

Co. and the Susanville Mining Co. The Badger mine is developed by an incline shaft on the vein to a depth of 500 feet. The bottom of the shaft or the 500 foot level is connected with the surface by a tunnel 1,400 feet long. From the 500 foot level a winz was sunk to a depth of 400 feet. The total development work consists of between 3,000 and 4,000 feet of underground workings. It is reported that at the time that operations closed down the lower workings contained a shoot of medium high grade ore. There is no data available as to the production of this property. The property adjoining the Badger group belongs to the Stockton Mining Co. and ^{was} is also closed down at the time that litigation was started.

To the northwest of the Gem mine lies the Chatanooga and Daisy Two claims. At present the Chatanooga workings are full of water and the Daisy Two workings are being pumped out. The ore shoot on the Chatanooga is reported to be 125 feet long and to average \$9.00 in gold and silver for a width of 1 to 8 feet. The Daisy Two is said to contain a shoot of ore 75 feet long which averages \$15.00 per ton in gold and silver over a width of 4 feet. Both of these properties were visited by the writer and the dumps of each show good looking sulphide ore. At the present time the only operations in the district are carried on by the Hunter Bros. and associates who are operating a small mill on Elk creek and doing development on the Gold Bug claim.

GENERAL GEOLOGY

Such a limited study as I was able to give this matter in the field has led to the conclusion that generalization in regard to the genesis of the ore bodies of this district would be unsafe without the comparison of many rock sections and the collection of a vast array of evidence. This section has no detailed geological work done thereon but the sequence of geological events are no doubt similar to those effecting the Blue mountains in general.

During the Paleozoic Age the area now covered by the Blue mountains was the bottom of an inland sea. Upon this sea bottom was deposited argillaceous and silicious mud which is now found in the form of argillites and slates more or less rich in silica, together with isolated deposits of limestones. All of the argillite series are composed of fine grained sediments indicating deposition in deep water. During this time volcanos began to emit lavas and tuffs which are now found interbedded with the muds and limestones. Emergence or uplift of this area then took place with consequent disappearance of the sea. Later the water again covered this area but to a much shallower depth. This was during the Triassic Period. During the following age that of the Mesozoic came an organic uplift which could geologically be termed a Jurassic revolution. Huge masses of magma, which when cold became granodiorite, diorite, gabbro and peridotite invaded the overlying sediments, contorting and fissuring them on a large scale. So great was the pressure

Cen Mine		South Cen Mine		North Cen Mine		Gold	
NAME		OLD NAMES		PRINCIPAL ORE		MINOR MINERALS	
10 S	33 R	S		<u>PUBLISHED REFERENCES</u>			
T	R	S		Ore Metal Mines Handbook 14B:140			
Grant		COUNTY		Parks & Swartley 16:164			
Susanville		AREA		Gilluly, Reed & Park 33:112			
about 3500'		ELEVATION		Lindgren 01:907			
about 27 miles to Austin		ROAD OR HIGHWAY		Swartley 14:171			
		DISTANCE TO SHIPPING POINT		<u>MISCELLANEOUS RECORDS</u>			
PRESENT LEGAL OWNER (S)		Mrs. J. H. Dunstan		Address Susanville, Oregon			
OPERATOR							
Name of claims		Area	Pat.	Unpat.	Name of claims		Area Pat. Unpat.
2 claims			x				
1 160 acre homestead							
<u>EQUIPMENT ON PROPERTY</u>							

REPORT
GEM MINE.

SUSANVILLE, OREGON

Notes:

The copy of this report on file in the Baker Field Office is more complete than ~~this~~ in that it contains a very considerable appendage of charts + maps

(C O P Y)

R E P O R T

ON THE PROPERTY OF

T H E G E M M I N I N G C O M P A N Y

SUSANVILLE DISTRICT, GRANT COUNTY,

OREGON.

By:-
Carl N. Anderson,
Mining Engineer,
Registered in State of Oregon
December 9, 1919.

GENERAL STATEMENT

This report is based upon my personal examination of the Gem Mine which is situated in the Susanville Mining district in Grant County, Oregon, U.S.A. This examination was begun on October 10, 1922, and was concluded on October 20, 1922.

S U M M A R Y

ACCESSIBILITY:--This property is easily accessible being about 24 miles from the nearest railroad station and connected with same by a good automobile road.

ACREAGE:--This property contains 238.24 acres of mineral land. Of this 196.6 acres are patented and the balance are not.

TITLE:--There is \$1,500.00 (now paid) due Mr. Phil Metschan of Portland, Oregon, to complete the purchase of the patented mining claim known as the South Gem. The Gem Mining Company holds undisputed title to the rest of the property which is free from all encumbrances. (Since date of this report title to this property has passed to Mr. G. S. L. Smith and Mr. J. H. Dunstan, and is now held by them free and clear of all encumbrances.)

GEOLOGY:--The Gem Vein is of the true fault fissure type and all geological indications favor its continuance in depth.

ORE-TONNAGE:--The main Ore shoot that is developed in the Gem Mine contains approximately 18,000 tons which ~~has~~ has a foot assay value of gold 0.873 Oz. per ton and silver 0.86 Oz. per ton. The monetary value of this ore, at \$20.00 per ounce for gold and \$1.00 per ounce for silver, is \$18.32 per ton of 2000 pounds.

TIMBER:--Upon the property of this company there is at present a stand of approximately 3,000,000 feet of Yellow Pine timber. The company also owns a small saw mill which has on hand about 150,000 board feet of sawed lumber.

POWER:--About three and one half miles from the mine there is a stream of water capable of furnishing sufficient power for mining and milling purposes.

EQUIPMENT:--The property is equipped with boilers, steam hoist, air compressor, air drills, tools, etc., sufficient to carry on mining on a moderate scale.

MILLING:--The ore has been tested by the General Engineering Company of Salt Lake City, Utah, who obtained an extraction of 93% of the gold and 73% of the silver by the cyanide process.

DEVELOPMENT:--The development work that has been done on this property consists of the following:

355	feet	of	incline	shaft.			
145	"	"	drifting	on	the	50	foot
310	"	"	"	"	"	125	"
220	"	"	"	"	"	250	"
625	"	"	"	"	"	350	"
60	"	"	Cross	cutting	125	"	"
180	"	"	"	"	250	"	"
240	"	"	"	"	350	"	"
100	"	"	Raises	(70	ft.	caved)
50	"	"	Winz.				

Numerous surface cuts have been made but these are all caved in.

C O N C L U S I O N S

After having given this property a thorough examination and conservatively gone into its possibilities I do not hesitate to state that it has real merit and should be put upon a producing basis without delay. The ore shoot which is now more or less developed contains approximately 18,000 tons with an average content of 0.873 oz., gold and 0.86 oz., silver. The gross value of this block of ore is about \$329,760.00. It is assumed that this ore can be mined and milled at a cost of \$6.00 per ton and that an extraction of 92.5% can be made. The net value of the above block would then be \$197,100.00. Depreciation on equipment, amortization of capital invested and federal income tax have not been deducted from this figure. This property is ready for a milling plant of not less than 50 tons daily capacity. Further development work should be done so as to explore the main ore shoot to the north of the fault zone. Exploration should also be carried on at a greater depth than now attained by the present workings. There is every reason to believe that undeveloped ore shoots will be found which will out weigh the present known quantities.

L O C A T I O N

The property of the Gem Mining Company is situated in the Susanville Mining district of Grant County, Oregon, in Township 10 south, range 33 east of the Willamette meridian. Its geographical location is shown by sketch on Plate 1. (All plates, maps, etc. are in original copy of report.) The nearest post-office at this time is that of Susanville which is reached by one and one quarter miles of good wagon road. Susanville in turn is about 23 miles down the Middle Fork of the John Day river from Austin, a station on the narrow gauge railroad of the Sumpter Valley R. R. Co. Austin is about 60 miles from the town of Baker which is the main supply point of this section.

Baker is situated on the main line of the O.-W. R. & N. R. R. 357 miles from Portland, Oregon.

C L A I M S

This property consists of four full sized mining claims, each one being 1,500 feet long by 600 feet wide, and one homestead entry of 155.6 acres which carries all mineral rights. The total area covered by this property is 238.24 acres. The location of the claims with respect to each other and to other patented claims in the district is shown on Plate II.

T I T L E

On August 10, 1920, Mr. G. S. L. Smith and Mr. J. H. Dunstan deeded to the Gem Mining Company the land now embraced in their property with the exception of the claim known as the "South Gem." This claim which is patented was later purchased from Mr. Phil Metschan of Portland, Oregon. There is still due Mr. Metschan on this transaction the sum of \$1,500.00. (Now Paid.)

The homestead which is described as the west 1/2 of the southeast 1/4; and the southeast 1/4 of the southwest 1/4 and lot #10 of section 5, T-10-S, R-33-E., W. M. in Oregon was patented under the act of April 24, 1820, and thereby is vested with all mining rights.

The Gem of the Mountains quartz claim was patented by John H. Blake on September 16, 1897, and was purchased from his heirs by G. S. L. Smith on June 15, 1906.

The quartz claim known as the Gem No. 1, was located on October 2, 1918, by Messrs. Smith and Dunstan.

The quartz claim known as the Gem No. 2, was located by the same men on August 4, 1919.

