

REPORT
on Property of
NORTHWEST COPPER COMPANY
Marion County,
Oregon.

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PROPERTY.

Lode Claims. The property of the Northwest Copper Company includes the following lode claims:--

Smelter No. 1.
Harrison.
Mountain View No. 1.
Yellow Jacket.
Francis.
May Day No. 1.
Freeland.
Josephine.
Black Hawk.
Five Spot No. 1.
Santiago.
Crown.
Chief Justice.
Northwestern Extension.
Go Devil.

Smelter No. 2.
Handsome.
Mountain View No. 2.
June.
Golden Rule.
May Day No. 2.
Shilo.
London.
Granger.
Five Spot No. 2.
Utah.
Sunny Jim.
Judge.
Hoo Hoo.

Map B.

Thirty-one claims, about 550 acres, a length along the veins or lodes of 13,500 feet.

These claims and some of the workings are shown in their approximate relative positions on Map B, accompanying this report. This map is the only one available and no accurate survey of the claim boundaries has, apparently, ever been made.

A complete survey is now in progress by Mr. Herman Bueche, C.E., but his illness has delayed its completion. As there are no known conflicting interests, Map B is probably sufficiently accurate for the purposes of this report.

Buildings. These include an office, kitchen and dining room with rooms above, several cabins and dwellings, blacksmith shop and machine shop, and several garages. They are shown on Map C. The housing facilities of the camp is sufficient for twenty men.

electricity and are in fairly good condition.

Assay Office. There is a small but fairly complete assay outfit on the property. It is a great convenience as well as an economy to have assaying done on the ground. One of the men now at the mine is competent to do this. All assays reported by Mr. Romischer were made with this outfit and at the mine.

Mill. There is a small mill on the property which is equipped with 1 Downie 14" jaw crusher, 1 Downie 14" rolls, 1 3'x4' ball mill, 1 concentrating table, 1 Ziegler 5-cell flotation machine, classifier, elevator, shafting, belting and pulleys.

The mill was driven by a 36" McCormick turbine water-wheel, which also drives the generators for the compressor and lighting plants.

Mine Equipment. The buildings at the mine include a good blacksmith shop and power house for the compressor. The machinery consists of several light drills, 1 Rand compressor of 130 cu. ft. capacity, 1-21 K.W. generator, 1-30 H.P. motor, 1-7 H.P. motor, 1-15 K.W. generator and the usual blacksmith tools, steel, &c.

Motors. The Company owns two tractors, an 8-16 H.P. International and a 15-30 H.P. Altman and Taylor. The latter is hooked up as auxiliary power to carry the compressor in the event of exceptionally low water.

The Company also owns a Big Six Studebaker which is used for the most necessary trips to Salem or Portland. This car has brought in all the supplies and equipment for the camp and mine and easily pays for its upkeep by this service alone.

LOCATION.

District.

The property is situated in the Lester Mining District, Marion County, State of Oregon. The nearest railway station is Lyons, on the Corvallis and Eastern, twenty-four miles distant. Mehama is the nearest town and post-office for the mine, about twenty-three miles almost due west from the mine. This town lies between the mine and Salem, the State Capital, which is fifty miles distant. Reference is had to Map A.

Accessibility.

The road from Salem to Mehama is paved and from Mehama to the mine graveled. There are many places where work is well warranted but, aside from the fact that it is a mountain road of steep grades and sharp turns, there is nothing in its condition that can be called bad or dangerous. All communication is by automobile and truck.

Transportation.

Mining and other supplies, when hauled from Salem, cost \$20.00 per ton freight. With an outgoing haul, this figure would be bettered. It is stated that ore or concentrate can be hauled to Lyons on the railway for \$8.00 per ton. As the distance is about twenty-four miles and there are few reverse grades in the down hill haul, this seems about right. The railway freight from Lyons to Tacoma is \$4.00 per ton, a total freight from the mine to the smelter of \$12.00 per ton.

Water Power.

Water for power purposes is secured from Gold Creek, a flume 2' x 5' and 425' in length conducting the water to the mill and power site where a 36" turbine is run under a 27' head.

