Enhancing Geophysical Interpretation and Mineral Deposit Modelling Through Knowledge of Physical Rock Properties: Magnetic Susceptibility Studies for Porphyry Deposits in the QUEST and QUEST-West Areas (NTS 093E, K, N)

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Introduction

Knowledge of physical rock properties is necessary for interpretation of geophysical data and maps, and is also essential for constraining geophysical inversion calculations to yield improved three-dimensional (3-D) models of the Earth's subsurface. With recent release by Geoscience BC of a series of geophysical datasets over mineral deposits in west-central British Columbia (Geotech Limited, 2008, 2009; Aeroquest Limited, 2009; Phillips et al., 2009), there is increased interest in improving our understanding of the links between geology and geophysics.

A postdoctoral project was initiated by the Mineral Deposit Research Unit at the University of British Columbia that focuses on understanding the relationships between geology and physical properties in porphyry deposit settings. Study sites for this project include the Mount Milligan copper-gold deposit, the Endako molybdenum mine and the Huckleberry copper-molybdenum mine. These porphyry deposits were surveyed as part of the Geoscience BC QUEST and QUEST-West airborne electromagnetic (EM) and magnetic geophysical surveys (Figure 1). Magnetic susceptibility is the first physical property dataset to be compiled. This report provides a preliminary summary of the characteristic susceptibility ranges for suites of rocks from the three deposits. Data collected from the three deposits reveal three distinct susceptibility distributions. In each case, however, the presence or absence of magnetite may help to distinguish prospective versus barren zones, or else enhance geological mapping in these areas of extensive cover and limited outcrop.

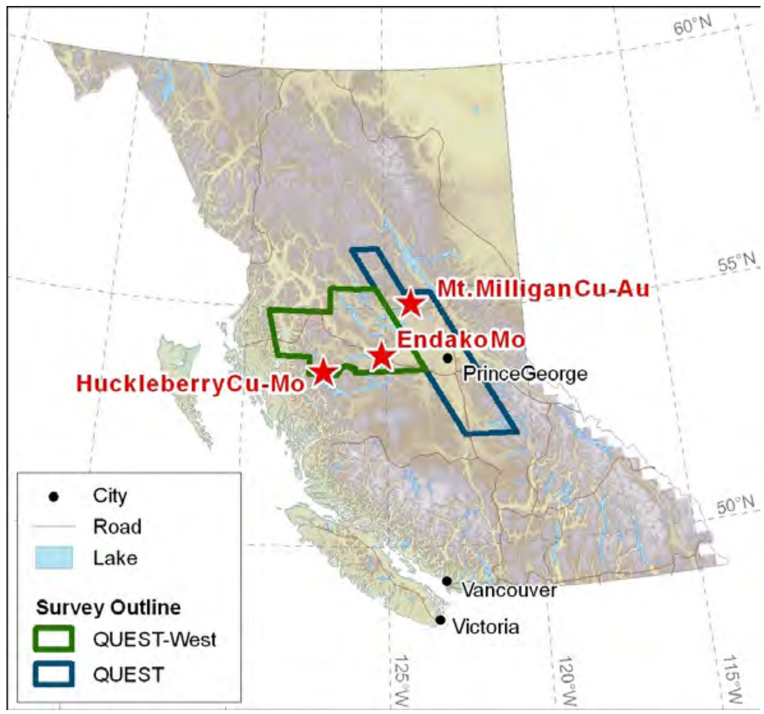

Figure 1. Areas covered by the Geoscience BC QUEST and QUEST-West airborne electromagnetic (EM) and magnetic geophysical surveys of central British Columbia. Smaller scale surveys were completed over several deposits within the larger survey areas, including the three deposits investigated during this study: the Endako, Huckleberry and Mount Milligan deposits (MINFILE, 2010). Base map from Canadian Council on Geomatics (2004) and Natural Resources Canada (2007).

Physical Property Measurements

Representative rock samples for each major geological unit and alteration type were collected from each of the three porphyry deposits. Magnetic susceptibility measurements were taken along selected drillholes, and from the collected samples, using a KT-9 Kappameter hand-held susceptibil-

Keywords: *QUEST, QUEST-West, Mount Milligan, Endako, Huckleberry, porphyry deposit, physical properties, magnetic susceptibility, geophysical inversion*

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ity probe. The suite of samples was sent to the physical property laboratory of Geological Survey of Canada–Pacific in Sidney, BC for further property measurements. Although these data were not available at the time this paper was written, there is a large enough magnetic susceptibility dataset to gain some preliminary insight into how this physical property relates to geological and mineralization processes at each study site, and how the susceptibility distribution may influence magnetic signatures.

Mount Milligan Susceptibility Trends: Alteration-Related Magnetite Formation

Geology of the Mount Milligan Copper-Gold Deposit

The Mount Milligan deposit occurs within the Quesnel Terrane of central BC. The geology underlying the deposit is dominated by augite-phyric basaltic rocks of the Takla Group (Figure 2), a volcanic package that extends over a significant portion of the Quesnel Terrane. Mineralization is spatially associated with two silica-saturated alkalic monzonite stocks. The stocks are part of a suite of Early Jurassic intrusions known to be related to a number of gold-rich alkalic porphyry copper deposits in north-central BC (Nelson and Bellefontaine, 1996). Although the Mount Milligan deposit is subdivided into two zones, the Main and Southern Star zones, the more well-documented Main zone is the focus of this study. Mineralization occurs predominantly in basaltic volcaniclastic rocks in four subzones (the MBX, WBX, DWBX and 66 zones) surrounding the Main zone monzonite stock, with the MBX and 66 zones having higher gold grades relative to the others (Sketchley et al., 1995; Jago, 2008). Hydrothermal alteration, thought to be related to ore-bearing fluids, forms near-concentric zones around the monzonite stock (Jago, 2008). Potassic alteration, manifested by biotite and K-feldspar±magnetite, occurs centrally, passing outward into albite+actinolite+epidote alteration (sodic-calcic zone of Jago, 2008) and then into a propylitic alteration assemblage of epidote+albite+chlorite+actinolite+calcite+pyrite. The MBX, WBX and DWBX mineralization is hosted within rocks exhibiting strong potassic alteration. Gold and copper mineralization within the 66 zone is spatially related to a phyllic alteration assemblage that contains chlorite, sericite and iron-rich carbonate. This mineral assemblage is interpreted to have formed from low-temperature magmatic fluids circulating at higher levels within the Mount Milligan porphyry system (Jago, 2008).

