrees E and dipping 80 degrees S at intervals of 500 and 600 feet. The vein on which the principal development has been done, the Homestake, is centrally located between the other two upon which little work other than surface trenching has been done.

The Homestake vein is exposed over a vertical range of some 300 feet and horizontally in drift number 3 for 700 feet. The vein is terminated by a cross fault - 200 feet from the end of drift number 3 - which is marked by a seam of gouge one to two inches wide.

SUMMARY

The Penman property; located in west-central Idaho, comprises 29 claims which cover at least two major auriferous quartz-vein structures, both of which have undergone some development prior to the 1940's. Old records indicate the presence of up to five structures.

The Badger and Homestake veins consist of white quartz hosted by faults within altered biotite quartz-monzonites. Gold and minor silver occur with minor sulphides in lead-enriched shoots which occupy more than 60% of the vein structures.

The Badger vein is traceable on surface for at least 1,000 feet, has been exposed to 150 foot depths and is up to 3.5 feet wide. Typical grades are in the 0.1 to 0.3 oz/T gold range.

The more extensive Homestake vein, on which five adits have been driven, has been traced on surface for more than 2,300 feet. Old workings have exposed it over a vertical range of 500 feet, however, it rarely exceeds 3.5 feet in width, averaging 1.5 to 2.0 feet. At least fourteen, fault-bounded ore-shoots averaging 0.15 to 0.86 oz/T gold have been delineated. Six of these may be segments of a single shoot measuring up to 400 feet long by 300 feet high. The vertical extent is considered a minimum. At today's gold prices of \$320.00 an ounce, most ore-shoots would be economic using three-(3)-foot wide stoping methods.

The Homestake and Badger veins are typical of other epithermal deposits. Further exploration is warranted on the basis of the large tonnage potential, expected increases in the price of gold, expected low-cost logistics and on the possibility of mining three to four foot widths using today's technology. The Penman property potentially carries additional gold reserves and exploration should be conducted in order to determine total tonnages available.

This may be accomplished through surface geophysical/geochemical surveys combined with trenching, surface drilling and underground drilling of exposed ore-shoots. Estimated costs of the above recommended drilling program are \$110,000.00

INTRODUCTION

W.G.T. Consultants Ltd. has been retained by QUARTZ CREEK GOLD MINES (B.C.) LTD. to conduct a preliminary geological evaluation of their PENMAN property in Idaho, U.S.A.

The purpose of the examination is to test and sample underground workings with a view to expanding existing ore shoots and to examine surface workings and dumps to determine additional zones of potential mineralization.

This evaluation is based on an exhaustive study of numerous old maps and reports, as well as on a 10 day investigation of the property by the author, in July 1985. Much of the old assay data was obtained from a compilation report completed by L. Sookochoff in 1984.

The PENMAN property comprises 27 contiguous quartz-lode claims and two patented claims;

TABLE I
Quartz lode claims

Harry Poyneer	Harry Poyneer no.1	Sam Erwin
Sam Erwin no.1	Sam Erwin no.2	Sam Silverman
Sam Silverman no.1	Wm Yetter	Wm Yetter no.1
Ned Condit	Homestake Ext.	James Penman
James Penman no.1	James Penman no.2	James Penman no.3
Lead	Lead no. 2	Lead H no.1
Lead H no.2	Sadie H	Sadie H no.1
Sadie H no.2	Sadie H no.3	Sadie H no.4
Sadie H no.5	Sadie H no.6	Sadie H no.7
Pennsylvania		
Patented Claims		
Pennsylvania		
Homestake		

All of the claims are in Township 27N; Boise Meridian in the County of Idaho, State of Idaho.

LOCATION, ACCESS AND PHYSIOGRAPHY

The property is located three miles south-east of Orogrande, Idaho, on the divide between Crooked River and Big Creek, a tributary of the Salmon River.

Access is east via highway 14 from Grangeville for 50 miles to the Crooked River Road. An all weather secondary road is taken south for 11.5 miles to Orogrande from which point, a poor, three-mile, dry weather secondary road leads to the PENMAN workings and other areas on the property. A small airstrip, suitable for small private aircraft is located next to the Crooked River Road a few miles north of Orogrande.

