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RECOMMENDED EXPLORATION

MT. HALDANE SILVER-LEAD PROPERTY
KENO HILL DISTRICT, YUKON

HALDANE SILVER MINES LTD.

R.J. Cathro, P.Eng.

June 20, 1974

INTRODUCTION

This report describes a recommended exploration program on the Mt. Haldane silver-lead property in the Keno Hill District, central Yukon. These veins were among the earliest found in the district and a few small shipments of hand-cobbed ore were made between 1920 and 1927. The only extensive modern exploration was conducted on the property by Silver Titan Mines Ltd. between 1964 and 1967, under the direction of Dr. A.E. Aho. The writer visited the property three times in the latter stages of that program and has had complete access to previous data on the property. In addition, the writer is completely familiar with the geology and operating conditions in this district, having served as Assistant Chief Geologist and Assistant Mine Superintendent for United Keno Hill Mines Ltd. from 1963 to 1966.

PROPERTY

Haldane Silver Mines Ltd. is the owner of 50 contiguous claims which are registered in the Mayo recording office. The property consists of the following claims:

<u>Claim Name</u>	<u>Grant Number</u>	<u>Expiry Date</u>
Horn 1-8	83295-83302	April 16, 1975
May 1-9	83415-83423	May 25, 1975
Ted 1	83663	August 27, 1975
Ted 3	83665	August 27, 1975
Ted 5	83667	August 27, 1975
Ted 7	83669	August 27, 1975
Ted 9	83671	August 27, 1975
Ted 11-12	83673-83674	August 27, 1975
Ted 13-16 Fractional	83675-83678	August 27, 1975
Ted 17 Fractional	83707	September 18, 1975
Ted 18-20 Fractional	83679-83681	August 27, 1974
Ted 30 Fractional	83691	August 27, 1975
Jo	55321	February 20, 1975
John	55322	February 20, 1975
Andy	55357	October 18, 1974
Middlecoff	55320	February 20, 1975

<u>Claim Name</u>	<u>Grant Number</u>	<u>Expiry Date</u>
Lowell	55324	February 20, 1975
Moon Glow	59960	October 13, 1974
Sybil	55323	February 20, 1975
D.B. 5	83407	May 25, 1975
D.B. 7	83409	May 25, 1975
D.B. 9	83411	May 25, 1975
D.B. 11	83413	May 25, 1975
South 1-2	83425-83426	May 25, 1975
Ray 1-4	Y85716-85719	September 26, 1974

LOCATION AND ACCESS

The Mt. Haldane property is situated at 63°52'N, 132°52'W, within claim sheet 105M/13 (NTS), 220 miles north of Whitehorse and 13 miles west of Elsa, headquarters for United Keno Hill Mines Ltd. Mt. Haldane is a solitary, rugged 6,000 foot peak which is bounded on the north by South McQuesten River and is separated from Galena Hill to the southeast by a wide glaciated valley. The workings are located in Bighorn Gulch, which bisects the northwest side of the mountain into two high ridges.

The property is accessible by a 13 mile road which leaves the Mayo-Keno City Highway 15 miles north of Mayo.

HISTORY

Keno Hill District

Lode silver-lead deposits were discovered by placer prospectors in the Keno Hill district in the early 1900's. The district remained undeveloped until 1913 when sporadic mining began on the rich Silver King vein which outcropped in Galena Creek canyon on Galena Hill. Discovery of the No. 9 (Keno) Mine on the summit of Keno Hill in 1919 and its subsequent development by the Yukon Gold Company sparked a staking rush which resulted in the discovery of a number of major veins. Commencing in 1921 under the capable leadership of Livingston Wernecke, Treadwell Yukon Company Ltd. began acquiring

claims in the area and quickly gained control of the major deposits on Keno Hill, built a concentrating mill, and was shipping over one million ounces of silver per year by 1925. Treadwell Yukon continued to operate until late 1941 when falling metal prices, declining ore reserves, shortage of labour and the untimely death of Mr. Wernecke forced operations to cease. About 44 million ounces of silver were shipped by Treadwell from 1921 to 1941.

In 1945, Frobisher and Conwest interests formed the Keno Hill Mining Co. Ltd. (later reorganized as United Keno Hill Mines Ltd.) and purchased the Treadwell plant and property. United Keno had produced about 115 million ounces of silver up to the end of 1972.

