REPORT ON THE EXPLORATION POTENTIAL
OF THE
HIGHLAND VALLEY PROPERTY

MOAG COPPER-GOLD RESOURCES INC.

By

William R. Bergey, P.Eng.
Consulting Geologist

January 10, 2014
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>REGIONAL GEOLOGY</td>
<td>3</td>
</tr>
<tr>
<td>GEOLOGY OF THE GUICHON CREEK BATHOLITH</td>
<td>5</td>
</tr>
<tr>
<td>REGIONAL MINERALIZATION MODEL</td>
<td>9</td>
</tr>
<tr>
<td>DESCRIPTION OF SELECTED TARGET AREAS</td>
<td></td>
</tr>
<tr>
<td>Skuhun Target</td>
<td>15</td>
</tr>
<tr>
<td>Mamit Target</td>
<td>16</td>
</tr>
<tr>
<td>Tap Target</td>
<td>17</td>
</tr>
<tr>
<td>RECOMMENDATIONS FOR EXPLORATION</td>
<td>18</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>22</td>
</tr>
</tbody>
</table>

# ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Figure</th>
<th>Illustration</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Regional Geology</td>
<td>2</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Intrusive Breccia of Alkalic Intrusive Complex</td>
<td>3</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Intrusive Breccia of Alkalic Intrusive Complex</td>
<td>3</td>
</tr>
<tr>
<td>Figure 4</td>
<td>Geological Map of the Guichon Creek Batholith</td>
<td>7</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Geological Legend</td>
<td>8</td>
</tr>
<tr>
<td>Figure 6</td>
<td>Regional Geochemical Stream Sediment Sampling</td>
<td>10</td>
</tr>
<tr>
<td>Figure 7</td>
<td>Triassic &amp; Early Jurassic Faulting</td>
<td>13</td>
</tr>
<tr>
<td>Figure 8</td>
<td>Iron Mask Batholith</td>
<td>14</td>
</tr>
<tr>
<td>Figure 9</td>
<td>Skuhun Target Area</td>
<td>15</td>
</tr>
<tr>
<td>Figure 10</td>
<td>Mamit Target Area</td>
<td>16</td>
</tr>
<tr>
<td>Figure 11</td>
<td>Tap Target Area</td>
<td>17</td>
</tr>
</tbody>
</table>
REPORT ON THE EXPLORATION POTENTIAL OF THE HIGHLAND VALLEY PROPERTY

MOAG COPPER-GOLD RESOURCES INC.

INTRODUCTION

The Highland Valley Property ("the Property"), which covers an area of almost 100 square kilometres, is located along the eastern margin of the Guichon Creek granitic batholith, host to the porphyry copper-molybdenum mines of Highland Valley Copper, the largest in Canada. The Property lies 7.5 kilometres southeast of Highmont, most southerly of the mines in the Highland Valley district.

I have been involved with the geology and mineral deposits within Quesnellia off-and-on for many years. This terrane extends from the U.S. border northward to Prince George and beyond. My early geological work was carried out on behalf of Teck Corp., a long-time employer, and it included field work at the Highmont mine in the Highland Valley and at the Afton and Ajax mines in the Iron Mask batholith. More recently, I became deeply involved with the geology and mineral deposits of the southern portion of Quesnellia, both as a consulting geologist to exploration companies and in constructing a drastically revised geological map of the belt between Aspen Grove and Kamloops on my own account (see Figure 1). This work has involved the extensive use of photo-geological and aeromagnetic interpretations, techniques that I was introduced to early in my career by the eminent geologist Dr. J. Tuzo Wilson and by Dr. N.B. Keevil, founder of Teck Corporation, respectively. On the basis of this methodology, supported by extensive regional field mapping, I recently completed detailed geological reassessments of the Guichon Creek batholith and the Iron Mask batholith, which are the host intrusions of major copper-molybdenum and copper-gold deposits.

It is clear that an innovative exploration approach is essential, since a major new discovery has not been made in the study area within the past 40 years. Photo-geological & aeromagnetic studies supported by geological mapping are capable of defining geological features beneath glacial till -- and they are particularly well adapted to delineating faults and to identifying transported material that inhibits prospecting and conventional soil geochemical exploration. Large areas of continuous overburden, including areas that are marginal to the main part of the batholith, have received relatively little previous consideration, and it is these areas that I believe are of special interest for ongoing exploration on the Highland Valley property -- especially since they may reflect the presence of regional faults that are closely related to metallogeny in southern Quesnellia. Since the target areas are masked by deep overburden, the present report includes a detailed discussion of techniques appropriate to exploration within this environment.
REGIONAL GEOLOGY

The porphyry copper (-molybdenum) deposits in the calc-alkaline plutons [e.g., Guichon Creek batholith] generally are considered to be completely unconnected to the copper-gold deposits associated with alkaline intrusive rocks [e.g., Iron Mask batholith]. My recent work casts some doubt on this distinct categorization, and suggests that the two types may overlap in time and in space. Accordingly, I believe that the regional geology is pertinent to a discussion of the geology and mineralization of the Guichon Creek batholith. The most recent regional geological mapping was carried out by the GSC in the 1940's (Cockfield, 1947). The BCGS conducted more detailed surveys in several areas during the 1970’s (Northcote; 1977; McMillan; 1978; Preto, 1979). The earlier GSC mapping was reviewed & annotated and the BCGS maps were incorporated in regional format (McMillan & Monger, 1989). However, a minimum of field mapping was involved, and no substantive changes were made in the geology of the present map area.