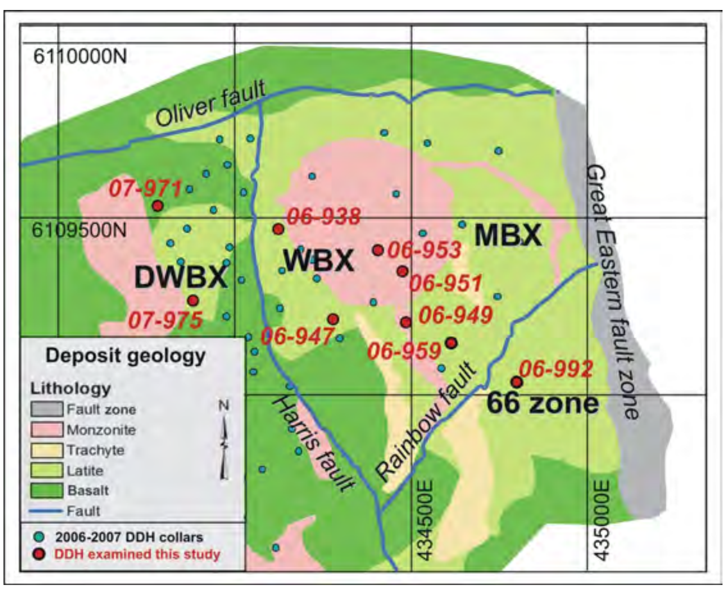

Figure 2. Plan-view geology of the Mount Milligan copper-gold deposit, central British Columbia, showing locations of the four main mineralized zones associated with the 'MBX' monzonite stock. Also shown are the locations of the 2006–2007 drillholes of Terrane Metals Corp. and the holes sampled for this study. Base-map files and collar locations provided by Terrane Metals Corp.

Magnetic Susceptibility Data from the Mount Milligan Deposit

In June 2009, the Mount Milligan deposit site was visited and nine drillholes from the 2006–2007 drilling program of Terrane Metals Corp. were examined and sampled (see Figure 2 for location of sampled drillholes). The drillholes were chosen to best sample representative geology and alteration from each of the different mineralized zones, and to sample least-altered rocks. Susceptibility measurements were taken on 65 samples using the KT-9 Kappameter hand-held probe. Terrane Metals Corp. collected downhole susceptibility data for holes drilled in 2006 and 2007, so there is an extensive database that can be used for analysis. This downhole database will be used to constrain future magnetic inversions for Mount Milligan but is not discussed herein due to an incomplete knowledge of mineralogy of the rocks at the measurement locations. Petrographic work was completed on most of the 65 samples from this study, so there is more control in interpretation of these samples and their associated susceptibility data.

Magnetic susceptibility data from Mount Milligan basaltic volcanic hostrock samples are shown in histograms in Figure 3, and monzonite sample data are plotted in Figure 4. Potassically altered basalt (biotite+K-feldspar; Figure 3) has a range of susceptibilities, but more than half of the samples have susceptibility values $>1 \times 10^{-3}$ SI units, a subset of which have susceptibilities of $>50 \times 10^{-3}$ SI units. Propylitic and albite-altered basalt does not exhibit the very high susceptibilities seen in the potassically altered sample suite, and most samples have susceptibilities of $<10 \times 10^{-3}$ SI units.

Most monzonite samples contain primary magnetite at various stages of destruction or alteration to hematite (Figure 5). Monzonite thus typically has moderate susceptibilities on average (>1 × 10^{-3} SI units; Figure 4), regardless of whether or not it is potassically altered. Secondary magnetite (Figure 5), related to hydrothermal alteration, can further increase the susceptibility. Monzonite samples do not attain the susceptibility values of >50 × 10^{-3} SI units measured in andesitic samples. This is interpreted to be due to the lower initial iron content of the monzonite rocks, which would prevent magnetite formation, but may also be related to the low permeability of the intrusive rocks, which makes them less conducive to alteration or crystallization of secondary magnetite. Albitic alteration of monzonite results in slightly lower susceptibility values (Figure 4).

Discussion

The close spatial relationship between magnetite, biotite and copper mineralization at Mount Milligan has been documented by several workers (Sketchley et al., 1995; Jago, 2008). This relationship is supported by the magnetic highs clearly associated with known mineralized areas on the magnetic map shown in Figure 6. The highest susceptibility measurements collected for this study occur within potassically altered basalt from near the bottom of east-dipping drillholes 07-975 and 07-971, and drillhole 06-959 in the DWBX and MBX zones (Figure 6). Although magnetite veins in a few selected basalt samples crosscut propylitic mineral assemblages, propylitic samples almost always have low susceptibilities. Targeting high-susceptibility rocks (greater than approximately 15 × 10^{-3} SI units) should therefore locate mainly potassically altered basalt, along with some monzonite (which, due to its role in porphyry formation, is also prospective). Less prospective, propylitically altered rocks could consequently be disregarded.

