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COMPARISON OF TAHTSA PROJECT GEOLOGY WITH THE BERG COPPER-MOLYBDENUM PORPHYRY AND REVIEW OF 1981 GEOPHYSICS

ADDENDUM TO GEOLOGICAL INVESTIGATION OF THE SAM, SWING, ET AL. MINERAL CLAIMS

TAHTSA LAKE AREA, B. C.
OMINECA MINING DIVISION
93 E/11 W

Prepared for

TAHTSA MINES LTD.

ARCTEX ENGINEERING SERVICES

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SUMMARY

Similarities between the Berg deposit and geology of the Tahtsa Project are discussed. A pyrite halo which surrounds Berg copper-molybdenum mineralization may be analogous to the pyritic stockwork exposed on the north side of the north ridge. Peripheral lead-zinc-silver veins at Berg may have counterparts in the Captain Vein and in the sphalerite veins within the pyritic stockwork at Tahtsa.

Geophysics has defined shear zones near the Captain Vein which should be explored in conjunction with work in the vicinity of the pyritic stockwork.

INTRODUCTION

The Berg deposit is a major copper-molybdenum porphyry deposit with geological reserve estimates of 400 million tonnes containing 0.4% copper and 0.05% molybdenite. The prospect is located 93 km southwest of Houston, B. C., and 18 km north-northwest of the Tahtsa Lake property of Tahtsa Mines Ltd. The geological setting and certain aspects of alteration and mineralization closely resemble features that have been noted at the Tahtsa prospect. A summary of Bulletin 66 of the B. C. Ministry of Energy, Mines and Petroleum Resources by Panteleyev (1981) concerning comparison with the Tahtsa property.

The magnetic and VLF-EM surveys which were completed in the vicinity of the Captain Vein are discussed in relation to geology.

GEOLOGY OF THE BERG DEPOSIT

The Berg deposit is about 12 km east of the Coast Plutonic Complex in a region of bedded volcanic and sedimentary rocks of Jurassic and Cretaceous age. Bedded rocks have been intruded by a number of Jurassic, Cretaceous and Tertiary stocks. The most important of these is a composite quartz monzonite porphyry plug which is less than 640 metres in diameter. Best grades of copper and molybdenum are found in an asymmetrical annular zone of biotitic hornfels surrounding the quartz monzonite stock. Pyrite and chalcopyrite are the most abundant sulphide minerals and occur primarily in fractures, in quartz veins, and as disseminations. Molybdenite is contained mainly in quartz veins.

The mineralized hornfels is part of the Hazelton Group of Middle Jurassic age. Hazelton rocks are green, grey, red, and maroon lithic tuff, tuff breccia and tuffaceous or epiclastic sedimentary rocks. An andesitic pyroclastic assemblage comprises the majority of the 1675 metres of strata exposed in the mineralized area.

Along the ridge above and to the east of Berg deposit, volcanic and sedimentary rocks of the Lower Cretaceous Skeena Group are exposed. A basal volcanic unit consisting predominantly of feldspathic amydaloidal flow rocks of andesitic or basaltic composition is grey to purple and dark green in colour and is a maximum of 600 metres thick. Overlying the volcanics are from 0 to 500 metres of mainly fine-grained, massive, grey to buff-coloured sandstone. A few pebble conglomerate beds, and thinly bedded siltstone and shale layers are also present. The top of the Skeena is marked by 40 metres of flaggy siltstone and dark brown shale beds.

Upper Cretaceous Kasalka Group unconformably overlies Skeena rocks. A basal member of red to maroon conglomerate ("red bed") containing ferruginous sandstone lenses is 5 to 12 metres thick. The conglomerate is composed of pebbles and cobbles of Hazelton and Skeena volcanic rocks. Overlying the conglomerate is up to 190 metres of strongly jointed hornblende feldspar porphyry and a fragmental unit. The porphyry resembles a sill but may, in fact, be an individual flow. Above the porphyry is 10 metres of red to purple conglomerate (lahar?) followed by 90 metres of basalt or andesite breccia. This in turn is overlain by a 75-metre layer of vitric flows. The lower portion of the Kasalka Group has been termed "Swing Peak Formation" by MacIntyre (1976).

