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WHITEHORSE, Y.T.

SILVER CITY MINES LTD.

RESULTS OF

PRELIMINARY EXPLORATION PROGRAM

WHITE RIVER COPPER, Y. T.

June 22, 1967

R. J. Cathro, P. Eng. Consultant Whitehorse, Y. T.

061677

SUMMARY AND RECOMMENDATIONS

The White River property of Silver City Mines Ltd. is located 220 miles northwest of Whitehorse, near the Yukon-Alaska boundary. It is 15 miles from the Alaska Highway at a point 300 road miles from the seaport of Haines, Alaska.

The property was discovered in 1905 and has received only sporadic conventional prospecting since that time. A thick, frozen blanket of pumice has been the major obstacle to exploration but modern equipment and techniques can be used to locate and evaluate areas of mineralization.

The copper was probably introduced syngenetically in the Triassic Mush Lake volcanics and later remobilized and concentrated by metamorphism into structurally controlled zones. Bornite appears to be the primary copper mineral but a surface enriched zone to an unknown depth contains chalcocite, native copper and minor copper oxides. A mill concentrate from this material would be expected to grade between 50°/o and 75°/o copper.

The potential of the property remains untested and further work is warranted because of the rich mineralization, accessible location, excellent outlook for copper prices and the possibility of large tonnages of open pit ore.

The next stage of exploration should consist of bulldozing, further soil sampling and 2000 feet of diamond drilling to delineate and sample the discovery showing. This is estimated to cost $60,000.00 If the results of this program are encouraging, deep soil-sampling beneath the pumice and an Induced Polarization geophysical survey should be conducted over the remainder of the property underlain by the favourable volcanics in order to locate new mineralized zones for drill sampling.

INTRODUCTION

Between May 19 and June 14, 1967, geological mapping, an orientation geochemical survey and test EM survey were carried out on the White River property of Silver City Mines Ltd. under the writer's direct supervision. Background information is taken mainly from G. S. C. Memoir 50, Upper White River District, Yukon, D. D. Cairnes, 1915; G. S. C. Memoir 267, Geology of Northwest Shakwak Valley, Y. T., H. S. Bostock, 1952; G. S. C. Memoir 340, Kluane Lake Map Area, Y. T., J. E. Muller, 1967; U. S. G. S. Bulletin 417, White River-Nabesna District, Alaska, Moffit and Knopf, 1910; and G. S. C. Aeromag Map 4260, Canyon City Y. T., 1966.

LOCATION AND ACCESS

The property lies within N. T. S. mapsheet 115 F-15, at 61°47'N and 140°48' W, about 6 1/2 miles east of the Alaska Boundary and 15 miles north of the main front of the St. Elias Mountains. It is 220 air miles northwest of Whitehorse, the nearest aircraft charter base, and 15 air miles from the nearest road point, mile 1168 (White River Lodge) on the Alaska Highway. By road, White River Lodge is 250 miles from Whitehorse and 300 miles from the seaport of Haines, Alaska. The claims straddle White River at Upper Canyon and extend east to the Klutlan (Generc) River.

The only access at present is by helicopter or by aircraft landing on Rifle Lake. This lake will accomodate a well-loaded Beaver with a north wind. A 20 mile winter road could be constructed to the property without difficulty. However, it is virtually isolated to land traffic during warm weather because of its location between the two rivers. Both rivers are glacially fed (rising up to 2 or 3 feet in a single day during summer runoff), milky, and follow braided, shifting courses in wide flood plains.

PROPERTY

The Silver City Mines property covers an area of about 15 square miles and comprises 172 contiguous unpatented mineral claims. An original Crown Grant, "Lost Treasure" (lot 15, grant 901), issued in 1916 and owned by the North American Transportation and Trading Co., of Chicago, lies within the boundaries of the Silver City property. It is some distance from the known showings and is not known to contain anything significant.

Claim Name	No. of Claims	Expiry Date	Grant No.
Marc 1, 3, 5, 7 - 16, 19 - 20, 22 - 66, 68, 70 - 78.	70	July 26, 1968	Y4991 – Y5044
Marc 2, 4, 6, 17 - 18, 21, 67, 68.	8	July 26, 1969	Y5216 – Y5237
Marc 80 - 114	35	July 26, 1968	Y5239 – Y5273
Marc 120 - 136	17	July 26, 1968	Y5279 – Y5295
Slaggard 1 - 2	2	Sept. 4, 1969	90561 – 90562
Goldenhorne 1 - 4	4	Sept. 4, 1969	90563 – 90566
KC 5 - 8, 13 - 20, 73 - 76	16	January 11, 1968	Y11670 – Y11686
KC 1 - 4, 9 - 12, 21 - 32	20	April 5, 1968	Y12359 – Y12378
TOTAL	172		

HISTORY

Native copper had been traded and used by Indians in the Upper White River region for centuries before it was first reported by Hayes, in 1892, from Kletsan Creek, a tributary just inside Alaska. Placer miners prospected the area for copper and gold during the next decade and most of the early copper discoveries were nearer the headwaters of the White River, in Alaska. The Silver City property was first staked in 1905.

