

Athelstan-  
Jackpot  
82E/2

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deposit

- See Econ. Geol.  
Doc/Jan

November 24, 1981

TO: Arrowhead Resources Ltd.  
FROM: A. R. Grant, Consulting Geologist  
SUBJECT: Summary of Exploration Results  
1981 Athelstan-Jackpot Project  
Greenwood Mining Divison. B.C.

Fieldwork on the property commenced March 28, 1981 and was completed September 22, 1981. Work performed is tabulated below by time period.

<u>Period</u>	<u>Work Performed</u>
March 28-29	Mapping and sampling Jackpot workings, 12 bulk rock samples collected.
May 15-23	Mapping and sampling underground and surface. 139 soils and 31 bulk rock samples collected. Survey grid prepared.
June 16-July 8	1,009m of percussion drilling in 17 holes. 80 soil and 30 bulk rock samples collected. 13.2 line km of VLF-EM and magnetometer survey conducted.
August 31-Sept. 22	494m of percussion drilling in 11 holes. 123m of core drilled in 3 holes paralleling previously drilled percussion holes.

$\Sigma = 31$  holes

The soil and rock sampling results have outlined an anomalous zone of Au-in-soil values ca. 800m x 150m. This zone is roughly coincident with the area of the Athelstan-Jackpot workings and the outcrop pattern of the silicified serpentinite host-rock. Numerous other 1-3 station Au-in-soil anomalies exist within the survey grid. Some of these are thought to reflect the presence of gold-bearing, massive pyrrhotite veins in a post-serpentinite diorite stock which is adjacent and subjacent to the serpentine host.

Observations, made primarily from accessible underground workings and percussion drill cuttings, suggest that the higher-grade gold sections

occur in several sub-parallel massive sulfide lenses within a wide shear zone in the serpentinite. Assay values from exposed massive sulfide sections in the Jackpot underground workings range from 0.06-0.84 oz./ton Au over widths varying from 1m-2.2m. The thickest exposed sulfide lens is 4.2m and has a weighted average of 0.26 Au and 0.35 Ag. The weighted average of 11 samples of silicified, locally brecciated serpentinite taken at various localities in the Jackpot underground is 0.048 o.z/ton Au. In the lowest and easternmost level of the accessible Jackpot workings, the serpentinite is strongly sheared but contains low sulfide. Six samples taken along the drift over a total length of 40m average 0.385 oz./ton Au and 2.05 oz./ton Ag.

The percussion drilling program tested an area ca. 200m x 600m. The results of this work indicate that gold values in the Athelstan-Butte zone (western half of the target area) are very erratic in distribution and that diorite dikes cause significant dilution in the potential ore section. The eastern half (i.e. Jackpot zone) of the target area does contain low- to possible commercial-grade gold values at varying depths in the serpentine. The anomalous percussion values range from 0.03 to 0.345 oz./ton Ag. The thickness of the serpentine and the depth of the anomalous intersections increase to the north. As a consequence, the target zone appears open to the north, albeit at increasing depth.

The reliability of true or indicated grade values from percussion cuttings is subject to question. As an example, variation of gold values from a 1.5m intercept in percussion hole P-13 and parallel core hole 81-2 are 1590 ppb (converted to 0.046 oz./ton) and 0.158 oz./ton (converted to 5448 ppb), respectively. Significant percussion sample loss is suspected.

Results obtained from the 1981 program indicate that the property has a reasonable probability for the presence of economically viable underground gold target. Currently, all data are being evaluated in order to determine what type of further exploration will be required to fully assess the property potential.

Respectfully submitted,



A. R. Grant, PhD  
Consulting Geologist

ARG/lp

June/81

June 18, 1981 .

To: Arrowhead Resources Ltd.  
From: A.R. Grant, Consulting Geologist  
Subject: Phase I Progress Report  
Athelstan - Jackpot Report  
Greenwood Mining Division, B.C.