Total production for the Keno Hill district to the end of 1972 is 175 million ounces of silver from 4.04 million tons of ore, at an average grade of about 44 ounces per ton silver.

Mt. Haldane

Silver-lead ore was found on Mt. Haldane prior to the first discoveries on Keno Hill, possibly even before the Galena Creek discovery in 1906. W.E. Cockfield of the Geological Survey of Canada reported in 1918 that two short adits had been driven on a vein on the southern side of Bighorn Gulch (Middlecoff Vein), and that several other veins had been traced, one for a distance of more than 2,000 feet, by surface float. In 1919, the property was taken over by Yukon Silver-Lead Mining Co. Ltd., which drove a third adit 125 feet below the older adits and shipped 27.2 tons in 1920 which graded 90.47 ounces per ton silver and 59 per cent lead.

The Wolf claim, about 1,500 feet northeast of the Yukon Silver-Lead adits, was worked by Mr. A. Johnson starting in 1918. A short adit was driven in the vein (Johnson Vein) and two shipments of ore were made through the Treadwell Yukon Co. in 1926 and 1927, of which 1.484 tons graded 141.75 ounces per ton silver and 60.8% lead, and 0.815 tons assayed 120.6 ounces per ton silver and 52.5% lead.

The property lay idle until it was restaked by E. Bleiler and M. Ewing of Mayo, commencing in October, 1944. Their claims were optioned to Lookout Mountain Mines Ltd. in 1952 but received little work until they were optioned in 1964 to Silver Titan Mines Ltd., which exercised the option in 1966 and transferred the property to a new company, Haldane Silver Mines Ltd. During the period to April, 1967, a vigorous program was conducted under the direction of A.E. Aho. This program consisted of rehabilitation, mapping and sampling of the old workings, a small soil sampling program, bulldozer trenching, 2300 feet of overburden drilling, 1600 feet of drifting and 1750 feet of underground drilling. The camp was then dismantled and, to the writers knowledge, no exploration has been conducted since 1967. Total expenditure to date on the Mt. Haldane property exceeds \$250,000.

GEOLOGY

Keno Hill District

Nearly all of the economic mineral deposits in the Keno Hill district are found in Lower Cretaceous Central Quartzite formation, which is about 3,500 feet thick on Galena Hill. The quartzites are overlain by phyllitic schists and underlain by phyllitic schists and greenstone sills. Greenstone sills are also found in the quartzites, usually in the central to lower portion.

Two gentle anticlinal folds have been recognized in the district. The north-south trending Mayo Lake anticline is the major fold, the western limb of which forms Keno Hill. Superimposed on this western limb is a smaller fold called the McQuesten anticline. This anticline extends westward from the east side of Keno Hill and its axis follows the McQuesten Valley. Galena Hill and Mt. Haldane are on the southern limb, which dips about 30° to the south.

All of the ore mined in the district has come from vein faults in the southern limb of the McQuesten anticline, and nearly all economic deposits have been found where these faults cut the Central Quartzite formation. The vein faults usually strike northeast and dip steeply to the southeast and most of them have normal left lateral displacements ranging from a few feet to several thousand feet. The majority of the vein faults are complex and show indications of many periods of movement and several stages of ore deposition. The vein faults are themselves offset by northwest striking cross-faults. These cross-faults usually dip moderately to the southwest and all have normal right-hand displacements. The cross-faults have movements ranging from a few feet to several thousand feet and are all unmineralized.

Most of the mineralization in the Keno Hill district occurs as simple open-space filling in the vein fault structures. There are no recognizable chemical controls and there is no evidence that mineralization is a near surface feature. The best mineralization is usually found where vein faults cut brittle rocks (quartzite), at vein junctions, and near cross-faults, although mineralization can be found at almost any point on a vein within a mineralized zone. It is also important that the vein fault must have formed under tension rather than compression, and, since many distinct stages of

mineralization occurred, that the vein fault must have been open at a time when the mineralizing fluids were precipitating silver, lead and zinc rather than siderite, pyrite or quartz.