The dominant supercrustal rock unit shown on published geological maps of the southern part of the Quesnel Terrane is the Nicola Group, composed of volcanic and sedimentary rocks of Triassic age. (This region is sometimes referred to as the “Nicola Belt.”) My work within the portion of this belt shown on Figure 1 suggests that at least 50% of the rocks previously mapped as belonging to the Nicola Group are part of a younger intrusive assemblage that I refer to as the Alkalic Intrusive Complex. This unit includes a group of alkaline intrusive rocks (including those of the Iron Mask batholith) that generally have been considered to be coeval with the deposition of the rocks of the Nicola Group. My geological work strongly suggests: 1) that by far the largest part of the Alkalic Intrusive Complex is composed of intrusive breccia pipes; 2) that this unit was emplaced after the rocks of the Nicola Group were folded and metamorphosed, and after they were intruded by the calc-alkaline batholiths.

The photo at left above is from a large, gently curving outcrop that exposes the contact of a breccia pipe that intrudes limestone of the Nicola Group near Mamit Lake. The limestone has accreted to the surface of the breccia and fragments
are incorporated for a few centimetres. The pipe appears to have intruded rather passively at a comparatively low temperature. The photo at right is “typical” of one of the several intrusive breccia assemblages that I have identified in the region. [Note the evidence of at least two stages of re-brecciation.] The photos were taken in areas that were mapped as rocks of the Nicola Group. In detailed mapping the intrusive breccia was designated as volcanic breccia, conglomerate, tuff, lahar, etc.

Aside from being the host to two major porphyry copper-gold deposits, the Iron Mask batholith is a very distinctive unit. The intrusion is completely enclosed within a pair of faults -- and it is completely surrounded by rocks of the Alkaline Intrusive Complex, mainly intrusive breccia, belonging to two assemblages. Intrusive breccia is rare within the batholith, except in association with the mines. However, two of the units within the batholith were emplaced mainly as pipe-shaped bodies of intrusion breccia (also termed “agmatite”) that was formed from the incorporation of wallrock during intrusion at much higher temperatures than was the case with intrusive breccia. Mineralization within the batholith appears is closely associated with certain regional faults (Figure 7a).

An extremely important geological feature of the region is a group of north-trending, deep-seated faults of Late Triassic age. [I believe that they are transcurrent faults related to the early stages of plate movement, but this is not relevant to the present discussion.] I have inferred that four of these faults are present within my study area (Figure 1). Since these are the oldest known structures in the region, they are truncated by all of the later intrusions and are masked by younger sedimentary and volcanic rocks. However, it is evident that these deep-seated structural zones have created lines of weakness that are followed, at least locally, by much younger “successor” faults that assist in the interpretation of the locations of the primordial structures. The deep-seated faults commonly are reflected by magnetic “lows.” A linear magnetic feature of this type has been traced along Otter Creek near Aspen Grove for a distance of more than 20 kilometres. Big Kidd and PAR prospects are located in or close to this zone.

There is a considerable amount of evidence suggesting that deep-seated faults exerted some control over later mineralization. The Otter Creek and Summers Creek faults are located at the eastern and western junctions of the faults that enclose the Iron Mask batholith. [The Afton mine lies at the western junction.] Several other copper occurrences are located close to the trace of the Otter Creek fault, including the Big Kidd and PAR advanced prospects and the Copper Mountain mine, near the U.S. border. Two of the mineralized zones of the Axe developed prospect were deposited in Nicola volcanic rocks along the Summers Creek fault. [The same fault has been interpreted to extend more than 300 kilometres to the north along a trace that lies a short distance east of the Mount Polley mine.] I recently located a fifth deep-seated fault, one located east of my study area that is indicated to pass close to the former Brenda porphyry copper-
GEOLOGY OF THE GUICHON CREEK BATHOLITH

The published geology of the Guichon Creek batholith, almost unrevised in the past 45 years or so since the last major copper discovery was made in the area, reveals a rather elegant intrusion pattern in cross section. The various facies of the intrusive rocks that make up the batholith are composed of granodiorite and quartz monzonite that are arranged in concentric layers that are assumed to increase in age toward the margin. These layers are typified by gradual decreases in silica and increases in the magnetic property of the rocks. An even older and more mafic “Border Phase” composed of diorite, quartz diorite and granodiorite, occupies most of the margin. To account for the significant decrease in silica near the border, large-scale hybridization of the granodiorite with volcanic rocks of the Nicola Group was postulated. In the western part of the batholith, which is shown on Figure 6, this area of putative hybridization attains a surface width of more than four kilometres.