Map C.

For power purposes in the future, a hydro-electric installation should be contemplated by using the water in the Little North Fork of the Santiam River. A survey of this proposed installation has been made and is shown on Map G. with this report. No elevations are given on this survey, but the difference in elevation between the proposed intake and power house is approximately 250 feet. Neither does the flow seem to have been accurately measured but it is very considerable and, in fact, ample for all needs at the mine for many years of operation.

Map G.

Timber. Most of the surface of the claims is covered with a superb growth of timber. This is principally Oregon fir, many of the trees being of noble size. Some hemlock and cedar is also available. A small sawmill will be of great use on the property later for sawing mine timbers and the lumber for a mill and other buildings as they are needed. It is estimated that, with such a mill installed, timbers and lumber should not cost more than \$10.00 per thousand feet.

Fuel used at the camp consists of wood alone. With the supply immediately at hand, this is not unduly costly.

TITLES.

All the mining claims are held by virtue of location and the assessment work on them is accounted to July 1st, 1926. No question has ever been raised as to their possession.

The Northwest Copper Company holds the mining claims and all the other property under a Lease and Option to Purchase from the Consolidated Copper Mining and Power Company, of Portland, Oregon, whose address is 613 Pacific Building, Portland. The papers are made to W. I. Staley, Of Salem, Oregon, who is trustee for the Northwest Copper Company and its Secretary and Treasurer.

The lease and option is for a period of five years from April 22nd, 1926, and the purchase price \$40,000. This amount is payable as follows:-

April 22, 1927,	\$ 500.00
April 22, 1928,	4,500.00
April 22, 1929,	10,000.00
April 22, 1930,	10,000.00
April 22, 1931,	15,000.00

"10% of smelter returns, or 10% of returns from ore treated upon the ground by any process of extracting minerals from the ores" shall be applied upon the payment, whether due or not, as royalty.

TOPOGRAPHY AND HISTORY.

General Description. The mining property of the Northwest Copper Company is located at and near the confluence of Gold Creek with the Little North Fork of the Santiam River. The camp is at an altitude of about 1,950 feet and the surrounding mountains rise 3,000 to 5,000 feet above sea level. It is a westerly projecting spur of the Cascade Range and in the Santiam Forest Reserve. As all mining properties are allowed to cut timber for mining uses, this location in a forest reserve area is an advantage, providing, as it does, a large measure of protection from fire risks and logging operations.

The Little North Fork of the Santiam River has a gradient of about 200 feet to the mile above the camp and flows westward through a fairly precipitous valley, the sides of which slope to the river at angles of from 15 to 30 degrees from the horizontal.

Gold Creek is a turbulent stream of considerable size with, perhaps, 300 feet fall to the mile. It is reported that in the early days of the district, from \$5,000 to \$16,000 of placer gold was recovered from this stream immediately above its mouth. Some gold was certainly won, but the amount is doubtful.

Throughout the district the streams are crystal clear and many of the tributaries of the main streams have canons near their mouths. Dissection is only moderate and while the hillsides are fairly well covered with eroded detritus, rock outcrops are plentiful down to the stream levels. There is no apparent evidence of glaciation. As a whole,

the area is not especially rugged and the building of roads and trails is easily accomplished on moderate grades. The abundance of rock for ballast everywhere available insures good road-beds which are not easily washed out.

The climate of the district is mild and the days of sunshine are many. The annual precipitation is about 50-inches and heavy rains occur at times, but the snowfall is light and rarely interferes with traffic. As a whole, the locality is one of great natural beauty with many advantages conducive to convenient and economical operation for mining the whole year around.