The main ore minerals in the Keno Hill district are silver bearing galena and sphalerite. During most of the productive period of the Keno Hill District, zinc prices were so low that sphalerite was only considered as a by-product in mining the argentiferous galena. The silver content of the galena is largely derived from associated silver bearing tetrahedrite and pyrargyrite. Gangue minerals commonly associated with the ore minerals are siderite, pyrite, arsenopyrite and quartz. Each mineralized vein in the district usually has a fairly consistent ratio between ounces silver and per cent lead although this ratio may vary widely in individual ore shoots within the vein system.

Mt. Haldane

The central part of Mt. Haldane consists of a 4,000 foot thickness of the Central Quartzite formation that strikes approximately east, dips 25 to 30 degrees south and, as already mentioned, is part of the south limb of the McQuesten anticline. Phyllitic schists lie above and below the quartzite, being mainly sericitic on the footwall side and chloritic and graphitic on the hanging wall side.

A zone of north striking vein faults cuts Mt. Haldane west of the peak and has been traced through Bighorn Gulch for a length of almost two miles. The zone seems to coalesce into one main fault structure south of Bighorn Gulch while to the north it branches out into at least five separate veins. The overall strike of the zone is about 10 degrees east of north, with a dip of about 60 degrees west. The vein fault has an apparent right-hand movement of 6,000 feet as indicated by the horizontal displacement of the quartzite formation

The ridge north of Bighorn Gulch is covered by frost-riven rubble which could be up to 50 feet in depth in places. Much of the rubble has been carried from further up the slope by rock glaciers and rock slides. The south slope of Bighorn Gulch contains some outcrop and probably has a shallower cover of overburden. Most of Mt. Haldane has been untouched by recent glaciation although local alpine glaciation must have existed at one time in Bighorn Gulch.

MT. HALDANE VEIN SYSTEM

Middlecoff Workings (South of Bighorn Gulch)

These workings consist of three old adits, with the upper two 40 feet apart in elevation and the lowest 125 feet below the central adit and about 50 feet above Bighorn Gulch. The upper adit was driven on the vein for its entire length of about 40 feet. No definite ore shoot was identified but a select sample of galena from the collar of the adit assayed 318.0 ounces per ton silver and 74.8 per cent lead, and a two foot width of mineralization near the face of the adit assayed 97.8 ounces per ton silver and 15.8 per cent lead. The middle adit was driven 25 feet west to intersect the vein and then followed the vein zone south for a further 90 feet. A sample from the face of the adit assayed 13.6 ounces per ton silver and 8.1 per cent lead over a 5.3 foot width. The lower adit was cross-cut 125 feet west to intersect the vein zone and was then drifted a further 310 feet south. A footwall vein, the "A" vein, was intersected 125 feet from the collar and was drifted approximately 40 feet south, at which point the adit turned right, dropped the "A" vein, and drifted along the "B" vein. Assays from a 20 foot length of the "A" vein averaged 27.4 ounces per ton silver, 20 per cent lead and 0.75 per cent zinc over a 2.7 foot width. An inclined shaft sunk on the "B" vein some 175 feet from the adit collar was reopened and sampled for a slope distance of 45 feet, at which point it was inaccessible due to broken timber and cave.

The 45 foot length averaged 22.6 ounces per ton silver, 18.0 per cent lead and 1.2 per cent zinc over an average width of 3.2 feet. A fourth level was driven in 1919, according to the G.S.C., that was 55 slope distance down the winze and extended at least 100 feet south on the vein, where it connects back to the adit level through a raise. The ore shipped in 1920 is supposed to have come from the fourth level or the raise although no overall grade or size was given. Five selected samples taken from this zone by the G.S.C. averaged 37.9 ounces per ton silver and 31.7 per cent lead.

In 1967, Silver Titan drove a new 375 foot adit at the same elevation as the old middle adit. Part of this footage was used to drive around the old workings and the vein was only seen in three places [75, 100 and 175 feet beyond (south of) the old adit face] because of bad ground conditions. The Middlecoff Vein was found to be terminated by the Ewing Fault. Diamond drilling from the face of the adit located a mineralized vein, possibly the offset portion of the Middlecoff, on the opposite (west) side of the Ewing Fault from the old workings. Core assays from this intersection assayed 81.4 ounces per ton silver and 18.7 per cent lead over a 4 foot length and 10.0 ounces per ton silver and 7.1 per cent lead over a 3 foot length. The true width represented by this core is uncertain because the strike of the vein is unknown. An interesting feature of the vein intersected in the drill hole is that it has a greenstone hanging wall rather than the incompetent graphite schist encountered in the adits. The balance of the drilling was done from the lower adit to explore for other veins parallel to and near the Middlecoff Vein but nothing significant was found.