I have done only cursory field work supplemental to the photo-geological interpretation of the western part of the batholith. However, in eastern and southern portions I found very little evidence of hybridization. Since my initial identification of diorite pipes intruding granodiorite north of the Highland Valley Property, I have found evidence that this diorite is a part of the geological assemblage along the margin of the batholith for almost all of its known extent. [Much of the evidence has come from mining company assessment reports.] My photo-geological interpretation suggests the diorite follows the marginal zone of the batholith as discontinuous clusters of pipes. They are scarce in the vicinity of the Property. However, the aeromagnetic data suggest that they are present beneath younger cover in the Guichon Creek valley, which follows the Mamit Lake fault. My most recent photo-geological interpretation indicated that small clusters of pipe-shaped bodies that post-date the recognized intrusive phases are present throughout the batholith. Except for the diorite, these tend to be weakly magnetic and are not readily distinguishable from older granitic phases.

The diorite was mapped as a widespread entity along the margin of the batholith in extensive surveys by several of the earlier geologists including Charlie Ney, one of British Columbia’s foremost exploration geologists, but its existence as a younger unit was rejected in the early 1970’s by an academic consensus in favour of a more elegant solution. Samples of the diorite that I had analyzed indicate that the diorite is alkaline, in contrast to the calc-alkaline rocks of the batholith. On a silica vs. total alkali plot that was used in interpreting the intrusive phases of the Iron Mask batholith it falls within the more siliceous portion of the field for the Pothook diorite – the oldest unit. Both the Pothook diorite and the diorite in the Guichon Creek batholith were emplaced as pipes. However, the
former often contains abundant fragments, including some that are composed of
gabbro, presumably from an older intrusion. A large body of alkaline gabbro that
appears to be older than the diorite crops out entirely within the Property west of
Mamit Lake. It is tempting to suggest that this intrusion (Unit JCg) is a
counterpart of the gabbro that is the source of the fragments in the Pothook
“agmatite.”

The most prominent faults within the batholith are part of a group that I refer to as
the “N-S regional faults”, but their strike varies considerably from north-south.
They tend to be somewhat sinuous in plan. The N-S regional faults are extremely
continuous and individual structures may well extend the entire length of the
batholith. It is clear that they cut all of the major intrusive phases. This fault set
make a very good “time line” since they are truncated by the younger intrusive
pipes, as indicated on Figure 5.

The N-S faults are truncated by the alkaline diorite and by one group of “pipes” of
unknown affiliation. They also are occupied by felsic dikes, some of which are
mineralized, that are believed to be part of a high-level phase of the batholith. A
distinctive quartz diorite and various “pipe” clusters of undefined affiliation are
older than the N-S faulting. The metallogenic significance of the N-S regional
faults is discussed in the next section of this report.

The Lornex fault, which trends almost due north-south and can be traced for
more than 100 kilometres, is a highly atypical member of the N-S fault set. It is
unusually straight by any standard – and it intersects rocks that are dated to be
as young as Eocene. It also offsets the Lornex and Valley portions of a
previously larger copper deposit. Because of the linearity and great extent of the
fault, not to mention its close relationship to the largest mines in the region, I
have concluded that it represents the reactivation of a deep-seated fault zone of
the Otter Creek type.

A second major deep-seated structure, the Mamit Lake fault zone’ is inferred to
follow the valley of Guichon Creek. It is not exposed within the map area.
However, it has been traced, assisted by a combination of successor faults and
aeromagnetic data, to the north and to the south for distances of greater than
100 kilometres in each direction. The inferred fault zone borders the Guichon
Creek batholith for its entire 25-kilometre extent. The Mamit Lake structural zone
has been followed by younger structures, most recently by a graben that
successively down-faulted the “Chataway Lake” formation (Nc) from its
depositional site on an erosion surface at 1500 metres to the level of Mamit Lake,
a vertical drop of about 500 metres. The broad valley of Guichon Creek, which
follows the Mamit Lake fault has inhibited mineral exploration within an area that
appears to be structurally favourable for mineral deposits.
FIGURE 5

GEOLOGY OF THE GUICHON CREEK BATHOLITH

LEGEND

NEOGENE
- g: Mainly late-glacial ice-contact deposits
- mw: Mine waste

PALEOGENE
- Pk: Kamloops Group: mainly volcanic rocks
- PPs: Undifferentiated sedimentary rocks (includes “Coldwater Beds”)
- Ppv: Princeton Group: volcanic rocks

CRETACEOUS
- Ksb: Spences Bridge Group: mainly volcanic rocks

JURASSIC
- JA: Ashcroft Formation: sedimentary & volcanic rocks

Alkaline Intrusive Complex
- Jcd: Diorite
- Jcg: Gabbronorite
- Jcu: Undifferentiated alkaline intrusive rocks

LATE TRIASSIC and/or EARLY JURASSIC
- Tjp2: Intrusive pipes of unknown affiliation

----------- “NORTH-SOUTH” REGIONAL FAULTS -----------

- Tjm: West Marginal Complex
- Tjqd: Quartz Diorite
- Tjp1: Intrusive pipes of unknown affiliation

