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MEMORANDUM REPORT OF THE EXPLORATION WORK IN 1970
ON THE ATNA MINES LIMITED PROPERTIES, SALMON RIVER,
DISTRICT OF BRITISH COLUMBIA, CANADA

INTRODUCTION:

A detailed geological investigation and evaluation of the subject properties was initiated and carried on during June, July and August of 1970 by Holt Incorporated personnel for the Colorado Corporation of Denver, Colorado. Due to the scope of the investigation and the brevity of the field season, the contemplated field work has not yet been completed. Compilation and interpretation of the data gleaned during this past field season is still underway. This provisional report has been prepared at the request of Dr. Stanley Jerome, Donaldson Securities Limited.

SUMMARY AND CONCLUSIONS:

The exploration targets and concepts which motivated the inception of this project are still valid after the first stage of field investigation. The field work has disclosed and more closely defined several areas of exploration interest by reason of their geologic aspects. The potential for economic concentrations of gold, silver, lead, zinc and molybdenum is considered to be good. The property should continue to undergo the thorough geologic development and exploration as originally planned.

LOCATION:

The properties of the Atna Mines Limited lie north of Stewart, British Columbia, roughly astraddle of the Grand Duc-Stewart Highway. They extend north from the Silbak-Premier Mine, 14 miles north of Stewart, to the foot of the Mt. Dillsworth

glacier, 7 miles above the Silbak Premier mine. They also extend from the Salmon River and glacier, 6 miles easterly to the east side of Long Lake. The area containing the claims comprises some 70 sq. miles.

ACCESSIBILITY:

The property is accessible along its western margin by the Grand Duc Mine road, an excellent well-graded gravel highway maintained throughout the year by the Grand Duc Mine Company. The interior of the claims is accessible by the Big Missouri road extending northward from the Silbak-Premier mine to the Big Missouri mine townsite at Hog Lake, a rough, narrow road with steep grades, suitable for pickup and moderate sized flat-bed trucks. Several branch roads of similar nature extend north, east, and west of the townsite to the foot of Mt. Dillsworth glacier on the north, to Long Lake on the east, and the Grand Duc road on the west.

Helicopter service is available at Stewart. Stewart is serviced weekly by the Northland Shipping Lines freighters out of Vancouver. It is serviced daily by the Trans Provincial Airlines from Prince Rupert, serviced by the Canadian Pacific Airlines.

FACILITIES:

Timber and water supplies are abundant throughout the area. There are no building or housing facilities. Power may be developed by repairing the existing hydropower station at Hog Lake or by importing diesel electric plants. The port of Stewart is the nearest supply point but its resources are too limited to be effective to mining operation. Supplies must be shipped or air freighted from Vancouver.

PROPERTY:

Atna Mines Limited have consolidated the control of approximately 105 mining claims of varied ownership including leases and Crown grants, which comprise about 3800 acres. The components of the property package are best shown on the company claim maps. Roughly the claims are contained in an area of 70 sq. miles. A few non-affiliated claim blocks lie within the area.

CLIMATE:

The property area is one of high annual precipitation, with mild temperatures and strong rainfall during the summer months. Heavy snowfall is experienced from September through April. Winter temperatures vary from moderate to extreme for outside activities, depending upon the altitude. The summer field season normally starts in June and extends into September. Mining operations are carried out in the area the year around at the Grand Duc Mine and in the past have similarly been conducted at the Silbak-Premier and Big Missouri mines.

GEOGRAPHIC SETTING:

The area is one of strong topographic contrast. Stewart, British Columbia, and Hyder, Alaska lie at the head of the Portland Canal where mountain peaks about the area arise from sea level to 6,000 to 8,000 feet in elevation. The area has been glaciated and is characterized by steep precipitious slopes and heavy forest cover. The Atna properties elevations range from 600 ft. on the west side to 3500 ft. on the east.

HISTORY AND PRODUCTION:

Prospecting and mining has extended from around or just prior to 1900 to recent times and have produced but small shipments of ore for the most part. The lack of access roads and transportation facilities has been the major deterrent to adequate exploration in the district. The principle production

of the area came from the Siibak-Premier Mine between 1918 and 1954. This mine was a major producer for Canada of gold, silver, lead, zinc and copper. The Big Missouri mine, a part of the present Atna holdings, was explored and developed by Cominco between 1928 and 1941. The property produced about half a million tons of low grade ore containing gold, silver, lead and zinc. Recently the Grand Duc Mine, which lies some 10 miles to the northwest, has been brought to the point of production which was scheduled for 1970.