Field work on the property commenced May 15, 1981. Prior to that a brief sampling - geologic examination of the Jackpot stope was made in late March. As of this date, a total of 319 soils (including those collected in the Fall, 1980) have been analysed for Au. Ag. one hundred twenty five bulk rock samples (including late 1980 samples) have also been assayed and/or geochemically analysed. A total of 12.8 lime km have been surveyed on grid. VLF-EM and magnetometer surveys, conducted by Mr. Steve Persunka, have been completed over the surveyed grid and minor extensions for a total of 13.2 lime km. Geologic surface and underground mapping and sampling have been completed to provide adequate control for spotting initial drill sites. Drill sites are in the process of being prepared using local contractor's equipment. A percussion drill is on site, scheduled to commence drilling on June 19th. Fourteen holes, each 65-70m in proposed depth, are located on site. Further drilling and hole locations are contingent on initial drill results.

Current data indicate the presence of the gold-bearing host rock (sheared, silicified serpentinite) over an area of at least ca. 960m X 240m. Observations, made primarily from accessible underground workings, demonstrate that the higher-grade gold sections occur in numerous sub parallel massive sulfides lenses within a wide shear zone in the serpentinite. Assay values from exposed massive sulfide sections in the jackpot stope range from 0.06 - 0.84 oz./ton Au over widths varying from 1m - 2.2m. The thickest exposed section of massive sulfide lenses in the stope is 4.1m. Weighted average of this section is 0.26 Au and 0.35 Ag. The weighted average of 11 samples of silicified, locally brecciated serpentinite at various localities in the Jackpot workings is 0.048oz./ton Au.

A most surprising section of the Jackpot workings is present in the lowest level eastern drift. There the serpentinite is strongly sheared parallel to but above the projected down dip extension of sulfide lens section. Little if any quartz introduction has occurred. Both gold and silver values in this section are uniformly higher than at any other locality in the mine. Six samples taken along the drift over a total length of 40m average 0.385oz./ton Au and 2.05oz./ton Ag. Neither the top nor bottom of the section is exposed in the drift.

Although outcrops are scattered and disconnected, the total thickness of the serpentinitized potential ore host appears to be greater than 125m.

The serpentinite is intruded by a diorite stock ca.100m east of the Jackpot workings. Although sections of the mineralized serpentinite do occur along the irregular contact of the diorite, the stock currently is considered to be an exploration cut off. Within the stock however, numerous massive sulfide lenses, dominantly pyrrhotite, are found. Some of these lenses contain argentiferous galena and silver values range from 0.58 - 4.16/ton.

VLF-EM and magnetic survey results are mixed. Unfortunately, much of the target area on the property is within an area of interference from adjacent telephone and electric power lines. Outside the interference zone, however, geophysical response suggests the presence of linear conductor greater than 300m in length. This conductor is open to the west beyond the current grid. The target will be drilled during the present drilling phase.

Respectfully submitted,



A.R. Grant, PhD  
Consulting Geologist

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GREENWOOD MINING DIVISION  
BRITISH COLUMBIA

Introduction  
Location and Access  
History and Development  
Work Accomplished  
Geology  
Economic Geology  
Summary and Recommendations

N.T.S.  
82E/2

By

A. R. Grant, PhD  
Consulting Economic Geologist  
November 25, 1980

*Report taken VSE, Statement of material Facts - Arrowhead Resources Ltd (A-2 file)*

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SUMMARY REPORT AND RECOMMENDATIONS  
ATHELSTAN - JACKPOT PROPERTY  
GREENWOOD MINING DIVISION  
BRITISH COLUMBIA

Introduction

This report is prepared at the request of Mr. J. R. Billingsley of Vancouver, B.C. During the fall of 1978, I conducted an initial investigation of the subject property. The results of this work indicated the presence of several potentially economic gold-bearing lenses within a meta-igneous complex. In addition, erratic but significant gold values between some of the identified siliceous gold-bearing lenses suggested the possibility of a bulk gold exploration target. As a consequence, soil and additional bulk rock sampling was accomplished on the property during September, 1980. The results of this program have been sufficiently encouraging to justify recommending a two phase exploration project to determine either the bulk gold potential or the presence of smaller, high-grade economic lenses. The two recommended exploration phases are estimated to cost \$200,000 with the \$150,000 phase 2 contingent on the results of the \$50,000 phase 1.

Location and Access

The center of the claim block is situated at approximately 49° 03' 48" N, 118° 32' 44" W.