Guichon Creek Batholith and Adjacent Stocks
- Tjg: Guichon Phase Group
- Tjb: Bethsaida Phase Group
- Tjg: Gump Lake Stock
- Tjc: Coyle Stock
- Tjj: Jesse Creek Stock

TRIASSIC
- Nicola Group
- Knw: Sedimentary & volcanic rocks
- Knl: Limestone-rich unit

- Tnq: Mainly quartzite

- Copper mineralized zone
- Drill-tested mineralized fault zone
REGIONAL MINERALIZATION MODEL

The mines of the Highland Valley copper district, which are located between 8 and 14 kilometres northeast of the Property, have produced almost all of the copper mined in the Guichon Creek batholith. These are the largest producers of copper in Canada, and they generate a substantial tonnage of molybdenum as well. The Highland Valley mines are classified as porphyry copper and copper-molybdenum deposits of the calc-alkaline type. They include several very large orebodies (150 million to more than one billion tonnes) that are spatially associated with regional faults. Almost all of the mineralization occurs along fractures -- and fracture density is considered to be the most important factor influencing ore grade. (Casselman, et al., 1995). North-south and east-west fracturing appear to be dominant (Highland Valley Copper mine staff, pers. comm.) The copper minerals are bornite and chalcopyrite. Pyrite is present, but it is not abundant in the ore. The total sulphide content of an orebody may be less than 2%. The mineralized zones are not enriched in magnetite. Consequently, geophysical techniques other than induced polarization (IP) are ineffective, and even the IP response over a major deposit may be relatively weak, particularly if molybdenum is a co-product. This problem is exacerbated on the plateau surrounding Chataway Lake where deep oxidation beneath an ancient erosion surface has resulted in a drastic reduction of the metallic-mineral content of the near-surface rocks.

The major copper deposits of the Highland Valley area are found mainly within the Bethsaida and Bethlehem phases of the Guichon Creek batholith. However, ore-grade mineralization extends into the adjacent, somewhat older, intrusive rocks, particularly in association with high-level dikes and intrusive breccia. This is not to say that the remainder of the batholith lacks widespread copper mineralization. Deposits of the “vein-type” have been explored and mined on a small scale for more than a century. (These are more properly referred to as shear-related deposits). Most of the more significant prospects occur along or adjacent to north-south regional faults.

The orebody at the former Craigmont mine is classified as skarn type. It was deposited in Nicola Group volcanic and sedimentary rocks, including limestone, adjacent to diorite at the southern margin of the batholith. The key element in the precipitation of copper minerals in this case appears to have been the “reactive” nature of the host rocks rather than the fracture density. The orebody contained some very high-grade ore where limestone was replaced by chalcopyrite.

The photo-geological interpretation outlined a number of very continuous faults within the Guichon Creek batholith that I have termed “N-S regional faults.” An astonishingly large proportion of the known mineral occurrences in the region, including all of the mines and advanced prospects, and most of the significant copper showings, appear to be spatially associated with these structures. The recent copper discoveries in the Rateria area, located west and north of the
property near Chataway Lake, are oriented approximately north-south adjacent to a group of faults, as is the Yubet advanced prospect, which is associated with a late-stage dike along fault of the same set.

I have examined the results of a number of geochemical stream-sediment surveys within the central part of the batholith. The copper values of samples obtained from these surveys are far higher than can be accounted for by the average copper content of the rocks in the area. I carried out test work on a number of streams that followed interpreted north-south faults throughout the area and determined that that the high values (some of them greater than 1000 parts per million) could not have been the result of concentration in the sampling procedure or of downstream movement of copper-rich sediment from known deposits. It was concluded that the fault zones were preferentially occupied by creek valleys from which the stream sediments were collected, and that the anomalously high values reflect the deposition of copper along N-S regional faults. This conclusion is supported by the results from a number of geochemical soil surveys that indicate anomalous concentrations of copper along these faults.

The results of regional stream-sediment sampling published by the B.C. Geological Survey illustrate the regional pattern of the anomalous values (Figure 6a.) This sampling was of particular value because it covered a large area in which the collection and analysis were carried out under uniform conditions. Figure 6 demonstrates a coherent pattern of copper values throughout the entire southern portion of the Guichon Creek batholith. All of the anomalous values (>100 ppm) are confined to the batholith, and the strongly anomalous values follow a trend that extends south-southeast from the Highland Valley mining district. However, the data were too sparse to define the extension of the strongly anomalous zone – and they covered only a very small part of the Property. An
interesting feature highlighted by Figure 6 is that the distribution of the copper values is antithetic to the distribution of copper in the unmineralized rocks of the batholith. [A paper by a Highland Valley Copper geologist stated, “copper decreases dramatically from nearly 100 parts per million in the Border Phase to less than 10 ppm in some of the Bethsaida Phase rocks.”] In other words, the rocks in the core of the batholith are anomalously low in copper, but the stream sediments in the same area are the most anomalous in the region. The implications are that these faults form lines of weakness that are followed by the continuous streams in the area, the ones most likely to be sampled for stream sediment in a reconnaissance survey, and that the regional N-S faults appear to act as a distribution system for copper-rich hydrothermal solutions. The stream-sediment anomaly pattern suggests that the mineralized faults extend at least as far south as the Craigmont mine, at the margin of the batholith, where fractured volcanic rocks and limestone may have provided a favourable environment for high-grade ore deposition from hydrothermal solutions that utilized the regional north-south faults as conduits.