Few records exist of early activity in the area, but the fact that Canyon City consisted of only half a dozen cabins in 1912 indicates that exploration activity was short-lived. In 1913, a small but furious gold rush in the neighbouring Chisana district of Alaska attracted more prospectors to the White River area but no further significant copper discoveries were made.

No records exist of further interest in the property until 1943 when Harry Townsend staked two claims, Molly and Carita, to cover the original workings. Townsend was an American field engineer for Anaconda who worked on the property privately. The Canalask nickel-copper property, 15 miles northeast, was discovered in late 1952 and subsequently drilled by Prospector's Airways and Canalask Nickel Mines Ltd. This probably stimulated the staking, in April 1954, of 32 claims surrounding Townsend's claims by Waddington Mining Corp. and Golden Slipper Mines Ltd. In October of that year, an additional 72 claims were staked. All claims lapsed a few years later.

The discovery showings were then staked in 1962 and finally restaked by Rivers in August 1964. Most of the Silver City claims were staked in April, 1966.

PREVIOUS WORK

Most of the early work was done on the Discovery Copper Grant, now staked as Goldenhorne No. 1 claim. When Cairnes visited the property in 1913 for the G. S. C., three adits had been driven distances of 30, 20 and 20 feet respectively near a large slab of native copper found in the overburden. These adits can still be seen but only one, about 30 feet long, is open. It was driven beside a large open cut just above the slab and shows no mineralization. The other two adits are badly caved, but, from the size of the dumps, each is estimated to have reached an ultimate length of at least 50 feet. Specimens of rich mineralization are scattered downslope from these adits. The large slab, weighing 2590 pounds, was moved to Whitehorse in the winter of 1957 - 58 by the Yukon Historical Society and is now located at the McBride Museum.

In addition to the adits, a great deal of open cutting was done and the river bank was well prospected for native copper. A large quantity of nuggets and slabs, perhaps 5 to 10 tons, was found. Part of this was stockpiled at Canyon City and the remainder was presumably removed by collectors or lost in the river during rafting attempts.

An adit and shaft, now caved, were driven further uphill towards Rifle Lake, on Goldenhorne No. 2 claim. No mineralization can be seen in the vicinity. A flume ditch started from the outlet of Rifle Lake (La Feu Creek) probably dates from about the same period. An old adit, some 20 feet long, is reported by Rivers to be present on the Lost Treasure Grant claim close to the river. It was not found by the writer although only a cursory search was made for it as the canyon at the point is precipitous.

The only evidence of previous modern exploration of the property is a base line, 11,000 feet long in a N – S direction, near the flume ditch. An insulated wire on the line suggests that some type of electrical survey was done.

GEOLOGY

General

Except for a few scattered outcrops near Rifle Lake, the only bedrock exposed on the property is in Upper Canyon. Three separate rock units have been mapped. Due to lack of outcrop and the lack of attitudes in the volcanics, the exact lithological sequence is rather indefinite. The rock units present are (after Muller):

Upper Triassic	Mush Lake Group	Andesite and basalt flows, often amygdaloidal or porphyritic, green to purple, strongly altered.
Lower Permian (or older)	Cache Creek Group (?)	Sedimentary Division Siltstone, shale, limestone pebble conglomerate. Volcanic Division Tuff, greenstone.

Cache Creek Group

Volcanic Division: Two distinct sub-units are present: an older tuff and a younger, altered flow. The former is a siliceous, glassy, green rock with good to poor bedding and blocky jointing. It was seen only

on the west side of the canyon. The greenstone occurs there as well and also at the base of the west side of Slaggard Ridge, on the east shore of Rifle Lake. It is a dark green, metamorphosed volcanic flow comprised largely of biotite, pyroxene and feldspar.

Sedimentary Division: The contact between volcanics and sediments seems to be conformable and gradational.The transition zone is poorly exposed but is represented by tuff, mudstone, and tuff-cemented pebble conglomerate on the west side of Slaggard Ridge. The lower part of the division is mostly thin-bedded argillaceous limestone and limy shale, well exposed on the east side on the canyon, upstream from the discovery workings. Above this is a thick-bedded, massive dolomitic limestone, best seen at the southwest side of Rifle Lake. At the top of the sequence is more thin-bedded silty limestone similar to that at the bottom.