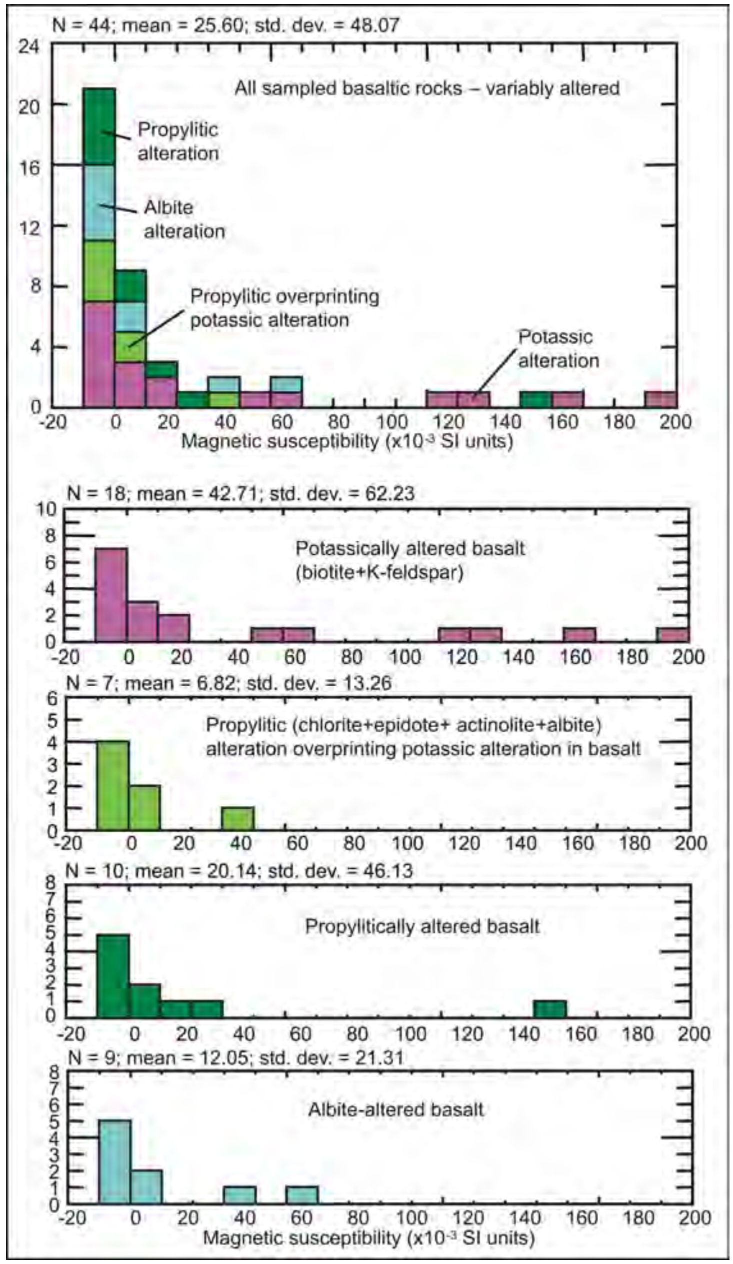

Figure 3. Magnetic susceptibility data for basaltic rock samples taken from drillcore at the Mount Milligan deposit, central British Columbia. Alteration types are shown plotted together in the upper histogram for comparison, and then separately. Abbreviations: N, number of samples; std. dev., standard deviation.

Basalt samples were collected distally from the Mount Milligan deposit for a regional footprint study of alkalic porphyry deposits (Bissig et al., 2010). From the initial assessment by Bissig et al. (2010) of susceptibility measurements, both high-susceptibility (>20 × 10^{-3} SI units) and low-susceptibility (<1 × 10^{-3} SI units), least-altered basaltic volcanic rocks occur within the district. Future petrographic and geochemical work on these distal volcanic samples, and on the more consistently high-susceptibility rocks from the area of the Mount Polley copper-gold deposit, may indicate varying compositions of volcanic rocks throughout the Takla Group and within the laterally equivalent Nicola Group. This preliminary work suggests that it would be important to determine whether or not the volcanic rocks being explored for porphyry copper-gold deposits in this region are magnetite bearing before it is assumed that magnetic highs represent potassic alteration. Least-altered ('background') samples collected during this study from the immediate vicinity of the Mount Milligan deposit are likely weakly altered to inner and outer propylitic mineral assemblages (Jago, 2008). If it is shown that distally these volcanic sequences contain magnetite in their least-altered states, this might mean that, at district scales of exploration, lower susceptibility rocks (indicative of propylitic alteration) should initially be targeted, within which localized areas of high susceptibility (potassic alteration) would be of interest.

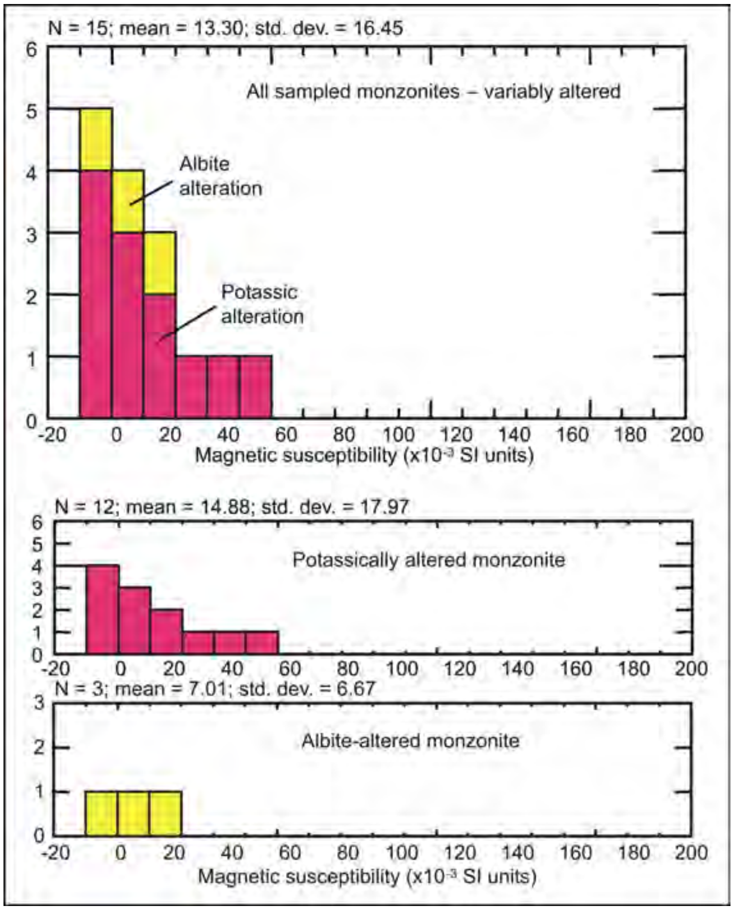

Figure 4. Magnetic susceptibility data for monzonite intrusive rock samples taken from drillcore at the Mount Milligan deposit, central British Columbia. Abbreviations: N, number of samples; std. dev., standard deviation.

Endako Susceptibility Trends: Alteration-Related Magnetite Destruction

Geology of the Endako Molybdenum Deposit

The Endako molybdenum deposit is located in north-central BC at the boundary between the Cache Creek and Stikine terranes. It is hosted by the Endako quartz monzonite (Figure 7), one of the calcalkaline granitoid phases making up the extensive Upper Jurassic Francois Lake intrusion suite. Bounding granitic intrusive rocks, the Francois Lake granite and the Casey granite, are younger than, and intrude, the Endako quartz monzonite (Bysouth and Wong, 1995). The Casey granite has been dated at an age similar to that of late-stage molybdenite mineralization at Endako (ca. 145 Ma; Villeneuve et al., 2001), and the mineralization closely follows the contact between the two granites, suggesting a linkage between the Casey intrusion and the formation of the deposit.

Molybdenite occurs with quartz in a series of east-northeastward-striking vein systems. Proximal alteration phases include a potassic phase and a quartz-sericite phase, characterized respectively by pink K-feldspar and by quartz-sericite fracture and vein selvages of varying widths (Kimura et al., 1976). Quartz-sericite alteration is documented to be most consistently related to molybdenum mineralization (Selby et al., 2000). Pervasive kaolinite alteration overprints all other alteration phases and is considered to be a late, postmineral alteration stage (Selby et al., 2000).

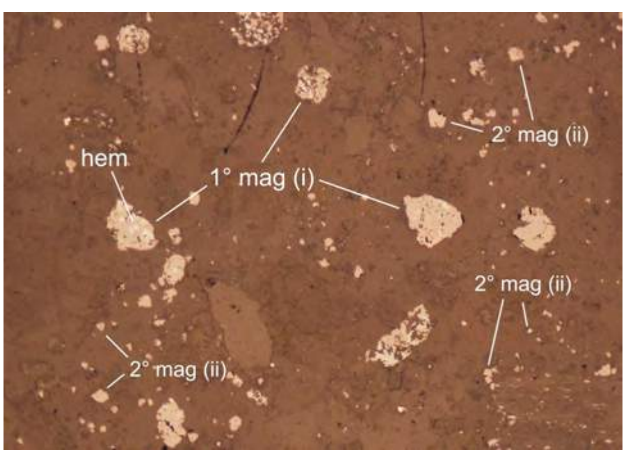

Figure 5. Reflected-light photomicrograph of potassically altered monzonite sample from the Mount Milligan deposit, central British Columbia, showing i) breakdown of primary magnetite (1 mag) to hematite (hem) within monzonite, and ii) subhedral secondary magnetite (2 mag) occurring within the groundmass. Field of view approximately 4 mm.