The last two named claims are held by possessory title obtained by legal locations and the performance of annual assessment work.

I have carefully examined the abstract of title to the above property and find that the Gem Mining company holds an undisputed title to same and also that there are no suits, judgments or other liens pending.

H I S T O R Y

Placer gold was discovered in the Susanville district in 1864 and for the following 35 years it contributed to the state's production. The greater portion of the placer gold produced by this district has been taken from Elk creek upon which the Gem mine is situated. This creek was noted for the large nuggets obtained from its placers. Some of these nuggets carried individual values of from \$480.00 to \$800.00. On June 19, 1913, a nugget was found by George Armstrong on Buck Gulch which weighed 80.4 ounces. This at \$17.60 per ounce would have a value of \$1,415.00.

Quartz prospecting began early in 1869, but as this district was almost inaccessible at that time, only the veins containing the highest grade ore could be worked at a profit. The quartz vein on the Gem mine was discovered in the early seventies by John H. Blake. He extracted a quantity of the oxidized surface ore and ran it through a mill built by a Mr. Cabell on Elk creek two and one half miles above its mouth. Mr. Cabell was operating this mill on ore taken from the Gem vein south of the claim located by Mr. Blake. The Blake property was purchased from his heirs by Mr. G. S. L. Smith on June 15, 1906. On May 9, 1910, Mr. Smith deeded a one third interest in this property to Mr. James H. Dunstan. These men renewed work on this property; sinking an incline shaft on the vein and developing it in general. On August 10, 1920, the Gem Mining company was incorporated at Baker, Oregon, under the laws of the State of Oregon. On this date Messers. Smith and Dunstan deeded the Gem property to this organization. The Gem Mining company further developed the ore ^{beds} and put the mine in shape for a reduction plant.

OTHER PROPERTIES IN DISTRICT

Mining has been carried on in this district for a great number of years. As is the case in most every productive mining section, a few large companies gradually absorbed the smaller ones and today the greater portion of this district is owned by a few large corporations. The Badger group has been the most important producer of this district. The main vein of this group which is apparently a continuation of the Gem vein was known as early as 1869. Between 1870 and 1874 oxidized ore was extracted from the surface outcroppings and milled in an arrastra, yielding \$26.00 per ton in gold 691 fine. Later a ten stamp mill was built on Elk creek. This mill was equipped with concentrators the product of which was shipped to the smelter. The free gold continued from 25 to 50 feet below the outcrop, but from this point down the ore contained increasing quantities of the sulphides of iron, lead and zinc. Development work and milling were carried on until November, 1905, when all work was closed down ^{due} to litigation in the case of the Stockton Mining Co., vs. the Badger Mining

Co. and the Susanville Mining Co. The Badger mine is developed by an incline shaft on the vein to a depth of 500 feet. The bottom of the shaft or the 500 foot level is connected with the surface by a tunnel 1,400 feet long. From the 500 foot level a winz was sunk to a depth of 400 feet. The total development work consists of between 3,000 and 4,000 feet of underground workings. It is reported that at the time that operations closed down the lower workings contained a shoot of medium high grade ore. There is no data available as to the production of this property. The property adjoining the Badger group belongs to the Stockton Mining Co. and ^{was} is also closed down at the time that litigation was started.

To the northwest of the Gem mine lies the Chatanooga and Daisy Two claims. At present the Chatanooga workings are full of water and the Daisy Two workings are being pumped out. The ore shoot on the Chatanooga is reported to be 125 feet long and to average \$9.00 in gold and silver for a width of 1 to 8 feet. The Daisy Two is said to contain a shoot of ore 75 feet long which averages \$15.00 per ton in gold and silver over a width of 4 feet. Both of these properties were visited by the writer and the dumps of each show good looking sulphide ore. At the present time the only operations in the district are carried on by the Hunter Bros. and associates who are operating a small mill on Elk creek and doing development on the Gold Bug claim.

GENERAL GEOLOGY

Such a limited study as I was able to give this matter in the field has led to the conclusion that generalization in regard to the genesis of the ore bodies of this district would be unsafe without the comparison of many rock sections and the collection of a vast array of evidence. This section has no detailed geological work done thereon but the sequence of geological events are no doubt similar to those effecting the Blue mountains in general.

During the Paleozoic Age the area now covered by the Blue mountains was the bottom of an inland sea. Upon this sea bottom was deposited argillaceous and silicious mud which is now found in the form of argillites and slates more or less rich in silica, together with isolated deposits of limestones. All of the argillite series are composed of fine grained sediments indicating deposition in deep water. During this time volcanos began to emit lavas and tuffs which are now found interbedded with the muds and limestones. Emergence or uplift of this area then took place with consequent disappearance of the sea. Later the water again covered this area but to a much shallower depth. This was during the Triassic Period. During the following age that of the Mesozoic came an organic uplift which could geologically be termed a Jurassic revolution. Huge masses of magma, which when cold became granodiorite, diorite, gabbro and peridotite invaded the overlying sediments, contorting and fissuring them on a large scale. So great was the pressure

that some of the rock layers were crushed to fragments. The cooling of these magmas gave rise to vapors and solutions that penetrated the adjacent formations, filling seams and fissures with quartz and even altering the rocks themselves. The following Tertiary Period caused continual erosion and sedimentation with a corresponding development of topography which in numerous places removed portions of the contorted sedimentary rocks, exposing the intrusive masses such as are seen at Greenhorn and Bald mountains. By this wearing down process the major portion of the Blue mountains was removed. During the middle of the period there was renewed volcanic activity. Great flows of lava poured numberless fissures and vents on the mountain sides. They came stream upon stream in endless succession and filled and dammed the then existing water ways, causing them to lay out their courses anew. This accounts for the changed river channels and the gravel filled basins found high up on the mountains. Deformation continued until the Quaternary Period when the mountains were again re-elevated. During the Glacial Epoch which followed the climate became colder and glaciers filled the valley heads. These glaciers softened the contour of the uplifted areas and steepened the slopes of the youthful valleys. Then came the cycle of Post-Glacial Erosion with the formation of terraces, gorges and ravines, together with the recent stream deposits of gravel, subsoil and soil.

V E G E T A T I O N

Upon the property of this company is a stand of about 3,000,000 feet of Yellow pine timber which will fill the needs of the mine for a number of years. The company also owns a small sawmill. Willows, alders, Etc., are found along the water courses and scattered among the yellow pine there is some tamarack and black pine. As this area has not been logged or burnedover, one does not find much second growth. This last season about 14 tons of hay was put up on the homestead.

C L I M A T E

This district has an agreeable and healthful climate. The cold in winter is not extreme, although there are periods when the thermometer drops to zero. The summers as a rule are temperate and dry with cool nights and moderately warm days, the thermometer occasionally rising to 90 degrees in the shade. The annual precipitation amounts to about 30 inches, a large part of which falls as snow during the winter months.

T R A N S P O R T A T I O N

Transportation facilities from the mine to the railroad are good. Freight is handled on the logging branch of the Sumpter Valley R. R. which extends down the middle fork of the John Day river to within about 13 miles of the Gem mine. The road connecting this railroad with the mine is fit for heavy truck haulage for at least six months each year and it should

degrees to the east. The main ore shoot has a pitch of about 48 degrees to the northwest.

1. UNDERGROUND WORKINGS

This mine is developed by an incline shaft which is 355 feet deep on the vein. At 50 feet below the collar of the shaft the 50 foot level extends southward 100 feet to the surface. This level also drifts on the vein to the northeast for a distance of 40 feet. To the south of the shaft and above this level the ore was removed by the early miners. Some ore was also removed from this level by understopping. At the north end of this level the ore shoot narrows down to a seam of quartz only a few inches wide. The total length of the ore shoot exposed by this level is about 160 feet. The average width of the vein on the 50 foot level that was stoped out was about 4 feet. A sample taken in the floor 10 feet south of the shaft gave an assay value of \$17.32 per ton in gold and silver.

Between the 50 foot level and the 125 foot level the shaft is all in the vein which has an average width of 6 feet and an average value of \$16.60 per ton in gold and silver.

The shaft station on the 125 foot level is in the hanging wall of the vein. To the southwest this level is in the form of a drift for a distance of 100 feet. About 50 feet south of the shaft station a raise has been put up about 15 feet. At this raise the ore shoot narrows and pinches out for a distance of about 10 feet, when from six inches to one foot of good ore appears on the foot wall. At the south face the vein consists of numerous small seams of barren quartz. Throughout the southwest part of the level there are a number of branches of quartz which run ~~about~~ both into the hanging and foot walls. To the northeast of the shaft station the 125 foot level drifts on the vein for about 130 feet. At a point about 40 feet north of the station there is a fault plane striking north 50 degrees west and dipping 80 degrees to the south. The indications are that the vein to the north of this fault has slipped down. This is also borne out by the broken condition of the vein on this and the lower levels. About 40 feet north of this fault the ore shoot ends in a maze of quartz stringers which turn into the foot wall. A short crosscut was run into the foot wall at this point, but the stringers that it followed were found to terminate in a short distance. The north face of this level is in broken and fractured ground highly schistose in character. This is no doubt close to the fault zone intersected by the lower levels. The length of the ore shoot exposed by this level is 140 feet. Its average width is 4.3 feet and its average value is \$12.00 per ton in gold and silver. About 20 feet below the 125 foot level the shaft leaves the greater portion of the vein in the foot wall. At a point 15 feet below this level a small crosscut has been run into the foot wall through the vein. A sample taken at this point over a width of 3.1 feet assayed \$45.77 per ton in gold and silver.