Mush Lake Group

This unit consists of green to red and purple amygdaloidal andesite and basalt with minor amounts of tuff and massive green basalt. The rocks are highly sheared and altered where seen near the discovery workings, and display few bedding features. Incipient metamorphism to the greenschist facies is common with secondary epidote, chlorite, carbonate and chalcedony present in veinlets or vessicles. The Mush Lake Group lies unconformably on the Cache Creek Group elsewhere in the district and this unconformity was observed near the mouth of Boulder Creek where flows overlies strongly folded limestone.

Intrusives

No granitic rocks outcrop on the property but a small granodiorite batholith forms the mountainous east wall of the Klutlan River. Aeromag evidence suggests that the intrusive may underlie this river and also the broad, low plain at the east end of the Silver City property. Two aeromag anomalies are found within this low plain but their cause cannot be determined because of the thick overburden cover.

Structure

A major west-dipping thrust fault, the Generc-Tchawsahmon Fault, is postulated by Muller from regional considerations along the east scarp of Slaggard Ridge. Evidence exists for two other strong faults at the property, one crossing White River Upper Canyon at a shallow angle, separating Cache Creek volcanics from Mush Lake rocks; the other following the north-striking east side of Rifle Lake. The former fault was considered by Muller to be a thrust fault branching off the Generc-Tchawsahmon Fault, but little conclusive evidence exists for this. Air photo lineations, aeromag data and the present drainage features suggest that many more faults cross the property.

Block faulting and tilting is suggested by repetition of the limestone-volcanic contact. Locally, folding seems to be complex but the lack of bedding features in the volcanics prevent a satisfactory explanation.

Glaciation

The present topography is mainly a result of recent glacial action. Slaggard Ridge, the highest elevation on the property, was once the floor of a wide valley carved by the Ruby Ice Sheet. Later, during the St. Elias Glacial Advance, Klutlan Glacier advanced almost to the Shakwak Valley, scouring a broad northwest trending valley to Tchawsahmon Lake. The west side of the glacier passed close to the site of Canyon City and carved the abrupt east slope of Slaggard Ridge. At the same time, Russell Glacier advanced to about the top of the Upper Canyon from the headwaters of the White River in Alaska.

A large terminal moraine was formed by the Klutlan Glacier about six miles downstream from the present junction of the White and Klutlan Rivers. Until the White River was able to cut its way through this dam, a glacial lake was formed and lacustrine clay was deposited up to 100 feet above the present river elevation. Concurrent uplift of the St. Elias Range and Coast and rapid runoff and retreat of the glaciers caused the White River to swiftly cut its way down some 300 feet and form the Upper Canyon. The resulting river gravels, combined with the outwash from the retreating Klutlan Glacier has produced the present wide flood-plains below the Upper Canyon.

White River may have flowed through Rifle Lake at one time as the river appears to have followed fault scarps throughout this period of rejuvenation.

Recent Volcanic Pumice

In geologically recent times, a volcanic explosion occured in the southwestern corner of the Yukon. The exact location has not been pinpointed but is believed to be at the floot of the Natazhat Glacier, 12 miles southwest of Rifle Lake. The date of the explosion was between 200 and 500 AD (1450 to 1750 years ago).

The material produced by the explosion ranged in size from coarse fragments of pumice near the crater to very fine ash further away, and was rhyolitic to dacitic in composition. The ash was dispersed by prevailing winds into two large fans, one stretching 450 miles east and the other 250 miles north. The thickness of the layer naturally decreased with distance from the source.

On the Silver City property, the pumice is subangular to rounded, somewhat spongy, creamy white and generally about 1/16 inch in size. A few fragments up to 1/4 inch in length are seen but size is generally uniform with no indication of graded bedding. Average thickness of the layer is from one to two feet but appears to vary quickly from almost nill to an unknown maximum thickness. Following deposition major dust storms undoubtedly developed and most accumulations over 2 feet in thickness are due to wind action rather than water.

Only on steeper slopes and sharp ridges has the pumice been blown or washed away to expose the mature soil profile and outcrop present before the explosion. The pumice blanket is tightly cemented by permafrost and insulated by a thick, widespread moss layer and is a major exploration obstacle.

East of Slaggard Ridge, prominent flow lines can be seen in aerial photos, probably representing sheet wash accumulations of pumice on the almost level slope.

