

WILLIAM M. SHARP, P. ENG.
CONSULTING GEOLOGICAL ENGINEER

Expect a-ablett to call before he moves off grid job; so that we can assign Cu-Mo soil sampling to him if necessary. (KOTHS)
Date: August 18, 1970

171 WEST ESPLANADE
NORTH VANCOUVER, B.C.

801274

President & Directors,
Pathfinder Resources Ltd. (N.P.L.),
617 - 789 West Pender Street,
Vancouver 1, B.C.

Attention: Mr. G. L. Oates

Report primarily a straight forward eval'n for clients information - not concerned w/ financing matters.

Dear Sirs:

GEOLOGICAL EVALUATION - RECOMMENDATIONS & COSTS
SANTA MARIA & WAR EAGLE ZONES, NORCAN PROPERTY,
HOWSON BASIN, OMINCEA MINING DIVISION, B.C.

*In following report
Lithology Petrograph
of N-1 core specimens*

GENERAL

This report is based principally on information derived from the Norcan file of geological maps and reports pertaining to geological investigations and exploratory work performed between the spring of 1966 and fall of 1968, and to a lesser extent on personal observations by the writer during his July 29-31, 1970 appraisals of mineral exposures, bed-rock geology, and drill cores relating to the Santa Maria and War Eagle prospect zones.

Supplementary Drawings 70-1, -2, -3 are essentially compilations of data from the various exploration maps and reports included in the Norcan file. The superimposed grids are essentially based on survey control established during the 1966-67 period of exploration and, as shown on the current map set, are believed to be reasonably close approximations to those actually existing on the Santa Maria and War Eagle prospect zones. The current plot of the War Eagle grid hinges largely on the writer's own survey ties between local grid points and trench intersections which are identifiable on the 1968 map sets.

This report includes brief descriptions of the main features of the Santa Maria and War Eagle geology and mineralization, a summary and evaluation of previous exploration programs, and recommendations for future exploration. Detailed descriptions pertaining to such matters as property, location, access, history, etc. are not included; for these the reader is referred to the series of formal reports submitted to Norcan and others during 1967-68.

Continued.....

*Dec/70 -
grid system
shown on prev
map set revised
to conform w/
rehab'd grid*

GEOLOGY & MINERALIZATION - General

rec/70
The Norcan claims are mostly underlain by andesitic flow and fragmental volcanic rocks of the regional Hazelton Group. These are, in turn, intruded by numerous dykes, sills, and small plutons relating to the regional 'Skeena Arch' transverse zone of intrusives. The numerous small stocks and bosses comprising this W-E zone are considered to be the source-rocks for the Ag-Cu-Mo mineralization within most of the mines and principal prospects of the Omineca district. The Howson Basin intrusives, with which both the Santa Maria and War Eagle mineralization are structurally and/or genetically related, have acid to intermediate compositions and felsitic, granitoid and porphyritic ranges of textures.

SANTA MARIA ZONE

Trenched bedrock exposures of the Santa Maria zone show that the principal mineralized fracture structures lie within the upper and lower contact zones of a west-dipping quartz porphyry/aplite 'sill'. The respective footwall and hanging wall structures comprise the "Santa Maria" and "S.H." veins. These are variably silicified and/or quartz-filled, and further mineralized with pyrite, chalcopyrite, plus minor bornite and chalcocite. Locally, the silicified wall rocks contain subordinate amounts of sulphides in the form of veinlets and disseminations.

700 ft strike length of host structure not yet delineated - pit extending upwards 1800 feet.

Drill and trench exploration have tentatively delineated a 700-800 foot strike-length of good-grade Ag-Cu mineralization within the main, or footwall structure to a depth of some 200 feet. This exploration has less thoroughly delineated other shorter, but well mineralized shoots on strike extensions of the footwall structure and within corresponding strike-intervals of the hanging wall zone. The present extent of exploration has exposed intermittent mineralization over a 1,200 foot length of the zone-principally on the footwall vein. Trench and drill-hole intersections indicate that mineable grades of mineralization are present over widths ranging from two to at least ten feet.

The dip-extent of the Santa Maria mineralization is only partially delineated; however, the current drill-hole data permit assumptions of continuity to 150-200 foot depths, at least. On a purely geological basis it would appear, that from the evident strength of the host structures and the mesothermal characteristics of the mineralization

Continued.....

i.e. excellent probability that additional ore bodies, providing no surf. exp. of these epithermal, will be found by further exploration.

that ore-grade mineralization could be expected for some additional hundreds of feet down the dip - this possibly occurring as distinct, non-outcropping ('blind') ore bodies.