The youngest Kasalka rocks range from intermediate to felsic, dark to pale, and fragmental to massive. Pale grey rhyolite flows and breccia are an important part of this mixed volcanic assemblage which may exceed 100 metres.

The largest intrusion in the Berg area is a quartz diorite which is at least 600 metres wide and several kilometres in length. The intrusion is texturally and compositionally zoned ranging from fine-grained, equigranular to locally porphyritic, biotite hornblende quartz diorite or diorite. The intrusive contact is steeply dipping, somewhat serrated in plan, but continuous without known offshoots or projections. It has no inherent mineralization and has recrystallized intruded rock into a purplish brown hornfels commonly 30 metres or less in width. An Eocene or older age has been estimated for the quartz diorite.

The most economically significant intrusive body at the Berg prospect is the small composite stock of quartz monzonite porphyry. It is composed of at least three phases of coarse-grained, biotite quartz feldspar porphyry that are intruded by at least one crosscutting phase of hornblende quartz feldspar porphyry. All phases of the quartz monzonite are hydrothermally altered and mineralized. The main phases of quartz monzonite have not been observed to intrude the previously mentioned quartz diorite stock and are separated from it by a screen of hornfelsed volcanic rocks, on average about 90 metres wide. The portion of quartz diorite close to the quartz monzonite is strongly altered and mineralized.

An intrusive breccia approximately 450 metres southeast of the quartz monzonite intrudes quartz diorite and pyritic volcanics at the outer edge of the zone of mineralization. It is similar to quartz monzonite in composition and alteration. The breccia pipe is 580 metres long and 175 metres wide. It is thought to be explosive in origin and formed by venting of volatiles related to magma intrusion or by phreatic explosion of groundwater. Other breccias observed in drill holes at the property may also be genetically related to the mineralized stock.

Other minor intrusives have been observed at the Berg property: rhyolite dykes related to the Kasalka rocks; feldspar porphyry sills, which may in fact be flows of the Kasalka Group; and Miocene (and younger?) basalt dykes which intrude all major rock units.

Bedded rocks in the Berg area form a gently eastward dipping succession, younger rocks showing gentler dips. Gentle folding of the Hazelton rocks has taken place.

Fracture patterns indicate predominance of east-northeast and north to northeast trends. Displacements of some tens of metres have been measured along northwesterly breaks. Elongated intrusives may have been influenced by structural breaks during emplacement exemplified by the north-south trend of the quartz diorite.

As previously stated disseminations and stockwork veins of chalcopyrite and molybdenite occur near the margin of the quartz monzonite plug. Outward from the contact, pyrite increases to form a pyritic halo around the zone of Cu-Mo mineralization. Sphalerite with pyrite and some tennantite and galena are found in veins within and peripheral to the pyritic halo as well as in small late-forming quartz and quartz carbonate veinlets in the main Cu-Mo zone.

Supergene alteration caused by weathering, oxidation, hydration, hydrolysis, recrystallization, and leaching by acid solutions is extensive and has resulted in a thick leached capping containing mainly quartz, limonite, sericite, chlorite and clay minerals. At Berg, hypogene alteration zones with dominant quartz-orthoclase and quartz-sericite alteration are developed centrally in the weakly-mineralized quartz monzonite stock and are surrounded by alteration aureoles containing first biotitic cupiferous rocks, then pyritic chlorite-calcite-epidote-bearing rocks. Quartz-sericite-pyrite zones occur extensively along the intrusive contact of the quartz monzonite stock and clay-bearing zones are developed locally in positions intermediate between the intrusive core and pyritic periphery.

Distribution of primary minerals is not readily seen in outcrop because of weathering and sulphide leaching. At surface, rocks are bleached, crumbly masses commonly stained and cemented by limonite. Below approximately 38 metres, secondary copper minerals are deposited in a zone of supergene enrichment which begins approximately at the present water table. Below this zone gypsum, which cements all fractures, remains intact and prevents solution movement.