Johnson Vein (North of Bighorn Gulch)

The Johnson Vein is approximately 1,500 feet north of the Middlecoff workings along strike. The vein strikes about 10 degrees east of north and dips steeply to the west. A trench 400 feet south of the old adit intersected 5 feet of vein material assaying 13.8 ounces per ton silver, 5.5 per cent lead and 1.5 per cent zinc. A grab sample of galena from the vein assayed 156.8 ounces per ton silver and 39.7 per cent lead.

In 1966-67, Silver Titan collared an adit at the 3750 Level in a geochemical anomaly some distance from the old Johnson adit. The anomaly was found to be caused by a weakly mineralized cross fault and considerable difficulty was experienced in locating the veins themselves because the adit was started at a point so far from a known surface position. Of the 1,125 feet of advance, all but a few feet was crosscut. Two veins were intersected by the crosscut, both oriented in the bedding attitude. Two holes were also drilled underground totalling about 600 feet but nothing of interest was intersected.

Main Zone

The main zone is exposed in several trenches on the north side of Bighorn Gulch about 1,500 feet northeast of the Johnson workings. The exposures are on a steep hillside which at this point trends parallel to the vein (almost due north). The vein dips 70 to 80 degrees down the hill (west) and in several areas the hangingwall section of the vein appears to have sloughed down the hill leaving steep slicken-sided bluffs that likely define the footwall of the vein. One trench exposed the vein for a length of 50 feet, where it averaged 4.4 ounces per ton silver, 0.6 per cent lead and 1.6 per cent zinc over a width of 25 feet. The main vein was further exposed in a trench some 300 feet south at which point it was 3.5 feet wide and assayed 22.8 ounces per ton silver, 5.3 per cent lead and 1.4 per cent zinc.

Other Showings

A trench about 600 feet east of the Middlecoff workings exposed vein float from which selected samples assayed 12 ounces per ton silver.

Several areas of vein float material were found by trenching immediately north of Bighorn Gulch, and trenching uphill from the Johnson Vein located two areas with mineralized vein float that assayed between 4 and 11 ounces per ton silver. Altogether, bulldozing indicated the presence of five separate, sub-parallel vein zones on the northern slope of Bighorn Gulch. Most of the veins were poorly exposed because of the great thickness of slide material that occur on this slope. The veins are each separated by an average of 250 feet of quartzite and appear to diverge slightly as they approach Bighorn Gulch. It is possible that the main vein is the same vein that was drifted in the Middlecoff workings.

Mineralization in all showings is fairly similar. The main ore mineral is galena and the main gangue mineral is manganiferous siderite. The exposed float consists largely of manganese oxides mixed with limonite, some quartz, breccia, fragments of country rock, lead oxides and the occasional bit of unoxidized galena.

CONCLUSIONS

Although the vein system explored by the Middlecoff workings, Johnson adit and trenching occurs in the Central Quartzite formation, it exhibits a number of features that are different from veins found on Keno and Galena Hills. It dips west rather than east and has a right-hand displacement rather than left-hand, thus resembling Galena Hill cross-faulting rather than vein faulting. Nevertheless the various structures in the system show ample evidence of mineralization over at least 4,000 feet of strike length.

The drifting program on the Johnson Vein system was at too great a depth below and distance from the known mineral showings for effective initial exploration in the Keno Hill district. Very little new information was gained by the Silver Titan drifting and the potential of the veins north of Bighorn Gulch is still unknown.