The shaft station on the 250 foot level is in the hanging wall of the vein. From this station the drift swings back to the north and cuts the vein in about 30 feet. From this the drift continues on the vein to the northeast for a distance of 120 feet. About 35 feet from the point where this north drift intersects the vein a fault plane is found which strikes north 60 degrees and dips 65 degrees to the south. In all probability this connects with the fault plane found on the 125 foot level. North of this fault plane on the 250 foot level the ore shoot is broken and bent but it continues for about 50 feet at which point it narrows down and pinches out. However within the next 25 feet it opens up again and at the face of the drift is about 0.8 feet in width. 20 feet south of the present face a raise has been put up for 70 feet on an incline to the south. Only about 15 feet of this raise was accessible at the time of this examination. This showed from six inches to one foot of ore having a value of over \$100.00 per ton. Figures on a shipment of ore that was taken from this raise will be found under "Shipments to Smelter." A few feet north of this raise a winz has been sunk which connects with a raise put up from the 350 foot level. This will be described later. A few feet north of the shaft station on the 250 foot level a crosscut has been run into the hanging wall for a distance of 95 feet. At 80 feet from the drift a sheared zone 12 feet wide was intersected. This zone contains seams of quartz and calcite and runs in value from \$1.00 to \$2.00 per ton. Its strike is north 50 degrees east and it dips 50 degrees to the east. Beyond this sheared zone the hanging wall formation was found.

From the shaft station on the 250 foot the drift runs southwest and intersects the vein in about 20 feet. From this point southward the drift is inaccessible, but no ore was reported as found therein. At this point of intersection of the south drift with the vein a crosscut has been run into the foot wall for a distance of 60 feet. The first 35 feet of this crosscut is in hard, fine grained intrusive rock which is seamed with quartz and iron sulphide. A sample of the first 15 feet of this dike rock assayed \$3.20 in gold and silver. A sample of the entire 35 feet assayed \$1.24 per ton. This dike is cut off by a fault striking north 20 degrees east and dipping 65 degrees to the east. Beyond this fault the cross cut is in highly broken and slickensided wall rock. This dike shows up on the surface about 200 feet southwest of the collar of the shaft and can be traced for a considerable distance. Its strike seems to be between north 20 and 50 degrees west. The fault which cuts this dike on the 250 level has such a strike and dip as would make it intersect with the creek bed on the surface. This dike rock is extremely hard and tough and would make an ideal grinding medium in a tube mill, if such were installed in the milling plant. It contains sufficient gold and silver values to pay for its extraction and there is no reason why it can not replace the pebbles customarily used in tube mill grinding. The average width of the ore shoot on this level is about 3 feet and its value \$15.20 per ton in gold and silver.

Between the 250 and the 350 foot levels the shaft is all in the hanging wall of the vein. Mr. James H. Dunstan who was in charge of the work when the shaft was sunk states that: "At a point about 40 feet above the 350 foot level there was a split in the vein, one branch holding the original dip of the vein and the other running slightly into the hanging wall." Owing to better drilling ground the hanging wall branch was followed. The 350 foot level drifts to the northeast on the hanging wall branch of the vein for about 360 feet. 125 feet from the shaft a crosscut has been run into the foot wall vein. A drift was run on the foot wall vein to the north and it was found that in a short distance the two veins came together. A drift was also run to the south but this is caved and inaccessible. The two veins come together about 50 feet northeast of the crosscut. At this point of intersection of the two veins a raise has been put up 50 feet. From the top of this raise a small drift has been run to the south connecting with the bottom of the winz sunk in the north end of the 250 foot level. This raise intermediate level and winz are all in good ore. On the 350 foot level the ore continues for about 25 feet north of the raise. There is then about 20 feet of vein matter which is barren of quartz, but at this point the quartz appears and continues for 20 feet, where it is cut off by a cross vein striking north and south. This cross vein is on the foot wall of a fault which has sheared and broken the formation for a considerable distance. The workings are inaccessible beyond this fault zone, but Mr. Dunstan reports that the solid country rock was found to the north of this zone and that one foot of good ore was exposed by the last work done. This would be what would be expected as good looking quartz float is found on the surface to the northeast of this fault zone. The cross vein contains good looking quartz but its values are low and at present it is not counted on as ore. About midway between the crosscut to the foot wall vein and the shaft the drift exposes a body of quartz on the hanging wall which does not reach to the top of the drift. This may be the top of an undeveloped ore shoot. South of the shaft the 350 foot level is inaccessible. Its course has been plotted from the mine map which was made when this work was done. About 80 feet south of the shaft station a crosscut was run into the foot wall for a distance of 50 feet. It is reported that this crosscut intersected a vein of good ore which is no doubt a continuation of the foot wall vein. From this cross cut the main drift continues on for a distance of 160 feet trending in a curve to the east. It evidently followed a smooth wall which was assumed to be hanging wall of the vein. About 200 feet southeast of the shaft, quartz began to show up. This quartz about one foot in width turned to the southwest and the drift followed it for about 20 feet. Mr. James H. Dunstan is the authority for the above information on the drift of the 350 foot level to the southeast of the shaft. Mr. Dunstan was in charge of the Gem mine when this work was done. The average width of the ore shoot on this level is two feet and its value is \$15.00 per ton in gold and silver. The average width of the ore shoot as exposed in the raise, intermediate level and winz

is one foot with an average value of \$118.70 per ton in gold and silver. This is the highest grade portion of the mine. This ore is of such a grade that it could be shipped to the smelter direct and marketed at a profit, but with a mill on the property it would be better to run it with the lower grade ore and thereby keep up the mill head.

S A M P L E S

The taking of all samples was supervised by me personally and were assayed by E. W. Lazell in his laboratory at 537 Railway Exchange Bldg., Portland, Oregon. The vein samples were taken by the channel method and represented the material as it would come from the mine. In a few places owing to the hardness of the quartz it was necessary to drill and blast out a quantity of the vein in order to obtain a representative sample. Throughout the entire sampling an average of ten pounds of material was taken for each foot of width of the vein.

O R E T O N N A G E

This property contains one ore shoot which is exposed on each of the four levels in the mine. In the north end of the 350 foot level it is cut by a fault, but Mr. Dunstan states that it has been found beyond this fault zone. This could not be corroborated as the workings in this part of the mine were caved at the time of this examination. The main shoot as developed shows a width at right angles to its pitch of 145 feet and a pitch length of 380 feet above the 350 foot level. As this ore shoot pitches toward the fault zone it is assumed that it will continue downward on its course until cut off by this fault.

The average thickness of this ore shoot as determined by this examination is calculated by dividing the total length of sample cuts by the number of cuts made. The total of the cuts on the main ore shoot was 195 feet. This represents 60 samples so 195 divided by 60 equals 3.25 feet as the average width.

The number of cubic feet of ore required to weigh one ton is calculated as follows:-

The contents of this ore is approximately 90% quartz and 10% iron sulphides. 12.07 cubic feet of quartz or 6.40 cubic feet of sulphides weigh one ton. Hence:-

90% quartz	0.9 X 12.07	- 10.86
10% Sulphides	.1 X 6.40	- 0.64

11.40 cubic feet.

To compensate for porosity in the ore I shall figure in the following calculation that 11.75 cubic feet of ore will weigh one ton.

Block of ore above the 350 foot level.

145 ft. X 380 ft. X 3.25 ft-----	179,075	cu. ft.
Two small corners near the surface-----	4,387	" "
Total-----	183,482	" "
Removed by workings approximately-----	13,000	" "
Total in mine above the 350 foot level-----	170,482	" "
On the dump 75% of ore removed by workings-----	9,750	" "
Total-----	180,232	" "

Below the 350 foot level.

(100' X 175'/2 plus 100' X 90'/2) X 3.25'-----	43,062	" "
Total volume of ore shoot-----	223,294	" "
This converted into tons equals 223,294/11.75 -	19,000	tons.
Approximately 1,000 tons has been stoped-----	1,000	"
Ore tonnage at the present time-----	18,000	"

SHIPMENTS TO SMELTER

On September 16, 1916, three lots of ore were shipped from the Gem mine to the Tacoma smelter.

The result of this shipment was as follows:-

Lot No.	Tons Weight.	Gross Value.	Net Proceeds.
1.	3.102	\$171.80	\$488.02
2.	7.607	120.26	804.84
3.	3.397	59.40	153.01

M I L L I N G

In May 1921 a quantity of ore representing the average of the mine was sent to the General Engineering Co., of Salt Lake City, Utah, where tests were made relative to the most efficient method of milling applicable to this ore. After numerous tests covering amalgamation, flotation and concentration it was found that by cyanidation the highest extraction of the gold and silver could be obtained.