COMPARISON OF BERG WITH TAHTSA GEOLOGY

Several features which occur at Berg have similarities to the Tahtsa geology. Conversely, some of the characteristics of Berg are lacking or are as yet undiscovered at Tahtsa.

The most striking similarity between the two properties is the geological setting. Nearly identical situations exist where the Kasalka volcanics occupy ridges and have at their bases a red bed conglomerate. The shales and siltstone of the Skeena Group are the next underlying bedded sequence. At Tahtsa the Hazelton Group underlies the east half of the property and probably forms the basement beneath the north and south ridges. Near the west-central part of the "Long" claim a 300 x 900 metre dioritic plug is partially exposed. A diorite dyke cutting pyritic hornfels (?) near the north margin of the north ridge and a nearby granitic outcrop are encouraging signs of intrusive activity. A very small granitic exposure at the extreme southeast corner of the "Sam" claim and granodiorite talus along the southwest part of the south ridge (also in the "Sam" claim) lend additional encouragement to the possibility of "porphyry" type plumbing systems existing at the Tahtsa property. Minor felsite, latite and porphyry dykes along with Tertiary (?) basalt and diabase dykes are common at Tahtsa.

Interestingly, the strongly jointed hornblende-feldspar porphyry which occurs near the base of the Kasalka Group at the Berg property was first thought to be an intrusive sill, but later opinions favour a volcanic flow. At Tahtsa the Unit 3, andesite-diorite, may also be more extrusive than intrusive-related. Other rock units such as the rhyolite breccia and flows and the complex volcanics of the Kasalka Group are also present at Tahtsa.

Two notable geologic units which have not yet been found at Tahtsa are the intrusive breccia pipe and a mineralized and altered plug such as the quartz monzonite.

North-northwest to north-northeast faults are very common at Tahtsa. E-W faults are also present. MacIntyre (1976) suggests that north to northeasterly trends are subsidiary trends within fault blocks bounded by northwesterly faults in the Tahtsa region. Gentle southerly dips of bedded units are common at Tahtsa as opposed to easterly dips at Berg.

At Berg, pyrite content of the quartz monzonite stock is <2%. Pyrite content increases to 6%, 150 metres outward from the contact in the hornfelsic volcanics. A general similarity to this pyrite halo can be seen at Tahtsa, in the weak stockwork pyrite zone on the north side of the north ridge. At higher elevations on the Tahtsa property pyrite may have been significantly leached. At Berg, limonite and goethite display numerous varieties such as granular, coagulate, botryoidal, crusty, etc. and most can be classified as fringing (contiguous) or exotic (transported) types in which a specific source of iron cannot be identified. Many of these criteria fit Tahtsa as does the fact that cellular boxwork or sponge type limonite is rare or absent on the property, and ferricrete is the most abundant accumulation of limonite.

At Berg, distribution of primary minerals is not readily seen at surface due to weathering and leaching but strongly anomalous amounts of copper and molybdenum can be detected by geochemical analyses of the cap rock. Strong copper or molybdenum anomalies have not yet been found at Tahtsa. However, quartz-carbonate-pyrite-sphalerite veins with minor lead and silver occur in the pyritic rocks on the north side of the north ridge as is the case at Berg where pyritic rocks surrounding the stock contain a number of quartz carbonate-pyrite-sphalerite-galena-tetrahedrite veins a few tens of centimetres in width. This type of veining is very similar to the Captain Vein and numerous other occurrences on the "Sam" claim. Also, black amophous iron-manganese oxides that have formed from lead and zinc-bearing carbonate veins have been observed at Berg. This oxide is also common with the main veins at Tahtsa.

At Berg, ore tenor and mineralogy are strongly affected by the downward percolation of acid solutions. Similarly, the present topography also reflects this same leaching system where pyrite has created acid solutions to weather the hydrothermally altered zone along the margin of the stock. At Tahtsa a system similar to this appears to be working. On both sides of the north ridge, deposits of ferric hydroxide which cements detrital material, extremely clay-rich deposits, active precipitation of deposits of limonite and white precipitates (possibly anomalous in zinc), and intensely silicified and leached zones are present. Anomalous zinc and lesser lead and silver soil and stream sediment geochemistry may also be related to the strongly iron-stained north ridge area. Furthermore, theoretically favourable ground in the flats to the north of the north ridge is largely covered by soil.