Accumulations of overburden in most trenches precluded ready inspection or sampling of the formerly-exposed mineralization. However, with the vein remaining well exposed in the open cut situating 50 feet south of the shaft, the writer was able to take continuous-chip samples across the vein in both the south and north walls. These assayed as follows:

- 1.7' true width @ Ag, 4.9 oz./ton; Cu, 4.23%
- & 2.0' true width @ Ag, 10.4 oz./ton; Cu, 12.90%

- compare these to previous widths & grades.

WAR EAGLE ZONE

Natural exposures of bedrock occur only along the northerly (cirque), westerly (ridge), and easterly (War Eagle Creek) sections of the claims area. Over the remaining (80% approx.) area of the block other exposures are the result of trenching accomplished during the 1966-68 period, and most of these are ~~contiguous~~ ^{adjacent} to the above-noted bedrock outcrop areas. *drift-covered plateau and steep slopes*

*Dec/70
brief extract*

Numerous small occurrences of Ag-Cu mineralization, primarily shear and fracture-controlled, have been discovered - mainly within, and contiguous to the northerly and westerly areas of bedrock exposures. Besides these, one principal zone of mineralization - currently termed the 'War Eagle Vein' - has been further exposed by systematic cross-trenching; however, to the extent of the writer's information, no drilling has been done to test depth extensions of this significantly altered and mineralized zone.

*Dec/70
brief extract*

From personal observations the writer suggests that the War Eagle structure is more than a simple vein. From the few trench exposures remaining it appears to be more in the nature of a broadly mineralized zone in which shearing, fracturing, or brecciation locally comprise the more significant features of the structure. Within the group of trenches north of the road mixed pyrite and chalcopyrite occur as stockworks-fillings, patches and clots, and as general disseminations. Host rocks comprise more-or-less silicified, chloritized and epidotized andesitic tuffs and breccias.

*Dec/70
poss. incl.
near brief
extract*

and dacitic
the alterations variously involving silica, feldspar, chlorite, and epidote.

Continued.....

Dec/70
brief

Trenching southward of the cirque have exposed the zone over a total strike-length of about 1,000 feet. Within this is a 200-foot length containing substantial mineralization over widths ranging 15 and 30 feet, plus minor values over additional widths of the flanking wallrocks. The writer's grab-samples of average well-mineralized material from each of two trenches on the above-noted 200-foot segment respectively assayed:

between

<u>Location</u>	<u>Ag. oz. per Ton</u>	<u>Cu. percent</u>
12+50N	0.63	1.55
13+65N	1.80	2.35

To the north and south of this mineralized segment the zone appears to weaken, at least temporarily, by pinching or branching. The existing trenches do not necessarily reveal all components of the zone.

Trenching to the west and southwest of the main War Eagle showings has exposed several other occurrences of veining and disseminated chalcopyrite in similar volcanic rocks. Their frequency, along with that of mineralized float, suggests that others occur within the larger, overburdened area - some possibly at considerable depth below the plateau surface. An effective search for them will require the application of a combination of appropriate geophysical and geochemical exploration techniques.

particularly if, as is quite possible, they relate to deep seated or blind intrusive bodies.

Previous exploration has partially outlined a large zone of disseminated pyrite within the general area lying 1/4 to 3/4 miles southeast of the 'Vein Zone', and which is traversed by a tributary of War Eagle Creek. This pyrite mineralization occurs within a local granitic stock and the surrounding volcanics. Minor occurrences of chalcopyrite - typically found in quartz veins and silicified shear zones - have been exposed by the relatively minor amount of trenching accomplished over the War Eagle Creek area.

Systematic sampling, during 1968, of a pyrite-rich, fine-grained phase of the stock returned copper assays in the range of 0.04 - 0.16 percent.

The extensive area of predominantly-pyritic mineralization has been only partly delineated and confirmed by relatively shallow-based I.P. surveys made during 1966 and 1968. Geochemical soil surveys resulted in the delineation of several areally-extensive copper anomalies over the same general area; however, no geochemical-profiling - to discriminate between 'real' and 'apparent' anomalies appears to have been done even over the larger of these.

Continued.....