The property consists of 9 Crown Granted mineral claims, 1 claim held by location and 1 mineral lease. The Crown Grants are (see Fig. 1):

Oro - L 1167  
Butte - L 1067  
Molly Pritchard - L 1554  
Athelstan Fraction - L 1065  
Jackpot - L 2224  
Jackpot Fraction - L 3158  
Athelstan Fraction - L 1320  
Coronet Fraction - L 677  
Iron Clad - L 1489

The M. P. Fraction, Record No. 916, is currently valid through November 16, 1981. The mineral lease, known as the Bayhorse (M. L. 276) is valid through April 18, 1981.

Included in the property package are 19 acres of land which are part of the Cascade Water Power right of way that crosses several of the claims as a narrow strip ca. 40 m wide. This right of way is recorded

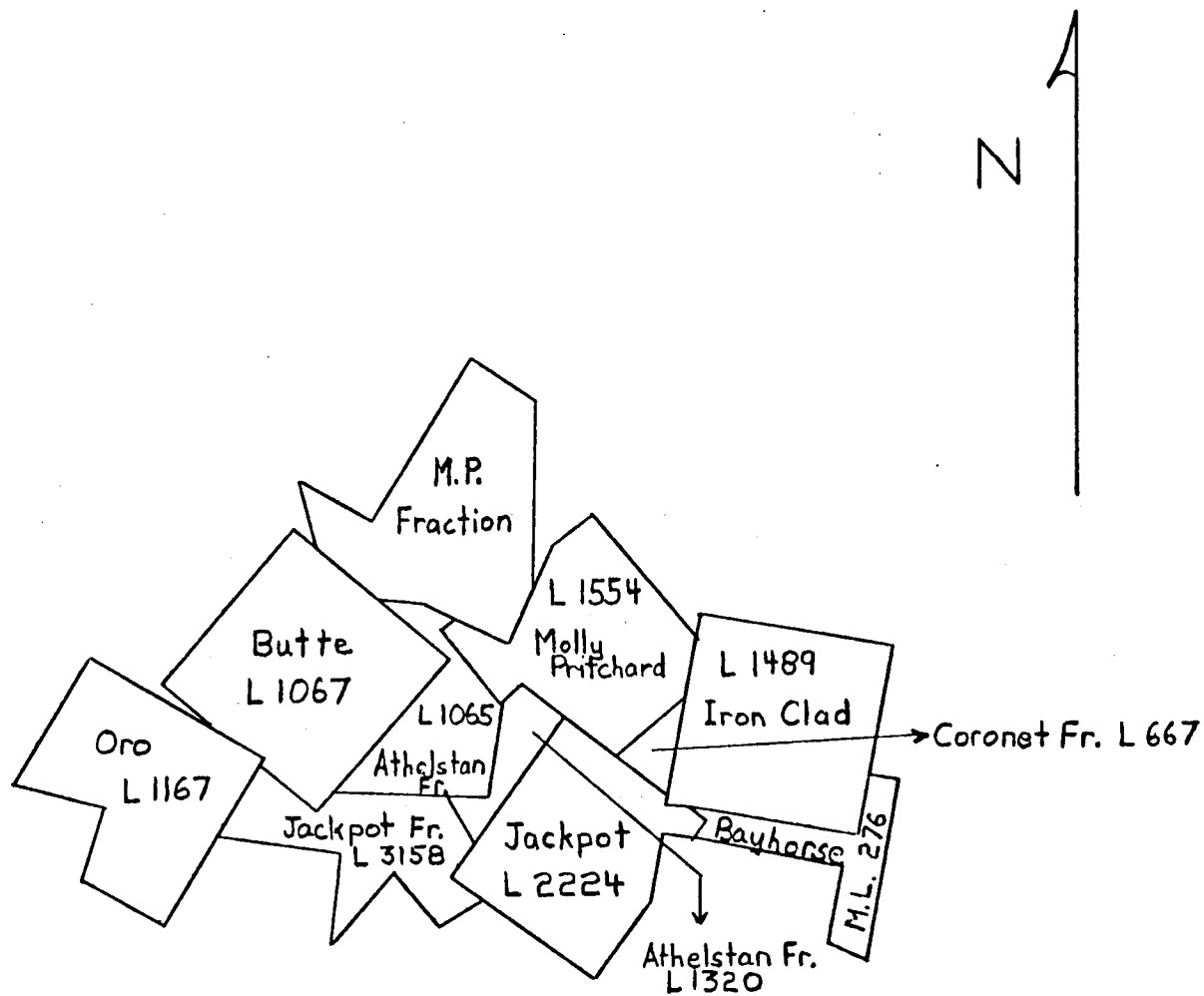


Fig.1 Athelstan Group Mineral Claims  
 Greenwood Mining Division  
 B.C.



as District Lot 1248S in the Kettle River Assessment District (Smilkameen Division Yale District).

The claims are situated approximately 8 km ESE of Greenwood at an elevation of ca. 1,200 m. Access to the property is excellent, either directly from Greenwood via the Phoenix mine (closed 1978) or via a logging road leaving Highway 3 approximately 16 km east of Grand Forks. During the early days, a 5 km RR spur was built, connecting the property with the CPR spur at the Phoenix Camp. This spur could easily be cleared allowing a gentle grade road access directly to the Jackpot workings. Currently, the final 1.5 km of the access road from Phoenix is rough and not maintained.

### History and Development

Production records on the property are not complete. According to the Federal Department of Mines and Resources report (GS Paper 45-20) on the Greenwood-Phoenix area, production on the property prior to 1930 totaled 36,614 tons yielding 5,781 oz. Au, 6,757 oz. Ag and 15,965 lbs. Cu. Older reports, while not indicating tonnage, state the average production grade varied between 0.3 and 0.4 oz./ton Au. According to the previous owner (Mr. W. E. McArthur, Jr.), post 1930 production was 2,051 tons averaging 0.582 Au, 0.72 Ag, 0.15% Cu, 0.04% Ni and 12.47% As.

Considerable development work was accomplished on both the Athelstan and Jackpot claims prior to 1912. This work included an unknown amount of drifts, crosscuts and shallow stopes. Many of the workings are now inaccessible but it is possible to enter sections of both the Athelstan and Jackpot stopes for purpose of inspection. In addition, numerous shafts and inclined adits (particularly on the Butte claim) were found during the property evaluations (see Plate I).