A larger scale cyanide test checking the laboratory work was as follows:-

Heads of test by assay: Gold 0.60 oz. per ton; silver 1.1 oz per ton; copper 0.16%

The material was ground in a ball mill to 90% through 100 mesh with 5 lbs. lime per ton and 3 lbs cyanide (NaCN)

solution. The ball mill product was agitated for 12 hours with a 3 lb., NaCN solution; density 2 to 1. The results were as follows:-

	<u>%-Weight</u>	<u>Assays</u>		<u>Contents</u>		<u>%-of Head Sample</u>	
		Au	Ag	Au	Ag	Au	Ag
Heads-----	100.00	0.60	1.1	60.0	110.0	100.00	100.00
Cyanide tails	100.00	0.04	0.3	4.0	30.0	6.67	27.27
Cyanide extraction		0.56	0.8	56.0	80.0	93.33	72.73

Total extraction on gold 93.33%
 " " " silver 72.73%
 " " " value 91.60%

Sodium cyanide consumption was 1.3 lb. per ton.
 Protective alkalinity " 0.4 " lime (CaO)

From the data obtained from this test work the General Engineering Co., then designed a mill flow sheet for a cyanide plant having a capacity of 60 tons per day.

The total cost of a mill built to this flow sheet and containing new equipment would be \$54,000.00 exclusive of power plant. This cost could be lowered to \$34,000.00 if used equipment could be incorporated into the plant. There is a large assortment of cyanide equipment throughout the Northwest that is in A-1 condition, which can be purchased at a fraction of its original cost. These figures are not rough estimates but are taken from a report on the cost of such a plant which was made by the writer for the Gem Mining Co., March 1, 1922.

M A R K E T I N G

The product of a cyanide plant would be gold and silver bullion which would be marketed at the United States mint. Portions of the Gem vein contain ore of such a grade that it could be shipped to a smelter if desired.

AVERAGE VALUE OF ORE

The foot-ounce method is one generally adopted in the calculation of ore reserves. In this method the length of each sample is multiplied by its assay value; the products of all samples are added and this total divided by the sum of the lengths, the quotient being the average value. In the following the gold is calculated in dollars and cents and the silver in ounces:

Sample No.	Width Ft.	Gold Oz.	Gold \$	Gold Value X-Width	Silver Oz.	Silver Oz. X-Width.
1.	4.0	0.73	14.60	\$58.40	2.72	\$10.88
2.	5.5	0.04	0.80	4.40	1.09	5.99
3.	2.0	0.06	1.20	2.40	0.14	0.28
4.	5.5	1.05	21.00	115.50	0.79	4.35
5.	6.0	0.24	4.80	28.80	2.50	15.00
6.	5.0	0.32	6.40	32.00	1.72	8.60
7.	6.4	0.22	4.40	28.16	1.82	11.65
8.	8.7	0.63	12.60	109.61	0.01	0.09
9/	4.0	2.38	47.60	190.40	2.26	9.04
10.	2.0	0.44	8.80	17.60	0.30	0.60
11.	2.3	0.38	7.60	17.48	1.82	4.19
12.	2.7	1.25	25.00	67.50	Trace	0.00
13.	4.8	0.22	4.40	21.12	0.02	0.09
14.	2.8	0.20	4.00	11.20	0.14	0.39
15.	3.3	0.15	3.00	9.90	0.49	1.62
16.	5.6	0.22	4.40	24.64	0.22	1.23
17.	19.0	0.73	14.60	277.40	0.87	16.53
18.	5.6	0.96	19.20	107.52	1.04	5.82
19.	14.0	0.45	9.00	126.00	0.25	3.50
20.	3.6	0.55	11.00	39.60	0.60	2.16
21.	4.3	0.18	3.60	15.48	0.92	3.95
22.	3.2	0.52	10.40	33.28	1.18	3.77
23.	1.0	0.20	4.00	4.00	0.20	0.20
24.	0.8	0.12	2.40	1.92	0.80	0.64
25.	0.5	0.10	2.00	1.00	0.00	0.00
26.	0.7	6.16	123.20	86.24	2.51	1.76
27.	1.5	0.60	12.00	18.00	1.74	2.61
29.	3.1	2.20	44.00	136.40	1.77	5.49
30.	2.0	0.27	5.40	10.80	Trace	0.00
31.	2.0	0.24	4.80	9.60	2.86	5.72
32.	3.5	0.06	1.20	4.20	Trace	0.00
33.	3.9	0.05	1.00	3.90	"	0.00
34.	4.7	0.05	1.00	4.70	"	0.00
35.	1.6	0.23	4.60	7.36	0.00	0.00
36.	3.6	0.49	9.80	35.28	0.16	0.57
37.	7.9	0.51	10.80	80.58	0.00	0.00
38.	1.5	1.25	25.00	37.50	3.70	5.55
39.	0.8	4.50	90.00	72.00	0.00	0.00
40.	0.8	5.90	118.00	94.40	0.00	0.00
41.	2.0	2.40	48.00	96.00	0.30	0.60
42.	1.3	2.44	48.80	63.44	0.61	0.79
43.	1.0	5.54	110.80	110.80	3.71	3.71
44.	0.5	9.95	199.00	99.50	Trace	0.00
45.	1.0	1.12	22.40	22.40	0.08	0.08
46.	2.80	2.20	44.00	123.20	1.90	5.32
47.	2.0	2.40	48.00	96.00	0.30	0.60
48.A.	1.2	15.35	307.00	368.40	2.20	2.64
48.B.	1.0	1.88	37.60	37.60	0.27	0.27
49.	0.8	3.74	74.88	59.84	0.00	0.00
50.	1.5	3.45	69.00	103.50	0.85	1.27

51.	0.7	0.65	13.00	9.10	1.70	1.19
52.	3.8	0.73	14.60	55.48	2.12	8.06
53.	1.5	0.05	1.00	1.50	0.00	0.00
54.	1.2	1.46	29.20	35.04	2.19	2.63
55.	1.0	1.52	30.40	30.40	2.54	2.50
57.	2.0	1.20	24.00	48.00	1.05	2.10
58.	1.65	0.51	10.20	15.30	0.24	0.36
59.	3.0	0.63	12.60	37.80	0.27	0.81
60.	<u>5.0</u>	<u>0.18</u>	<u>3.60</u>	<u>10.80</u>	<u>0.00</u>	<u>0.00</u>

59. 193.0 \$3,370.37 \$165.24

The average value of the ore in gold per ton is 3,370.37 divided by 193 or \$17.46. As gold is figured at \$20.00 per ounce the gold content per ton is 0.873 ~~an~~ ounce.

The average value of the ore in silver per ton is 165.24 divided by 193 or 0.86 ounce.

At the present time the price paid for domestic silver is \$1.00 per ounce. This price was established by the Pittman Act which went into effect April 23, 1918. It is my opinion that this act will not be effective after January 1, 1924, so for silver produced after that time, the value which will be received per ounce can be conservatively assumed as an average of the price for a period of 10 years prior to this act. This price is 58.33 cents per ounce.

In the lower levels there is present some copper in the form of chalcopyrite (CuFeS₂ : Copper 34.6%, iron 30.4%, sulphur 35.9%). The amount of copper that would be contained in the feed of the mill would not be enough to interfere with the cyanide process. A composite sample of the ore above the 250 foot level assayed only a trace in copper. A composite sample of the ore between the 250 foot and the 350 foot levels assayed 0.35% copper.

* * * * *

The present developed ore shoot will keep a mill of 60 tons daily capacity operating for 300 days and the net return will be \$18,000 X \$10.95 or \$197,100.00. This does not mean the absolute net profit as taxes and insurance have not been deducted.

E Q U I P M E N T

The mine is equipped with track, cars for ore, air lines, ventilation lines, etc.

(Since the making of this report there have been some changes in the equipment and buildings. These are not listed

FUTURE DEVELOPMENT

125 foot level

The southwest drift of this level should be continued as long as indications for ore are favorable.

250 foot level

The vein should be drifted on to the south under the shaft. A raise should be put up to the 125 foot level from a point about 80 feet northeast of the shaft. Drifts should be run on the zone intersected in the east end of the crosscut to the east.

350 foot level

About 40 feet northeast of the shaft a crosscut should be run into the foot wall to intersect the foot wall vein which should be drifted on in both directions. The south drift should be reopened and further drifting done on the vein found therein. The north drift which exposed the ore beyond the fault zone should be reopened and further drifting done.

The shaft should be sunk at least 200 feet before starting another level so as to get below the zone of disturbance of the fault on the main ore shoot.

In closing this report I wish to acknowledge the courtesies and aid given me by Mr. G. S. Leeston Smith and Mr. James H. Dunstan who were at the property during this examination and who were ever ready to assist in the work.

(Signed) Carl N. Anderson.

(Seal)

Registered Professional
Engineer 623
Oregon, Dec. 8, 1919.

COPY OF ANDERSONS REPORT ON THE GEM MINE, SUSANVILLE

General Statement.

This report is based upon my personal examination of the Gem Mine, which is situated in the Susanville Mining District in Grant County, Oregon, U.S.A. This examination was begun on October 10th, 1922 and was concluded on October 20th, 1922.

SUMMARY

ACCESSIBILITY:- This property is easily accessible being about 24 miles from the nearest Rail Road Station and connected with the same by a good automobile road.

ACREAGE:- This property contains 238.24 acres of Mineral land. Of this 196.6 acres are patented and the balance are not.

Title:- There is due Mr Phil Metschan of Portland, Oregon \$1500.00 to complete the purchase the Patented Mining Claim known as the South Gem. The Gem Mining Company holds an undisputed title to the rest of the property which is free from all incumbrances.