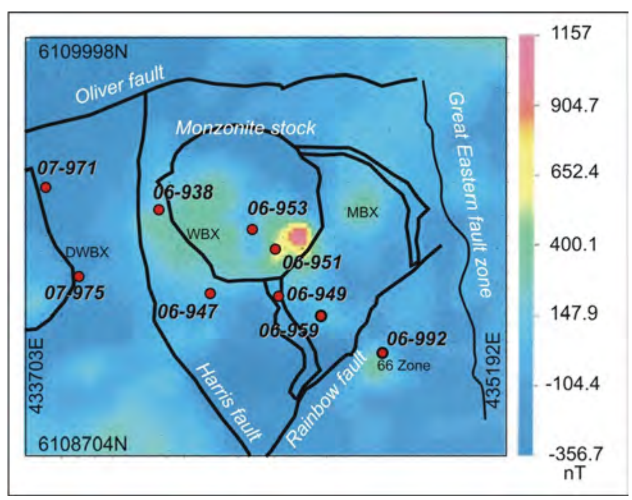

Figure 6. Ground magnetic data over the Mount Milligan deposit, central British Columbia, showing important geological contacts and mineralized zones. Data collected in 1984–1985 by BP Minerals. Abbreviation: nT, nanoteslas.

Magnetic Susceptibility Data from the Endako Deposit

Four drillholes from within and outside the Endako open pits (Figure 7) were examined and 40 representative samples collected of the different granitic units, and of the typical overprinting alteration assemblages. Susceptibility measurements were taken on all samples and also at approximately 1.2 m (4 ft.) intervals along drillcore from two holes, for later incorporation into magnetic-inversion-model calculations. Additionally, a suite of 17 samples was collected from the Endako open pits.

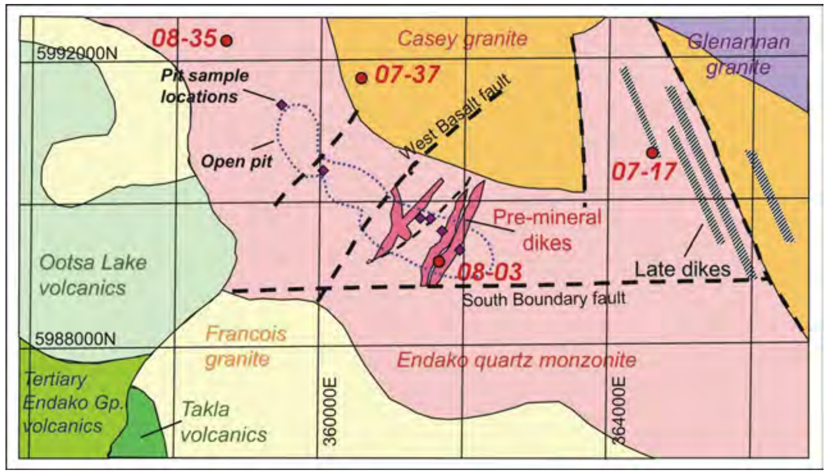

Figure 7. Plan-view geology of the Endako molybdenum deposit (modified from Kimura et al., 1976). The dotted blue line represents the outline of the Endako open pit. Drillholes sampled for this project are indicated by the red circles, and open-pit sample locations are indicated by purple diamonds.

Least-altered Endako quartz monzonite was sampled from the near-surface portion of drillhole 08-35. Susceptibility values, which reflect the presence of accessory magnetite, were relatively consistent along the core, with values around 25×10^{-3} SI units. Some monzonite samples characterized as 'least altered' from other drillcore have low susceptibilities (Figure 8). There is a distinct bimodal distribution in the least-altered sample data, with few samples falling into the gap between 5×10^{-3} and 25×10^{-3} SI units. The lower susceptibility values may be attributed to weak clay alteration of the monzonite. Figure 9 compares a relatively fresh Endako quartz monzonite with a clay-altered monzonite, the associated susceptibility values dropping significantly from 19×10^{-3} to 0.27×10^{-3} SI units.

In order to compare the magnetic susceptibilities of altered quartz monzonite samples, they were grouped based on the predominant or latest apparent alteration phase. All potassically altered samples are overprinted by either later quartz-sericite or kaolinite, and were grouped accordingly. Altered quartz monzonite, regardless of alteration assemblage, is characterized by consistently low susceptibilities (Figure 8), indicating that accessory magnetite is destroyed in association with one or more of the hydrothermal alteration events overprinting it.

Postmineral basalt has generally high susceptibilities. The Casey granite does not appear to contain magnetite and therefore has consistently low susceptibilities (Figure 8).

Discussion

The destruction of magnetite associated with the alteration and mineralization of the Endako quartz monzonite hostrocks results in low susceptibility values. Thus, the use of magnetic and susceptibility data, and related models, may highlight potentially prospective zones within the monzonite. However, late kaolinite alteration, which is not consistently spatially related to mineralization, appears to also result in magnetite destruction. This means that not all low-susceptibility monzonite should be assumed to be mineralized.

Magnetic surveys have been useful in outlining the contact between the low susceptibility Casey granite and the Endako quartz monzonite (Figure 10). Modelling susceptibility in the subsurface via magnetic inversion could help to further define the 3-D geometry of this important contact.

Huckleberry Susceptibility Trends: Overprinting Magnetite Constructive and Destructive Events

Geology of the Huckleberry Copper-Molybdenum Deposit

The Huckleberry deposit occurs within the west-central Stikine Terrane. The underlying geology (Figure 11) is dominated by Early to Middle Jurassic Hazelton Group volcanic rocks and Late Cretaceous Bulkley intrusive rocks (Jackson and Illerbrun, 1995). The intrusion of the Bulkley granodiorite resulted in contact metamorphism (hornfels development) in the volcanic rocks of this area, which added biotite, amphibole, chlorite, magnetite, hematite and pyrite to the host andesite (Jackson and Illerbrun, 1995). Mineralization at Huckleberry occurs in proximity to the granodiorite stocks. The Main zone is located on the eastern flank of the western granodiorite stock, and the East zone occurs within and adjacent to the eastern stock (Figure 11).