The results of a more detailed stream sediment survey that covered the western portion of the property (Troup, 1992) are shown on Figure 6b. These indicate that extremely high stream-sediment copper values are present throughout this area. Soil geochemical anomalies and mineralization following north-south faults suggest that the association of copper mineralization with faults certainly continues to the south-southeast at least as far as the margin of the batholith.

The concept of north-south faults forming a sort of “plumbing system” for the distribution of copper in hydrothermal solution does not imply that the important deposits are likely to be oriented north-south. Although many of the prospects have a close spatial relationship with north-south faults, the major deposits tend to be more nearly equidimensional -- except for the JA and Highmont. The JA zone is strongly elongated along the Highland Valley fault, and the Highmont deposit follows the Dupuis Creek fault. [The latter fault continues the west to the giant Lornex/Valley deposit.]

It is evident that an individual N-S regional fault zone by itself did not provide the “stockwork” fracturing that are a hallmark of the Highland Valley deposits. This requirement appears to have been fulfilled by cross faulting. I believe that the fault intersections act as the loci for more widespread shattering in a complex process that involves intrusive breccias and high-level intrusions.

The copper deposit at the former Alwin Mine, which lies four kilometres west of the Valley orebody, provides a good exemplar of a deposit (albeit a small one) at the junction of north-south and east-west fault zones. In this case, east-west fracturing is more obvious, and it apparently controls most of the high-grade mineralization found in this mine.
Based on the available evidence I believe that the combination of one or more N-S regional faults and a transverse fault is a necessity for a major ore deposit within the main batholith because of the requirement that the deposit be very large due to the very low ore grade that is characteristic of this region. However, linear fracture zones adjacent to north-south faults and dikes have provided conditions for the deposition of relatively high-grade copper mineralization at several known sites (Yubet, Zone 4, Aberdeen). Under suitable conditions, wider zones of mineralization of this type might contain economically significant concentrations of high-grade mineralization adjacent to the regional faults. Deposits of this type may not be revealed using an exploration approach designed for the discovery of extremely large orebodies. The promising recently discovered Rateria Zone 1 deposit of Happy Creek minerals, which is located 1.5 kilometres west the Chat Block, is a case in point. Although not high grade, this deposit is at least a kilometre in length. The mineralization is restricted to a linear north-south zone that appears to follow a cluster of faults peripheral to the Roscoe Lake fault system. No cross faulting is evident. Three IP surveys covered the area. All three showed weak chargeability indications that failed to resolve the geometry of the deposit. The failure of the geophysical approach to detect this body is understandable. The mineralized zone is relatively narrow relative to the electrode spacings, and the drill logs indicate that the oxidation is very deep (to 300 metres) along the altered fracture zone.

My recent geological activity has been concentrated along the eastern margin of the batholith. This work suggested an entirely new concept for exploration. Diamond drilling at the Dansey prospect, which is located near Logan Lake north of the property, encountered a number of significant copper intersections, some of them quite high grade. The best mineralization was found in a cluster of alkaline diorite pipes that were intrusive into granodiorite of the Guichon Creek batholith. Faults of the N-S regional set were truncated by the pipes. However, mineralization that followed these faults extended into the diorite. The best mineralization in the diorite was deposited in wide cataclastic zones along northwest-trending faults. Although the affiliation of the alkaline diorite with the Alkaline intrusive Complex is unproven, this indicates that the mineralization in the Guichon Creek batholith was emplaced after the intrusion of alkaline rocks that are younger than the main phases of the batholith and the north-south faults. The published age dates for the two types of mineralization and their host rocks are not sufficiently precise to eliminate the possibility that a sort of “unified theory” links the two types of intrusions and their mineralizing events. This could lead to deposits of mixed parentage. The Axe advanced prospect, which is located along the Summers Creek deep-seated fault southeast of Aspen Grove, could be one of these. Both alkaline and calc alkaline intrusions are present in the mineralized area, and both Cu/Mo and Cu/Au zones are included in the resource base.

The high-grade Craigmont deposit was deposited in sedimentary rocks of the Nicola Group at the south margin of the Guichon Creek batholith. The highest
grade ore was precipitated by limestone. The adjacent diorite intrusion is younger than the main stages of the batholith, suggesting that the deposit could be related to the Alkaline Intrusive Complex. The deposit area is covered almost entirely by younger strata (see Figure 4), but rocks of the alkaline complex are widespread in the farther to the south.