(The \$1500.00 since paid. Nelson)

Geology:- The Gem Vein is of the true fault fissure type and all geological indications favor its continuance in depth.

ORE-TONNAGE:- The main ore shoot that is developed in the Gem Mine contains approximately 18,000 tons which has a foot assay value in gold of 0.873 Oz. per ton and Silver 0.86 Oz. per ton. The monetary value of this ore, at \$20.00 per ounce for Gold and \$1.00 per ounce for Silver, is \$18.32 per ton of 2000 pounds.

TIMBER:- Upon the property of this company there is at present a stand of approximately 3,000,000 feet of Yellow Pine timber. The Company also owns a saw-mill which has on hand about 150,000 board feet of sawed lumber.

(This lumber was since used in buildings on the property) NELSON.

Power:- About 3 1/2 miles from the mine there is a stream of water, capable of furnishing sufficient power for mining and milling purposes.

Equipment:- The property is equipped with Boilers, Steam Hoist, Air Compressor, Air Drills, Tools etc., sufficient to carry on mining on a moderate scale. (Boilers since condemned. Nelson)

Milling:- The ore has been tested by the General Engineering Co of Salt Lake City, Utah, who obtained an extraction of 93% of the Gold and 73% of the silver by Cyanide Process.

DEVELOPMENT:- The development work that has been done on this property consists of the following:-

355 feet of	incline shaft.	
145 feet of	drifting on the	50 foot level.
310 feet of	„ „ „	125 „ „
220 „ „	„ „ „	250 „ „ (50 ft. caved)
625 „ „	„ „ „	350 „ „ (370 „ „)
60 „ „	cross-cutting	125 „ „
180 „ „	„ „ „	250 „ „
240 „ „	„ „ „	350 „ „
100 „ „	raises (70 Foot caved)	„ „
50 „ „	Winz.	
<u>2285</u> „ „	work done beside	Numerous surface cuts have been made

but these are all caved in.

* CONCLUSIONS *

After having given this property a thorough examination and conservatively gone into its possibilities I do not hesitate to state that it has real merit and should be put on a producing basis without delay. The ore shoot which is now more or less developed contains approximately 18,000 tons with an average content of 0.873 oz. gold and 0.86 oz. silver. The gross value of this block of ore is about \$329,760.00. It is assumed that this ore can be mined and milled at a cost of \$6.00

This property is ready for a milling plant of not less than 50 tons daily capacity. Further development work should be done so as to explore the main ore shoot to the north of the fault Zone. Exploration should also be carried on at a greater depth than that now attained by the present workings. There is every reason to believe that undeveloped ore-shoots will be found which will outweigh the present known quantities.

LOCATION

The property of the Gem Mining Company is situated in the Susanville Mining District of Grant County, Oregon. in Township 10 South of Range 33 East of the Willamette Meridian. Its geographical location is shown by sketch on Plate 1, Page 4. The nearest Post Office at the present time is that of Susanville which is reached by one and one quarter miles of good wagon road. Susanville in turn is about 23 miles from down the Middle-Fork of the John Day River from Austin a station of the narrow gauge R.R. of the Sumpter Valley R.R. Co. Austin is about 60 miles from the town of Baker which is the main supply point of this section. Baker is situated on the main line of the O.W.R. & N.R.R. 357 miles from Portland, Oregon. The Sumpter Smelter which is being reopened is situated about mid-way between Austin and Baker.

CLAIMS

~~This property consists of two claims, one of 155.6 acres and one of 182.64 acres,~~
being 1,500 ft, long by 600 ft, wide, and one Homestead entry of 155.6 acres which carries all mineral rights. The total area covered by this property is 238.24 acres. The location of the claims with respect to each other and to other patented claims in the district is shown on Plate 11., Page 5.

TITLE

On August 10 1920 Mr G. S. L. Smith and J. H. Dunston deeded to the Gem Mining Co. the land now embraced in their property with the exception of the claim known as "THE SOUTH GEM", this claim which is patented was later purchased from Mr. Phil. Metschan of Portland, Oregon. There is still due Mr Metschan on this transaction the sum of \$1,600.

(This is the \$1,500 I said had since been paid off.) NELSON.

The Homestead which is described as the West $\frac{1}{2}$ of the Southeast $\frac{1}{4}$ & the South east $\frac{1}{4}$ of the Southwest $\frac{1}{4}$ and Lot # 10 of Section 5 T-10-South, Range 33. E. W. M. in Oregon was patented under the act of April 24th, 1920 and thereby is vested with all mining rights.

The Gem of the Mountain Quartz Claim was patented by John H. Blake on September 16th, 1906

The Quartz Claim known as the Gem No 1 was located on October 2d, 1918 by Messrs Smith and Dunston.

The Quartz Claim known as the Gem No. 2. was located by the same men on August 4. 1919. These two named claims were held by possessory title obtained by legal locations and the performance of annual assessment work.

I have carefully examined the Abstract of Title pertaining to the above property and find that the Gem Mining Company holds an undisputed title to same and also that there are no suits, Judgments or other liens pending.

HISTORY

Placer Gold was discovered in the Susanville district in 1864 and for the following thirty five years it contributed to the States production. The greater portion of the placer Gold produced by this district was taken from Elk Creek upon which the Gem Mine is situated. This creek was noted for the large nuggets obtained from its placers.

Some of these nuggets carried individual values of from \$480.00 to \$800.00. On June 19 1913 a nugget was found by George Armstrong on Buck Gulch which weighed 80.4 ounces, this at \$17.60 per ounce would have a value of \$1,415.00.

Quartz prospecting began early in 1869, but as this district was almost inaccessible at that time, only the veins containing the highest grade ore could be worked at a profit.

The Quartz vein on the Gem Mine was discovered in ~~1862~~ the early seventies by John H. Blake. He extracted a quantity of the oxidized surface ore and ran it through a mill built by a Mr Cabell on Elk Creek two and one half miles above its mouth. Mr Cabell was operating this mill on ore taken from the Gem vein south of the claim located by Mr Blake. The Blake property was purchased from his heirs by Mr G. S. L. Smith on June 15 1906. On May 9, 1910 Mr Smith deeded a one third interest in this property to Mr James H. Dunston. These men renewed work on this property; sinking an incline shaft on the vein and developing it in general. On August 10 1920 The Gem Mining Company was incorporated at Baker, Oregon. On this date Messrs Smith and Dunston deeded the Gem property to this organization. The Gem Mining Company further developed the ore bodies and put the mine in shape for a reduction plant.

OTHER PROPERTIES IN DISTRICT

Mining has been carried on in this district for a great number of years. As is the case in most every productive mining section, a few large companies gradually absorbed the smaller ones and to day the greater portion of this district is owned by a few large corporations. Plate 11 on page 5. shows the holdings adjoining the Gem property.

The Badger group has been the most important producer of this district. The main vein of this group which is apparently a continuation of the Gem vein was known as early as 1862. Between 1870 and 1874 oxidized ore was extracted from the surface croppings and milled in an Arastra, yielding \$26.00 per ton in gold 621 fine. Later a ten stamp mill was built on Elk Creek. This mill was equipped with concentrators the product of which was shipped to the smelter. The free gold continued from 25 to 50 feet below the outcrop, but from this point down the ore contained increasing quantities of sulphides of iron, lead and Zinc. Development work and milling were carried on until Nov, 1905 when all work was closed down due to litigation in the case of the Stockton Mining Company vs the Badger Mining Company., and the Susanville Mining Company. The Badger mine is developed by an incline shaft on the vein to a depth of 500 feet. The bottom of the shaft or the 500 foot level is connected with the surface by a tunnel 1,400 feet long. From the 500 level a winz was sunk to a depth of 400 feet. The total development work consists of between 3,000 and 4,000 feet, of underground workings. It is reported that at the time that operations closed down the lower workings contained a shoot of medium high grade ore. There is no data available as to the production of this property. The property adjoining the Badger group belongs to the Stockton Mining Co., and was also closed down at the time that litigation was started.

To the Northwest of the Gem Mine lies the Chatenooga and Daisy two claims. At present the Chatenooga workings are full of water and the Daisy two workings are being pumped out. The ore shoot on the Chatenooga is reported to be 125 feet long and to average \$9.00 in gold and silver for a width of 1 to 8 feet. The Daisy two is said to contain a shoot of ore 75 feet long which averages \$15.00 per ton in gold and silver over a width of 4 feet. Both of these properties were visited by the writer and the dumps of each show good looking sulphide ore. At the present time the only operations in the district are carried on by the Hunter Bro's., and associates who are operating a small mill on Elk Creek and doing development work on the Gold Bug Claim.

* GENERAL GEOLOGY *

Such a limited study as I was able to give this matter in the field has led to the conclusion that generalization in regard to the genesis of the ore bodies of this district would be unsafe without the comparison of many rock sections and the collection of a vast array of evidence. This section has had no detailed geological work done thereon but the sequence of geological events are no doubt similar to those effecting the Blue Mountains in general.