Copper and lesser molybdenum occur in narrow veins and as fracture coatings within andesitic hostrocks and, to a lesser degree, within granodiorite intrusions. The geological setting of the Huckleberry deposit is similar to that of Mount Milligan, with volcanic rock–hosted mineralization spatially related to granitic intrusions. The intrusive rocks at Huckleberry, however, are calc-alkalic in nature, as at Endako, and alteration assemblages include sericite and clays, mineral phases that are less typical in alkalic systems (Stanley, 1992). Distal alteration is characterized by chlorite+epidote+pyrite–bearing assemblages. Proximal alteration assemblages include biotite, albite, amphibole, chlorite and sericite. Many of these minerals also occur as alteration selvages to chalcopyrite-, pyrite- and molybdenum-bearing veins. Chalcopyrite-bearing veins commonly have K-feldspar, albite and/or albite-biotite haloes (Figure 12).

Magnetic Susceptibility Data from the Huckleberry deposit

Susceptibility measurements were taken on 25 samples from two drillholes on the Huckleberry property, one hole intersecting moderately mineralized andesitic volcanic rocks in an area currently being mined immediately north of the Main zone and the other intersecting poorly mineralized, relatively unaltered andesitic rocks in the East zone. Downhole measurements were taken at intervals of approximately 1.2 m (4 ft.). In addition, three samples were collected south of the deposit, and are thought to represent both subaerially and subaqueously deposited andesitic volcanic rocks from outside the influence of the intrusions and mineralizing system.

Magnetic susceptibility data from Huckleberry are compiled in a series of histograms in Figures 13 and 14. Andesitic rocks from outside the main mineralized zones have generally low to moderate susceptibilities (<50 $\times$ 10^{-3} SI units; Figure 13). Near the granodiorite intrusions, susceptibilities are typically >70 $\times$ 10^{-3} SI units and range up to 230 $\times$ 10^{-3} SI units. These high values are attributed to the premineral hornfels development in andesitic hostrocks (during contact metamorphism associated with granodiorite intrusion), which introduced magnetite. Within this high-susceptibility zone, susceptibilities can locally decrease slightly (to 30–100 $\times$ 10^{-3} SI units) where mineralized veins and fractures are associated with albite, K-feldspar and biotite alteration selvages. Since the sample population for propylitically altered and biotite-feldspar–altered andesitic samples is limited (15 samples), it is difficult to demonstrate the slight shift in susceptibility that occurs. However, by looking at the distributions of susceptibility data for each of the drillholes, one from a more strongly mineralized area than the other, a slight shift in susceptibility is apparent (Figure 15).

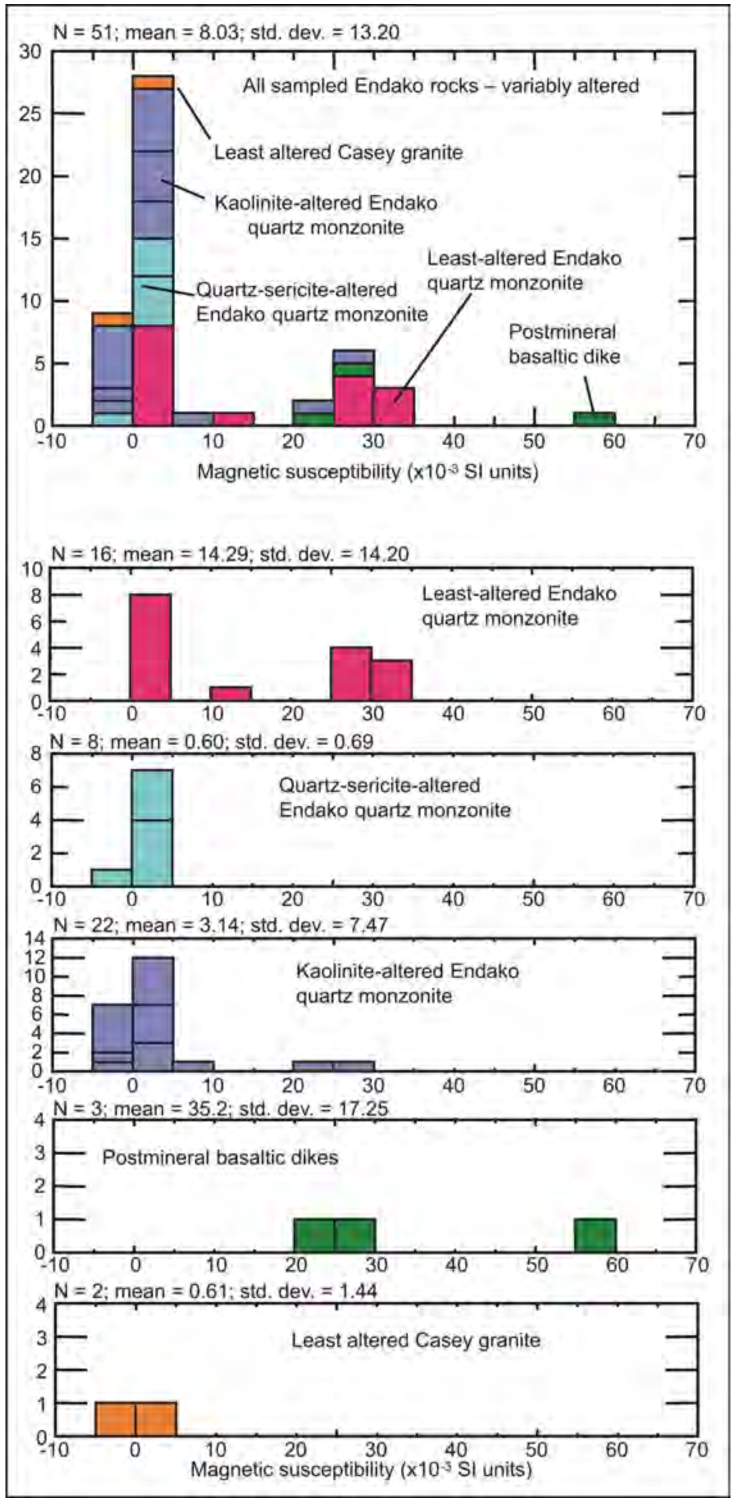

Figure 8. Magnetic susceptibility data from samples of monzonite, granite and basalt dikes taken from drillcore at the Endako molybdenum deposit, central British Columbia. Samples are shown plotted together in the upper histogram for comparison and then separately.

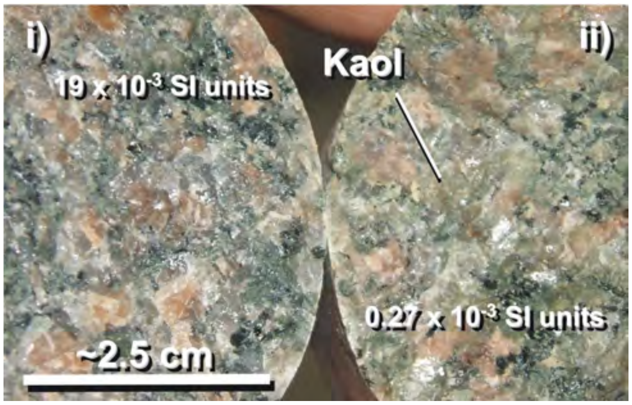

Figure 9. Comparison of least-altered Endako quartz monzonite (i) with weakly kaolinite (kaol)–altered Endako quartz monzonite (ii), Endako molybdenum deposit, central British Columbia. The susceptibility drops significantly between samples, from 19 x 10^{-3} SI units (least-altered sample on left) to 0.27 x 10^{-3} SI units (kaolinite-altered sample on right).