TAHTSA GEOPHYSICS AND GEOLOGICAL RELATIONSHIPS

Magnetic Responses

In the vicinity of relatively rapid fluctuations in magnetics on L300S + L400S, near the Bennett area, the character of the andesite-diorite, Unit 3, may be one of the causes. Although much of this area is covered, geologic field notes mention weakly magnetic pyrrhotite at two localities slightly to the north:

1) near 200S 2+50W to 200S 3+00W homogenous andesite-diorite porphyry contains 5% disseminated sulphides, local strong pyrrhotite;
2) near a shear zone at L200S, 1+50W and near or within the shear zone at L150S, 1+00W, there is 2-3% pyrite and 1-2% disseminated pyrrhotite.

Perhaps greater concentrations of pyrrhotite are affecting the magnetics on L300S and L400S.

The origin of Unit 3 is not clear. In the Berg deposit, feldspar porphyry sills which may be similar to the Tahtsa Unit 3, which occur in or near the Kasalka Group, have been redefined as extrusive flows.

Map Unit 3 is probably a mixture of porphyry and breccia and is of a questionable intrusive nature. It should be kept in mind that fairly shallow-dipping sedimentary and volcanic rocks occur above this unit on the south ridge. Also a shallow-dipping basal conglomerate outcrops in Swing Creek below the unit. Therefore, if a planar near-horizontal attitude is applied to rocks in the Bennett Lead area, the general outline of the erratic magnetic signature may be accounted for by the topographic relief along the eroded edge of a volcanic flow.

On the west ends of Lines 300 and 400 S the magnetic signature decreases in intensity. Extensive deposits of glacial debris may be acting in a screening fashion. Similarly, talus shoots and fans may be the cause of erratic jumps in the magnetics near and topographically below the Bennett Lead.

Strong jointing of andesite-diorite and breccia near the Bennett Lead trends N75°E 80°N almost perpendicular to the trend of the vein. This jointing is not apparent on the magnetics.

In the eastern part of the grid, the magnetic anomaly at L400S 7+50E may be related to a strong limonite-altered zone as much or more than to a presumed continuation of a fault on line 300S (which did not exhibit a magnetic high).

The magnetic high at L200S 7+00E appears to be related to a fault which follows a drainage. Several metres across the creek bed and up the banks, soft clay is ubiquitous.

The anomaly at L100S 5+75E coincides with a 28° dip VLF anomaly which probably traces a fault or intersection of faults. The same is true for the magnetic high at L0+00 5+50E.

An anomaly at 100N 4+00E is near the conglomerate/volcanic contact. It is also slightly west of a north-south fault.

The conglomerate/volcanic contact along Line 100N is not clearly defined but it does appear that red bed conglomerate, somewhere east of L1+00N 0+25E has a higher magnetic signature of ∿7600 gammas. Overlying volcanics to the west show 7475-7500 gammas decreasing to 7400 gammas slong Line 100S.

Several mafic dykes were mapped in the northeast quarter of the grid area, some up to several metres wide. Undoubtedly more of these features were unmapped and may have caused magnetic highs.

East of the break at L200S 2+00E magnetic signature is generally higher than the area west of the break. A strong fault follows this break. Similar faults and magnetic changes at L200S 0+50E (Captain Vein), L200S 4+25E and L200S 7+00E may be the northerly-trending block faults referred to by MacIntyre (1976) in the Berg report. Furthermore, a N-S cross-section drawn across the claims in this area shows the basal conglomerate at lower elevations in the east while the dip of these beds is toward the west. N-S block faulting with down-dropping steps on the east would account for the conglomerate position.