Property topography consists of gently sloped ridges which have not undergone significant glaciation. Relief is in the order of 1,200', ridge-crests being at 6,700 to 7,000 feet and mine-workings at 5,900 to 6,500 feet.

Vegetation comprises open lodgepole pine forest with denser spruce and poplar at lower altitudes.

Water and power, for exploration and development programs are available from watercourse headwaters and diesel sources respectively.

GEOLOGY

The dominant rock-types of the Grangeville-Orogrande region are the quartz-monzonites to alaskites of the Mesozoic Idaho Batholith. The main body of the batholith lies to the south of the property but numerous, large stocks outcrop throughout the region northwards beyond Grangeville. Pre-mesozoic rocks comprise the pre-Cambrian quartzites and augen biotite gneisses of the Ravali Group (pEqz) with gneissitic and quartzitic mica schists of the Prichard Formation (pEbg).

Despite a lack of outcrops, P.J. Shenen of the USGS described the local geology as follows:

"The prevailing wall rock at the Homestake mine is a hybrid type of granitic rock that is probably best termed "granodiorite." Quartzite and quartzitic schist and gneiss crop out a few hundred feet east of the mine. The granodiorite is prevailingly coarse-grained, and much of it is a pegmatitic texture. Pegmatite and andesite dikes cut it at the mine, and, a well-exposed dike of porphyritic dacite cuts the granodiorite along the road a short distance northwest of the mine. Inclusions of quartzite and quartzitic schists are numerous in the granodiorite, and many of them are exposed in the underground workings." (Shenen, 1939).

Underground mapping, during the 1985 examination, has indicated the presence of at least three types of quartz-monzonite. Most common is fresh to weakly propylitized biotite quartz-monzonite. Locally, this unit grades to a second igneous type pegmatitic, muscovite quartz-monzonite which appears silicified. These zones may represent areas which have undergone strong phyllic alteration. One such zone is found to be invaded by a well developed quartz-hematite-stockwork in level #5. The third type is found exclusively within 10 to 20 feet of the shear structures and consists of silicified and kaolinized monzonite, a result of the strong alteration associated with the veining/shearing.

The property is host to a minimum of two quartz vein systems, both of which have undergone some development in the past. Old records indicate the presence of up to 5 parallel veins, each separated by 500 to 600 feet. All major veins trend 115° to 120° and dip by 80° to the southwest; such attitudes being determined from float-tracing and trenching where the veins are not exposed by underground workings.

The Badger vein may be traced on the surface for a minimum of 1,000 feet, from the "#2 Shaft Adit" to the Badger shaft. Old records show it to vary from 1.0 to 3.5 feet in width and to consist of weakly banded to massive, white and grey quartz. At the Badger shaft, the vein was worked to a depth of 150 feet at which point it retained its 3 foot width, but decreased in grade (Moore, 1941 map).

The principal vein on the PENMAN property is the Homestake vein. On surface, it is traceable for a minimum of 2,300 feet from the #4 level portal area to the "discovery pits" at the eastern edge of the patented claims. Five adits have been driven on the vein; at altitudes of 5965, 6127, 6192, 6393 and 6464 feet (levels 5 through 1 respectively). These adits expose the vein over a vertical range of 500 feet, however, an additional 200 feet may be included between the level of #1 adit, and the level of the discovery pits" on surface. The #1 level has a length of 30 feet, #2-240 feet, #3-1150 feet, #4-880 feet and #5-440 feet. A 600' cross-cut was also driven from the #3 level to the Badger vein. The vein has been followed along all levels (up to 700 feet in #3) except in level #5 where it was intersected 430 feet from the portal. Widths were found to vary from less than one foot to 3.5 feet. It consists principally of massive grey-white quartz, hosted by a fault, in crushed, sheared and altered wall rock.

Underground mapping has indicated that the Homestake vein system may actually consist of two distinct structures, trending 120°/steep south and 100°/subvertical, respectively.

