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REPORT ON

THE PORCUPINE PROPERTY

Merritt Area,
Nicola Mining Division, B.C.

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H. C. B. LEITCH

P. Eng.
Consulting Geologist

May, 1966.

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GENERAL

At the request of Mr. P. Polischuk, the writer conducted an investigation of the Porcupine property of Amalgamated Resources in the Merritt area during the period May 13, 14 and 15, 1966. The writer, as investigating engineer, also examined and studied all data and information made available to him through the efforts and kindness of Mr. Sherwin F. Kelly, geologist and geophysicist.

LOCATION AND ACCESS

The Porcupine group of claims is located some 10 miles by road southeast of Merritt. The claims lie east of the paved Merritt-Princeton highway at a point just north of Corbett Lake. They are close to the highway and project north and east from the end of the lake.

Access to the claims and the main workings after leaving the highway is by way of a dirt road and tracks for 2 miles from the turnoff north of Corbett Lake. The workings were found to be readily accessible in May by an ordinary motor vehicle.

The highway is a main access route from Kamloops and Merritt to the Hope-Princeton road and to the Fraser Canyon section of the Trans-Canada Highway. Merritt is rapidly growing town and centre of a promising mining and mineral exploration area.

Railway connections are available at Merritt via the Kettle Valley line of the C.P.R. which connects to the Main line C.P.R. at Spences Bridge, 42 miles distant.

TOPOGRAPHY, CLIMATE

The claims were found to range in elevation from a low at Corbett Lake of 3500' to a high of 4500' on the flank of Mt. Nicola on the northern boundary. The claims cover portions of the southwesterly and southeasterly flanks of Mt. Nicola, which for the most part are range land - rolling, grassy slopes.

The climate of the area is usually relatively dry with light rainfall. There can, however, be prolonged periods of mistral or light rain at certain periods of the year. The flow of westerly maritime air over the mountains moderates the climate considerably in winter and summer at these altitudes. The specific area (Merritt and vicinity) is noted for fairly strong and persistent winds at higher levels. Average temperatures and snowfall are normally such that winter work is quite feasible.

WATER, TIMBER, ETC.

A number of small streams intersect the slopes of Nicola Mt. and a certain amount of water could be collected in spring and early summer in quickly made sumps behind small dams, provided this did not interfere with existing range water rights and was done with the cooperation of the land owners.

The upper parts of Nicola Mountain are lightly timbered, chiefly with small stands of firs, pine and poplars in draws. There should be adequate timber for most mining uses.

PROPERTY

The Porcupine property of Amalgamated Resources consists of 36 claims in one square black which is oriented north-south and east-west. The claims are numbered Porcupine 1 to 36, with record numbers as follows:

Porcupine #1 to #20,	Record Nos. 19301 to 19320 in good standing until Nov. 27/1967
Porcupine #21 to #24,	Record Nos. 21779-21782, in good standing till Dec. 31/1966
Porcupine #25 to #36,	Record Nos. 20557-20568 in good standing to April 30/1967

The claims are reported as having been staked in 1962 and 1963 by Sherwin F. Kelly, John McGoran and Diane Gillespie, and then sold to Amalgamated Resources Ltd. on April 25, 1963. It is also reported that Porcupine claims Nos. 21 to 24 had been allowed to lapse and were later re-staked.

HISTORY

Prior to the Amalgamated Resources purchase of the property, there appears to be some record of work done by others. It has been reported by S.F. Kelly that the inclined shaft, which is the main feature of the property, was sunk between 1900 and 1910 by a rancher named Corbett. It is stated that there has been no written record found of the exploration involving this shaft.

Columbia Explorations Ltd. is reported to have diamond drilled two short holes in the vicinity of the shaft following an electro-magnetic survey by Shield Mining Surveys, Ltd., of Ottawa. The results of these holes are not known nor has any core been found. Mr. Kelly pointed out the locations of the two hole sites while showing the writer over the Porcupine property. Further reference to the above work will be made under the heading "Geophysical Work".

GEOLOGICAL ASPECTS

Geology of the General Merritt Area

The Merritt area, extending from Promontory Hills east to Nicola Lake and from the midpoint on Guichon Creek to Aspen Grove, is occupied by rocks ranging in age from ?Paleozoics to Late Tertiary. The presumably early Paleozoics are found near the end of Nicola Lake in a small occurrence. The rest of the Merritt area, as defined, is occupied largely by undivided Nicola Volcanics of Triassic age, by Jurassic to Cretaceous granitic intrusives, and by lower Cretaceous continental volcanics such as the Spences Bridge.

The granitic rocks of the Coast Range Batholith, including granodiorite, diorite, quartz monzonite and granite of Jurassic to Upper Cretaceous age, intrude the Triassic Nicola Volcanic Series with which some sediments, including limestones, are known to be present. They also intrude all other rocks up to the Upper Cretaceous. The Nicola volcanics consist of basaltic and andesitic flows and tuffs of various types. Thicknesses vary greatly from place to place. A striking characteristic of the Nicola in many areas is the universal green colouration due to large amounts of chlorite and epidote (greenstones). Many different copper minerals are found throughout the Nicola series, but perhaps the most prominent of these are chalcopyrite and chalcocite. Attitudes and structure in the Nicola are generally difficult to interpret unless limestones, distinctive pillow lavas or tuffs can be traced.

The later volcanics of Lower Cretaceous age (Spences Bridge and Kingsvale) are predominantly reddish to purplish brown and tuffaceous. They are not specifically noted for containing mineral deposits and usually blanket the older rocks. However, in many places it is quite difficult to differentiate them from the reported or assumed Upper Nicola volcanics of similar appearance.

Overlying the above Lower Cretaceous volcanics of the area are Upper Cretaceous to Mid-Tertiary sediments of the Princeton and Coldwater formation. Some of the sediments of the Coldwater rocks are composed of reworked tuffaceous material.

Early Tertiary Volcanics of theKamloops and Princeton groups are found in the area. They have been noted southwest of Merritt and to the south of the Porcupine claims.

