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THE ADANAC MINERAL DEPOSIT

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THE ADANAC MINERAL DEPOSIT

The Adanac mineral deposit is located approximately 20 miles northeast of Atlin, British Columbia. Access to the property is by well maintained gravel road from Atlin to Surprise Lake and by rough access road from Surprise Lake to the headwaters of Ruby Creek.

Early History

Molybdenum mineralization at the 5000 foot elevation along Ruby Creek was located by early day prospectors searching for the lode source of the placer gold deposits on the surrounding creeks. The prospect was examined and noted by geologists of the Canadian Geological Survey in 1905. Although the property was staked and held almost continuously over the following years, exploration of the mineralized zone was not seriously attempted until late 1968.

Regional Geologic Setting

The Adanac deposit occurs within a regional tectonic unit known as the Atlin Horst, which in turn lies within the Whitehorse Trough. The Coast Range Mountains are located 40 miles to the west. The Atlin Horst is composed mainly of Paleozoic rocks which have been intruded by large granitic batholiths during the Cretaceous and Jurassic periods.

The area was glaciated during the Pleistocene, effects of the glaciation being readily apparent as widespread and locally thick morainic deposits.

Regional geology of the Atlin area was mapped by Dr. J. D. Aitken during the period 1951 to 1955, and is described in Geological Survey of Canada Memoir 307.

The molybdenum deposit occurs near the periphery of a small pluton called the Mount Leonard Boss, which probably is connected at shallow depth to the Surprise Lake Batholith. The rocks of both the boss and the batholith are classed as alaskite, a leucocratic granite usually containing less than 2 per cent mafics by volume.

The boundary relationships between the Alaskites and older intruded rocks are obscured by extensive roof pendants of the Cache Creek Group and contained ultrabasic Atlin intrusives. The contact between the Alaskites and the older granodiorites which lie immediately northwest of the deposit appears to dip steeply away from the younger intrusive. The boundary contact with amphibolitized volcanics to the northeast of the deposit is not exposed, while glacial debris and fluvial deposits effectively mask relationships at the head of Ruby Creek valley. Olivine basalts and scoria cover the lower valley. At lower elevations, Ruby Creek has cut through the basalt cover forming an impressive canyon and exposing underlying auriferous gravels. The principal source of the basalts and scoria was the volcano forming Ruby Mountain which is located approximately 2 miles southeast of the deposit. These volcanic rocks are dated as being late Tertiary in age.

In addition to molybdenum and minor tungsten at the Adanac mineral deposit, economically significant amounts of tungsten and placer gold occur in the same general area.

Early-day placer mining flourished on Boulder Creek and that portion of Ruby Creek which was not covered by basalt flows. Portions of the auriferous gravels underlying the Basalts on Ruby Creek were drift mined until the late 1930's.

Transcontinental Resources Ltd. in 1951 - 2 attempted to develop the Black Diamond Tungsten prospect which lies approximately 1 mile south of the Adanac deposit. This prospect consists of a quartz vein up to 4 feet in width, carrying variable amounts of wolframite and trace amounts of sulphides.

GEOLOGY OF THE ADANAC MINERAL DEPOSIT

GENERAL

The Adanac mineral deposit is classified as an epigenetic, bulk-type, low-grade molybdenum property. It occurs entirely within a late-Cretaceous Alaskite pluton which lies in contact with an older dioritic batholith to the north.

Molybdenum occurs primarily in quartz filled fractures within an alaskite host. Molybdenum content appears to be almost directly proportional to fracture density, but is erratically distributed within the individual fractures.

A notable characteristic of the deposit is the lack of hypogene minerals other than quartz and molybdenum.

Known molybdenite mineralization of economic significance is confined to an area along Ruby Creek between Ruby Creek and Molly Lake. The deposit is roughly oval in shape, with dimensions of approximately 2000 feet in an east-west direction and 1,200 feet from north to south. Reserve grade mineralization extends from surface to approximately 500 feet below surface. Concentration of mineralization appears to diminish gradationally in an outward direction from a central area or core.