A number of regional faults that are inferred to have pre-dated the main period of porphyry copper mineralization are shown on Figure 7 at left. (Only the area between the pair of inferred north-south structural zones that are older than the Guichon Creek batholith is shown in this figure.) Most of the regional faults are sub-parallel to the major deep-seated structural features, but there also are several transverse faults (“east-west faults”). The locations of the major porphyry copper deposits, and most of the significant copper occurrences, are shown as well.

A detailed interpretation of the aeromagnetic data showed linear magnetic “lows” along certain faults. The most prominent one follows the Mamit Lake structural zone for its entire length within the map area. (The gaps in this feature presumably are areas where subsequent alkaline and calc-alkaline intrusions truncated the fault zone.) Three of the major east-west faults are reflected by continuous magnetic “lows.” Fiddler fault, a prominent north-south fault in the eastern part of the map area is followed locally by a distinct magnetic “low”. The association of strong magnetic “lows” with major faults is fairly common worldwide, in my experience. In most cases, it appears to have been due to the destruction of magnetite in wide zones of argillic hydrothermal alteration, and I believe that this is almost certainly the case here. However, while the anomalies indicate that the faults probably acted as the pathways for hydrothermal solutions, the timing of this activity is unknown and it should not be taken as evidence of the existence of economic minerals throughout these zones.

The relationship between regional faults and porphyry deposits in the Guichon Creek batholith is closely paralleled by the geological situation within the Iron Mask batholith. The two major deposits and most of the prospects and small mines are strung out along two northwest-trending faults – the Leemac fault and
the Galaxy fault. The small “mines” of the Makaoo Group are associated with another northwest fault near the north boundary of the batholith. Cross faulting does not appear to play a part in the picture, but the Afton deposit is located at the junction of the two crucial faults, and the Ajax deposit was emplaced astride two branches of the Leemac fault.

The close relationship of mineralization with faulting in the Iron Mask batholith is of interest in the context of the present report because it helps to support my suggestion that the alkaline and calc-alkaline porphyry deposits may be parts of the same metallogenic episode. Rather than engulfing some of the calc-alkaline mineralization, as I earlier supposed, the Alkaline Intrusive Complex actually may have supplemented its growth. Mineralized northwest-trending faults that offset rocks that I believe are related to the Alkaline Intrusive Complex, which includes the Iron Mask batholith, are present along the eastern margin of Guichon Creek batholith and possibly at the Craigmont deposit along the southern margin. The important transverse faults in the Guichon Creek batholith, which bear some resemblance to the Leemac and Galaxy faults, also may be younger than the rocks of the Alkaline Intrusive Complex, but convincing evidence is lacking.

A swarm of northeast-trending faults is interpreted between the Leemac and Galaxy faults north of the Ajax deposit, but they have no apparent association with any mineralization. These faults may well be related to the Northeast Deformation Zone located south of the batholith, which I believe is younger than the porphyry mineralization.
DESCRIPTIONS OF SELECTED TARGET AREAS

The Highland Valley Property is a very large one and, considering its proximity to major porphyry copper mines, it has received relatively little serious exploration activity. Drilling by Moag in 2011 in the north-eastern portion of the Property intersected significant copper mineralization along a north-south fault. Systematic testing has been done on several similar targets in the Rateria area on the adjacent property, but their results indicate that the mineralization appears to be limited to relatively narrow linear zones. (These include the No. 2 zone on the northern extension of the Moag discovery.) My considered opinion is that the widely distributed linear zones of mineralization along north-south faults within the batholith are unlikely to produce a mineable deposit. Accordingly, I believe that next stage of exploration on the Property should be concentrated on targets based on my structural model, as elaborated above, in areas where prior exploration has been inhibited by extensive cover of younger materials. Three areas that fit these criteria are shown on Figure 7.

Skuhun Target

The Skuhun Block is comprised of a single tenure that is isolated from the remainder of the Property. It is located along Skuhun Creek, 12 kilometres south of the Highland Valley Mining District.

The Skuhun Block overlaps the junctions of the east-west Skuhun fault with a group of north-south faults that extend south from the Highland Valley mines. The target area follows the southern margin of the Bethsaida Phase, which constitutes most of the “core” of the batholith -- and is the host for almost all of the mineralization in the mines. The Skuhun fault is reflected by a linear magnetic “low” along its entire length between the deep-seated regional fault zones that are shown on Figure 7.

Within the target area the Skuhun fault is followed by a steep-sided valley, about 1.25 kilometres in width. This valley is filled entirely with sand and gravel of late-glacial origin. A previous drilling test hole was abandoned in overburden at a depth of about 100 metres.
Mamit Target

The Mamit Target area covers the northernmost part of the Property, including the north half of Mamit Lake. Like the Skuhun Target, it follows an overburden-filled valley. In the present target area, this valley follows the Mamit Lake fault zone, one of the regional deep-seated structures that appear to be of fundamental importance in the control of several episodes of intrusion near the end of the Triassic. There also is some evidence to suggest that these faults may have been important factors in the emplacement of the major ore deposits within Quesnellia.

The outstanding feature in this target area is the junction of the Mamit Lake structural zone with the Dupuis Creek fault. Both the “primordial” Lornex/Valley and Highmont deposits are located along the latter fault, 12 kilometres west of the junction.