VLF-EM Responses

Anomaly (a) at L100S 2+50E is coincident with galena and sphalerite veins in a broad shear zone. The anomaly crosses the creek diagonally toward the north. Outcrops in this area did not contain vein material or obvious shears. Diligent search for vein material on the west side of the creek was not successful. As stated by Anderson in the Geotronics report the anomaly can probably be connected to the 8 degree response found on L400S 2+00E. This zone contains alteration and lead-zinc-silver mineralization which is very similar to the Captain Vein. It has a stronger VLF signature than the Captain Vein, therefore shearing with incipient clay gouge and/or greater sulphide content is indicated.

The 32^{o} anomaly (b) at L100S 4+75E is probably fault controlled, possibly at the intersection of two or more faults. A steeply dipping latite dyke and the trend of a felsite dyke are nearly coincident with this anomaly. The north-south fault touching the northwest side of this anomaly is strong and probably continues northward to the fault on the north side of Swing Creek.

In the fault zone at L300S 3+75E, which trends northeast toward VLF anomaly (b), is contained up to 1 metre of fault-clay gouge in a 2-metre-wide shear zone, also with local concentrations of 3-5% pyrite. Several areas show manganese oxides typical of Pb-Zn carbonate vein zones. A fine-grained felsite dyke may parallel this zone. Two small pods, <1 metre wide, of massive felty biotite, were also seen near the creek bed. Near the southern tip of anomaly (b) a small outcrop of andesite-diorite was mapped which contains up to 5% disseminated pyrite. In addition, a few small cobbles or pebbles of manganese-stained volcanics (?) were seen on the debris-covered slopes less than 25 metres east of the centre of anomaly (b).

Anomaly (c) at L100S 5+75E is slightly west (about 25 metres) of outcrops of intensely silicified breccia (as shown on the geology map), which may have contained up to 20% pyrite (and other sulphides?). Faults which are parallel to the trend of anomaly (c) have been noted to the east and south of the anomaly. Perhaps a similar shear zone is responsible for part of the VLF signature.

Approximately 100 metres east of anomaly (c) another weak, linear VLF anomaly was detected. It nearly coincides with a strong fault zone trending north-northwest which contains several metres of clay and gouge.

Most of the other "anomalies" on the VLF grid are less than 10° of dip, which is very weak. They could easily be contoured in other directions across the 100-metre line spacings. Nevertheless, VLF does seem to confirm the geological observations of numerous NNW to NNE trending shear zones in the grid area.

VLF anomalies (a) and (c) are associated with weak magnetic highs. In the general area of the Bennett Lead, VLF anomalies occur at:

L400S 2+25W, L400S 1+00W, L400S 0+00
L300S 1+00W, L300S 0+00

Although weak, they do occur on the west flank of magnetic highs. The VLF anomalies at the Bennett Lead and Captain Veins are associated with fault zones.

It should be noted that some of the geological mapping was done prior to the establishment of the grid, hence there is some discrepancy between geophysical stations and geological locations.

There appears to be a slight error in the location of the lower adit on the alteration map. The location on the geology is more correct. Therefore the coincident VLF anomaly is nearly exactly over the vein.

CONCLUSIONS

Important geologic and metallogenic events associated with the Berg deposit are present or are suggested on the property of Tahtsa Mines Ltd. Exploration for disseminated mineralization should proceed with parameters from Berg to be used as a working model which should be refined as data are collected.

VLF anomaly (a) defines a lead-zinc-silver-bearing fault zone, probably greater than 500 metres long, which has greater conductivity than the similar appearing Captain Vein. Carbonate-sulphide veins and shears occur on strike with anomaly (b). Although only slightly over 200 metres in length, its signature is 32° dip, which is the strongest encountered on the grid. Anomaly (c) is largely covered by overburden but adjacent parallel shears indicate that faulting also underlies this anomaly. A limited amount of exploration should be completed near these anomalies in the event that high-grade direct-shipping mineralization may be present beneath soil cover.

RECOMMENDATIONS

1. Earlier recommendations (2) concerning concentrated exploration in the vicinity of the pyritic stockwork on the north side of the north ridge are supported by analogy to the Berg deposit. Thin sections of several of the rock specimens which were collected in this area during the 1981 programme will be prepared for petrographic descriptions.