*allly purple
granite in
K-F. granites
with + veining
also + 92 feet
doubt if phase is
and (K-F?)
and is rounded
+ some comp in
hand sp.*

The few trenches excavated to date provide only a rough guide in regard to general & mineralogical features of the widely pyritized stock

Core from the single deep hole drilled from a point (transported Cu anomaly?) situating about 1,000 feet southeast of the sampled (creek) zone, in general returned only 'trace-copper' assays. In spite of this, however, all core (granite and porphyry) from the 700 foot-plus hole appears to be significantly altered and pyritized - the megascopically-visible alteration comprising propylitization of mafics and feldspars and pronounced kaolinization (sericite locally?) of some of the feldspar. Representative sections of the core have been submitted for thin-section analysis.

and some uncertainty

The present drill-core and outcrop evidence provides some geological substantiation for inferences concerning the existence of a large zone of porphyry-type copper mineralization to which the known pyritized altered zone may relate as a halo or fringe. On this premise the writer points out the advisability of applying saturation geophysical-geochemical prospecting methods to thoroughly explore the War Eagle east zone, at least.

SUMMARY OF PREVIOUS EXPLORATION

Electromagnetic Surveys

A helicopter-borne survey, featuring a rotor-induced primary field, was made of the full claim group. However, this method has not received favourable geophysical acceptance - partly because of the difficulty of continuously maintaining a horizontal 'platform' - and is not thought to have made any truly significant contributions to the program.

Ground surveys were carried out over the Santa Maria and War Eagle (vein) zones, using Sharpe S.E. 250, 1000 c.p.s., horizontal-loop equipment.

Within the Santa Maria area E.M. responses over the actual 'footwall' vein were generally weaker than those received from more easterly sections of the grid. From this, it may be inferred that overburden and other non-mineral conductors were the principal cause of the anomalies. The equipment produced similar results over the War Eagle grid - confirming its limited depth capabilities due to its low-power and high-frequency characteristics.

Continued.....

S.P. Surveys

These displayed a characteristic lack of selectivity with respect to mineral and non-mineral sources of natural ground currents.

I.P. Surveys

All of these were accomplished, using 2.5 KW pulse-type equipment and normal three-electrode arrays. Electrode-spacing was fixed at 200 feet, and readings each 100 feet. ^{generally}

Over the Santa Maria zone one major, and one minor anomaly resulted; however neither appear to have related to known zones of mineralization. An obvious conclusion is that the anomalous response were due to either local concentrations of disseminated sulphides, or to deep accumulations of polarizable overburden - more possibly the latter. In any event, the applicability of the method to the Santa Maria essentially vein-type mineralization is rather doubtful - particularly if accruing from low-power equipment.

Over the War Eagle zone the survey produced its major anomalous response over the easterly area of pyritized volcanics and intrusives. However, it appears that no attempt was made to trace out its more easterly or southeasterly extensions. Some half dozen minor anomalies were delineated within the remaining area of the grid.

In view of the fact that deeper-seated zones of I.P.-detectable mineralization - possibly related to other concealed or buried intrusives - could occur anywhere under the general blanket of reportedly highly-resistive overburden, a re-survey using higher-powered equipment is indicated.

Geochemical Surveys

Silt-sampling of most drainages was carried out with useful results.

Soil sampling, for copper-detection only, was carried out over the Santa Maria and War Eagle zones. These resulted in the delineation of several broadly anomalous areas - some of which are coincident with known zones of bedrock mineralization, and others which may actually

Continued.....

outline secondary dispersions. Drill hole N-1, penetrating the War Eagle stock, actually appears to have been sited on a small high-scale drainage anomaly - the lack of copper mineralization in the core seemingly bearing this out. From this it is evident that other means of geochemical confirmation are required to supplement the data resulting from conventional soil-sampling techniques - particularly in the War Eagle area, where extensive bedrock-related anomalies undoubtedly exist.

SUMMARY

- A. Santa Maria Zone: Previous drilling results have indicated good possibilities for the occurrence of one or more ^{the aggregate and} bodies of economically-mineable copper-silver mineralization. However, additional diamond drilling is required to verify the grade, continuity, and extent of currently-indicated shoots. For maximum effectiveness, further drilling should be preceded by more comprehensive geophysical delineation of individual vein segments.
- B. War Eagle Zone: The current exploration data indicate a fair degree of potential for the existence of both vein-type and 'porphyry-type' copper-silver mineralization within the general plateau area - but most specifically on possible lateral and/or depth extensions of the 'vein' and 'pyrite-oxide' zones. Prior to actual drill, or trench-exploration of either of these, however, more comprehensive exploration utilizing more diagnostic geophysical and geochemical techniques is required.

Continued.....