Structurally, the Merritt area has some important features. In the Promontory Hills sector and in the sector south of Merritt in the vicinity of Aspen Grove, there are indications of east west fold axes. In the sector stretching from Nicola Lake southwards through Aspen Grove and incorporating the Porcupine property, fold axes have been mapped which show general north-south trend but which locally bend to the northeast. The axes mapped are synclinal axes and concern the Nicola series chiefly. One such axis passes about 4 miles east of the highway through Aspen Grove and is about the same distance east of the Porcupine. Paralleling this structure is a long and persistent fault structure - the Alison Creek-Otter Creek fault. This fault probably passes through Corbett Lake or just west of it and possibly along the western boundary of the claims. Another fault that appears headed for the Courtney Lake-Corbett Lake area is that which seems to run up along the east side of Kentucky Lake-Alleyne Lake toward Courtney Lake. This latter fault seems to be a late movement.

The Merritt area is generally considered to have been a basin of infolded Tertiary sediments which are softer and less resistant formations. The structural basin is also an apparent topographic basin.

Porphyritic rocks are known in the area in conjunction with the Nicola Series. When these are related to the granitic and other intrusives they are found in places to be associated with copper mineralization.

Copper mineralization is known to extend into late volcanics in nearby areas and it may well do so in the Merritt area.

Geology of the Claims

The Porcupine claims, when plotted on a geological map, appear to lie chiefly within an area of Triassic Nicola group rocks. The same maps also show a sizeable area of Upper Cretaceous to Mid-Tertiary sediments of the Princeton Group and Coldwater formation in a portion of the area covered by the Porcupine block.

The writer traversed only a limited amount of ground in the claim group, chiefly in the southern half of the claims, and did not enter the northern half except possibly where a sortie was made into Porcupine #6. The large area of the workings were the chief focus of the investigation. The views of the writer are, therefore, based largely on what he saw in that section of the block.

In general, the impression is that rocks occupying most of the area of the workings and at elevations below the level of the shaft are from the Nicola Group and probably from the upper division of that Group. The uppermost portions of the workings and above elevations of 4200' give indications of some change in rock types and sequence. There is difficulty in distinguishing the differences and at this point it is not known whether they represent a different group of rocks.

The Workings and Their Geological Features: The workings are located in claims 1, 2, and 4, but very largely in claims 1 and 2. They extend in a northeast to southwest direction and consist of 1 inclined shaft and 6 large main bulldozer trenches or cuts, topographically above and below the shaft. In addition to these, there are numerous smaller pits and cuts made by a bulldozer which are scattered about, chiefly in the area to the northeast of the shaft, and a broad, lengthy bank or road cut type of bulldozer operation which partially exposes rock for several hundred feet well to the east of the shaft. Other long bulldozer cuts were noted inthe surrounding areas both on the hilltops, the hillsides and in deep draws. Those on the hilltops and in some cases on the hillsides, have exposed rock while those in the draws have not done so. The important workings and mineralization are shown to scale on the accompanying map, a copy of which was produced and submitted by Mr. Kelly for use in the writer's report. The writer, during his examination, had the control points indicated to him and was able to use these in his own work, finding that all points tied together very well. The early survey was reported made by chain and mounted compass. Points at every 200' can still be found along the base line. It is not known if distances on the base line have been corrected for slope.

The large trenches have cut bed rock in most instances, but as the trenches cut through several feet or more of overburden, slump of side wall material has obscured the broken bed rock to some degree at a large number of points. Little cleaning of the bedrock by blasting and pick and shovel appears to have been done.

The workings reveal the presence of a series of flows, andesitic and basaltic, interbedded with tuffs or tuffaceous material and some flow breccias. The flows which appear to be largely andesitic, especially in the upper areas near the shaft, range in apparent thickness from a few feet to something like an apparent thickness of 10 to 20 feet. Nearly all show an amygdaloidal character or a streakiness as in the case of some andesites. Some reveal brecciated or broken tops where they adjoin tuffs. The andesites do seem to have a range of colour ranging from a distinct green in the type with a slightly larger grain size to a much denser and darker green type. A few tests here and there suggest that these are all non-magnetic. The basalts, on the other hand, appear to be distinctly blackish, dense, amygdular and generally somewhat magnetic. It cannot be established as a rule, however, that magnetic rock is basaltic. Amygdules of most of the flows contain carbonate (calcite) and silica (chalcedony), but in particular the basaltic flows have some amygdules filled with blackish Fe-mg mineral. The amygdules are, for the most part, elongated or stretched. The stretching distinguishes the bases of some flows. The lighter green andesitic flows are distinguished in places by not so much by the amygdules as by the poorly formed phenocrysts of feldspar, probably andesite. A tendency to porphyritic was noted in one or two places. At one or two points also a structure suggestive of pillows inter-mixed with broken flow material exists.

Recognizable tuff horizons are nearly all of a purplish-brown colour or of reddish brick colour if well weathered. The finer-grained tuffs are distinctly reddish on the weathered surface or near surface exposures. The colouration is due to hematitic iron.

In fresher tuffaceous material from below surface, the impression is that the material is greenish with whitish spotting, but a blackish purple hue persists in the dense material.

The tuffs or tuffaceous beds are distinct enough from the flows to be used as tracer beds, provided they persist along the strike, and it is by no means certain that they always do. The material making up the tuffs interbedded with the flows at lower levels of the workings is fine to medium-grained with occasional coarse material. The coarseness in the tuffs, in a general way, appears to increase uphill. The section of tuffs exposed by the top-most large mapped trench shows considerable fragmental material, chiefly tuffaceous, but also containing a large percentage of fragmented flow material. There are sections which indicate basaltic and andesitic material are still present but greatly reduced in proportion. This apparent reduction in the proportion of flow to tuff could be due in part to a flattening of the dip. As one moves further uphill towards the immediate summit in this area, the flows disappear and, on a rough survey, coarse tuff or fragmental beds seem to be everywhere. There is a distinct impression that the fragmental beds are nearly flat-lying at the summit or at best dipping slightly to the east. The coarseness is quite apparent and there is a general appearance similar to that of an arkosic sediment. Following the fragmental beds around to the east and going down the eastern slope of the hill, one is struck with the amount of fragmental material encountered there. Near the base of the slope, perhaps 600' east of the shaft and a little north, a very long road-like cut has revealed mostly tuffs and fragmental material. However, in this lower area, the tuffs are once more finer grained and more reddish brown in colour.