2. (i) Fill-in geophysics on 50-metre-spaced grid lines should be completed in the vicinity of anomalies (a), (b), and (c). Surveys should be extended to the north and south as topography permits until the responses are closed off on both ends.

(ii) Dozer trenches should be cut on anomalies (a), (b), and (c) where feasible.

(iii) Following (i) and (ii), the new grid should be mapped on the same scale (1:2000) as the geophysical coverage.

COST ESTIMATE

To complete part 2 of the recommendations if undertaken as part of the programme which was outlined previously:

Magnetics and VLF-EM with grid preparation and report	$ 8,000
Dozer trenching	5,000
Geological mapping, sampling, reporting	4,000
Assays, analyses	500
Supervision	1,000
Camp supplies	1,500
Camp maintenance	1,500
	$21,500
Contingencies @ 10%	2,100
TOTAL	$23,600

REGISTERED PROFESSIONAL ENGINEER
L. B. GOLDSMITH
PROVINCE OF ONTARIO

Respectfully submitted,

Locke B. Goldsmith

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Consulting Geologist

Paul Kallock
Geologist

Vancouver, B. C.

January 7, 1982

ENGINEER'S CERTIFICATE

LOCKE B. GOLDSMITH

1. I, Locke B. Goldsmith, am a Registered Professional Engineer in the Province of Ontario and a Registered Professional Geologist in the State of Oregon. My address is 301, 1855 Balsam Street, Vancouver, B. C.
2. I have a B.Sc. (Honours) degree from Michigan Technological University and have done postgraduate study in Geology at Michigan Tech, University of Nevada and the University of British Columbia. I am a graduate of the Haileybury School of Mines and am a Certified Mining Technician. I am a member of the Society of Economic Geologists, the AIME, and the Australasian Institute of Mining and Metallurgy, and a Fellow of the Geological Association of Canada.
3. I have been engaged in mining exploration for the past 23 years.
4. I have co-authored the report entitled, "Comparison of Tahtsa Project Geology with the Berg Copper-Molybdenum Prophyry and Review of 1981 Geophysics," dated January 1982. The report is based upon fieldwork and research supervised by the author.
5. I have no ownership in the property, nor in the stocks of Tahtsa Mines Ltd.
6. I consent to the use of this report in a prospectus or in a statement of material facts related to the raising of funds.

L. B. GOLDSMITH

Respectfully submitted,

Locke B. Goldsmith

Locke B. Goldsmith, P.Eng.
Consulting Geologist

Vancouver, B. C.

January 7, 1982

GEOLOGIST'S CERTIFICATE

I, Paul Kallock, do state: that I am a geologist to Arctex Engineering Services, 301-1855 Balsam Street, Vancouver, B. C.

I Further State That:

1. I have a B.Sc. degree in Geology from Washington State University, 1970.
2. I have engaged in mineral exploration since 1970, both for major mining and exploration companies and as an independent geologist.
3. I have co-authored the report entitled, "Comparison of Tahtsa Project Geology with the Berg Copper-Molybdenum Prophyry and Review of 1981 Geophysics." The report is based on my fieldwork carried out on the property and from previously accumulated geologic data.
4. I have no direct or indirect interest in any manner in either the property or securities of Tahtsa Mines Ltd., or its affiliates, nor do I anticipate to receive any such interest.
5. I consent to the use of this report in a prospectus or in a statement of material facts related to the raising of funds.

Paul Kallock
Geologist

Vancouver, B. C.
January 7, 1982

REFERENCES

1) Anderson, J. M. 1981. Geophysical Report on VLF-EM and Magnetic Surveys over Swing Peak Property, Tahtsa Lake Area, Omineca Mining Division, B. C.; Geotronic Surveys Ltd.

2) Goldsmith, L. B. and Kallock, P. 1981. Geological Investigation of the Sam, Swing, et al. Mineral Claims, Tahtsa Lake Area, B. C.; Tahtsa Mines Ltd.

3) Panteleyev, A. 1981. Berg Porphyry Copper-Molybdenum Deposit; BCDM Bulletin 66.