SCOPE OF THE WORK:

In 1970 field work made a start at the ultimate evaluations of the numerous well mineralized quartz veins throughout the property; the large, low-grade sulfide replacement zones of the Big Missouri ridge, and the mineral potential of the extensive well mineralized contact zone of the Texas Creek pluton as it extends through the property. Great difficulty was experienced from the unusually great depth of snow and its late retreat which was due to the persistence of low temperatures into the spring months. Usually prolonged heavy rainfall during July and August inhibited surface geological work although it facilitated snow melting. Unfortunately, the snow pack at 3500 ft. elevation & above still existed at the close of the project in mid-August and Long Lake, at that time, had not cleared of ice. The Grand Duc road and Salmon River valley outcrops were mapped on 200 scale detail through the properties for a distance of about 8 miles. The best copper mineralized zone currently located along the intrusive contact was also mapped and sampled in detail. The Big Missouri mine was opened up, mapped and sampled in detail. Geo-Chemical rock chip soil and sampling was carried on a 500 scale grid over the bulk of the Big Missouri ridge zone (\pm 600 or 700 samples). Closer spaced sampling was carried out along the Grand Duc road and the Salmon River glacier where the best rock exposures exist.

DEVELOPMENT:

Aside from the existing underground work at the Big Missouri mine, there is essentially no development of the property area. There are a large number of open cuts, trenches, and pits, and shallow adits on the numerous prospects, veins and other zones of mineralization throughout the area. The Big Missouri mine workings are largely intact. The ground is very good and there has been a minimum of sluffing from the walls, and backs of drifts, cross cuts, and stopes. The shrinkage stopes were pulled almost empty with the closure of the mine in 1941 and essentially there has been no caving. The underground mill chamber is intact, although all equipment has been removed. The mine could be quickly rehabilitated and made operable if sufficient ore were found to warrant this. Natural ventilation is excellent except in the extreme northwest cross cut at several thousand feet beyond the mine workings.

REGIONAL GEOLOGY:

The Texas Creek pluton, a member of the Coast Range batholith (Laramide Age) intruded a tightly folded metamorphosed series of interbedded metavolcanic and metasedimentary rocks of the Hazelton series which are Jurassic in age. The contact is irregular and serrate in trend and hydrothermally altered and mineralized in many areas. The intrusion of the pluton has created a highly altered and disturbed belt between the intrusive rock and the Hazelton series wherein the older rock has been crushed and indurated with its original characteristics completely altered. The rocks of this intermediate belt are designated as cataclasites and mylonites and grade into identifiable members of the Hazelton group away from the contact. The Jurassic rocks have been strongly folded and faulted and two systems of faults have been superimposed on the region which strike northeast and north-south. A dike swarm approximately $2\frac{1}{2}$ mile wide, cuts through the region, striking from northwest to southeast across the district and through the Atna property. These dikes vary

from granite through basalt and lamprophyre. Some of the earlier dikes are premineral, while a bulk of the later dikes are post-mineral. The district has been strongly inflated by quartz/carbonate veins which are multiply oriented and of various sizes. Moreover, large areas of the contact zone contain large amounts of disseminated pyrite and base and precious metals as well as stock works of quartz carbonate veins, also bearing similar sulfides and precious metals. Vein deposits have been most explored in the area and some of these are known to contain important amounts of native gold and silver and the sulfides: pyrite, chalcopyrite, galena sphalerite, tetrahedrite, polybasite and molybdenite, which also contain gold and silver values.

GEOLOGY OF THE PROPERTY:

The following geological account is based upon the incomplete field work and compilation done during 1970. This report is provisional and tentative at this time.

The intrusive contact of the Texas Creek pluton was investigated by 200 scaled geological mapping along the Grand Duc road from stations 4,000 south to 10,000 north, and from 0 north to 7,000 north along the east side of the Salmon River valley some 2500 to 3000 ft. west of the Grand Duc road. The traverses were essentially parallel. Between these traverses mapping was done only in a better mineralized section of the contact between the intrusive and the cataclasite zone in the Hazelton series and, because of the prevalence of the copper here, it has been designated as the copper zone. The remainder of the area was in the process of being mapped as weather conditions permitted. In addition to this the Grand Duc road was similarly mapped onward to its exit from the property boundaries at 20,000 north.

Salmon Prospect

The geology indicates that the Hazelton series is highly faulted, drag folded and metamorphosed by the Texas Creek pluton. The contact in the copper zone has been highly fractured and in the limited exposures is strongly inflated by swarms of quartz veins and veinlets with large volumes of chalcopyrite, sphalerite, some tetrahedrite, galena and pyrite. Disseminated sulfide is subordinate to the vein and seamed mode of occurrence. The intrusive proper contains low amounts of pyrite and chalcopyrite disseminations and fractured fillings, ranging from around 1% to 2% by volume. Pyrrhotite is present in lens pods and some disseminations along and in the vicinity of some early, dark fine grain basic dikes. Recent glaciation has stripped the rocks to the primary sulfide zone and there is no secondary enrichment in the area.