The more distinct structure is the first one. This vein comprises the massive grey-white quartz, usually in excess of one foot in width, bound by thin sulphide-rich gouge zones. This structure appears to carry the more favorable gold

values. Representatives of this group include most surface shows, as well as shoots 3-C, 3-D, 3-E of level #3 and stopes 404-A, G.C.C., 417, 420-A and 425 of level #4. Locally, such as in section 410 to 411 of level #4, it is reduced to 0.2 foot thick pyritized gouge zone.

The second vein is a narrow siliceous shear zone consisting essentially of crushed and brecciated wall rock, locally impregnated with quartz. This shear rarely exceeds one foot in width, and is best represented by section 405-407 and stopes 408 and 419 of level #4. It may widen at depth, since it is 2.0 feet thick in shoot 5 of level #5. Above the #4 level, the shear is host to a 1.5 to 2 foot thick quartz vein as demonstrated in shoot 2 of level #2 and in shoots 3-A, 3-B and possibly 3-F of level #3.

Abundant late faulting has broken the veins into segments of up to 100 feet in length. These have also been displaced south and north by as much as 100 feet. These cross-cutting faults consist of thin, altered, shear zones, locally with quartz.

Of particular interest is the complex relationship and distribution of the 120° and 100° veins. Whereas the 100° structure appears undisturbed (all main segments are aligned), the 120° vein is consistently offset in NE-SW and downdip directions (section A-A'). It appears that the 100° shear may have bisected the 120° vein at the time of quartz-veining (120° vein/100° Shear-Plan). The two intersection points (I) indicate where the north and south portions of the 120° vein may have been joined, prior to displacement. The area surrounding the traces of these two intersection points will probably have the highest concentration of ore-bearing vein material. Furthermore, in the area above and to the west of the intersection; i.e. in the hanging wall of the 120° vein, the 100° shear has been invaded by auriferous quartz, creating two mineralized targets in that area.

MINERALIZATION

Simple shear structures (e.g. 100° shear) are devoid of sulphide mineralization. The quartz veins are consistently mineralized with up to 3% sulphides. These include pyrite, chalcopyrite, galena, sphalerite, tetrahedrite and covellite as disseminations and fracture-fill. Where the quartz vein pinches out to a simple gouge, it contains significant amounts of coarse pyrite and chalcopyrite. Hematite and malachite staining are characteristic of the 120° vein system and of the quartz stockwork observed in level #5.

Circular 19 of the USGS indicates that pyrite and chalcopyrite were introduced along fractures in the quartz whereas the other sulphides were introduced later. The gold and silver were apparently introduced with the later sulphides.

Rock samples collected from various surface and underground locations are shown on figures 4 and 5 respectively, while assays from samples collected in the #2 and #3 levels are discussed in Circular 9 and tabulated in Appendix I.

i) Surface Sampling:

Limited surface sampling was conducted on vein material collected from various old pits and trenches (Series 3200-3215). Group 3210 to 3214 represents a 50 foot section across the 100° shear at the #3 portal where results show only the vein to be auriferous (3211).

In this section the rocks are devoid of copper, zinc and silver, however, lead is enriched, but only up to 3 feet from the vein. Vein and footwall grade 0.065 oz/T Au over 4.5 feet.

The other samples consist of random chips from individual pit diggings, a situation which causes geochemical dilutions, therefore, only those values in excess of 0.05 oz/T Au (1.7 ppm) should be considered. Most samples are above this limit) 1 particular samples 3207 and 3209 which represent the western half of the Badger vein. A characteristic of the surface exposures is the lack of silver, copper and zinc, counterbalanced by an enrichment in lead (in excess of 100 ppm). It has been shown from old records that surface showings are rich in immobile elements, such as gold and lead; e.g. 6.02 oz/T Au - #1 dump, 5.48 oz/T Au - #2 dump, 2.48 oz/T Au - #3 dump (Sookochoff, 1984). This is most certainly a result of secondary, physical enrichment of gold due to weathering in the absence of glaciation.

These results suggest that soil sampling for gold and lead would be instrumental in vein detection. Fourteen soil samples taken across the trace of the Homestake vein in the vicinity of samples 3201 and 3202 show this to be the case only for lead. Only two spot-gold anomalies were detected. It is believed that more useful results, would have been obtained if auger-assisted sampling had been carried out to get below the upper foot of organic rich and leached soil.