During the Paleozoic age the area now covered by the Blue Mountains was the bottom of the inland sea. Upon this sea bottom was deposited argelaceous and silicious mud which is now found in the form of A-ites and slates more or less rich in silica. together with

All of the Argelite series are composed of fine grained sediments indication deposition in deep water. During this time volcanos began to emit lavas and tuffs which are now found interbedded with the muds and limestones. Emergence of uplifts of this areathen took place with consequent disappearance of the sea. Later the water covered this area but to a much shallower depth. This was during the Triassic Period. During the following age that of the Mesozoic came an organic uplift which could geologically be termed a Jurassic Revolution. Huge Masses of magma, which when cold, became granodiorite, diorite, gabbro and peridotite invaded the overlying sediments, contorting and fissuring them on a large scale. So great was the pressure that some of the rock-layers were crushed to fragments. The cooling of these magmas gave rise to vapors and solutions that penetrated the adjacent formations, filling seams and fissures with quartz and even altering the rocks themselves. The following tertiary period caused continual erosion and sedimentation with a corresponding development of topography which in numerous places removed portions of the contorted sedimentary rocks, exposing the intrusive masses such as are seen at Greenhorn and Baldmountain, by this wearing down process the major portion of the Blue Mountains was removed. During the middle of the period there was renewed volcanic activity. Great flows of lava poured from numberless fissures and vents on the mountain sides. They came stream upon stream in endless succession and filled and dammed the then existing waterways, causing them to lay out their courses anew. This accounts for the changed river channels and the gravel filled basins found high up on the mountains. Deformation continued until the Quaternary period when the mountains were again re-elevated. During the Glacial Epoch which followed the climate became colder and glaciers filled the valley heads. These glaciers softened the contour of the uplifted areas and steepened the slopes of the youthful valleys. Then came the cycle of post-glacial erosion with the formation of terraces, gorges and ravines, together with the recent stream deposits of gravel, sub-soil and soil.

- VEGETATION -

Upon the property of this company there is a stand of about 3,000,000 feet of yellow pine timber which will fill the needs of the mine for a number of years. The company also own a saw mill which has on hand about 150,000 board feet of lumber (since used in buildings, Nelson) Plate 111. Page 12 shows a photograph of the mill and the typical stand of timber which covers the property, willows, alders etc. found along the water courses and scattered among the yellow pine there is some Tamarack and Black Pine. As this area has not been logged off or burned over, one does not find much second growth. This last season there was about 14 tons of hay put up on the homestead.

- CLIMATE *

This district has an agreeable and healthful climate. The cold in winter is not extreme, although there are periods when the thermometer drops to zero. The summers are as a rule temperate and dry, with cool nights and moderately warm days, The thermometer occasionally rising to 90 degrees in the shade. The annual precipitation amounts to about thirty inches, a large part of which falls as snow during the winter months.

- TRANSPORTATION -

Transportation facilities from the mine to the R.R. are good. Freight is hauled on the logging branch of the Sumpter Valley R.R. which extends down the Middle fork of the John Day River to within about 13 miles of the Gem Mine. The road connecting this R.R. with the mine is fit for heavy truck haulage for at least six months each year and it should be possible to haul freight over this distance for about \$4.00 per ton. From the first of January to the middle of February the roads are generally in good shape for sled haulage.

- VEIN -

In the past it has been assumed that the vein on this property was in a contact between a Diorite Dike and Slate. On the surface there are bold outcrops on both sides of the vein which are of Igneous Origin. These represent the main country rock containing the Gem Vein but they are altered to such an extent that their original form can not be determined without resorting to microscopic study of this section.

From all appearances they resemble a rock known as a peridotite and until further study determines them otherwise I shall class them as such. It is no doubt true that the vein in the Badger workings is in a fossil clay slate but that is no criterion as to the formation of this property. In some of the underground workings of the Gem mine there is found a formation which I have classed as a phyllite. It is found at the south end of the 125 foot level, at the shaft station of the 250 foot level and in the crosscut to the foot wall vein in the 350 foot level. A Phyllite is generally derived from slates but as it may also be derived from igneous rocks I will not decide its original state without the examination of thin sections under a microscope. So closely do Phyllites resemble slates that in early field work in geology; areas were plotted as being of slate formation which in reality were Phyllites. The formation adjoining the vein has been subjected to the energetic operation of metamorphism through dynamic forces, to pressure and great shearing, aided probably by liquids and heat, so that to day one finds all stages of transition from peridotite to serpentine. The Gem vein has been very little effected by subsequent faulting. The faults that were not previous to the formation of the ore shoots are of vertical thrust and effect the shoots only by changing their horizon. This vein is of the simple fault fissure type. It is a continuous filling of coarse, crystalline quartz with irregular scatters of sulphides of Iron, copper and zinc between sharply defined, clear cut walls. A ribbon structure due to shearing is developed in numerous places. From all indications this vein will continue to a great depth and there is every reason to believe that the ore shoots will also continue downward. The lowest levels of the Badger mine are 800 feet vertically below the lowest level in the Gem mine which practically assures the continuation of the Gem ore shoots to that depth at least. As a point of interest, will state that the pitch of the ore shoot in the Gem mine is true to the rule applied to the ore shoots of Nevada and Grass Valley districts of California. That is that the pitch of the ore shoots are generally to the left of an observer standing upon the croppings and facing the dip of the vein. The strike of the Gem vein is about North 50 degrees East and its dip is about 64 degrees to the East. The main ore shoot has a pitch of about 48 degrees to the Northwest.

- UNDER GROUND WORKINGS -

On Plate IV Page 15 will be found a composite map of the under ground workings. This mine is developed by an incline shaft which is 355 feet deep on the vein. At 50 feet below the collar of the shaft the 50 foot level extends southwards 100 feet to the surface. This level also drifts on the vein to the northeast for a distance of 40 feet. To the south of the shaft and above this level the ore was removed by the early miners some ore was also removed from this level by understoping. At the north end of this level the ore shoot narrows down to a seam of quartz only a few inches wide. The total length of the ore shoot exposed by this level is about 160 feet. The average width of the vein on the 50 foot level that was stoped out was 4 feet. A sample taken in the floor ten feet south of the shaft, gave an assay value of \$17.32 per ton in gold and silver. Between the 50 foot level and the 125 foot level the shaft is all in the vein which has an average width of six feet and an average value of \$16.60 per ton in gold and silver. The shaft station on the 125 foot level is in the hanging wall of the vein. To the southwest this level is in the form of a drift for a distance of 100 feet. About 50 feet south of the shaft station a raise has been put up about 15 feet. At this raise the ore shoot narrows and pinches out for a distance of about ten feet, when from six inches to one foot of good ore appears on the foot wall. At the south face the vein consists of numerous small seams of barren quartz. Throughout the southwest part of this level there are a number of branches of quartz which run both into the hanging and foot walls. To the northeast of the shaft station the 125 foot level drifts on the vein for about 130 feet. At a point about 40 feet north of the station there is a fault plane striking north 50 degrees west and dipping 80 degrees to the south. The indications are that the vein to the north of this fault has slipped down also borne out by the broken condition of the vein on this lower levels. About 40 feet north of this fault the ore in a maze of quartz stringers which turn into the foot

Cross-cut was run into the foot wall at this point, but the stringers that it followed were found to terminate in a short distance. The north face of this level is in broken and fractured ground highly schistose in character. This is no doubt close to the fault zone intersected by the lower levels. The length of the ore shoot exposed by this level is 140 feet. Its average width is 4.3 feet and its average value is \$12.00 per ton in gold and silver. About 20 feet below the 125 foot level the shaft leaves the greater portion of the vein in the foot wall. At a point about 15 feet below this level a small cross-cut has been run into the foot wall through the vein. A sample taken at this point over a width of 3.1 feet assayed \$45.77 per ton in gold and silver. The shaft station on the 250 foot level is in the hanging wall of the vein. From this station the drift swings back to the north and cuts the vein in about 30 feet. From this point the drift continues on the vein to the northeast for a distance of 120 feet. About 35 feet from the point where this north drift intersects the vein a fault plane is found which strikes north 60 degrees east and dips 65 degrees to the south. In all probability this connects with the fault plane found on the 125 foot level. North of this fault plane on the 250 foot level the ore shoot is broken and bent but it continues for about 50 feet at which point it narrows down and pinches out. However within the next 25 feet it opens up again and at the face of the drift is about 0.8 feet in width. 20 feet south of the present face a raise has been put up for 70 feet on an incline to the south. Only about 15 feet of this raise was accessible at the time of this examination. This showed from six inches to one foot of ore having a value of over \$100.00 per ton. Figures from a shipment of ore that was taken from this raise will be found under "Shipments to Smelter". A few feet north of this raise a winz has been sunk which connects with a raise put up from the 350 foot level. This will be described later. A few feet north of the shaft station on the 250 foot level a cross-cut has been run into the hanging wall for a distance of 95 feet. At 80 feet from the drift a sheared zone contains seams of quartz and calcite and runs in value \$1.00 to \$2.00 per ton and is 12 feet wide. Its strike is 50 degrees east and it dips 50 degrees to the east. Beyond this sheared zone the hanging wall formation was found. From the shaft station on the 250 foot level the drift runs southwest and intersects the vein in about 20 feet. From this point southward the drift is inaccessible, but no ore was reported as found therein. At this point of intersection of the south drift with the vein a cross-cut has been run into the foot wall for a distance of 60 feet, the first 35 feet of this cross-cut is in hard, fine grained intrusive rock which is seamed with quartz and iron sulphide. A sample of the first 15 feet of this dike rock assayed \$3.20 in gold and silver. A sample of the entire 35 feet assayed \$1.24 per ton. This dike is cut off by a fault striking north 20 degrees east and dipping 65 degrees to the east. Beyond this fault the cross cut is in highly broken and slickensided wall rock. This dike shows up on the surface about 200 feet southwest of the collar of the shaft and can be traced for a considerable distance. Its strike seems to be between north 20 and 50 degrees west. The fault which cuts this dike on the 250 foot level has such a strike and dip as would make it intersect with the creek bed on the surface. This dike rock is extremely hard and tough and would make an ideal grinding medium in a tube mill, if such were installed in the milling plant. It contains sufficient gold and silver values to pay for its extraction and there is no reason why it can not replace the pebbles customarily used in tube mill grinding. The average width of the ore shoot on this level is about 3 feet and its value \$15.20 per ton in gold and silver. Between the 250 foot and the 350 foot levels the shaft is all in the hanging wall of the vein. Mr James H. Dunston who was in charge of the work when the shaft was sunk states that; "at a point about 40 feet above the 350 foot level there was a split in the vein, one branch holding the original dip of the vein and the other running slightly into the hanging wall". Owing to better drilling ground the hanging wall branch was followed. The 350 foot level drifts to the east on the hanging wall ~~NXXXXXXXXX~~ branch of the vein for about 360 feet. 125 feet from the shaft a cross-cut has been run into the foot wall vein. A drift was run on the foot wall vein to the north and it was found that in a short distance the two veins came together. A drift was also run to the south but this is caved and inaccessible. The two veins come together about 50 feet