Neither of the two granodiorite stocks was intersected in the two drillholes examined, but nine samples were randomly collected from drillcore stacked at the Huckleberry core repository. From the small sample suite collected, weakly biotite-altered Main zone granodiorite is moderately susceptible (~25–40 $\times 10^{-3}$ SI units), with susceptibility decreasing to around zero with increasing K-feldspar, sericite and clay alteration (Figure 14). The East zone granodiorite was mineralized and therefore mined in addition to the mineralized andesite. This granodiorite has lower susceptibilities (~1 $\times 10^{-3}$ SI units) but also exhibits variable degrees of overprinting clay, sericite and K-feldspar alteration.

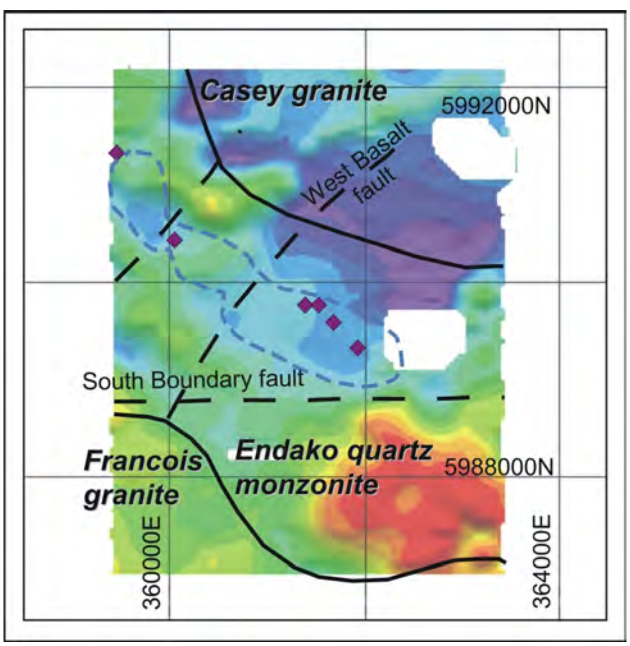

Figure 10. Total magnetic intensity data over the Endako molybdenum deposit, central British Columbia, showing outlines of the open pit (blue dashed line), open-pit samples (purple diamonds), geological contacts (black solid lines) and faults (black dashed lines). Data collected by Aeroquest Limited (2009) as part of the Geoscience BC QUEST-West initiative.

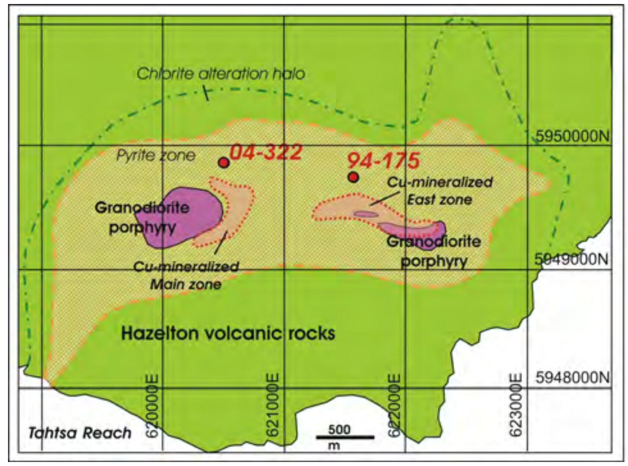

Figure 11. Plan-view geology and alteration of the Huckleberry mine area (modified from Jackson and Illerbrun, 1995), central British Columbia, showing the two mineralized zones, Main and East, and related granodiorite intrusive rocks. Drillholes examined for this study are indicated by red dots.

Discussion

Magnetite-destructive albite and K-feldspar alteration appears to be quite localized, perhaps because of the poor permeability of the very competent hornfels rocks. The applicability of magnetic and susceptibility data in the Huckleberry area to target mineralized veining and fracture zones could therefore be limited. It may not be possible, using geophysics or geophysical inversion, to separate the moderate-susceptibility albite- and K-feldspar–altered andesite from the high-susceptibility hornfels andesite.

Figure 16 shows magnetic data collected over the Huckleberry deposit for the Geoscience BC QUEST-West project. The mineralized zones appear to lie within magnetic lows,

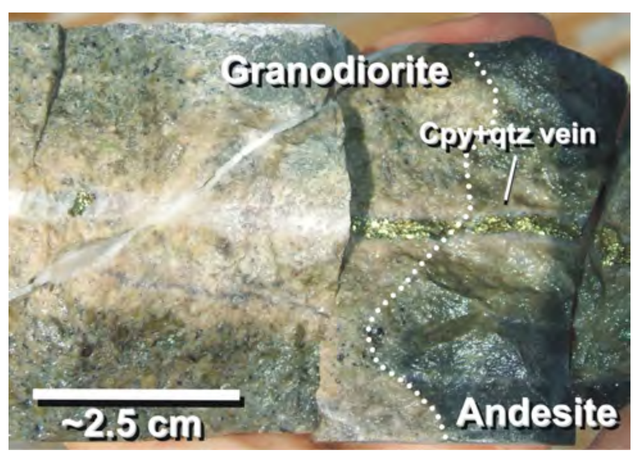

Figure 12. Quartz-chalcopyrite vein with a bleached, K-feldspar–bearing alteration selvage crosscutting andesitic and granodioritic rocks from the Main zone of the Huckleberry copper-molybdenum deposit, central British Columbia.

which likely represent footprints of the relatively low susceptibility granodiorite, possibly combined with proximal magnetite-destructive alteration. If these lows on the magnetic map are related to granodiorite, it is possible that the western intrusive unit extends farther to the west.