From the very limited mapping done by the writer, there is an impression that there might be an unconformity of some kind beyond the first large trench north of the shaft. Dip in the shaft is known to be about 30°-35° and dips in the flows and tuffs revealed in the trenches downslope or to the southwest are to the southeast and apparently of the order of 20° or greater. East of the shaft on surface there are indications of a roll in the formations there which does not conform to the structure in the shaft. Further east, although there is little to guide one as to the attitudes of the rocks there, it would appear that the dips are low and most likely to the east and south. To the north, above the trenches, aside from a rib or two on the prolongation of line of the strike of the lower tuffs which appear to be projecting out of the soil at steeper angles, the balance of the fragmental resembles a capping.

The hilltop falls within the area geologically mapped as ?Coldwater, or perhaps better to say, undivided Princeton or Coldwater. The rocks seen by the writer do not appear to belong whatsoever to the Coldwater, but they could possibly belong to the Princeton group. It is much more likely, if they are not Nicola Volcanics, that they belong to the Kingsvale Group of volcanics.

The inclined shaft reveals a formation which underlies, at least at the top, a reddish tuff and which dips as an apparent unit at 30°-35° to the southeast. The dipping formation as shown by the shaft is between 6' to 10' in thickness and is notable for its fracturing and for its green staining from weathering copper minerals. The shaft is reportedly 60' in length but only about 30' were clear of water at the time of the visit.

The tuff overlying the shaft at its collar can be traced with some certainty for 100' to 125' about the shaft. Thereafter it is traceable by downslope cuts. There is not the same certainty about its extensions through the lower trenches because of the separation but taking into consideration the strike, dip and slope, the bed should be in approximately the position as shown. The strike of the section mapped around the shaft on a fairly level area is N.47° E.

Because of the relationship at the shaft, the tuff has been considered important as a marker horizon. There is a suggestion that the base of the tuff resting on the mineralized andesite flow at the collar of the shaft does not entirely conform in attitude with the underlying flow. Copper mineralization, as revealed in the lower trenches, does seem to remain close to the same horizon. Other brick or purplish-brown tuffs have been located parallel and close to the marker band and there are indications of other copper mineralized bands above and below the marker band. The lithology, the attitude of the beds, the structural controls, are of importance in tracing the copper horizons.

MINERALOGY AND MINERALIZATION

The copper minerals found in the deposit are reported to be chalcopyrite, possibly bornite, chalcocite, native copper, cuprite, malachite and azurite. With the exception of bornite, the writer has seen specimens which show one or several of all the copper minerals mentioned. Gangue minerals accompanying the copper are chiefly pyrite, calcite, silica and some epidote. Though certain flows (? basaltic) cause a swinging magnet to be attracted weakly to moderately because of original magnetite or magnetic constituents, there is little or no evidence of a later introduction of magnetite.

Native copper was observed in knots, grains and very tiny hair-like particles in or in direct association with calcite. The native copper was observed as hair-like or flat particles in small amygdules twice and there appears to be something like a faint copper "paint" at a number of different points in other amygdules. The larger loose knots of native copper probably come from larger amygdules (from large masses of calcite enclosed by breccia) or from calcite filled fractures. The chalcocite occurs in close relationship with the native copper but seems to be black, sooty and in tiny blebs or streaks in the rock. The streaks are probably partings or fractures cemented by chalcocite. There is no clear indication that the chalcocite is primary. Most appearances suggest a secondary origin, perhaps after chalcopyrite. Its presence must be fairly general, however, to yield the fairly high assays at depth in the shaft, in which case it may be very fine and of primary origin. Cuprite is rare and probably produced by weathering and oxidation.

Chalcopyrite is believed to be one of the principal copper minerals if not the prime copper mineral of the Porcupine deposit. It is observed in freshly broken greyish andesite rock from the shaft area in the style of fine dust throughout portions of the rock. It would appear that it also occurs in fractures along with quartz. Staining of the rocks by copper carbonates obscures much of the real relationship as far as the copper mineralization and the fractures are concerned. Chalcopyrite has been observed in one of the southernmost trenches on the sides of a calcite stringer.

The writer observed that the lighter green andesitic flows, in places, show an abundance of very fine-grained (dust-like) pyrite with occasional chalcopyrite.

Calcite in some form, whether around brecciated flow fragments, in amygdules, in veinlets or fractures, is found in close association with copper mineralization and is fairly abundant as an introduced mineral. The copper mineralization indicated by staining such as copper carbonate is found in many of the trenches as indicated earlier at more than one horizon. It only very exceptionally is noted in the fragmental material. Chalcopyrite was observed by the writer in one spot in fragmental rocks on the summit of the hill.

Assays of stained andesitic trench rock through which samples have been cut can return moderate results when channel sampled, but close examination with 20 power lens of other sections of fresh dark green andesitic rock also reveals copper mineralization that would not be seen or noticed at all by visual inspection alone. Sampling of the trenches by the writer had to be limited as the trenches were not cleaned after the bulldozing. Broken mineralized rock from some half-buried band could be found displaced and masking relatively unmineralized rock sections. Where sampling was done, time had to be taken to cut down to clean rock and to brush out the loose muck and soil-filled crevices.