Lithology

Within the immediate area of the deposit the Mount Leonard Boss is composed of four distinct lithological units. These are:

a) Coarse Alaskite
b) Alaskite Porphyry
c) Fine Alaskite
d) Granodiorite

The alaskite porphyry is essentially a transitional phase between the coarse and fine alaskites. Contacts between them are generally gradational and irregular.

Granodiorite is actually a misnomer for this rock unit as it is in fact a slightly more mafic alaskite. In addition, the plagioclase feldspar makes up a higher percentage of the total feldspars.

This classification is based almost entirely on textural variations of chemically similar rock units. Each of the four phases is effectively an alaskite characterized by abundant smoky quartz (approximately 35 %), low mafic content (1 - 5%) and lack of colour contrast between the two feldspars. In surface exposures it has a characteristic light brown colour while fresh specimens are a mottled light-grey.

Average modal compositions are shown in the following table:

Average Composition, %

Minerals	Coarse Alaskite	Alaskite Porphyry	Fine Alaskite	Granodiorite
Quartz	36.6	33.1	34.9	31.3
K-Feldspars	41.1	39.1	37.8	27.8
Plagioclase	20.5	26.0	24.9	36.2
Mafics	1.7	1.8	2.4	4.8
Opaques	0.5	0.3	0.2	1.4

Analyses indicate that the principal minerals in the deposit other than molybdenite are pyrite and magnetite with trace amounts of scheelite, chalcopyrite, arsenopyrite, galena, monazite, zircon, rutile, gold and silver. Of these scheelite probably is the only one of economic significance.

Mineralization

Molybdenum is found as unusually coarse platey rosettes or scales in otherwise barren quartz fractures. The fractures are for the most part randomly oriented although the stronger fractures exhibit a low angle, northerly dip. These fractures are quite continuous and range in thickness from a normal 1 cm. up to 5 or 7 cm. Molybdenite is also found in some cases as an erratically distributed filling in dry fractures.

Molybdenum content within the deposit appears to be closely related to fracture density and magnitude. No fixed relationship between molybdenite concentration and the various phases of the alaskite has been determined. Locally the fine alaskites appear to be more closely fractured than the other rock units, perhaps because of their more brittle nature. Sampling within a number of shear zones indicates that the molybdenum content in these zones is comparable to that of the wall rock. It thus appears that shearing does not significantly affect the overall grade.

Alteration

Hydrothermal alteration within the deposit is noticeably lacking. Alteration of shear zones is well defined and does not extend into the wall rock.

Beyond the boundaries of the deposit there is a halo of greater alteration, which although still relatively weak, does exhibit more intense chloritization and sericitization along with an increase in pyrite content.

Supergene alteration is evidenced by a shallow oxidization cap over the deposit. The degree of oxidization is slight and rarely extends more than 50 feet into bedrock except within the confines of some large shear zones. Minor decomposition of the feldspars and some oxidization of the molybdenite is noted within the capping.

Structure

Some post mineralization shear zones have been located although movement along them does not appear to be extensive.

One major fault zone involving substantial movement cuts the deposit near the known northern limit. The magnitude and direction of movement along this fault zone has not been effectively determined. Diamond drilling to the north of the zone indicates that the ore zone was faulted off, probably by a down thrust fault.

Structural relationships between the various phases of the alaskite pluton have not yet been determined due to its complex nature.

EXPLORATION TECHNIQUES

Geochemistry

During the 1968 summer field season, soil samples were collected on 200 foot centres over a 400 foot grid covering the 12 original Adera claims. These samples were analysed for Mo, Ag, and Cu. Significant Mo anomolous areas covering portions of the upper Ruby Creek valley were indicated by the study.