MINERALIZATION

The only confirmed source of mineralization on the property is from the immediate vicinity of the discovery workings in Upper Canyon. Mineralization has been rumoured to occur on the Klutlan River, on the Lost Treasure Crown Grant, and in Boulder Creek but was not seen in these locations during the present survey.

Most of the discovery workings are now badly caved and slumped. They consist of at least three adits and a number of pits and open cuts. Bedrock is partially exposed by several true outcrops, one of the adits and several pits. Only minor amounts of copper mineralization can actually be seen in place. On the other hand, rich mineralization is common in the adit dump material. Pieces of native copper can still be found in the overburden in the form of rough slabs, irregular dendritic forms, and rounded nuggets. It is likely that the bulk of the native copper removed from the property was found at the foot of the hill along the river.

Copper is present in two principal forms: (1) as native metal in the overburden, and (2) as intimate chalcocite-bornite mixtures, replacing and filling fissures and veinlets in the amygdaloidal flows. Chalcocite appears to have formed by alteration from bornite but this has not been confirmed by microscopy. Contacts of the veinlets and wall rocks are sharp. Calcite is usually associated with the copper sulfides. The lack of exposures of sulfide veinlets in place prevents a study of the fracture system or a useful sampling program.

Two other minor, but perhaps significant types of copper occurrences were noted. Occasional fine flecks of native copper were seen in pieces of volcanic wall rock on the dump and, in one outcrop, two small patches of chalcopyrite were seen replacing volcanics. Copper oxides, mainly azurite and malachite with lesser amounts of cuprite, are widespread.

For many years this deposit was considered to consist of veinlets and flecks of native copper. The nuggets and slabs found by early prospectors in the river bank were traced uphill in the conventional manner to their supposed source. It is significant that most of the pits and adits failed to encounter copper and the one adit which did intersected sulfides rather than native metal.

During this mapping program, fist-size nuggets were found on the uphill edge of the discovery showings indicating that another mineralized zone exists uphill. It is even possible that the source of all the native copper is uphill and has not yet been found.

The writer is of the opinion that much, if not all, of the native copper in the area has precipitated in the overburden after being released in solution by the weathering of buried sulfide mineralization.

Mineral deposits in this area would be expected to exhibit surface enrichment due to oxidation, probably related to the older topography which has been modified by the Ruby glaciation and rejuvenation of White River. Native copper can be expected at surface, rapidly giving way to chalcocite and finally bornite at depth. Copper concentrate from the upper few hundred feet could thus be expected to carry from 50 to 75 percent copper. Cairnes felt that chalcopyrite was likely the primary sulfide rather than bornite. It is the writer's opinion that there is insufficient evidence on which to make this assumption and that until the relationship between the chalcopyrite and bornite can be studied the composition at depth will remain a mystery. A representative hand picked specimen of chalcocite-bornite replacement mineralization assayed 11.4 ^{o}/o Cu., trace gold, and 0.44 oz/ton silver, indicating that precious metal content is low.

The association of copper with Upper Triassic volcanics is widespread in the southwest Yukon. There seems little doubt that in the White River area, syngenetic copper in the flows was mobilized by metamorphism and deformation to become localized in structurally complex zones.

GEOCHEMICAL SURVEY

Three test pits were dug in separate locations to examine the overburden profile of the property. The average profile, from top to bottom is as follows:

1. 3 inches to 6 inches moss and peat derived from recent surface vegetation.
2. 1 foot to 2 feet of pumice varying from brown to white in color.
3. 4 inches to 8 inches of organic soil and peat representing the pre-eruptive vegetation.
4. A clay horizon, possibly a true "B" horizon, of undetermined thickness.

In all cases, the soil was permanently frozen within a few inches of surface. Little thawing of this permafrost can be expected during the summer because of the insulating surface layer of moss and peat.

On the basis of the test-pits it was decided that reconnaissance soil sampling to the "B" horizon could not be done with hand tools, and the program was restricted to (1) an orientation survey in the vicinity of the old showings, and (2) reconnaissance silt sampling along the steep east bank of the Upper White River Canyon and

the West side of the Klutlan River.

(1) Orientation Survey: The orientation survey was made possible by the fact that the old showings occur on a steep slope where much of the pumice has been washed away or has been partially mixed with soil by downhill slumping. Permafrost in this area was less intense due to a general absence of moss. Samples were taken on 100 foot centres on lines running up and down the hill and an area of about 1500 feet by 700 feet was covered. A distinct soil anomaly was found along a length of approximately 500 feet, parallel to the hillside, just below the two uppermost adits. This anomaly extends downhill almost to the river (about 500 feet) and tends to fan out on the lower edges. Rock chips taken from outcrops near the old showings assayed between 110 p.p.m. and 3100 p.p.m. copper while rock chips from the same formation elsewhere on the property assayed between 50 p.p.m and 153 p. p. m. copper.