The following are assays taken by S. F. Kelly for Sugar Mountain Copper in 1961 in the inclined shaft:-

			Copper
Chip sample	#19465	- 10' down shaft	0.70%
Chip sample	#19464	- 25' down shaft	2.65%
Random samples	#19462	- 30' along N. wall	2.10%
Random samples	#19463	- 30' along S. wall	2.15%
? type sample	#20759	- 230' S.W. from shaft	1.30%
? type sample	#20760	- Float, 1500' S. of shaft on road to main vein	4.10%
Chalcocite	#20761	- 480' S.W. from shaft	1.40%
Vein ?	#20762	- 480' " " " "	1.10%
Muck sample	#20763	- from shaft	11.00%
Azurite sample	#20764	- 50' N.E.	3.50%

The 6 last named samples, with the possible exception of #20762, are evidently samples picked for some specific purpose and are assumed to be not truly representative of any width. The vein sample has no indication of width taken or other necessary details such as if it were a channel sample or not. The latter 6 samples were taken by J. F. Kelly or by others from Amalgamated Resources Ltd.

		Au	Ag	Cu
Sample #4401	Incline shaft	0.005 ozs.	2.60 ozs.	2.37%

The above sample is interesting as it shows the definite presence of silver and indicates gold could be present. This sample was taken byJ. McGoren, but no other details are given.

		Cu
Sample #1	From trench vicinity, base line 1 OS, flow top with heavy calcite and some malachite	0.40%

The following samples are reproduced in part from a copy delivered to the writer by S.F. Kelly. They were taken by Grant Gibson of C. M. & S. on November 13, 1962:

			Oz.	Oz.
"Sample #1,	assay #32515 -- 1.1% Cu			
#2,	#32514 -- 1.1% Cu			
#3,	#32512 -- 0.9% Cu		0.01 Au,	0.1 Ag.
#4,	#32513 -- 2.8% Cu		0.01 Au,	0.4 Ag.

Serial No. 1643".

A surface showing of copper mineralization is reported by S. F. Kelly some 700'-800' westerly from the shaft. Surface fragments assayed 0.20% Cu.

The assays given below are from sampling done by the writer and his assistant during his investigation in May, 1966:-

	Shaft	Cu
Channel Samples		
#31534	N. Wall, 9' down incline from collar, cut 6'.3, true width 5'.4	1.25%
#31535	S. Wall, 18' down incline from collar, cut 7'.0 true width 6'.0	0.13%
#31536	S. Wall, 27' down incline from entrance collar, true width 5'.8	2.10%

Other samples were taken from the dump and 2 trenches by the investigator.

		Cu
#31537	- carefully taken grab sample, handfuls at a separation of 1½' from entire surface of shaft dump, 10 lb. sample	3.00%
#31538	- channel sample 15'-20' N.E. of base line point 8S in trench. Width 32", true width = 25"?. Some copper stain.	0.50%

#31539 - channel sample in main trench in andesite below tuff band N. of shaft. Base line 6S + 80 N + 20E. True width = 5'.3 — Cu 0.20%

Gold and silver were not tested for in these samples but it is probable that there may be very minor amounts of both. In future, it would be advisable to test for these metals periodically, as it is known that the eruptives such as these can contain consistent amounts of Au and Ag in some places.

GEOPHYSICAL

Geophysical work consisting of E.M. work was done initially by Shield Mining Surveys of Ottawa in 1957. A report on this work was not available to the writer. However, Mr. S. F. Kelly had made an earlier tracing of the linear anomalies from Shield Mining Ltd. data recorded in the Mining Recorder's office at Merritt. He placed a print of this at the disposal of the writer for use in this report. The print is enclosed.

The following is quoted from Mr. Kelly's report of April, 1966: "The electromagnetic survey covered an area about a mile square, and revealed a series of linear anomalies of varying strength, all trending in the direction of the formations. One of the longest, although not strongest of these anomalies, extends for a distance of 3,000 feet, right through the shaft, which is at the mid-point. The anomaly evidently corresponds to the andesitic flow known to be well mineralised in the shaft zone. Flanking this anomaly are numerous others, possibly a dozen, varying in length from a few hundred feet to 3,000 feet, and all parallel.

"Three thousand feet to the east, is another group of anomalies which extends, with interruptions, for a length of 6,000 feet and with the same strike as the first group. They are all strong electrical axes, and individually measure between a few hundred and a thousand feet in length.

"Shield Mining Explorations recommended that these anomalies be checked by other methods, such as spontaneous polarisation and soil analysis, because they may have been caused, in part, by water-soaked structures, such as shear zones or bedding contacts. Except for the two drill holes mentioned and four shallow pits, now sloughed in, no checking or testing of these anomalies was carried out prior to the acquisition of the claims by Amalgamated Resources Ltd."

The examining party had a Sharpe A-2 Magnetometer and a dip needle on the property at the time of their visit, with the objective of learning if magnetic susceptibility differences could be detected between geological formations or between rock types, especially where one rock type or formation would likely be mineralized and another not. There appears to be differences in magnetic susceptibility between andesites and apparent basaltic rocks and since the andesites show less susceptibility and are apparently the choice loci for copper mineralization, it might have been helpful to use the magnetometer to locate areas of lower magnetic attraction. However, the series of tuffs, andesites and basalts are so intermixed, the layers so thin and the dips of the beds are of such an angle that in consideration of these and other factors, differentiating one flow from another would be nearly impossible unless very detailed work were carried out. The idea of using the magnetometer was, therefore, discarded and no readings were taken.

It will be noted that from accompanying map sheets which show the geophysical E.M. conductor axes tied into the shaft and base lines, that the axes are linear and oriented northeast at azimuths 35° to 42° or N. 35°-42° E. It is difficult to relate these directly to the geology since there is too little detail. Also, there is no data other than the map to help establish what methods of testing were used and what detailed information was obtained. Since the conductors do not appear to be related in any way to overburden clays, graphitic shears or carbonaceous sediments, it is quite probable that they are the result of fault-fracture zones, of sulphide mineralization, or possibly of shear zones. It will be observed that the orientation of the conductors is very close to the best obtainable indications of strike of tuffs and flows and there could be a possible connection. Another possibility is that northeast oriented fault-fracture zones may be produced by stresses in the area (it is not an unusual pattern). The fracture zones may be somewhat discontinuous in the manner of steps. In certain portions of the steps, possibly either the flat or the rise, but probably the rise, mineralization may be more concentrated and yield E.M. conductors. The conductors may be at different levels, be controlled in position by more favourable lithological horizons, and they may be blind. These are only suggestions, but evidence for or against could be sought.