Additional work is needed to determine if better mineralization is elsewhere along the immediate intrusive contact. The trend of this mineralized zone in the Hazelton series is not yet disclosed and the effect of drag folding, which is a strong ore control in the Grand Duc mine, is not yet determined. The effect of post and pre-mineral faulting which is present, similarly, is not yet known.

In addition to the copper zone several areas of strongly disseminated pyritization in the Hazelton series have been found along the Big Missouri ridge and the Grand Duc road. Within these areas several new fairly large veins have been found, although they have not yet been investigated. These veins are similar to other in the area in that they consist of quartz-carbonate gangue which has been replaced by sulfides. However, in these new veins the gangue has been almost completely replaced by essentially massive sphalerite, galena, tetrahedrite and lesser amounts of chalcopyrite. Pyrite is scarcely present in these veins. Other veins, as yet uninvestigated, exist in old prospects

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along the Big Missouri ridge, but these have only partially explored by old shallow prospect pits and trenches.

A molybdenum zone has been partially indicated along the Grand Duc road within the contact zone extending 1,000 north to about 1,000 south. Molybdenum occurs in discrete quartz-chlorite veinlets and also as thin coatings on chloritized joints. The zone has not been investigated beyond the preliminary mapping and sampling. This occurrence and its control is not yet understood.

The work on the Big Missouri mine has disclosed that the Hazelton series in the Big Missouri ridge area are highly folded and faulted. The rocks are also strongly chloritized and also intensely silicified. Several large zones of brecciation occur which contain the bulk of the sulfide mineralization. The breccia fragments are made up of the Hazelton rocks with the original matrix replaced by quartz. Within the breccia zones stock works of carbonate and quartz veins occur cutting the breccia as well as the surrounding rock. These veins contain sulfides as well as the breccia and sulfide is more abundant in the quartz than the carbonate veins. Swarms of carbonate veins surround the area of the breccia for a radius of several hundreds of feet. Quartz veins beyond the breccia zones are essentially absent. A pattern of a carbonate halo surrounding a silicified center appears to exist with the lead, zinc, sulfides and precious metals being concentrated in the core. Disseminated pyrite is present throughout the area regardless of the environment and is probably part of the pyritization which pervades the rocks all along the Big Missouri ridge. The sulfides, other than pyrite, within the mined area consist of very fine grained, chocolate brown sphalerite, galena and minor chalcocite with low values in gold and silver. The value of the ore shoots appears to have ranged from \$3.50 to \$7.00.

The control of the Big Missouri ore shoots is not known and consequently their projection to depth or surface is difficult. The supposition that these are related to intrusive rock in some depth and that they may halo about a better copper zone below is still valid. The apparent rake of the ore shoots to the south and a suggestion of flexuring or doming also suggests some control by the folding within the country rock. A thorough investigation of the lower levels below the Province Adit (upper), which was not done in 1970, is in order and the procurement and study of the logs of the thousands of feet of diamond drilling done in the mine would be very enlightening.

The potential of a large number of high grade quartz and carbonate veins throughout the property area is yet to be determined. Nothing was accomplished on this phase of the project this year. Prior reconnaissance indicated the presence of high grade shoots of galena, sphalerite, as well as unpresence of free gold, polybasite, and chalcopryrite in veins at several localities. There is a possibility that Silbak-Premier veins and ore shoots can still be found in this area.

GEOCHEMISTRY:

A number of geological chemical anomalies in gold, silver, lead, zinc, and molybdenum were detected in the grid sampling, which are worthy of closer follow-up both geologically and chemically. Compilation has been only recently completed with the recent receipt of the analysis of the last of the project and no samples, interpretation has been done. Little can be said beyond this at this time.

GEOPHYSICS

Several magnetic anomalies which were considered to be of interest were found which have not yet been investigated. Investigation of these should certainly be done as soon as possible.

The valid exploration targets in the Atna mines are summarily tabulated below:

1. Individual veins - numerous - base and precious metal content high-possibility of Silbak-Premier types.
2. Stock works of apparently barren carbonate and quartz veins at surface/ these may halo metalliferous deposits at depth - analagous pattern to that seen in the Big Missouri mine.
3. Geophysical targets - numerous magnetically active zones found in the aerial survey have to be geologically evaluated.
4. Contact zone of the Texas Creek pluton-continued reconnaissance work must be done along this zone. Geophysical work (I.P.) will probably be needed for some areas to find sulfide concentrations beneath the glacial debris and forest cover.
5. Outland area - a portion of the intrusive contact zone not yet examined on the west side of the Salmon River glacier.
6. Big Missouri ridge - possible base metal concentrations in replacement zones other than in the vicinity of the Missouri mine - also, numerous individual large quartz veins with high grade lead, silver, zinc and gold values.
7. Molybdenum deposits on the Grand Duc road on the west side of the Big Missouri ridge - possibly related to the intrusive contact.
8. Deep mineralization beneath the Big Missouri Mine ore shoots.

Russ Robinson