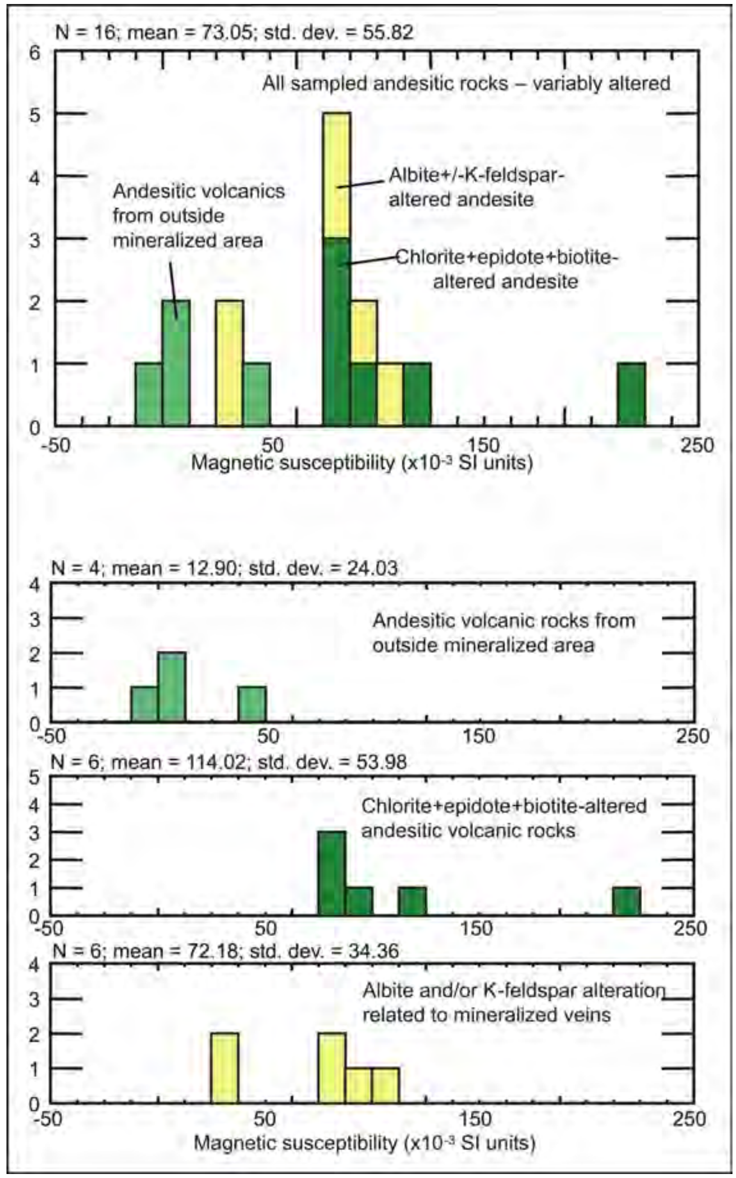

Figure 13. Magnetic susceptibility data for samples of andesitic rocks taken from drillcore at the Huckleberry copper-molybdenum deposit, central British Columbia. Samples are shown plotted together in the upper histogram for comparison, and then separately.

The extent of the broad magnetic high over the area may represent the extent of hornfels development. More regional samples are needed to determine if hornfels development is indeed the cause of strong susceptibility in the Huckleberry mine area. If the Telkwa volcanic rocks are normally magnetite poor, then it may be possible to explore for magnetite-rich hornfels zones within them using magnetic data and modelling. This might help to locate other unexposed Bulkley intrusive rocks in the area and, with subsequent fine-scale geophysics applied, it may be possible to detect variations related to hydrothermal alteration within these thermal haloes.

Summary of Findings

This study was successful in gaining further insight into the magnetic susceptibility characteristics of rocks in a range of porphyry settings in central BC. Both alkaline and calcalkaline systems were considered, and intrusion- and volcanic-hosted porphyry deposits were assessed.

Formation of secondary magnetite in association with potassic alteration, like that occurring at the Mount Milligan deposit, is common within the known alkalic porphyry systems hosted by the Quesnel Terrane (Nelson and Bellefontaine, 1996), and local magnetic anomalies in andesitic rocks should be considered for exploration targeting. Initial regional volcanic rock studies by Bissig et al. (2010), however, indicate that not all basaltic volcanic rocks within the equivalent Takla and Nicola groups are low susceptibility. Magnetic data may not be as useful for targeting copper-gold, porphyry-related, magnetite-bearing potassic alteration if hosting volcanic sequences contain primary magnetite and already have high susceptibilities.

As demonstrated for Endako, it is important to understand the physical properties of regional least-altered hostrocks. Understanding that the Endako granite is a magnetic body makes it possible to use geophysics to map the contact between it and other granites, and to target areas of magnetite-destructive alteration within it.

More data must be collected for background susceptibility of distal Telkwa volcanic rocks to determine if their geophysical signatures differ from volcanic rocks that exhibit hornfels development and are potentially mineralized. Other porphyry deposits near Huckleberry, occurring in spatial association with stocks related to the Bulkley intrusive suite, also exist within contact-metamorphosed volcanic rocks (MacIntyre, 1985). Understanding physical property variations between rocks with and without hornfels development, and within hornfels zones, may help to localize mineralization related to Bulkley intrusions.

The data collected and general trends observed will be useful in helping to understand magnetic data collected over areas that are along strike from mineralization, or over geologically similar settings. The data can also be used to help geologically constrain magnetic inversions in these districts.

Future Work

Continued Physical Property Analysis

Density, conductivity and chargeability measurements on representative rocks from each of the three deposits are being taken at the physical property laboratory of Geological Survey of Canada–Pacific in Sidney, BC. The resulting data will help relate the rocks to other geophysical datasets collected.

Petrographic analysis on Endako and Huckleberry rocks will confirm alteration assemblages, and help identify processes causing magnetite formation and destruction. X-ray diffraction analyses, using the Rietveld method, may be carried out to quantify abundances of specific minerals, such as magnetite and sulphides, that control physical properties. From this, it will be possible to identify whether there are direct relationships between alteration or mineralization and physical property data, making it feasible to use such data as a proxy for alteration or mineralization.

Geophysical Inversion

Three-dimensional (3-D) electromagnetic (EM) inversions on the Mount Milligan geophysical data collected during the Geoscience BC QUEST project are ongoing at the Geophysical Inversion Facility of the University of British Columbia. As part of future work, EM and magnetic inversions will be performed over the Endako and Huckleberry deposits using data collected during the QUEST-West initiative. With an improved understanding of physical property characteristics of rocks in central BC porphyry deposit settings, geophysical inversion models in these, or similar, settings can be constrained in an informed way. Interpretations of the 3-D inversion results will also consequently be more informed.