Spontaneous polarization testing was carried out by S. F. Kelly, but is reported to be minor in area and in amount of detail. No comments were offered by Mr. Kelly on its effectiveness or on area covered. An elaborate system of stakes was noted in the working area, but many of these were probably used for location of workings and other survey work.

DRILLING

Drilling was done on the property initially by Shield Mining Services. Two short holes were drilled in the vicinity of the shaft on the basis, presumably, of E.M. conductors there. No results on these holes is available and no core has been found. No other testing of the E.M. anomalies at the time was carried out.

Drilling was done by Amalgamated Resources at a later date, beginning in the shaft area. "The first two were collared near shaft and drilled parallel to it down the dip to check values found in the shaft walls. The first hole passed from hanging to foot wall, revealing a mineralised formation about eleven feet thick. Assays on thirty-two feet of core ran from 0.65% to 2.50% copper. The weighted average assay for the sampled sections (one ten foot section was not assayed) was 1.38% copper. The second hole went straight down the dip for 60 feet. Assays ran from 0.65% to 2.70% copper, with a weighted average of 1.65% copper.

"Evidence from these drill holes, and from sampling the shaft, indicates that the upper 25 feet of the ore-bearing bed, are low in copper, doubtless due to atmospheric leaching. Below that mark, copper values increase. This is an important point to be kept in mind when inspecting outcrops or trench exposures that appear poorly mineralised.

"Three short holes (nos. 4, 5, 6) were drilled within a distance of about 75 feet northeast and southeast of the shaft, inclined westerly at roughly 60° to cut the mineralised bed at about right angles. They returned well-mineralised intersections from 10 ft. to 12 ft. thick, assaying from 3.25% copper across 10 feet, to 6.25% copper across 12 feet. Hole #7 was spotted about 175 ft. southeasterly from the shaft. Although deeper than the previous ones (129 ft.) it did not go quite deep enough to encounter the down-dip extension of the mineralised bed in the shaft. Nevertheless, at approximately 50 ft. stratigraphically above the anticipated position of the shaft bed, it intersected 5½ ft. of mineralised andesite assaying 1.20% copper. Thus, it offers evidence that there are other copper-bearing horizons above, and possibly below, the one in the shaft."

"Diamond drill hole #9 was drilled under a trench exposure 400 ft. SSW of the shaft, and intersected 7 ft. of vein material assaying 1.90% copper. Nearer the shaft, DDH #10 drilled beneath a good trench exposure 200 ft. southwesterly from the shaft, and cut 5 ft. assaying 0.37% copper; a grab sample from the trench assayed 1.30% copper.

"DDH #11 was spotted to test a small spontaneous polarisation anomaly some 670 ft. north of the shaft, and stratigraphically below the shaft bed. A five-foot section assayed 0.15% copper, but was not far below bedrock surface, and gave evidence of considerable leaching."

"Drill hole #12 was a check hole, collared 65 ft. east of the shaft and drilled to a depth of 101 ft. From bedrock to the bottom, the assays ranged between a low of 0.09% and a high of 1.65% copper. The entire 94 ft. from bedrock to the bottom of the hole, gave a weighted average of 0.32% copper. The 20 ft. from bedrock to 27 ft. averaged (weighted) 0.16%; from 27 to 32½ it was 0.89%; the weighted average for the 8½ feet from 32½ to 41 ft., was 1.50% copper. The next 7½ feet to 48½ ft. depth, gave a weighted average of 0.33% copper. This entire 41½ ft. section, from 7 feet to 48½ ft. showed a weighted average of 0.56% copper. Below 48½ ft. the values ranged between 0.09% and 0.23% copper. This core was logged and split by me in collaboration with Gordon Bubb, at that time (summer, 1965) resident engineer for Emrex Mining Co. Ltd.

"Drill hole #13, collared 114 ft. south of #12, drilled only 25 ft., and has yet to be completed."

(All of the quotations immediately above are taken from the previously mentioned April, 1966, report of S.F.Kelly.)

The writer observed sites of holes 1, 2, 5, 6, 7, 9, 10, 11, 12 and 13. Hole #3 is reported as an abandoned hole. Hole #4 site had been obliterated by the trench work north of shaft.

All the above data were obtained from S.F. Kelly's report of April, 1966. No cores of any of the diamond drill holes, other than #11 and #2, were available for study. These were held by Mr. Kelly in his office. He explained that for one reason or another over the time lapse, the cores of all other holes had either been lost, dumped or done away with by accident. From his information, however, they had been sampled. Core from Hole 12 was viewed by the writer and good chalcopyrite mineralization was noted in portions of the greener andesitic rock. Some native copper indications were noted in association with calcite. This copper mineralization was not directly related to fracturing. The chalcopyrite mineralization observed was disseminated as a dust-like material through the andesite. Pyrite of the same fineness was observed in association with this chalcopyrite or occurred as pyrite alone. Some sections of the core were tuffaceous and some seemed basaltic. The latter were dense, fine-grained, blackish and amygdaloidal in which some amygdules contained only Fe-Mg constituents which resembled a brown serpentine. This type of rock was found to be distinctly magnetic in two sections of core tested.

CONCLUSIONS

Enough information is available and has been checked to indicate that copper mineralization consisting of the minerals native copper, chalcocite and chalcopyrite, basically, and the associate iron mineralization consisting of iron sulphides, and just possibly some magnetite, is widespread in the general area of the workings. Concentrations of copper minerals do occur, particularly in andesite flows which are relatively thin and interbedded with tuffs and basaltic flows. There is one prominent horizon of, generally, 6' to 10' in width established in which copper mineralization is concentrated to a degree that the average material of that horizon for at least one substantial length should be of ore grade.