RECOMMENDATIONS

Stage-1

- A. Improve mine access road.
- B. Re-establish exploration grids over Santa Maria and War Eagle zones.
- C. Conduct Turam-E.M. Surveys over the Santa Maria zone, and over the mineralized War Eagle vein - breccia zone.
- D. Carry out follow-up diamond-drill exploration and sampling of the Santa Maria vein system.
- E. Provisional: Confirmatory drilling of possible Turam-indicated lateral and/or depth extensions of the War Eagle vein-breccia mineralization.

Specify for 2400-2800' depth probe to be done over total grid; subsequent I.P.F. detailing to be based on Cu-Mo x Hg geochem indications

Stage-2

- A. Conduct further I.P. coverage of the general War Eagle prospect area via 7.5 KW (or more) pulse-type I.P. equipment.
- B. Carry out check Cu-Mo soil sampling over the easterly half of the War Eagle grid.
- C. Carry out reconnaissance-scale geochemical-Hg coverage of the full War Eagle grid.
- D. Conduct EM 16 'structure' surveys over the easterly half of the War Eagle grid. *30E-60E; 16K-16S - - 1*
- E. Provide for bulldozer trenching within War Eagle zones.
- F. Provide for follow-up drill exploration within War Eagle zones.

note petrograph - cuts show sericite, kaol. chlorite

Continued.....

ESTIMATED COSTS

Stage-1

<i>road</i>	A. Estimate 6 Days @ \$200.00	\$ 1,200.00
<i>grid prep</i>	B. Santa Maria: 5 Miles @ \$125.00 gross	\$ 625.00
<i>" grid</i>	War Eagle Turam: 3 1/2 Miles @ \$80.00 gross	\$ 280.00
<i>" grid</i>	General War Eagle: 18 Miles @ average \$50.00	\$ 900.00
<i>S.M. & W.E. Turam</i>	C. Estimate 9 Miles @ \$150.00 gross	\$ 1,350.00
	D. Estimate 3000 ft. BQ Core @ \$12.00 per ft.	\$36,000.00
	E. Provisional 1000 ft. BQ Core @ \$12.00 per ft.	\$12,000.00
	F. Provision for sampling - assaying	\$ 500.00
	G. Provision, incidentals + contingencies	\$ 7,500.00
	<i>(incl. geol. engineering)</i>	
	Stage-1 TOTAL	<u>\$60,355.00</u>

*Sample costs
divided \$2225.00
gross \$2857.50*

Stage-2

<i>U.E. I.P.</i>	A. Reconnaissance plus detail, 12 Miles @ \$800.00 gross....	\$ 9,600.00
<i>have results of these before detail I.P.</i>	B. Estimate 300 Samples @ \$3.30 gross - approx.	\$ 1,000.00
	C. Estimate 150 Samples @ \$3.50 gross	\$ 525.00
	D. Estimate 10 Miles @ \$100.00 gross	\$ 1,000.00
	E. Estimate 10 Days @ \$300.00 gross	\$ 3,000.00
	F. Allow 3000 ft. @ \$12.00 per ft.	\$36,000.00
	G. Provision for sampling & Assaying	\$ 1,000.00
	H. General provision - incidentals and contingencies	\$ 7,500.00
	<i>(incl. geol. engineering)</i>	
	Stage-2 TOTAL	<u>\$59,625.00</u>

Respectfully submitted,

W. M. Sharp
W. M. Sharp, P. Eng.

WMS/jf.

CERTIFICATE

I, William M. Sharp, with business and residential addresses in North Vancouver, British Columbia, DO HEREBY CERTIFY THAT:

- 1) I am a graduate of the University of British Columbia with B.A.Sc. and M.A.Sc. (1950) degrees in Geological Engineering.
- 2) I am a registered Professional Engineer in the Province of British Columbia.
- 3) I have practiced my profession, in senior geological positions, for 20 years and as a consultant since 1964.
- 4) I have personally examined the War Eagle and Santa Maria areas of the Norcan property at Howson Basin, Omineca Mining Division, B.C. and all available reference material prior to the preparation of my August 18, 1970 report.
- 5) I have no direct or indirect interest in the properties of Pathfinder Resources Ltd. (N.P.L.), nor do I expect to acquire any such interest.
- 6) I inspected such claim posts and location lines as were encountered during my July, 1970 examination and believe that these have been established as specified by the B.C. Mineral Act.



W. M. Sharp, P. Eng.

WMS/jf.

August, 1970
North Vancouver, Canada