### Work Accomplished During the 1978 and 1980 Field Programs

During 1978, I conducted preliminary geologic mapping and sampling of the claims for Mr. W. G. Hallauer, the present property owner. Fifty-two rock samples were collected for analysis within the general area of the Butte, Athelstan and Jackpot workings. During September, 1980 10 days were spent on the property collecting 180 soils (within a surveyed grid) and 82 additional bulk rock samples. This work, performed under my supervision, was accomplished by D. Wigg and R. Grant for Mr. J. R. Billingsley of Vancouver, B.C. The field crew was able to gain access into the Jackpot stope area, thus providing an important addition to the sampling coverage.

### Geology

The property is underlain by a complex of meta-igneous rocks. The gold mineralization of potential economic significance appears to occur mostly in a metamorphosed mafic unit, now partly serpentized and subjected to talc-carbonate alteration. The relationship of this mafic host to the other meta-igneous rocks is not clear. In some areas,

the sheared, talc-carbonate altered rocks appear to be intermixed with meta-dacite and meta-diorite. In other areas, the gold host unit appears to be intruded by the dacite and diorite. It should be noted that the dacite-diorite rock classification is based on field observation only.

The total extent of either the talc-carbonate rocks or the meta-dacite - diorite unit is not known but reconnaissance mapping indicates probably most, if not all of the claim area is underlain by similar type rocks. The youngest rocks in the area are post-mineral, pyroxene-bearing porphyritic dikes (GS Paper 45-20). All rocks, with the possible exception of the late dikes, are considered to be Pre-Tertiary in age.

Structural control data in the central mine area are abundant; particularly in light of the recent opening of the Jackpot stope. The dominant trend of shearing appears to vary from ca. NE-SW to NW-SE. Dips of these structures range from  $<10^{\circ}$  to  $>70^{\circ}$  both E and W. Near horizontal shearing also appears to be common. It is suspected that many of the higher angle shears are normal faults which have caused some displacement of the sulfide lenses.