Most evidence indicates that origin of the copper mineralization is closely linked with the period of vulcanicity which produced the flows. Native copper enclosed in amygdules and in the calcite cement of a broken flow top or other brecciated rock material seems to signify this, insofar as those forms of copper are concerned. The copper mineral chalcocite may be widespread; at least the high assays in the more highly mineralized sections of volcanic rock seem to indicate this. This mineral is one which is also found where copper is commonly closely associated with volcanic activity. There are, however, indications that the type of chalcocite may be of secondary, not primary, origin. Study of polished sections of ore should help to establish the primary or secondary nature of this mineral.

Chalcopyrite, which at present is considered to be the main copper mineral, is observed in green andesites disseminated as dust-like particles in sufficient concentration in places to render a copper grade of 1.5 to 2.0% in selected material. Copper mineralization in such a form is found elsewhere in the Merritt-Kamloops areas and along with all the other phenomena mentioned above, i.e. native copper in calcite veining and amygdules, considerable amounts of chalcocite, etc., are, in all the occurrences known to the writer, associated with volcanic flows and red-brown tuffs. Copper mineralization appears to enter the tuffs as chalcocite in black thin lines along fractures or to "soak"? into the tuff at tuff-flow contacts. These features are found also elsewhere in the world when copper mineralization is associated with volcanic activity, but such occurrences are usually Tertiary.

Appearances suggest that the copper mineralization could be introduced largely through a gaseous medium. Although there is general dissemination of copper minerals in minor amounts throughout the flows, as indicated by the drill results, the main concentrations appear to be directly connected with andesite flows in particular and to remain in them. Fracturing and staining are quite evident in surface exposures of these horizons, but the fracturing seen in connection with stronger copper mineralization appears largely confined to specific flows. Therefore, the fracturing does not necessarily imply a later period of movement than that of the volcanic period in which the rocks originated. There is, however, a strong suggestion that the fractured beds are the locus of stronger copper mineralization and that both copper concentration and fracturing are closely associated with cross shearing. Areas in which there is a general intensification of shearing, fracturing and movement appear to be ones where there is a spreading out of copper values beyond the main horizon. There is an implication in these facts that some copper mineralization may be of a second and later period.

Geological mapping, with an eye to structural aspects, is a necessity in this area. There are indications that the flows which contain the copper minerals may be overlain, possibly somewhat uncomformably, by layers of fragmental rocks which could belong to another later group of volcanics such as the Kingsvale or even the Princeton group. If this were the case, then exploration efforts could be confined somewhat to certain areas and horizons. The idea must be treated as a suggestion until more detailed study is made of the geology of the area. There may be some such reason for the apparent discontinuity of the highly mineralized andesite and its overlying accompanying tuff in the main trench to the north of the shaft. Faulting might also be the cause of the apparent break there. The trench is not cleaned sufficiently to enable one to see if the marker tuff and mineralized andesite are actually and completely terminated there. A band of cross shearing complicates the picture. Hole #4 may have just caught the sheared zone and the end of the main mineralized andesite horizon. It is noted that no drilling has been done along what would be the projection of the main zone beyond and to the north of #4 hole.

Extension of the main mineralized horizon to the southwest seems established. The drill holes to the southwest and surface workings there indicate more than one mineralized horizon. Although some good assay results are indicated in a narrow layer in #10, this hole did not necessarily cut the main horizon considerably. To the mind of the writer, from what little data is available to peruse, the drilling work strongly indicates copper mineralization in thin zones above and below the main horizon. There has, of course, been no opportunity to view the core and check the grades of material.

The writer accepts the fact that an ore shoot some 140'-150' long and 6' to 10' in thickness with reasonably good grades of copper mineralization is indicated, but he would not attempt, on the basis of the work done, to state that a certain tonnage of a certain grade exists in a block. If a careful surface survey and plot of the holes already drilled is made, clean fresh rock exposed in trenches and sampled, additional holes drilled to intersect the main horizon at different elevations, and the true dip of this mineralized main horizon established, then a block of ore could be satisfactorily indicated.

It is concluded, however, that because of the various factors involved, such as mining widths, mining problems with regard to selective mining, geological complexities, etc., that the main exploration should not be focused on the one good higher grade horizon, but rather focussed on seeking to establish a much broader zone of grades around 0.5% to say 0.80% copper that might be obtainable by open pit methods. General zones of copper mineralization with drill intersections that yield greater than 0.20% or 0.25% Cu which occur on either side of higher grade bands containing 1-3% might be averaged in to make a grade of 0.5% or better. Very often better grades are obtained in drilling dispersed or disseminated ores by using a blast hole bit rather than a core bit and collecting only sludge at set intervals. Such work would need to be carefully done. Additional drilling is needed.

Other general zones of copper mineralization may exist and the E.M. conductors established during the old survey may be an indication of these. They follow the same trend as the more highly mineralized andesitic flow and its accompanying tuff and are close to the general trend of the fold axes of this area. Careful study is needed of the geology and structures in the conductor areas before drilling. It is concluded that additional geophysical work will be required and that Induced Polarization methods or a modification of E.M. methods which would be more applicable to detection of disseminated sulphides in fractured rock horizons would be the best methods for use on the property.

RECOMMENDATIONS

The following specific recommendations are put forward with regard to the present main mineralized zone: (1) that the large trench just north of the trench, designated TR #1 N., on map, be widened by at least 10' on the north side in order to try to uncover the suspected break in the mineralized zone there; (2) that this trench be cut down well into bedrock by means of ripper or by blasting in order to give clear definition to the structures in the intersection sought; (3) that additional and deeper cuts be made into the bedrock in trenches 2 south, 3 south, and 4 south, by means of bulldozer and ripper or by blasting in order that true dips of the layers can be observed on at least one side wall and that fresh undisturbed rock can be checked for mineralization.

All of the above are recommended as aids to detailed geological mapping. It is recommended that such mapping be done in detail at 50' = 1" preferably, and for a start, cover the present area of the workings. The area covering the workings, the hillside and hilltop extending from the bed of the draw to the west of main workings to the area covering the E.M. conductor axes to the east should be mapped on scales of 1" = 100' or 1" = 200', whichever will conveniently cover the desired area.