Surface sampling has thus shown that both vein systems are extensively mineralized.

ii) Underground Sampling

The Badger vein was not sampled underground. Old workings, however, have exposed at least three ore-shoots; the X, Y and Z. The upper two shoots appear to pinch out at 100 foot depths, although this may be a result of possible off-setting to the north or south of level 150. Laterally, the ore-shoots have not been traced out.

Calculated over 5 foot mining widths, grades in the X and Z shoots average 0.11 oz/T Au with highs of 0.38 oz/T. Stopping, however, may probably be successfully completed at narrower widths thereby increasing the grade. Silver values were apparently very low.

A large number of samples were collected from the Homestake workings in which fourteen. discreet shoots have been exposed. (Shoots 2, 3A to 3-F, 5 and stopes 404-A, 408, G.C.C./417, 419, 420-A and 425). Almost all of these are fault-bound.

The more important features to be discussed, are the widths and grades of these shoots. Few of them are wider than 2 feet and grades are typically variable between 0.15 and 0.86 oz/T Au. Very few samples contain more than 0.3 oz/T silver, thus it cannot be used to increase the gold-equivalent grade. One of the highest silver assays; 0.56 oz/T, is from the stockwork of level #5. This warrants additional work, regarding potential low-grade, bulk-tonnage mineralization. Geochemically, auriferous sections are anomalous in lead, in confirmation of surface results.

The 1985 sampling (series 3300 to 3341 incl.) was carried out in such a manner as to also determine gold concentrations in the immediate wall-rocks to the vein. Whereas the actual veins are auriferous, immediate wall-rocks are barren, except for stope 404-A where they are enriched to 0.064 oz/T Au. This indicates that economic stopping methods at today's gold prices would have to be restricted to 3 foot widths throughout most of the Homestake vein system.

Lateral limits to the shoots cannot be determined, although, it appears that most are certainly in excess of 80 feet long, being faulted and off-set. It is more than likely that shoots 3-C, D, E and stopes G.C.C., 417, 420-A and 425 are all members of the same large shoot (minimum length of 400 feet). A vertical range of 300 feet is indicated since old records show that shoots 3-A to 3-E were stoped to the surface (a distance of 300 feet). This fact is supported by the extensive caving along the surface, above #3 level. Whereas the 100° shear appear to decrease in grade at depth (e.g. shoot 3-A to stope 408 to shoot 5), the 120° vein may contain local grade-increases at depth (e.g. shoots 3C to 3E down to stopes 417, 420-A).

Fault off-setting and down-dip grade distribution of the ore-shoots suggests the presence of significant quantities of undiscovered ore-bearing material in the vicinity of the workings. Examples include shoot 3-F, and the lateral and downdip extensions of stopes 404-A, 417, 420-A and 425.

A further note concerns the "inter-ore-shoot" structures along the 120° vein, where it appears that these are very narrow but auriferous (e.g. section 410-411, level #4, averaging 0.04 oz/T Au over 1.5 feet, of which only 0.2 feet consists of gouge matter).

CONCLUSIONS AND RECOMMENDATIONS

The Homestake and Badger veins consist of extensive, though narrow, quartz-vein structures hosted by faults in quartz-monzonite. Auriferous and lead-enriched ore-shoots occur along these veins. In excess of 60% of the vein

structure is auriferous at the Homestake workings, indicating that most of the vein structures are mineralized. Wall rocks have proven to be non-auriferous and add little to the configuration of the ore shoots.

Considering the lateral and vertical extent of the exposed ore-shoots, (e.g. up to 400 X 300 feet), both vein structures represent viable exploration targets, provided 3-foot stoping methods may be carried out. In such a situation, the known ore-shoots would be economic at today's gold prices (320.00 US\$).