The Fiddler prospect is located about a kilometre to the west of the property close to the junction of the Dupuis Creek fault with the north-south Fiddler fault. The copper mineralization, which is in meta-sedimentary rocks of the Nicola Group, tends to be disseminated and in blebs rather than in the fracture fillings, more characteristic of the Craigmont deposit than of those in the Highland Valley mining district, suggesting that skarn-type mineralization is a possibility in this area since limestone is a fairly common in the Nicola Group near Mamit Lake (see Figure 2)
The Tap Target area follows the easternmost portion of the Tyner Creek fault close to the southern border of the Property. Like the Mamit Target it features an intersection of a transverse fault with the Mamit Lake deep-seated structural zone. The intersection of the Tyner Creek fault and the Fiddler fault is noteworthy as well. The latter fault has been traced for more than 30 kilometres and it is closely associated with a succession of prospects and old mines including (from north to south) Dansey prospect, Fiddler prospect, Vimy “mine”, Alhambra (Dot) prospect and the Aberdeen “mine.”

No fewer than four other north-south faults have been interpreted to intersect the Tyner Creek fault within the area blanketed by the transported overburden that covers almost the entire target area. [The Tap showing was emplaced in quartz diorite within a small inlier along a canyon that follows Tyner Creek.] The overburden in the Tap Target area is interpreted to be thinner than elsewhere along the Mamit Lake fault zone.
RECOMMENDATIONS FOR EXPLORATION

I have selected the three target areas that I believe offer the best chances for a mineral discovery within the Property. Two of these areas are located at the eastern margin of the batholith and the third lies along a deep, overburden-filled valley close to the centre of the batholith. The dearth of serious exploration in the selected areas, all of which are located close to major copper mines, is due in large part to the problems encountered in exploring for somewhat difficult targets in areas of deep overburden. The major known porphyry copper deposits of the Highland Valley have a very low content of conductive minerals and they are non-magnetic; hence they are not amenable to exploration by geophysical methods that rely on conductivity or magnetic property for their detection. However, induced polarization (IP) surveys are reliant on “chargeability” rather than “conductivity” and modern IP techniques are fully capable of exploration for very low levels of chargeable material to the depths that are anticipated to be present in the target areas. The problem is in the interpretation of the data, since the anomalous indications due to low-grade porphyry copper mineralization can be extremely difficult to distinguish from those due to chargeability effects from a variety of other sources – and the difficulty increases significantly with the depth. This complication is compounded for IP surveys in valleys following major fault zones since both shearing and conductive overburden provide abundant electrical current pathways that tend to reduce the chargeability effect. [Hence the “metal factor” concept that attempts, not entirely successfully, to rationalize the problem by multiplying resistivity by chargeability.]

Geochemical exploration is the method of choice for enhancing the significance of a geophysical anomaly since it indicates the actual presence of the sought after metals, and not merely the prospective physical properties of the ore. However, conventional soil sampling is precluded by transported overburden and bio-geochemical methods are ineffective at depths below a few metres. [Note: I regard till, often referred to as basal till, as non-transported overburden. The most common transported glacial material consists of ice-contact deposits – kames, eskers, kame terraces and other melt-out debris.] A number of techniques for the collection and analysis of soil samples using partial digestions have been devised in recent years for the putative detection of mineralization beneath a cover of barren rock and overburden. I recently examined the results of a fairly large number of surveys by one partial extraction method for clients, and I have directed two programs that utilized the technique. My evaluation of its effectiveness has changed gradually from scepticism to qualified enthusiasm.

The Mobile Metal Ion (MMI) analytical technique is based on the premise of an upward movement of metal ions derived from mineralized rock within the zone of weathering. These ions become concentrated and loosely attached to soil particles just below the base of the organic layer in the soil profile. A process of selective extraction removes these ions from the surface of the grains and an extremely sensitive quantitative analysis obtains the values for an array of
metals. My recent experience suggests that the analytical data on elements other than the target metals and their “pathfinders” also may be very useful in the evaluation of the overall geological environment. The following rather detailed account of my experience with MMI is presented in order to substantiate my decision to advocate this method as a crucial part of the program that is recommended for the exploration of structurally favourable areas on the Highland Valley Property that are covered by thick layers of transported material.

My original exposure to MMI was through detailed examination of earlier surveys made by clients and in assessment reports. The surveys that I examined did not turn up any convincing evidence of the discovery of previously unknown mineralization at depth. However, the MMI data in several cases gave strong indications of the continuity of mineralized zones across fairly wide areas of thin transported overburden that had previously yielded negative soil geochemical results. I concluded that MMI was capable of detection of mineralization beneath relatively thin cover of unconsolidated overburden (at least 50 metres) but that there was no convincing evidence of detection at greater depths or beneath consolidated material. More recently, my evaluation of surveys on two properties that are located within a short distance of Highland Valley Property turned up evidence that strongly suggests that MMI can be a powerful tool in the exploration for mineralization that is covered by a thick cover of materials that preclude the use of conventional soil sampling. Unfortunately the MMI anomalies in these cases have not yet been tested by drilling.