Reconnaissance lines surveyed by pace and compass bearings or chain and compass, are recommended for linking the outer mineralized areas to the detailed area. Reconnaissance geology should also be done along these lines and any other line thought to have useful geology.

It is recommended that bulldozing be done under the direction of an engineer. Additional general bulldozing will likely be required in the area of the workings beyond the above specific requests. Bulldozing will also be required to cut down to and into bedrock in the area of the eastern E.M. conductors.

Geochemical testing should be carried out across the trend of the eastern E.M. conductors. This testing should be by means of sections at right angles to the trend and should utilize both rock and soil testing.

Renewed geophysical testing and survey work should be undertaken in both the area of the workings and in the eastern area. Both E.M. and I.P. surveys could be used if required but Induced Polarization in conjunction with Resistivity testing should be the primary method. It is recommended that the geophysical survey be started across the main zone of mineralization and workings with line intervals at 200' initially and depth probes essentially to 100' to 200' depth. Some testing should be done with a 50' depth probe occasionally. If and when anomalous reactions are obtained, line intervals can be brought down to 100' separation in the areas of interest. For the balance of survey, intervals between lines could be at 250' to 300' with depth probes beginning at 100' and increasing and decreasing as first indications become interesting. The prime objective after the area of workings is covered, should be the eastern E.M. conductor zone. It will probably be necessary to spread the survey outwards from that centre.

E.M. modified methods could be used if desired, but if so, confirmation of anomalous indications should first be sought over the main mineralized zone and this used as a standard for elsewhere.

Drilling is recommended basically only as the third stage of this program after the completion of the geological mapping and the geophysical surveying. The drilling program, as a whole, is contingent on the completion of stages I and II and obtaining good targets for drilling.

Additional drilling is required in the main zone area. This drilling, "A" part of program, could begin in the Stage II as targets are available there. A short test hole should be put down, 25' to 40' to the northeast of #4 D.D. Hole with the purpose of cutting the projected line of the main mineralized horizon beyond the bulldozing done in Tr. #1 North. A long hole some 30' or 40' north or northeast of #7 D.D. Hole could be tried to see if an extension of that mineralization can be picked up. Other holes between Hole #6 and Hole #10 are required at 50' intervals. Consideration must be given to the completion of D.D. Hole #13.

Personnel will be needed for the surveys and some efforts should be made to put up rough accommodation for survey and drill crews, as this will reduce costs if the crew is large enough. Other facilities, such as core shack, tool shed, etc., already mentioned in earlier reports, will be required.

The suggested amounts to be allowed for various sections and stages of the program are given below:-

<u>Stage I</u>

Geological surveying Detailed and reconnaissance,	allow	$4,500
Bulldozing, blasting and cleaning trenches - for all stages,	allow	7,000
Research, trench and other sampling and assays,	allow	900
Buildings (combined cook and bunk-house, core shack, tool shed, etc.)	allow	1,800
Geochemical survey and testing	allow	2,100
Transportation expenses, accommodation and food,	allow	1,700
	Sub-total ----------	$18,000

<u>Stage II</u>

Grid line work with stations	allow	$2,000
Geophysical Surveying, Induced Polarization-Resistivity and/or E.M. Methods,	allow	14,000
	Sub-total ----------	$16,000

Stage III

Diamond Drilling

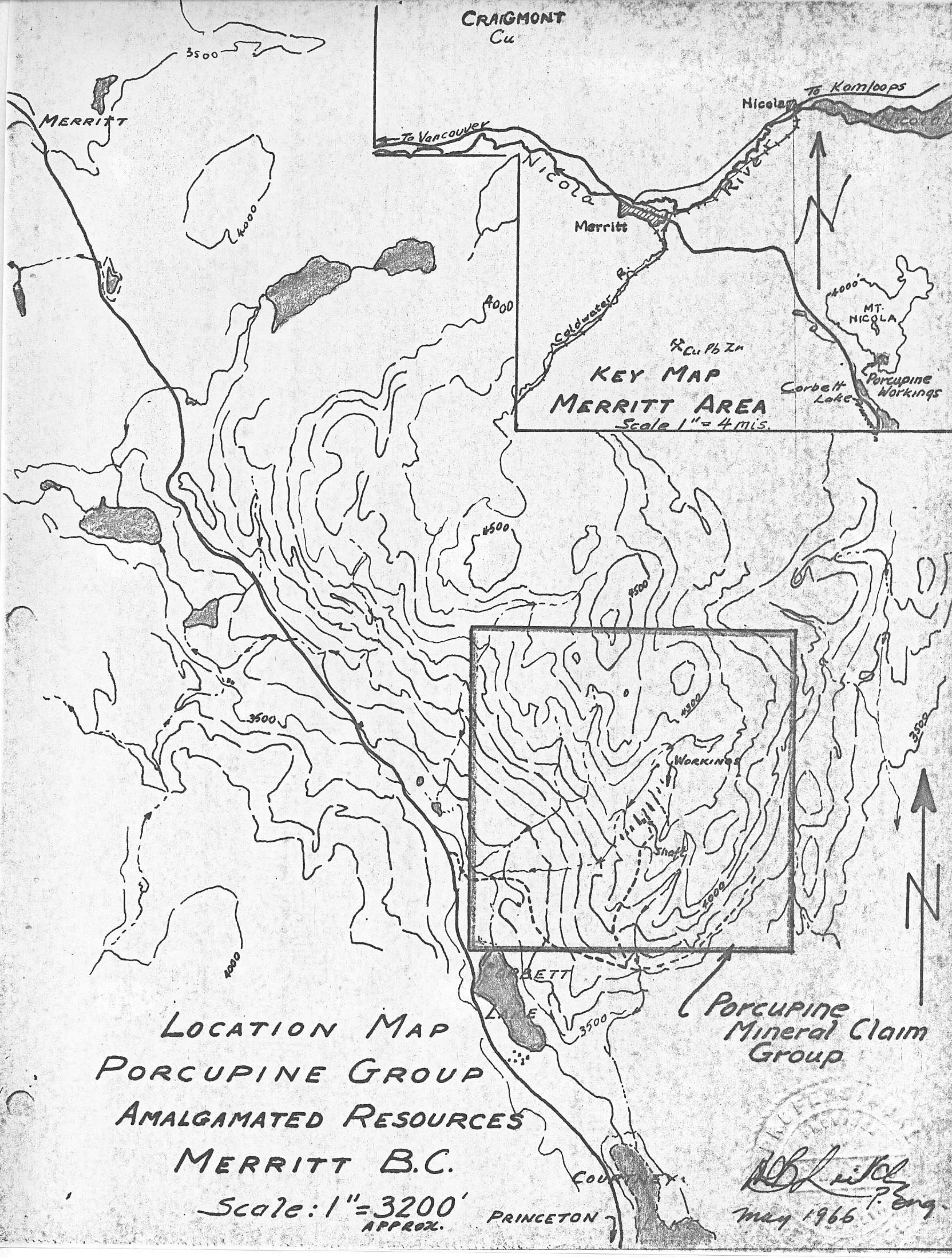
A. Program around shaft and extensions of main zone, 1000' @ $10/foot,	allow	$10,000
B. Drilling of eastern anomalous zone as required. Allow 3000' of possible drilling @ $11/foot,	allow	33,000
Accommodation, food supplies and transportation,	allow	2,000
Core logging,	allow	700
	Sub-total ------	$45,700