Diamond Drilling

A series of 500 foot holes were spotted on the north side of Ruby Creek parallel to the surface exposure on the basis of structural information gained from surface mapping. Initially 2 BQW holes were drilled from each drill site; one at -90° and the other at -50°. The angle holes were drilled to investigate the possibility of sampling bias based on fracture intersection angles.Later studies showed the amount of bias to be insignificant. All future holes were drilled at -90°. Approximately 3000 feet of drilling was completed before inclement weather forced closure of the program in 1968.

Assay results indicated that the program was worthy of pursuit the following year with only minor changes.

Core recoveries in the 70 per cent range experienced with the BQW drilling prompted changing the hole size to NQW during 1969. This change over raised recoveries to approximately 80 per cent. Several HQW holes were drilled within a few feet of existing NQW holes to investigate the relationship between the larger hole size and both recovery and grade. Little variation was noted.

Logging and Sampling

The drill core from each hole was carefully logged both descriptively and visually and all molybdenite bearing fractures carefully noted. The molybdenite bearing fractures were marked on the visual log in red; a practice which proved to be a help in later fracture density - mineral intensity studies. All holes were then sampled in 10 foot sections and the core split and bagged. Carefull examination and subsequent testing indicated that bias was being introduced to the results depending on which portion of the split core was being assayed. Coarse rosettes of molybdenite irregularly distributed through the core resulted in variations of assay value up to 100 per cent, depending on the split. As a result of these findings, the entire 10 foot sections were assayed.

Sludge Sampling

Sludge samples were collected throughout the diamond drilling program in the hopes of finding a means of determining the true grades of the sample sections. Initially the return water from the holes was run through a vane type sludge splitter and the 1/16th split run through settling tubs. Separan was added to the tubs to help depress any floating molybdenite. This system was later changed slightly whereby the split portion was filtered through a porous sample bag. This method proved to be as effective and eliminated the human error encountered when adding separan and decanting the sample.

Intensive correlation studies were undertaken in hopes of finding a logical correlation between core assays and sludge assays. Unfortunately no correlation existed.

Diamond Drill Summary

Since 1968, 106 NQW drill holes on a pattern grid varying from 200 to 400' feet have been completed. Total diamond drilling footage completed to date approaches 60,000 feet.

UNDERGROUND DEVELOPMENT AND BULK SAMPLING

General

During the early spring of 1970 an agreement was signed with Kerr Addison Mines Limited to undertake a feasibility study of the Ruby Creek prospect. Kerr Addison was to retain a 40 per cent interest in the property for continued development. Based on the results of the feasibility study, Kerr Addison deemed it financially unwarranted for them to continue development. Their option was relinquished early in 1971.

Underground Development

A drift was collared on Ruby Creek at the 4690 level in May 1970 with drifting to intersect a line of diamond drill holes on an approximate east west grid line. Both north and south cross cuts were developed from this drift to intersect diamond drill holes on a north-south grid line. Raises were driven on seven of the drill holes that were intersected to provide grade correlation with the drill hole assays.

Total underground exploration consisted of 2, 711 feet of lateral development and 873 feet of raising.

Underground Mapping

Staff geologists mapped the underground geology using conventional methods and closely following daily advance. The only deviation from normal mapping practice was that the ribs rather than the back were mapped to enable accurate recording of both horizontal and vertical fracture systems.

The surveying staff maintained up to date plans of all workings showing daily advance and limits of each round. This made it possible to plot the average grade of each round on the plans of the underground workings and establish average grades for both the horizontal and vertical planes of that portion of the orebody tested.

Bulk Sampling Methods

Seven large open concrete bins were constructed in a line approximately 100 feet downstream from the portal. The mine tracks continued from the portal to dump points on the upper edges of the individual bins. Muck from each round was dumped in separate bins and transfered to the crusher-loading-hopper by rubber tired,966B loaders.

Muck from the individual rounds travelled from the crusher-loading-hopper by conveyor to a roll crusher where it was crushed to -3/4 inch and sent by conveyor to the sampling tower. The crushed product flowed by gravity through a timed sample cutter with the reject going to a product bin. The cut sample then passed through a small cone crusher where it was reduced in size to - 10 mesh and fed to a Denver Vezin splitter. The average round sample of approximately 35 pounds was then bagged and sent to the assay office.