veins a raise has been put up 30 feet. From the top of this raise a small drift has been run ~~XXXXXXXXXXXXXXXXXXXX~~ to the south connecting with the bottom of the winz sunk in the north end of the 250 foot level. This raise, intermediate level and winz are all in good ore. On the 350 foot level the ore continues for about 25 feet north of the raise. There is then about 20 feet of vein matter which is barren of quartz, but at this point the quartz appears and continues for 20 feet, where it is cut off by a cross vein striking north and south. This cross vein is on the foot wall of a fault which has sheared and broken the formation for a considerable distance. The workings are inaccessible beyond the fault zone, but Mr Dunston reports that the solid country rock was found to the north of this zone and that one foot of good ore was exposed by the last work done. This would be what would be expected as good looking quartz float is found on the surface to the northeast of this fault zone. The cross vein contains good looking quartz but its values are low and at present it is not counted on as ore. About midway between the cross-cut to the foot wall vein and the shaft the drift exposes a body of quartz on the hanging wall which does not reach to the top of the drift. This may be the top of an undeveloped ore shoot. South of the shaft the 350 foot level is inaccessible. Its course has been plotted from the mine map which was made when this work was done. About 80 feet south of the shaft station a cross cut was run into the foot wall for a distance of 50 feet. It is reported that this cross cut intersected a vein of good ore which is no doubt a continuation of the foot wall vein. ~~From this cross cut the~~ main drift continues on for a distance of 160 feet trending in a curve to the east. It evidently followed a smooth wall which was assumed to be the hanging wall of the vein. About 200 feet southeast of the shaft, quartz began to show up. This quartz about one foot in width turned to the southwest and the drift followed it about 20 feet. Mr James H. Dunston is the authority for the above information on the drift of the 350 foot level to the southeast of the shaft. Mr Dunston was in charge of the Gem mine when this work was done. The average width of the ore shoot on this level is two feet and its value is \$15.00 per ton in gold and silver. The average width of the ore shoot as exposed in the raise, intermediate level and winz is one foot with an average value of \$118.70 per ton in gold and silver. This is the highest grade portion of the mine. This ore is of such a grade that it could be shipped to the smelter direct and marketed at a profit, but with a mill on the property it would be better to run it with the lower grade ore and thereby keep up the mill heads.

- S A M P L E S -

The taking of all samples was supervised by me personally and were assayed E.W. Lazell in his laboratory at 537-Railway Exchange Bldg. Portland, Oregon. The vein samples were taken by the channel method and represent the material as it would come from the mine. In a few places owing to the hardness of the quartz it was necessary to drill and blast out a quantity of the vein in order to obtain a representative sample. Throughout the entire sampling an average of ten pounds of material was taken for each foot of width of the vein. The following five pages show the results of the assays of samples taken, together with their location and widths.

- ORE -- T O N N A G E -

This property contains one ore shoot which is exposed on each of the four levels in the mine. In the north end of the 350 foot level it is cut by a fault, but Mr Dunston states that it has been found beyond this fault zone. This could not be corroborated as the workings in this part of the mine were caved at the time of this examination. The main ore shoot as developed shows a width at right angles to its pitch of 145 feet and a pitch length of 380 feet above the 350 foot level. As this ore shoot pitches toward the fault zone it is assumed that it will continue downward on its course until cut off by this fault.

The average thickness of this ore shoot as determined by this examination is calculated by dividing the total length of sample cut by the number of cuts made. The total of the cuts on the main ore was 195 feet. This represents 60 samples so 195 divided by 60 is 3.25 feet as the average width. The number of cubic feet required to weigh one ton is calculated as follows:-

The contents of this ore is approximately 90% quartz and 10% Iron sulphides. 12.07 Cubic feet of quartz or 6.40 cubic feet of Sulphides weigh one ton. Hence;-

90% Quartz - 0.9 X 12.07 = 10.86
 10% Sulphides .1 X 6.40 = 0.64
11.40 Cubic feet

To compensate for porosity in the ore I shall figure in the following calculation that 11.75 cubic feet of ore will weigh one ton.

Block of ore above the 350 foot level.
 145 ft. X 380 ft. X 3.25 ft,..... 179.075 cu.ft.
 Two small corners near the surface 4.387 ,, ,,
 Total 183.482
 Removed by workings approximately 13.000
 Total in mine above the 350 foot level: 170.482
 On the dump 75% of ore removed by workings: 9.750
180.232 cu.ft.

Below the 350 foot level.
 (100' X 175'/2 plus 100' X 90'/2) X 3.25':... 43.062
 Total volume of ore shoot:..... 223.294 ,, ,,
 This converted into tons equals 223.294/11.75= 19.000 Tons
 Approximately 1.000 tons has been stoped:..... 1.000 ,,
 Ore tonnage at the present time:..... 18.000 ,,

- SHIPMENTS TO SMELTER

On September 16, 1918 three lots of ore were shipped from the Gem Mine to the Tacoma Smelter. The result of this shipment was as follows:-

Lot NO.	Tons weight	Gross ton value	Net proceeds
1.	3.102	\$ 171.80	\$ 488.02
2.	7.607	120.26	804.84
3.	3.397	59.40	153.01

- MILLING -

In May 1921 a quantity of ore representing the average of the mine was sent to the General Engineering Company of Salt Lake City, Utah where tests were made relative to the most efficient method of milling applicable to this ore. After numerous tests covering Amalgamation, Flotation and concentration, it was found that by cyanidation the highest extraction of the gold and silver could be obtained.

(Here followed a flow sheet which I have not copied, Nelson)
 A large scale cyanide test checking the laboratory work was as follows:- Heads of test by assay:- 0.60 oz Gold per ton Silver 1.1 oz. copper 0.16%

The material was ground in a ball mill to 90% through 100 mesh with 5 lbs. Lime per ton and 3 lbs Sodium Cyanide (NaCN) solution. The Ball Mill product was agitated for 12 hours with a 3 lb, NaCN solution; density 2 to 1. The results were as follows:-

XXXXXXXXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXXXXXXXXXX
 XXXXXXXXXXXXXXXXXXXXXXX

	% - Weight.		Assays.		Contents.		% - of Head Samples	
	Au.	Ag.	Au.	Ag.	Au.	Ag.	Au.	Ag.
Heads:	100.0		0.60	1.1	60.0	110.0	100.0	100.0
Cyanide Tails:	100.0		0.04	0.3	4.0	30.0	6.67	27.27
Cyanide Extraction:			0.56	0.8	56.0	80.0	93.33	72.73

Total extraction on Gold 93.33%
 ,, ,, ,, Silver 72.73%
 Value 91.60%

Sodium Cyanide consumption was 1.3 lb per ton.
 Protective Alkalinity ,, 0.4 lb Lime. (CaO)

From the data obtained from this test work the General Engineering

capacity of 60 tons per day. This flow sheet is found on Plate X11 Page 29. The total cost of a mill built to this flow sheet and containing all new equipment would be \$54,000.00 exclusive of Power Plant. This cost could be lowered to \$34,000.00 if used equipment could be incorporated in the plant. There is a large assortment of Cyanide equipment throughout the Northwest that is in a-1 condition, which can be purchased at a fraction of its original cost. These figures are not rough estimates but are taken from a report on the cost of such a plant which was made by the writer for the Gem Mining Company March 1st, 1922.