(2) Silt Sampling: All streams draining the property west into White River Canyon and east into Klutlan River were silt sampled. No anomalies were located but the effectiveness of this sampling is questionable, particularly along the bank of the Klutlan River because the streams generally flow through lacustrine clay and silt deposits of unknown thickness.

The limited geochemical exploration conducted to date indicates that soil sampling will be an effective exploration tool – as long as the ' B" horizon, below the ash and pre-eruptive vegetation layer, is sampled. For most of the property bulldozing or overburden drilling will be required for this job. It is the writer's experience that power augers or their equivalent cannot be effectively used where the permafrost is heavy.

GEOPHYSICS

A test electromagnetic (EM) survey, using a Ronka EM16 instrument, was conducted over the grid lines in discovery area by H. S. Aikens of P. H. Sevensma Consultants Ltd. A zone of weak conductivity striking about N20^{O}W was found just downhill from the upper adits. Although this response was very weak it could represent a zone of mineralization as, at best, this type of deposit is only expected to respond weakly to electromagnetic techniques. The full significance of this survey will not be know until the extent of the mineralization is determined by diamond drilling.

The only magnetically responsive rocks encountered during outcrop mapping are located in the lower Cache Creek Group at the north end of Slaggard Ridge. Visible disseminated magnetite was noted in one outcrop.

CONCLUSIONS

Due to adverse surface conditions, conventional prospecting proved unsuccessful over the years in evaluating the White River copper showings. Except for the fortuitous location of the Upper Canyon even the known showings would have remained undiscovered under the thick cover of pumice.

The initial exploration program has proven that soil geochemistry can locate mineralized areas and has suggested that electro-magnetic surveys may be effective in detecting and tracing mineralized zones. The program has further shown that the rocks of economic interest are the Mush Lake volcanics and that mineralization has concentrated in structurally complex areas within this formation. Regional mapping and airphoto interpretation indicates that additional structurally complex areas, favourable for mineralization, are possible within the overburden covered parts of the property.

The richness of the known mineralization, the good outlook for copper price, the unexplained source of the native copper float, and the favourable location of the property in relation to existing transportation routes makes further work attractive.

Further work falls naturally into two programs: (1) the evaluation of the discovery showing, and (2) exploration of the property of other areas of mineralization. Evaluation of the discovery showing can only be done effectively by diamond drilling. Exploration efforts on the remainder of the property should concentrate on that part underlain by the Mush Lake volcanics. The only feasible approach is a combination of deep soil sampling and geophysics followed by drilling.

The next stage of exploration should consist of bulldozing, further soil sampling and 2000 feet of diamond drilling to delineate and sample the discovery showing. This is estimated to cost $60,000.00 If the results of this program are encouraging, deep soil-sampling beneath the pumice and an Induced Polarization geophysical survey should be conducted over the remainder of the property underlain by the favourable volcanics in order to locate new mineralized zones for drill sampling.

White River Copper Property:

Diamond Drilling	$ 25,000.00
Bulldozing and Trenching	15,000.00
Geochemical Survey	2,000.00
Consulting Engineering and Supervision	5,000.00
Transportation	4,000.00
General Administration	4,000.00
	$ 55,000.00
Contingencies	5,000.00
Total Estimated Cost	$ 60,000.00

Respectfully submitted,

ARCHER, CATHRO & ASSOC. LTD.

"R. J. Cathro"

R. J. Cathro, P. Eng.

RJC:pc

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June 22, 1967.

CERTIFICATE

I, Robert J. Cathro, with business and residential address in Whitehorse, Yukon, do hereby declare that:

(1) I am a consulting geological engineer.

(2) I am a graduate of the University of British Columbia, 1959.

(3) I am a registered professional engineer in the Yukon and British Columbia.

(4) From 1959 to 1966 I was engaged in mining and exploration geology and held positions of responsibility with United Keno Hill Mines Ltd., Giant Yellowknife Mines Ltd., and Eldorado Mining and Refining Ltd.

(5) I have personally studied the maps and reports referred to in this report and supervised the exploration of the White River Copper property owned by Silver City Mines Ltd.

(6) I have no interest, nor do I expect to receive any interest, direct, or indirect, in any properties or companies referred to in this report.

Respectfully submitted,

"R. J. Cathro"

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