Other Reports. Two reports on the property are available. Mr. Archy B. Carter, of Portland, was on the ground for two days in 1925, and his report is worth consideration. Owing to the limited time given to his examination he necessarily accepted many figures as to length of workings, depth, and distances, which subsequent surveys have altered. He also accepted, to some degree, the sampling of Mr. Harry Allen, (address unknown) as a basis for his conclusions. Mr. Allen took eleven samples and had them assayed, but no accurate description of their location is given although the widths are stated. One of these samples gives 5.88% copper for a width of 20 feet. As no such width of that grade ore was observed in the mine, it is possible that the width should have been inches, not feet. Allen's sampling is stated to average: Gold .162 ozs. Silver 1.37 ozs. per ton, and Copper 3.6%. The copper and silver values are entirely reasonable, but the gold requires explanation. The writer's sampling shows only an occasional gold value and this is confirmed by the fact that in the six lots of ore and concentrate shipped to the smelter, only one showed any gold, and that only 0.01 ozs. per ton. The Allen report is, nevertheless, competent and his conclusions, which are very favorable, justified from his data.

The other report is a series of notes from a reconnaissance report for the Oregon State Bureau of Mines, by Professor J. H. Batcheller, of Corvallis, in 1924. This report is excellent and it is a pity that there is not more of it. Mr. G. E. Stowell, also of the Bureau, took and assayed four general samples from strategic points. These samples for a width of 5'9" assayed: Gold 0.02 ozs., Silver 2.67

print with the report shows the exact location of this sampling. This average is simply given as "the general tenor of the ore body", but it is remarkable how closely it approximates the result of six weeks of careful work for this present report. Batcheller's opinion and conclusions meet with the writer's entire approval.

GEOLOGY.

Areal Geology. No competent geological survey has been made of the area in which the property is located and, so far as the matter of the rocks, no authoritative classification of the rocks has been had. The prevailing country rock has been generally classified as andesite and dacite. As Gold Creek is ascended from its mouth in a northerly direction, the dacite appears to replace the andesite but the change is gradual. Some basic dikes were observed but no connection could be seen between them and the veins or ore bodies. Limestones and perhaps other sedimentaries occur a short distance west of the property.

In a general way, the rocks in which the veins on the property of the Northwest Copper Company occur are igneous flows probably of great depth, as the veins are persistent for great distances along the surface and for differences of several thousand feet in elevation.

Veins or Fissure Zones. There are at least three well defined veins or fissure zones within the boundaries of the claims of the Northwest Copper Company and these are to a greater or less extent ore-bearing. They have a northwest strike and dip to the northeast.

Five Spot Vein. This is the least important of the three veins and crosses the west fork of Gold Creek about a mile and a half up from its mouth. It shows little mineralization and but little work has been done on it. No samples were taken from this vein, as it was considered

comparatively unimportant. High assays have been reported from this vein from specimens.

Granger Vein.

This vein shows on the surface of the Josephine, Shilo, Granger and, possibly, Five Spot claims.

It has the same general characteristics as the Northwestern vein -- to be later described -- but without its general mineralization. It is soft and in many places completely leached. As the workings on this vein are at a much higher level than are those on the Northwestern, this leached condition may be more complete than in the latter. It is not improbable that the Granger Vein may be productive at depth. It can be traced for about 4,000 feet on the surface and is a strong geologic feature. In the lower Granger tunnel channeled floor samples were carefully taken every forty feet, but in no case showed values. A caved part of the north drift in this working showed ore in the muck when it was cleaned out and a grab of this ore assayed Gold 0.16 ozs., Silver 1.60 ozs. per ton, and 4.82% Copper. Seemingly this ore was the remains of an unleached body near the surface. The tunnel on the Shilo claim is on the Granger vein and, while it shows no mineralization, its continuation might be good development later, as it is much lower than the workings on the Granger claim.

Northwestern Vein.

The most important vein on the property outcrops on the Northwestern, Northwestern Extension,

Chief Justice, Go Devil and May Day claims, and is known as the Northwestern Vein. It has a general strike of north 40° west and dips to the northeast at an angle of 70° to 80° from the horizontal. This strike and dip is the same as the other veins of this district.