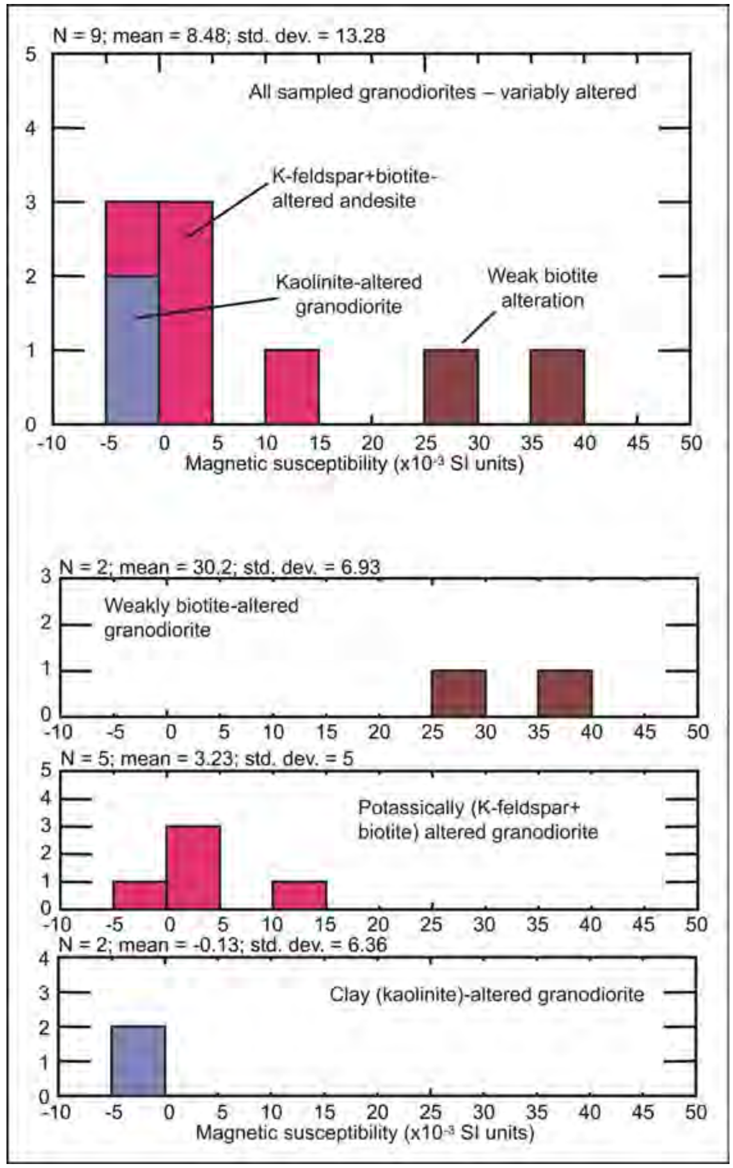

Figure 14. Magnetic susceptibility data for samples of granodiorite taken from drillcore at the Huckleberry copper-molybdenum deposit.

Physical property ranges determined to identify hostrocks, mineralization or prospective alteration can potentially be queried within 3-D physical property models produced from inversion. This type of querying can be especially powerful when multiple inversion models are queried in combination. For example, it may be possible in the Endako deposit area to separate low-susceptibility nonmineralized kaolinite-altered areas from prospective low-susceptibility rocks by considering conductivity or chargeability models.

With continued physical property data compilation for the range of mineral deposit settings in BC, increased quantitative data become available for assessment alongside geological and geochemical data. Use of multiple datasets and quantitative criteria for mineral exploration will help to narrow down and improve confidence in selected regional- and local-scale exploration targets.

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F. Ma of Geoscience BC compiled Figure 1 of this report, using an elevation model prepared by K. Shimamura of the Geological Survey of Canada.

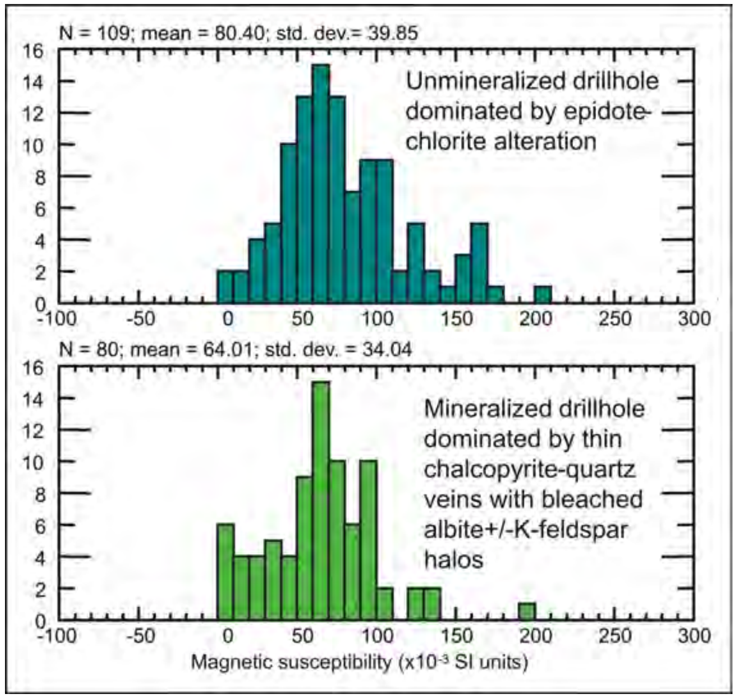

Figure 15. Comparison of susceptibility measurements taken along a poorly mineralized drillhole from near the East zone and measurements taken in a mineralized drillhole from the Main zone, Huckleberry copper-molybdenum deposit, central British Columbia. A slight decrease in average susceptibility values is apparent.

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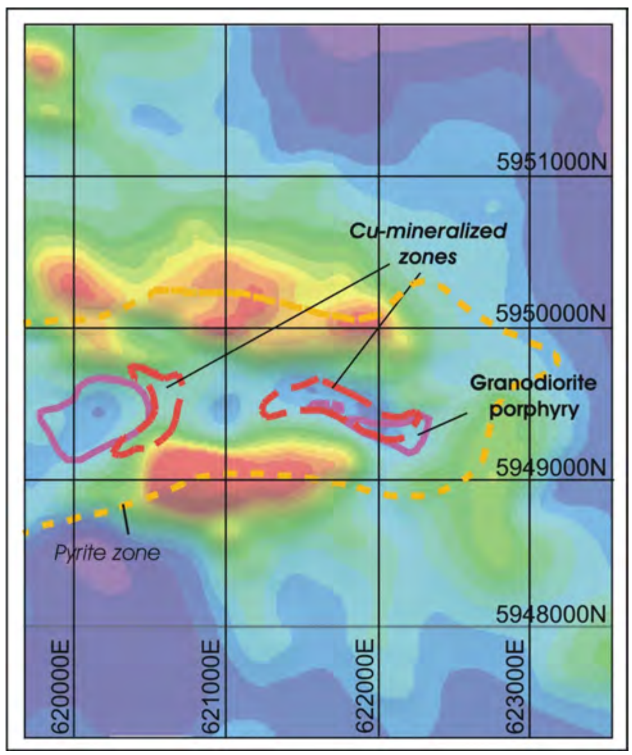

Figure 16. Total magnetic intensity data over the Huckleberry copper-molybdenum deposit, central British Columbia. Outlines of the mineralized zones (red), geological contacts (pink) and pyrite halo (orange) are shown. Data collected by Aeroquest Limited (2009) as part of the Geoscience BC QUEST-West initiative.

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