The work south of the Gulch, in the Middlecoff Zone, provided more information. It showed that the Ewing Fault is probably the strongest structural member of the Mt. Haldane system, comparable in degree of crushing and movement to the McLeod Vein at the Galkeno Mine on Galena Hill. It was obviously formed under strong compression, is completely unmineralized where seen, and offers no exploration potential. The Middlecoff Vein is a mineralized breccia zone following the footwall side of a narrow tension fracture rather than a true fissure-filled tension vein. The intensity and width of the breccia zone vary along strike and mineralization consists of siderite with patchy galena. This approached economic quantities only near the start of the lower adit and in the winze below it. The only potential for developing tonnage on this structure is below the lower adit and to the north below Bighorn Gulch.

The mineralized vein intersected in a drill hole on the west side (hanging wall) of the Ewing Fault is the most encouraging, not only for its own potential but because it suggests that mineralized tension fractures can be expected at intervals along strike on both sides of the fault. These veins could be loops which terminate against the fault, or "en echelon", parallel structures which diverge from the fault. Both types have produced significant mineral deposits in the Keno Hill district.

The silver content of the Mt. Haldane galena is consistently high enough (ratios between 1 and 5) to justify further exploration. The best potential on Mt. Haldane is for new mineralized veins near the Ewing Fault, where vein development would be expected to be strongest. The best initial targets are near the old Middlecoff workings, where a new vein is known to be present to the south, and in the vicinity of the old Johnson workings. The entire vein system should be explored with grid geochemical sampling, which has been used very effectively by United Keno Hill Mines Ltd. Any anomalies should be explored with bulldozing and diamond or percussion drilling.

SUMMARY AND RECOMMENDATIONS

The Mt. Haldane property is situated at the west end of the Keno Hill district, Yukon, and has a similar geological setting to the known orebodies on Galena and Keno Hills. Several small ore shipments were made from the property between 1920 and 1928, including one of 27 tons grading 90.47 ounces per ton silver and 59 per cent lead and 2.3 tons grading 140 ounces per ton silver and 60 per cent lead. The only extensive exploration was conducted by Silver Titan Mines Ltd. between 1964 and 1967 and it gave inconclusive results.

The potential of the vein system in the vicinity of the old workings has not been adequately tested and a surface program is recommended to both outline the vein pattern and define mineralized zones within it. This program should consist initially of grid soil sampling and prospecting and should cover an area three miles long and a mile wide, aligned parallel to the north-trending vein system and centered on its intersection with Bighorn Gulch. Soil samples should be collected at 200 foot intervals on east trending lines spaced 400 feet apart, and should be analyzed for lead and zinc. Anomalous areas may require more detailed sampling for better definition of the vein pattern.

The second stage should consist of bulldozer trenching and/or shallow drilling with a diamond drill (and possibly an overburden drill penetrating 50 to 100 feet into bedrock) to outline targets for possible future underground development. The drilling can be directed towards the mineralized veins south of the Middlecoff Workings and near the old Johnson adit, as well as towards the better geochemical anomalies.

Diamond drilling costs in the Keno Hill district are relatively high because of the extra care required to recover the friable vein mineralization and because of the broken , hard ground, and the following cost estimate makes adequate allowance for this. In addition, the drilling has been divided into a Stage One portion required to test known mineralization, and a larger contingency to test geochemical anomalies (Stage Two).

Recommended Exploration Budget

Stage One

Grid soil sampling - 50 claims @ \$200 including analyses and interpretation	\$ 10,000.
Shallow drilling of known mineralization - 2000 feet @ \$30 including supervision, assays and camp costs	<u>60,000.</u>

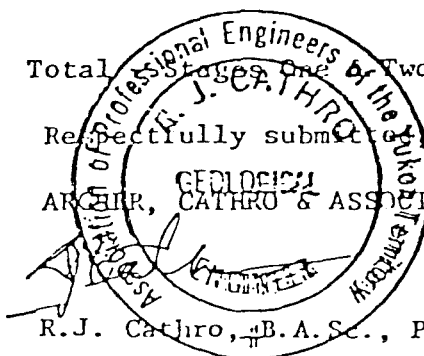
Total - Stage One ----- \$ 70,000

Stage Two

Contingency for additional shallow drilling to test geochemical anomalies - 3000 feet @ \$30 inclusive	\$ 90,000.
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Total Stages One & Two ----- \$160,000.

Respectfully submitted
ARCHER, CATHRO & ASSOCIATES LTD.



R.J. Cathro, B.A.Sc., P.Eng.