The Northwestern vein has been traced for a length of 4,000 feet on the surface and it has a width of from 5 to 45 feet, as shown by actual measurements. Batcheller considers this as a shear-zone of 50 feet in width at one point. It is possible that mineralization may lie in parallel bands to the main vein, but the fact is that the few feet nearest the hanging wall carries all the mineralization wherever opportunity for observation. This hanging wall is the most persistent and regular geologic feature observed on the property and the ore bearing vein is usually either in contact with or immediate proximity to it. The foot wall, on the other hand, is usually indeterminate and varies in position and definition with the width of the shear-zone.

Vein Filling.

The vein filling in the Northwestern and Granger veins consists of crushed andesite, quartz, ore, and some calcite. The veins are soft and timbering is necessary along much of their extent, owing to this leaching out condition. The significance of this leaching is most important in considering the future development of the property, as well as in determining its prospective value.

Leaching.

"In the upper portions of many copper deposits the primary ores, pyrite, pyrrhotite, chalcopyrite, etc., are oxidized ***** and the copper is carried as copper sulphate by superficial waters to a lower level, sometimes leaving no copper at the outcrop ***** The copper from these solutions is precipitated both by other sulphides and by organic matter as chalcocite or sometimes covellite or, if the primary ore is pyrite, partly as chalcopyrite, thus forming a zone of very much richer ore between the leached-out gossan and

the unchanged primary ore at greater depths." Elements of Mineralogy, Crystallography and Blow Pipe Analysis, Moses and Parsons, page 362.

"In copper-iron deposits, the comparatively easy decomposition and solubility and precipitation of the copper and some iron salts generally result in more intensive impoverishment of these metals near the surface and more predominant enrichment at a lower horizon than is the case with any other metals." Principles of Mining, Herbert Hoover, page 27.

Development.

The more important workings on the property of the Northwest Copper Company are shown with relation to each other on Map D. accompanying this report. The surveys were made by Mr. Herman Bueche, C.E., of Washougal, Washington, and it is the intention of the management to have all the claims surveyed by Mr. Bueche in the near future.

Map D.

The development on the Northwestern vein in the Northwestern, Northwestern Extension, and Chief Justice mining claims consists of two adits, known as the Main tunnel and the North tunnel. The Main tunnel has its portal on the south bank of the Little North Fork of the Santiam river and extends into the mountain in a general southerly direction. Its direction is diagonal to the line of the valley and depth is gained slowly for the first few hundred feet, as shown on Map E. of this report. From the present face depth will be rapidly gained.

Map F.

Map E.

The Main tunnel follows the vein or hanging wall of the shear-zone almost from portal to face, a distance of 913 feet on October 1st, 1926. In addition to the main drive, there are eleven cross-cuts and two raises from this tunnel, making a total of 1,150 feet of underground work in this tunnel.

The North tunnel starts from the north side of the river, opposite the portal of the Main tunnel and at about the same level. It extends diagonally into the hill in a general northerly direction and is 215 feet in length. The northerly 170 feet is in the Northwestern vein and, as in the case of the Main tunnel, the hanging wall is followed to a point close to the face when, for some unaccountable reason, the bearing seams. Crosscuts in this tunnel make the total footage 335 feet in all.

As the portals of both these tunnels are on the rocky bank of the river and only a few feet above it when at freshet height, the dumps have from time to time been washed away. It is said that much ore has in this way been carried away in the past. If ore is to be stored on the dumps in the future, provision must be made for it by cribbing and filling along the banks on both sides of the river. This will not be difficult and it is hard to understand why it has not been done by the former operators of the property.

Sampling and Assaying.

Preliminary to this report, a thorough sampling and assaying of the property was had. This work was done by Mr. Wm. M. Romischer, of the U. S. Bureau of Mines, and his report as to methods, etc., is a part of this. The sampling and assaying -- all of which was done on the ground -- covered a period of six weeks and every care was exercised to make the work accurate and conclusive. The position of all sampling was recorded with relation to the established survey points and a red painted arrow placed on the rock wall at each channel. On the assay Map E. all samples are channeled, except where noted otherwise. The results of all assays are recorded on this map and certified to by Mr. Romischer in his report.