General:

Engineering supervision, reports, etc.,	allow	$5,000
	Total	$84,700
Contingencies: Allow 8% of $84,700		6,800
	Grand Total..........	$91,500

H.C.B. Leitch, P. Eng.,
Consulting Geologist.

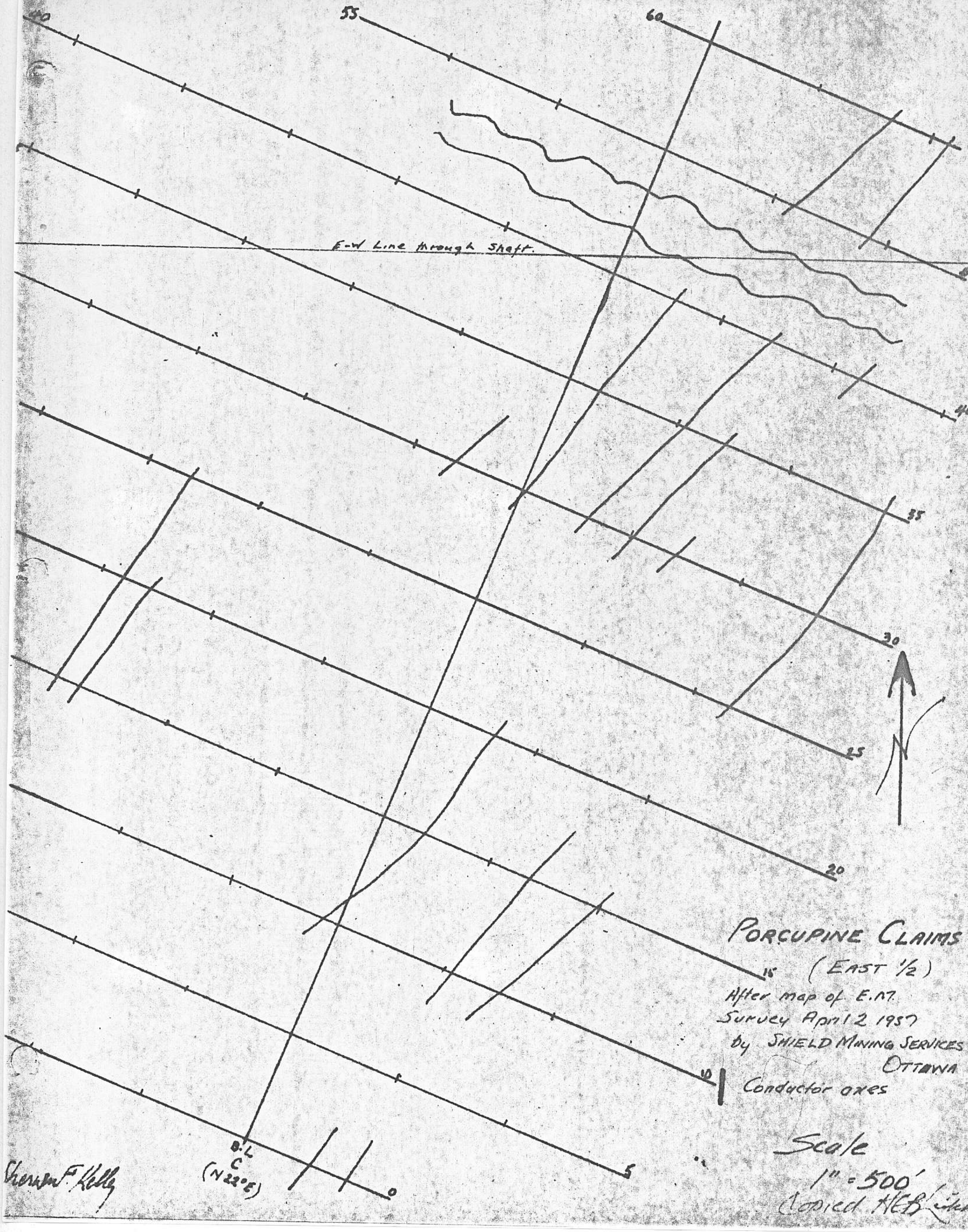
May, 1966.



Location Map
Porcupine Group
Amalgamated Resources
Merritt B.C.

Scale: 1" = 3200' approx.

May 1966


40
55
60
E-W Line through Shaft.
65
40
35
30
25
20
15
10
5
0
B.L
C
(N22°E)
Sherman F. Kelly
PORCUPINE CLAIMS
(EAST 1/2)
After map of E.M.
Survey April 2 1957
by SHIELD MINING SERVICES
OTTAWA
Conductor axes
Scale
1" = 500'
Copied HGB

PORCUPINE CLAIMS (WEST ½)