### Economic Geology

The dominant sulfides on the property are pyrite and arsenopyrite with subordinate pyrrhotite, chalcopyrite and, locally, sphalerite. Outside of the main sulfide shoots, 1%-2% pyrite is very common in the meta-igneous country rocks. Old reports on the mine suggest that the sulfide lenses are replacement deposits along localized zones of shearing in the talc-carbonate rocks. Observations made during recent examinations do not support this suggestion. Rather, the lenses more likely are the result of sulfide filling and deposition along pre-existing low-angle shears. According to the Geological Survey (GS Paper 45-20), the shape and size of several of the ore bodies mined could be inferred based upon examination of the workings still accessible in 1936. At the Jackpot, 2 of the lenses mined were crescentic in plan and plunged  $10^{\circ}$  -  $40^{\circ}$  E. They ranged in thickness from several feet to  $>25'$  (average  $10'$ ) over a length of at least  $100'$  and a width of at least  $40'$ . During the 1930's, narrower parts of these lenses were mined. At the Athelstan, ca. 100 vertical meters above the Jackpot, the only accessible stope as of 1936 measured  $60' \times 40'$  with an ore thickness ranging from  $3' - 8'$ . During 1936, a winze sunk in the floor of this stope to a depth of  $12'$  was entirely in ore (GS Paper 45-20).

Currently, sections of both the Athelstan and Jackpot stopes are accessible for mapping and sampling. Most of the quartz sulfide lenses dip gently east to southeast. The lenses appear to occur in a parallel to sub-parallel series of shear zones. These shears can be traced (mostly by exposures in the various underground workings and open cuts) from ca. 370 m east of the Jackpot stope area to ca. 185 m west of the Athelstan stope, a total distance of 945 m. The known eastern limit of the gold-bearing massive sulfide lenses occurs on the Iron Clad Crown Grant claim which is part of the Athelstan-

Jackpot package. The known western limit occurs within the Butte claim, which, as previously mentioned, is part of the property package.

Mapping data indicate the presence of at least several gold-bearing shears and incorporated sulfide lenses within a vertical range of >30 m. According to the GS report (1945), the sulfide lenses are displaced by numerous NE striking, 40° - 70° NW dipping normal faults. If this is the case, the various sulfide occurrences found in the workings from the Butte area eastward to the Jackpot area (downhill) cannot merely be structural offsets of the same lens but rather juxtaposed blocks of several lenses. On the other hand, 2 lens segments can be mapped within 20 vertical meters in adjacent workings on the Butte claim. There, the lens segments are separated by a NW trending NE dipping fault. If normal faulting prevails, these two segments could represent offsets of the same lens.

In the Jackpot workings, green stain is relatively common in the serpentinized rocks. The stain resembles garnierite but the low Ni content (see production data) indicates the staining is probably due to the presence of mariposite or fuchsite.

Samples collected by W. E. McArthur, Sr. in the 1930's indicate the variation in grade within the various sulfide shoots. Fourteen samples taken in the Athelstan stope (sample widths vary from 1.66' - 8') average 0.45 Au and 1.42 Ag. Six samples from the Jackpot stope (widths vary from 2' - 6') average 0.325 Au and 1.21 Ag. Eight samples from various Butte claim workings (widths vary from 1' - 8') average 0.245 Au and 0.61 Ag. 1978 grabs from several dumps assayed as follows:

<u>Location</u>	<u>Description</u>	<u>Au</u>	<u>Ag</u>
Athelstan stockpile	siliceous ore	0.356	0.44
Upper Jackpot dump	part oxid. massive py	0.360	0.38
Lower Jackpot dump	massive unoxid. py	0.680	2.76
Dump on RR cut	pyritic breccia	0.996	5.26