Ore Shoots. In the Main tunnel, the first ore shows just beyond station 102, which is 60 feet from the portal. This continues, somewhat irregularly, to just beyond station 106, a distance of 195 feet. Here better ore is reached, which continues for a length of 220 feet. At station 109, near the south end of this ore shoot, a raise has been put up and a stope taken out for 15 feet. This is known as the No. 1 stope. At the south end of this ore shoot a dyke of rather basic rock is encountered, which crosses the vein at nearly right angles, and is 10 feet thick. Beyond this dike, the seams of ore are smaller and the mineralization more disseminated for 260 feet. Beyond station 113, somewhat better ore shows to the face a distance of 165 feet.

Map F.

At a point 85 feet beyond station 113, a raise has been made for 40 feet and some stoping done. This is known as the No. 2 stope. Near station 106, a crosscut has been made to the west 45' in length and Batcheller says that this is the only point in the workings where the full width of the shear-zone is shown. Sampling of this crosscut gave very low values however, and those only in the seams encountered here and there.

Map F.

The last 25 feet of the Main tunnel has followed a strong seam of ore, which is, in places, four inches in width. This is clean chalcopyrite and there is in addition from one to two feet in width of disseminated mineralization. The face is promising and warrants farther work, especially as from this point on depth will be gained quite rapidly. The present face is only 192 feet below the outcrop, but from that point on the surface the hill rises steeply. Depth at this point may be important, as reaching a level in the vein where the leached condition so apparent throughout the tunnel may be bottomed. Already in the face the ground is more solid and while timbering is still kept up close, it does not look as if it would be needed much farther.

Map E.

In the North tunnel, the vein is entered in rather sparse mineralization; but just before station 141 is reached, a fine seam of ore and a general mineralization is reached. This continues for a length of 120 feet, practically to the face. A little stoping has been done between stations 141 and 150. This tunnel is running in the general direction of the hillside between the Santiam and Gold Creek and little depth is required to reach the vein. Therefore the best development, for this and other reasons, is to sink between stations 150 and 153 in the vein. The vein in this tunnel is not leached to the same extent as it is in the Main tunnel, and there is much less water percolating through the vein. There should be little difficulty in handling the water that a winze of considerable depth would make at this point. But little timbering was needed in this tunnel, and will not be in the winze.

A careful analysis of the assay results from the two tunnels on the Northwestern vein show that there is a well defined ore shoot in the main tunnel 197 feet in length and five feet in width extending from station 106 + 29 ft. to station 109 + 14', the ore in which averages: Copper 2.41%, Silver 0.75 ozs. per ton, and a trace of Gold. Of this ore shoot, the north 110 feet averages: Copper 3.00 %, Silver 1.18 ozs. per ton, and a trace of Gold.

Map F.

In the North tunnel between stations 141 - 15 ft. and 153, a distance of 110 feet in length and six feet in width, a strong ore shoot averages: Copper 4.475%, Silver 1.22 ozs. per ton.

Character of Ore.

The outstanding characteristic of the mineralization of the Northwest vein is its simplicity. The sulphides, and there are practically no carbonates or oxides, are almost entirely chalcopyrite. Pyrite, marcasite and pyrrhotite are rare, except as constit-

uents of the rocks, and one small crystal of sphalerite (zinc sulphide) was all the writer saw. In this respect, the Northwestern vein differs essentially from many of the other veins in the district, where sphalerite is plentiful. This favorable condition of the mineralization in this vein is pointed out by Batcheller in his report and his conclusion that such ore may be easily and simply concentrated. Samples of ore have assayed 25% copper where no other copper ore than chalcopyrite was present and it should be possible to approximate this content in concentrate by tabling and flotation. As the ratio of copper to silver is about three to one, this concentrate will run about 8 ozs. per ton in silver and be worth \$50.00 per ton in round figures.

SHIPMENTS.