Case History 1
The prospect described here is located along the eastern margin of the Guichon Creek batholith, about 12 kilometres north of Mamit Lake. Extensive diamond drilling has been carried out to test significant mineralized zones within alkaline diorite pipes. An extensive MMI survey was carried out several years ago, but the significance of the most important segment of the MMI data base was overlooked. Most of the survey was carried out within an area of relatively thin till that had undergone conventional geochemical soil sampling. The MMI survey in this part of the property showed essentially the same geochemical patterns as the previous survey, but with somewhat better definition. A small portion of the MMI work extended farther to the east, where it tested a portion of the overburden-filled valley of Guichon Creek in close proximity to the inferred trace of the deep-seated Mamit Lake fault zone.

Within this eastern section, a regional fault that parallels the Mamit Lake structure is clearly indicated by a sharp transformation in the MMI data within an area that is devoid of outcrops -- and of soil copper anomalies from earlier surveys. East of the indicated fault all of the MMI analyses are highly depleted in a group of elements that includes Ba, Cd, Nb, Th, Zn, Zr and all of the rare earths. Within the depletion zone, there are several strong Cu and Mo anomalies that appear to have been deposited in separate events. The anomalous area is located within the western portion of a strong magnetic “low”, the northern
extension of the one that encloses the Mamit Lake fault zone in the Mamit and Tap target areas. To me, these data provide convincing evidence that the MMI technique can detect metallic mineralization beneath continuous barren cover and, moreover, that it can provide evidence of associated intense hydrothermal alteration.

This case history has particular relevance to the present discussion since it is based on data obtained in an area with significant geological similarities to two of the Targets.

Case History 2

This account involves a property on the flank of Greenstone Mountain, located about 25 kilometres northeast of Mamit Lake. It has never been seriously explored, despite its location midway between the two major mining districts. My revised geological interpretation indicates that the area is underlain mainly by rocks of the Alkalic Intrusive Complex. Calc-alkaline intrusions of Late Triassic age are absent, but small bodies of granitic rocks of Early Cretaceous age (“Roper Lake Intrusions”) are widespread in this part of the region. These intrusions host a significant molybdenum resource at Roper Lake south of Greenstone Mountain, and several gold prospects are associated with them in this region as well. An extensive soil geochemical survey was carried out in the western part of the property about 25 years ago that outlined a broad area of anomalous molybdenum and gold. The anomalous area is enclosed by a conspicuous magnetic “low” about two kilometres in diameter. There are scattered very strong soil anomalies, but no coherent strong anomaly areas were defined except for a local cluster of high values along an interpreted north-south fault at the western boundary of the survey area.

Following my geological revision (described above) a 3D-induced polarization survey was carried out over the entire property. A number of chargeability anomalies were noted within the geochemical anomaly area. These were unusual in that they were represented in 3D as steeply-dipping pipe-shaped bodies that mostly failed to reach the surface. [A previous IP survey showed only a single local chargeability anomaly in this area. It was approximately coincident with the only “pipe” that the geophysicists interpreted as having reached the surface in the 3D version.] As it happens, my field geology and photo-geological interpretation indicated that the Roper Lake Intrusions in the region commonly include pipe-shaped bodies of intensely altered and fractured granitic rock, but that they are mainly confined to the lower elevations north of the Greenstone Mountain. Accordingly, I recommended an MMI survey be carried out to test the possibilities that the 3D model was real and that the chargeability anomalies represented mineralized zones of potential economic interest. The same survey also covered the north-south fault zone along the eastern boundary where the earlier geochemical survey had revealed a strongly anomalous cluster of Mo-Au-As samples along a small portion of the interpreted trace of the fault. My field
mapping and photo-geology indicates that this fault is covered by transported glacial material for most of its local extent. The MMI results outlined a strong, coherent Mo-Au anomaly along the western margin of the previous geochemical anomaly. The significant features of this anomaly are that it is coincident with several "pipes" that were interpreted from 3D-IP and that it overlies an area with abundant rock exposure that was weakly anomalous in the previous soil survey. This strongly suggests that the MMI technique is indeed capable of detecting mineralization at considerable depth beneath barren bedrock.

The MMI results along the overburden-covered north-south fault zone gave strong indications of Au and Mo where the previous survey had not. These data confirmed my long-held contention that MMI was very effective in areas of thin cover.

Another product of this MMI survey that is of particular significance is the finding that the group of depleted elements noted in the Dansey MMI results were similarly depleted in those from the Greenstone Mountain survey. The very strong association of the anomalies in the most common economic minerals (Mo, Au, Cu) with these zones of extreme depletion is of particular interest. This is well illustrated by the figure at left, which shows a comparison between Mo and Ce (one of the rare earths) in a portion of an MMI anomaly area.

The case histories are intended as support for the contention that a combination of mobile metal ion and induced polarization surveys could be a very effective means of exploring for mineralization under thick cover of barren material, and there is no implication that the MMI surveys detected economic deposits in either of these areas.
REFERENCES