A yard stockpile of lateral development crushed product was maintained for use as feed during tune up of a 100 ton per day pilot mill.

The raise crushed product was stored in large heated bins, one bin for each raise, and partially dryed for final mill feed.

PILOT MILL OPERATION

A 100 ton per day pilot mill was purchased from Brenda Mines Limited, with reconstruction on the Adanac property begining in mid-May. Equipment within the mill was set as determined during the bench scale milling tests. Basically the circuit consisted of primary grinding, bulk flotation, primary cleaning, secondary grinding, secondary cleaner and concentrate dewatering through a vacuum pan filter. A bank of new Humphrey Spirals on the head of the tailings line produced a rough tungsten concentrate.

The mill tune up proceeded on schedule and encountered fewer problems than anticipated. When final tune up was completed the mill was shut down for several days to permit a thorough flushing of all circuits in preparation for processing of the raise product. The crushed raise product was then transfered to the mill bin and processed raise by raise with temporary shut downs and cleaning of all circuits between raises. Both head assays and total recoveries were then checked against the calculated grade of each raise, providing an excellent check on the bulk sampling method used. These checked within tolerable limits.

Mill recovery during processing of the raise product averaged 97 per cent and produced a concentrate averaging 97 per cent MoS_2. Individual runs showed recoveries as high as 98 per cent with concentrate grades as high as 98 per cent MoS_2.

ROTARY DRILLING

A rotary drilling contract was let at this stage with the view of finding another method of sampling which would give results comparable to bulk sampling. Two holes were drilled within a few feet of two of the completed raises to enable comparisons to be made with the diamond drill and bulk sampling results. Comparison of these results showed the rotary assays to compare almost exactly with the bulk sample assays and to be slightly higher than the diamond drill assays. Extreme winter conditions forced closure of the program at this point.

On the strength of these results, further rotary drilling was undertaken during the 1971 season. After considerable testing, it became apparent that the rotary results were comparing with the bulk sampling results only in dry ground. Those holes which encountered appreciable water gave results identical to the diamond drill results. As a result, rotary drilling was suspended pending clarification of this problem.

ORE RESERVES

The Adanac deposit lends itself to removal of higher than average grade material during the early operating years, with stockpiling of marginal ore for subsequent reclamation.

Preliminary pit designs based on variable adjustment reserves indicate that the following production schedules could be anticipated:

Pit Source	Mill Feed % MoS_2	Mill Feed Tons	Tons to Stockpile/Waste	Cumulative Stripping Ratio
Preproduction			10,036,000	
Stage 1	0.210	6,293,000	2,534,000	0.40 : 1
Stage 2	0.185	7,373,000	13,680,000	1.18 : 1
Stage 3	0.184	5,613,000	933,000	0.89 : 1
Stage 4	0.184	7,027,000	15,827,000	1.25 : 1
Stage 5	0.183	7,306,000	1,799,000	1.04 : 1
Onward Pit	0.146	70,622,000	37,433,000	0.53 : 1
TOTALS	0.160	104,234,000	65,414,000	0.63 : 1

The pattern of metal distribution as observed in the underground workings is such that grade control in mining should not be a difficult problem. Large tonnages of low grade material lie within the normal pit path and hence could be stockpiled and eventually reclaimed for mill feed. These factors combine to indicate a low waste to mill feed ratio of 0.63: 1 for a proposed pit.

CONCLUSIONS

Metallurgically the Adanac ore is relatively simple and is amenable to inexpensive beneficiation techniques. The high recoveries and premium grade of concentrate produced during the pilot mill studies greatly enhance the overall grade of the deposit. These factors together with ore reserves virtually assures that the deposit will make a profitable producing mine with the advent of stronger mineral markets and demand.