The following shipments have been made to the Tacoma Smelter from the property:

<u>Date.</u>	<u>Tons Dry.</u>	<u>Copper %</u>	<u>Silver Ozs.</u>	<u>Gold Ozs.</u>
10-9-23	20.666	10.16	2.6	
10-17-23	29.629	11.36	3.49	0.01
8-26-24	31.655	8.97	1.29	
9-26-24	39.834	4.65	1.60	
9-9-25	4.698	20.05	5.17	
9-9-25	11.492	6.52	2.10	

The first two lots were from Stope No. 1, in the Main tunnel, and the ore was roughly sorted.

The third and fourth lots were crude ore, just as broken from the No. 2 Stope in the Main tunnel. Map I.

The fifth lot was concentrate and all that the mill produced during its brief run.

The last lot is crude ore, unsorted, from the North tunnel little stope.

Copies of the smelter returns are available.

RECOMMENDATIONS FOR FUTURE DEVELOPMENT.

Mine. As the most important immediate work, I recommend that a winze be sunk between stations 150 and 153, in the North tunnel, to as great a depth as facilities will permit. Drifts may be run north and south of a depth of 20 feet if the ore body appears to warrant. This winze should follow the hanging wall down in order to keep the ore. The vein in this tunnel does not show as much leaching as in the main tunnel, and the sinking of this winze should not present any serious difficulties of timbering or pumping.

In the North tunnel, between stations 141 and 150, in a somewhat leached chalcopyrite seam, secondary covellite and possibly chalcocite occur as coating on the chalcopyrite crystals. An assay from this ore gave 25.54% copper.

Map F.

Near the face of this tunnel, in the floor, a seam of ore is exposed 6 inches in width. A sample from this gave 25% copper and 6 ozs. silver. As this sample contained a certain amount of rock, the copper content is too high for the amount of chalcopyrite present to account for it. Another seam in the floor assayed 16.83% copper and 3.2 ozs. silver for a width of 3 inches. In no case were these high grade seams taken in the general sampling, which shows 4.475% copper and 1.22 ozs. silver per ton for a length of 110 feet and a width of 6 feet. The positions of all these assays are shown on Map F.

Map F.

Next in importance, I consider the driving ahead of the Main tunnel on the vein on its southerly course. As pointed out, this is rapidly gaining depth beyond the present face and it is likely that as greater depth is reached the leaching and soft

character of the vein may be gradually left behind and a horizon of secondary sulphide enrichment entered.

In fact, the future development of the property should be at lower levels than has yet been reached in order to get below the leaching, if possible. If a horizon of secondary sulphide enrichment can easily

it can be put into production quickly and at minimum expense. The ore in the North tunnel indicates that this horizon is only a short distance below and the tunnel may be just on its top. The location of the winze has been selected as the most likely point from which to prove this. Ultimately a raise could easily be put through the surface and hoisting machinery installed for the permanent shaft, if developments warrant. The site of this shaft would afford good dump room and the road could easily be extended to it.

Mill. The present mill is useless for any real work in the future. Much of the machinery may, however, be used in any plant that is built. A mill, to be economical, must not only be of good design, but must be located with regard to the mine so that the ore can be transported to it at a minimum of expense. No mill should be considered for the property until the development is carried along to a point where sufficient ore is in sight to supply the mill for a considerable time, at least six months. One of the most usual, and often a fatal, mistake in mining operation is the premature building of a mill. These monuments to bad judgment decorate the landscape of the entire mining works.

With sufficient ore developed, a competent mill man should be employed to design the sort of plant best fitted to save the particular character of ore to be milled. Such a plant will be simple and the extraction good, because there is no complexity in the nature of the ore.

Water Power: Before any extensive operations can be conducted at the property, more power must be had. It seems a pity not to contemplate the improvement of the splendid water power as surveyed on Map G, and which would give ample for all uses for years to come. This, however, entails a heavy expenditure and it is not until the same is farther developed. The most urgent need within a short time, will be for more air than the little compressor now on the ground can furnish. A larger compressor must be had soon and either an oil or steam plant will have to be provided to drive it until the larger water power installation is warranted.

CONCLUSIONS.