Results of the part of the 1978 and all of the 1980 sampling programs are shown on Plate I. The unweighted average of all 1980 samples taken in the Athelstan stope area (29 in total) is 0.105 oz./ton Au. Eight wall rock samples (included in the above average) collected in the stope average 1.350 ppb Au or 0.039 oz./ton Au. The unweighted average of all samples (23 in total) taken in the Jackpot stope is 0.127 oz./ton Au. Five wall rock samples taken in the stope average 660 ppb Au or 0.019 oz./ton Au. Samples taken from specific sulfide lenses or limonitized shear zones in the Athelstan stope range from 0.14 to 0.89 oz./ton Au over a sample width varying from 30 cm to 2.0 m. Samples taken from shears or sulfide lenses in the Jackpot stope range from 0.14 to 0.51 oz./ton Au over widths varying from 30 cm to 4 m. Only a few bulk rock samples have been taken in the Butte zone. There, several 60 cm thick semi-massive sulfide lenses range in value from 0.15 - 0.584 oz./ton Au. Wall rock values in the Butte area range from <0.003 to 0.02 oz./ton Au.

Analytical results for soils collected during 1980 delineate 2 significant and numerous small spot Au anomalies (Plate I). The largest anomalous zone (threshold Au is 100 ppb) can be traced E-W along slope for >700 m. The zone is open both to the west (towards the Butte zone) and to the east. In part, this anomaly reflects known gold mineralization in the Athelstan and Jackpot stope areas. Within this zone, Au-in-soil values average 340 ppb (37 samples) with a range of 100 ppb to 1,940 ppb. The Athelstan stope anomaly is less well defined and more irregular in shape than the large anomaly. It can be traced from NW of the stope area downslope to the east for ca. 180 m to connect with the larger linear anomaly at 0+00, 200E (see Plate I). Based upon the value of 11 samples, the Athelstan Au-in-soil anomaly averages 270 ppb. Ag-in-soil values are, for the most part, weakly anomalous (Ag threshold -1ppm) to non-anomalous. Numerous other small (1-2 point) Au-in-soil anomalies occur within the sample grid. Values in these spot anomalies range from 100-770 ppb.

The Athelstan-Jackpot-Butte zone target represents either a potential strippable bulk gold deposit or a more selective, potential open pit, higher grade lode gold occurrence. The gold mineralization which occurs in subparallel veins and/or shears appears to be distributed roughly parallel to the topography. Previous mining efforts extracted ore from a series of shallow, gently dipping stopes, mostly less than 10 m from surface. Had the mine operated using current technology, the ore probably would have been stripped from shallow pits. Future exploration efforts should concentrate mainly on determining 1) the number and continuity of the higher grade gold-bearing shoots and/or lenses within 30-40 m of surface and 2) whether the wall rock between the higher grade shoots carries low-grade but significant gold credits. Based on current data, the probability of discovery of multiple potential ore lenses with low-grade gold credits in the wall rock is favorable.

Presently, data are insufficient to evaluate the total zone potential. However, based upon the known distribution of values, the geologic potential of the deposit ranges from 56,800 tpvm to 201,500 tpvm (tons per vertical meter). It must be emphasized that the above figures represent geologic potential only and cannot be considered as a reserve of any classification. If a deposit of several hundred thousand to >1,000,000 tons of strippable ore could be defined, an average recoverable grade of 0.05-0.10 oz./ton Au appears to be economically acceptable. If the geometry of the deposit allowed a <1:1 stripping ratio and if proven reserves were >1,000,000 tons, an overall grade of 0.05 oz./ton recoverable Au would probably be economic.

#### Summary and Recommendations

The gold mineralization potential of the Athelstan-Jackpot property is significant. The priority consideration of the recommended exploration program is to determine if the property has the potential for the development of a bulk gold mining plan. Several relatively high-grade gold-bearing lenses appear to be present within a subparallel series of gold-bearing shear zones. Anomalous gold values are also present

in sections of the wall rock separating the veins and shears. If the weighted average of the veins and wall rock could be demonstrated to be in the range of 0.05 - 0.10 oz./ton recoverable gold, the tonnage potential of the property would appear to support a viable mining venture.

Currently there are no data available to suggest the true overall thickness of the gold zone. Old reports allude to a winze sunk in the sill of the Athelstan stope to a depth of 12' in continuous ore (no grade given). If indeed this were true, thicknesses of >10 m could be present in some parts of the target zone (based upon the height of the stope coupled with the reported winze depth). A flooded winze is present in the Athelstan stope and should be pumped out and sampled.