Further exploration is warranted on the basis of the following features:

- i) Large potential tonnages indicated in two to five veins
- ii) Good access and simplified logistics resulting in lower-cost exploration;
- iii) Potential rise in gold prices would dramatically increase the value of the "gold in the ground."
- iv) Three to four foot mining widths were feasible in the early 1900's. This should be the case as well, today
- v) Indicated increases in gold grades near the surface and locally at depth)

The main goal of further exploration programs would be; firstly, to improve the total ore-grade tonnages and secondly, to block out minable ore-shoots at 3 foot mining widths. Because the Homestake and Badger veins are typical of other narrow epithermal gold deposits, location and value of potential ore-shoots will be predictable using low-cost surface trenching and shallow drilling. Some drilling may be completed from the #4 level, thereby reducing total drill-footage. The principal complications will arise from the lateral off-setting of the vein and from erratic grades within individual shoots.

To attain the outlined goals while overcoming the reported complications, a two-pronged exploration program is recommended; surface and underground exploration. Both would be carried out simultaneously, the surface program to be followed by a second phase of test drilling.

Surface work should consist in carrying out detailed auger-assisted soil sampling and VLF-EM geophysical surveys over the property. One hundred-foot stations should be adequate. While the VLF survey would pinpoint all 100° to 120° structures, geochemistry would indicate which of these are mineralized. Anomalous zones would subsequently be trenched, thereby exposing the causative source. Ore shoots, exposed as such, would be drill-candidates for the phase II program.

Underground work should consist in rehabilitating the #4 and #5 levels to make them suitable for underground drilling. Recommended targets include:

- i) From stn. 406 downdip extension of 404-A chute.
- ii) Fran stn. 421 + 25' - downdip extension of 420-A chute.
- iii) From stn. 414 or surface - downdip extension of GCC/417 chute.
- iv) Fran stn. 425 - downdip extension of 425 chute.
- v) From stn. 425 - drill east to hit chute 3-F.

For more detailed grade estimates, a more detailed drilling program from new cross-cuts, should be envisaged at a later date Furthermore, the level #5 stockwork should be more adequately tested for low-grade, bulk-tonnage gold and silver mineralization.

APPENDIX I

SAMPLE	DESCRIPTION	GOLD OZ/T	SILVER OZ/T
LEVEL #2 (from USGS Circular 9)			
S2-A	Vein, 2.5' @ face	0.4	0.5
S2-B	Vein, 3.0' @ face	0.64	0.2
S2-C	Vein, 2.5' @ face	0.20	0.21
S2-D	Vein, 6.0° @ 150'	0.42	-
S2-E	HW, 2.0' @ 150'	1.48	-
LEVEL #3 (from USGS Circular 9)			
S3-A	Vein, 3.1' @ 78'	0.4	1.9
S3-B	Vein, 3.2' @ 87'	0.4	0.2
S3-C	Vein, 3.3' @ 97'	1.12	0.4
S3-D	Vein, 1.5' @ 600'+	1.44	-
S3-E	Vein, 1.5' @ 600'+	0.24	-
S3-F	Vein, 2.5' @ 600'+	0.64	-
DUMP #1 Level			
		6.02	5.1
DUMP #2 Level			
		5.48	-
DUMP #3 Level			
		2.48	1.0

Phase II - Surface and Underground:

Drilling for Tonnage Calculations:

5,000 feet @ \$50/foot all inclusive \$250,000.00
 + 10% contingency 25 000.00

TOTAL PHASE II 275,000.00

Further work would be contingent upon the results of the above program of work.

Respectfully submitted,
 P.D. Van Angeren, P. Geol.
 W.G.T. CONSULTANTS LTD.
 August 6, 1985

CERTIFICATE

I, PHILIP D. VAN ANGEREN, residing at #506, 521 - 57 Ave. S.W. Calgary, Alberta do hereby certify that:

1. I am a geologist having been practising my profession for eight years.
2. I am a graduate of McGill University, Montreal, P.Q., having received an honours B.Sc. degree in Geology in 1977.
3. I am a member in good standing of the Association of Professional Engineers, Geologists, and Geophysicists of Alberta.
4. I have no interest direct or indirect in the property or securities of Quartz Creek Gold Mines (B.C.) Ltd., nor do I expect to receive any such interest.
5. I am the author of this report which is based on personal knowledge of the area gained during a field trip on July of 1985 and ● on a study of, numerous reports and maps made available regarding the property.

Dated at Calgary, Alberta this 6th day of August, 1985.

P.D. Van Angeren, P. Geol.
W.G.T. Consultants Ltd.