The distance from the face of the Main tunnel on the south to the face of the North tunnel on the north is about 1,250 feet. For that distance, underground development of the Northwestern vein has been accomplished. At the level of these tunnels, the vein is leached throughout to a great extent, more in the Main than in the North tunnel, less in the face of the Main than elsewhere in it. Throughout this entire length chalcopyrite mineralization occurs.

The Main tunnel shows in the floor an ore shoot 197 feet in length and five feet in width, assaying 2.41% Copper, 0.75 ozs. Silver per ton, and a trace of Gold. Of this ore shoot, the north 110 feet, five feet wide, assays 3.00% Copper, 1.18 ozs. Silver per ton, and a trace of Gold.

The North tunnel shows in the floor an ore shoot 110 feet in length and six feet wide that assays: 4.475% Copper, 1.22 ozs. per ton silver. This tunnel shows some secondary covellite and, possibly, chalcocite.

It is my opinion that a horizon of secondary sulphide enrichment exists in the Northwestern vein at a not materially lower depth than the level of the Main and North tunnels and that it is only a short distance below the floor of the North tunnel. I believe that ore of high grade will be encountered in sinking from the North tunnel and that large ore bodies can be opened by drifts from this winze or shaft.

W. J. Klumendorf

Seattle, Washington, U.S.A.
October 20th, 1926.

REPORT OF SAMPLING AND ASSAYING OF THE
PROPERTIES OF NORTHWESTERN COPPER COMPANY.

By Wm. M. Romischer.

The sampling and assaying was carried on continuously between August 30th and October 13th, 1926, by the writer, assisted by Mr. R. E. Davis and Mr. N. M. Cook.

The main tunnel on the northwestern vein, which is located on the south side of the Little North Fork of the Santiam River, was sampled by cutting channel samples across the floor of the tunnel from side to side. By this means a representative cross-section sample of the vein was generally obtained. The reason that floor samples were taken was because the customary roof samples were impractical, the tunnel being timbered and the roof lagged.

The procedure used in taking the samples is as follows:

Samples were taken at intervals of 10 feet where it warranted. That is, where extensive mineralization occurred. In places where the mineralization was more lean, floor samples were taken across the drift at 30 foot intervals. The average width of all of the samples taken across the vein in the main tunnel is 5 feet.

When the samples were taken, the track bed was picked away until the solid material was exposed. This was then chipped out by means of a single jack and gad. The sample was put in a sampling sack and carried to the assaying laboratory, where the sample was thoroughly dried, broken, quartered and ground until the entire sample passed through a 100-mesh screen. The cyanide method was used for the determination of copper. One gram charges were used and duplicates on each sample were run. One-half gram charges in solution were used in the determination of silver and gold.

Samples were taken in cross-cuts 3, 6 and 8 in the main tunnel. These samples were taken as channel samples along the two sides and roof of the cross cut for distances of 5 feet. Samples were also taken across the face of the main tunnel as the work of driving the tunnel progressed. Channel samples were taken. Also, samples were taken of the adjoining raise in the same manner. As it was not safe to take samples in stope No. 2, a carload of the ore was sampled, which was taken out of the chute from stope No. 2 and the adjoining raise on stope No. 2 was also sampled.

The north tunnel of the Northwestern vein was sampled in a similar manner as that of the main tunnel, channel samples being taken across the floor of the tunnel from side to side. Where the vein showed good mineralization, samples were taken at 10 foot intervals and at places in the tunnel where the samples showed none, or small amounts of mineral an interval of 30' was used. The average width of all the samples was 6 feet.

The Shilo and Granger tunnels were sampled by means of floor samples across the vein from side to side. The interval used for sampling in the Shilo was 30', and that in the Granger 40'. A sample at the face of each

tunnel was also taken. These face samples were channel samples taken across the face perpendicular to the hanging wall.

The position and description of all samples taken in the Main and North tunnels on the Northwestern vein are correctly shown on Map F, accompanying the report of Mr. W. J. Elmendorf, and the results of assays as given on that map are correct.

(Signed) Wm. M. Romischer

U. S. Bureau of Mines

Seattle, Washington