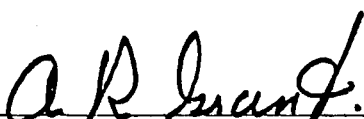
A two phase exploration program is recommended to determine the possible viability of a bulk gold mining venture. Phase I, estimated to cost \$50,000, would consist of an extension of the existing soil sampling grid, detailed mapping and sampling of all accessible underground workings and surface, EM surveys, rehabilitation of all accessible underground and pumping and sampling of the accessible Athelstan winze. EM could be helpful in locating drill targets because of the semi-massive to massive nature of some of the sulfide lenses. A breakdown of cost estimates for the Phase I program is as follows:

1. Continuation of the soil sampling grid (400 additional samples), preparation for the EM grid survey and field assistance in mapping and sampling - 40 days	
Wages	\$7,300.00
Support	4,000.00
Vehicle charges	2,000.00
2. EM survey - 20 line km at \$150/km (includes report)	3,000.00
3. Detailed property mapping and sampling (includes support)	8,200.00
4. Underground opening, rehabilitation and dewatering (includes labor and material)	10,000.00
5. Assays - 400 soils and 180 bulk rock	6,000.00
6. Report and maps	2,500.00
7. Contingency at 15%	<u>7,000.00</u>
TOTAL PHASE I	\$50,000.00

Provided the results of Phase I are encouraging, a percussion drill program is justified. Percussion drilling is recommended because 1) recovery would probably be adequate for purposes of bulk gold sampling and 2) a large number of holes could be drilled on grid to

maximize the sampling coverage per unit cost. A total of 33 holes, averaging 70 m/hole, is proposed to be drilled on a 50 m grid over a total area of 550 m x 100 m. Estimated costs for this Phase II program are as follows:

Drilling - 33 holes at 70 m/hole - estimated cost (all inclusive) at \$45.00/m	\$103,950.00
Project Geologist and samples - 60 days	7,500.00
Support (room, board, transportation, etc.)	6,000.00
Drill site preparation	4,000.00
Assays	9,550.00
Project supervision, report, maps, etc.	4,000.00
Contingency	<u>15,000.00</u>
 TOTAL PHASE II	 \$150,000.00

  
\_\_\_\_\_  
A. R. Grant  
Consulting Economic Geologist  
November 25, 1980

#### References

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2. Geol. Surv., Canada: Sum. Rept. 1901 and 1902
3. B.C. Dept. of Mines: Lode Gold Deposits of B.C., Bull. 1, 1932
4. Canada Dept. of Mines and Resources, Mines and Geology Branch: Geol. Surv. Paper 45-20 on the Phoenix-Greenwood Area, 1945

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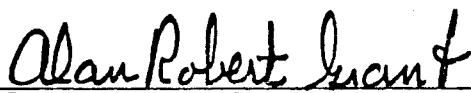
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**(206) 321-4365**


CERTIFICATE

I, Alan Robert Grant, of Langley, Washington, do hereby certify:

1. That I am a Consulting Geologist residing at 828 Edgecliff Drive (P. O. Box 15), Langley, Washington 98260.
2. That I am a graduate of the University of Washington with the following degrees: B.S. in Geology (1955), M.S. in Geology (1959) and PhD in Geology (1966).
3. That I have practiced my profession for over 21 years and that I have been self-employed as a Consulting Geologist since 1965.
4. That I do not have nor do I intend to receive directly or indirectly any interest in the property reported herein.
5. That I have been retained as a Consultant by Mr. J. R. Billingsley, Vancouver, B.C. and that this report, dated November 25, 1980, is based upon my personal examination of the property as discussed in this report.
6. That I hereby grant permission to Mr. J. R. Billingsley for the use of my report dated November 25, 1980.

  
\_\_\_\_\_  
Alan Robert Grant  
November 25, 1980

SUBSCRIBED AND SWORN to before me this 25th day of November, 1980.

  
\_\_\_\_\_  
Lonna M. Parker, Notary Public  
in and for the State of Washington,  
residing in Langley.

ARROWHEAD RESOURCES LTD. (N.P.L.)

FINANCIAL STATEMENTS

YEAR ENDED 30 APRIL, 1980