- P O W E R -

Big Creek the location of which is shown on Plate X111. Page 31. contains a flow of water sufficient to develop power for mining and milling 60 tons of ore per 24 hours from the Gem Mine and carry on such development work as will be necessary. On February 16, 1922 the writer measured the flow of water in this creek at a point one half mile below the junction of Big and Deadwood creeks. The average flow on that date was 10 cu. ft. per second or 400 miners inches. This amount of water under an effective head of 200 feet, will develop 180 horse power. A ditch from one to one and one half miles long will be necessary desired 200 feet head on a pipe line. As the slope of the ground from the pressure box location to the power house is quite steep, being about 40 degrees The length of pipe line necessary would be about 350 feet. The transmission line between the proposed POWER plant and the Gem Mine will be approximately three and one half miles in length. This line would be constructed under ideal conditions as there are no summits to cross, no underbrush to slash, and the poles could be obtained from the clearing of the right of way. The post holes with but few exceptions be in a general over burden common to this district. The cost of the above Hydro-Electric plant would be from \$14,500.00 to \$17,500.00 depending upon the grade of equipment used. New equipment and material would cost \$11,000.00. This figure includes the motors used in the mill. By installing a used generator water wheel, transformers etc, and having new material in the transmission line the equipment cost would be \$7,000.00 The cost of installation is estimated at \$6,500.00. This makes the total cost of a plant containing equipment that has been used but is in good condition, approximately \$14,500.00.

- M A R K E T I N G -

The product of a Cyanide Plant would be Gold and Silver Bullion which would be marketed at the United States Mint.

Portions of the Gem Mine contain ore of such a grade that it could be shipped direct to the smelter if desired. At the present time the closest smelter is at Tacoma, Washington. The freight rate from Austin to Tacoma is \$9.88 per ton. The treatment charges on the Gem type of ore runs from \$7.50 per ton on an ore having a value of \$50.00 to ~~XXXXXX~~ \$11.00 per ton on an ore having a value of \$300.00 per ton. At the present time the old Sumpter smelter at Sumpter, Oregon is undergoing renovation and it is expected that this smelter will be ready to receive ore before spring. With the reopening of this smelter the Gem mine will have ideal marketing conditions for its ore. The freight from Austin to Sumpter will no doubt be under \$1.00 per ton. The Sumpter Valley Smelting Company will not as yet give out any schedules of smelting ores but they state that their rates will not be any higher than those now charged by the Tacoma Smelter.

- A V E R A G E - V A L U E of O R E -

The foot-ounce method is one generally adopted in the calculation of ore reserves. In this method the length of each sample is multiplied by its assay value; the products of all samples are added, and this total divided by the sum of the lengths, the quotient being the average value. In the following the Gold is calculated in dollars and cents and the silver in ounces.

The average value of the ore in Gold per ton is 3.370.37 divided by 193 or \$17.46 . As the gold is figured at \$20.00 per oz. the gold content per ton is 0.873 ounce. The average value of the ore in silver per ton is 165.24 divided by 193 or 0.86 ounces . At the present time the price paid for domestic silver is \$1.00 per ounce, this price was established by the Pittman act which went into effect April 23d, 1918 It is my opinion that this act will not be effective after January 1st. 1924. so for silver produced after that time, the value which will be received per ounce can only conservatively be assumed as an average for the price for a period ten years prior to this act. This price is 58.33¢ per ounce. In the lower levels there is present some copper in the form of Chalcopyrite (CuFeS₂ : copper 34.6%-Iron 30.4% Sulphur 35%). Also some Zinc in the form of Sphalerite (ZnS:- Zinc 67.1% & Sulphur 32.9%). The amount of copper that would be contained in the feed to the mill would not be enough to interfere with the cyanide process. A composite sample of the ore above the 250 foot level assayed only a trace in copper. A composite sample of the ore between the 250 foot level and the 350 foot levels assayed 0.35% copper

- P R O F I T S -

CREDITS

Gold content per ton of ore	0.873 oz.		
Loss in milling	6.67%	0.057	.,
Gold recovered		0.816	., @ \$20.00 = \$16.32
Silver content per ton		0.86	.,
Loss in milling	27.27%	0.234	.,
Silver recovered		0.626	., @ \$1.00 = 0.63
Total credit per ton of ore milled			\$16.95

Debits

Mining per to of ore	\$2.00
Development & Gen. Exp.	1.00
Mining Debits:.....	\$ 3.00
<u>Mill Labor</u>	
Dry crushing plant, 1 man-1 shift:	\$4.00
Mill men, 2-3 shifts @ \$4.50 :	27.00
Mill Super. & Assayer:	8.00
Repair man	6.00
Total mill labor 24 hours :.....	\$45.00
\$45.00 divided by 60 tons - mill labor per ton	0.75

POWER

Hydro-Electric power @ 6.5 ¢ per H.P day:	0.15
Steel consumption 5# per ton @ 10¢ per #:	0.50
Chemicals per ton 1.5# cyanide @ 40¢ per #:	0.60
4.0# Lime @ 7¢ per #	0.28
1.0# Zinc @ 30¢ per #	0.30
Oils waste and miscellaneous repairs	0.25
Refining	0.12
Assay samples	0.05
Total Debits per ton	\$ 6.00

Net profit per ton of ore \$10.95

The present developed ore shoot will keep a mill of 60 tons daily capacity operating for 300 days and the net return will be 18.000 X \$10.95 or \$197.100.00. This does not mean the net absolute profit as taxes and insurance have to be deducted.

- E Q U I P M E N T -

The Mine is equipped with track, Ore Cars, Air Lines, Ventilation Lines etc.

In the shaft house there is the following;-

- One Hendrie & Bolthoff 8 X 10 D.C. Single drum Hoist With 7/8 in cable for sinking to a depth of 1000 feet.
- One Ingersoll Rand single stage air compressor, having capacity of 400 feet free air per minute.
- One ventilating fan 24 inch connected to 6 in galvanized pipe. and driven by small steam engine.
- One No. 6 Knowls Sinking Pump on 350 foot level
- One Station Pump

Blacksmithing Machine and drill equipment for present needs

(12)

Photographs of Shaft House

Photograph of Bunk House-Cook House, Office etc.

Photograph of Mill(saw-mill)

~~XXXXXX~~

- FUTURE * DEVELOPMENT -

125 foot level

The southwest drift of this level should be continued as long as indications for ore are favorable.

250 FOOT LEVEL.

The vein should be drifted on , to the south under the shaft. a raise should be put up to the 125 foot level from a point about 80 feet northeast of the shaft, drifts should be run on the Zone intersected in the east end of the cross-cut to the east.

350 FOOT LEVEL.

About 40 feet northeast of the shaft a cross-cut should be run into the foot wall vein which should be drifted on in both directions. The south drift should be reopened and further drifting done on the vein found therein. The north drift which exposed the ore beyond the fault zone should be re opened and further drifting done. The shaft should be sunk at least 200 feet before starting another level so as to get below the zone of disturbance of the fault on the main ore shoot.

In closing this report I wish to acknowledge the courtesies and aid given me by MR. G. S. Leeston Smith and James H. Dunston who were at the property during this examination who were ever ready to assist in the work.

Registered Professional
Engineer 623.
Carl N. Anderson
Oregon
December 8 1919



WASTE DUMP



MILL



147



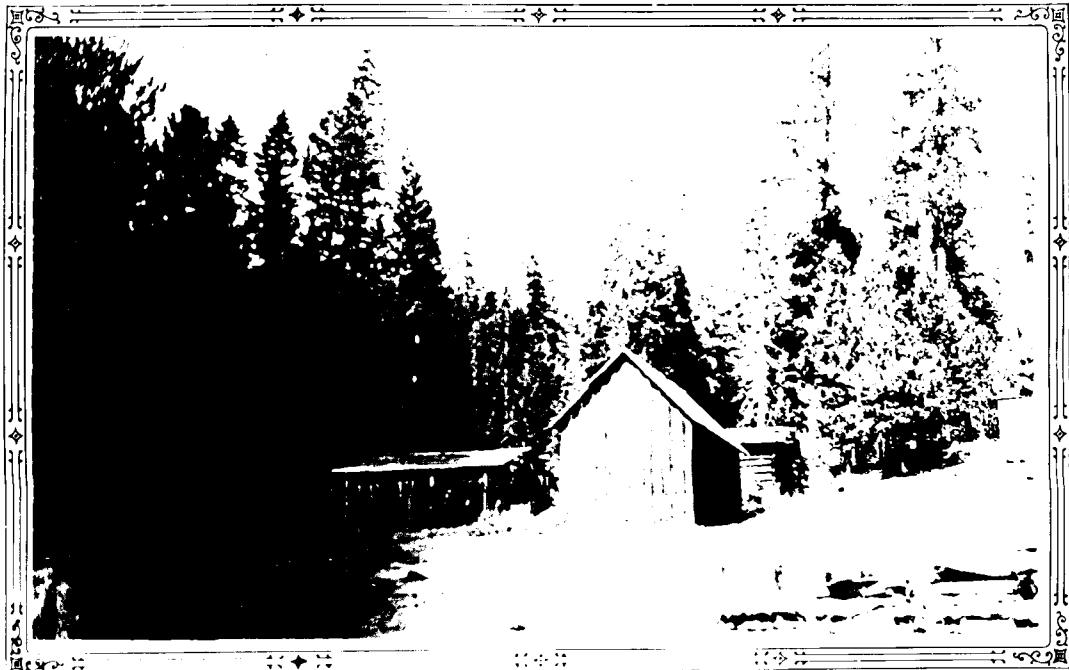
FRONT-BOARDING HOUSE



148



SIDE VIEW OF BOARDING HOUSE



CABIN HOUSE

5.6



5.7



SAW MILL