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Item 35

Quartette Mine  
7.11.29

CHARLES JONES

1725 1/2 No. Kinross Drive,  
Los Angeles, California,  
Nov. 9, 1934.

file with  
Henry B.

Mollin Investment Co.,  
Wright-Callender Bldg.,  
4th & Hill Sts.,  
Los Angeles, California.

Attention: Rex Moss.

Gentlemen:

In accordance with arrangements, I have prepared and am delivering to you at this time a report of the Quartette Mine at Searchlight, Nevada.

This report is intended primarily as a recommendation for work to be performed by you; and I have divided my recommendations into two classes, as follows:

1st, Minor work could be undertaken at the nominal cost and which could be accomplished in a few months time with a very great likelihood of a profitable return through the performance.

2nd, Major operations which would anticipate a major investment of several years of application effort.

The report is arranged with the recommendations first and with the reasons for the recommendations as made covered by subjects showing how and why the recommendation made is justified. Also exhibits attached covering the history of the mine in the past, chronological record of its management and comments showing the conditions existing at the mine and which would have an influence on decisions that were made by the various managements.

Very sincerely,

CHJ/E

CHRONOLOGICAL HISTORY OF THE QUARTETTE MINE MANAGEMENTS

<u>Year</u>	<u>Owner</u>	<u>Manager</u>	<u>Superintendent</u>	<u>Foreman</u>	<u>Shift Boss</u>
1898	G. F. Colton	Colton	-	-	-
1898	(Macready Hubbard	Macready	-	-	-
1899	(Fisher				
1899	(Macready, Hubbard	"			
1900	(Col. C. A. Hopkins	"	Macready	-	-
1901	Quartette Mining Co.	"	" - Harrington	Luxon	-
1902	"	"	" Harrington	Luxon	-
1903	"	"	" " "	King	-
1904	"	"	" " "	"	White
1905)					
1906)	"	"	" " "	"	"
1907	"	"	" Wilson	"	"
1908	"	"	" " "	"	"
1909	"	"	" " "	White	Bushnell
1910	"	"	" " "	"	"
1911	"	"	" White	Jonas	Pemberton
1912	"	"	" Jonas, Lessee	Jonas	Pemberton
1913	(	"	" " "	Pemberton	Bushnell
	(Searchlight Mercantile Co.				
1914	"	"	"		
			Jonas, B. F. Miller Jr.		
1915	"	"	" B. F. Miller Jr.		

Stamp Mill Operations

Cyanide Operations

1898	-	
1898	-	
1899		
1899		
1900	-	
1901	-	
1902	-	
1903	Dirlan	
1904	"	
1905)		
1906)	"	
1907	"	
1908	"	Construction
1909	"	C. H. Jonas, Supt.
1910	Newell	" " " "
1911	"	Wheelock, Supt.
1912		Jonas, Lessee, Slime Plant
1913)		
1914)		
1915-1916		Lease operations. Geiger, Barton, Etc.

## SHAFT DEVELOPMENT AT THE QUARTETTE MINE

## Main Shaft

Sunk to the	500	level prior to 1901
" " "	900	" 1901 to 1906
" " "	1100	" 1906 to 1909
" " "	1350	" 1910 to 1911

## Air Shaft

Raised from	600 level	1906 to 1908
"	" 800	" 1907 to 1908
"	" 900	" 1909

## Crocker Shaft

Sunk from Surface to 500 level prior to 1906

## CHRONOLOGICAL DEVELOPMENT OF MINE AND HISTORY OF LEASING OPERATIONS.

### WORK PERFORMED 1905-1906

All drifting on the 500'.

The 600' was driven east to a point a little way west of the airshaft or No. 3, but no drifting was done west of the main shaft station.

The 700' level was driven to within about 200' of the No. 3 shaft.

The 700' level was in about 400' from the main shaft.

The shaft was being sunk to near the 900' level.

In 1903 labor trouble developed and for several months a very fierce strike was carried on. It was during this time with knowledge of the men in charge, if not actual collusion, stopes were caved after valuable ore was bulkheaded off, so that it could be later reached by those in possession of the knowledge of its location.

### WORK PERFORMED 1906-1908

The West 600' were driven in 1906.

The West 700' and the stopes West on the 700' station were worked in 1907.

The stoping operations above the 500' level up to the 600' were carried on almost entirely under the supervision of J. E. White in the years 1907-1908.

### WORK PERFORMED UNDER SUPERVISION OF CHAS. H. JOHNS, 1910-1912.

1. Driving the 600' East from the point about 300' east of the airshaft through to a connection with the lower workings of the Rambler Mine.

2. Driving the 900' level east from the No. 3 shaft.

3. Driving the 1000' level its last easterly 400'.

4. Driving the 1100' level easterly from about a point where the 1101 raise starts upward.

5. Sinking the main shaft from a 1150' point to below the 1300' level.

6. Driving the 1200' and 1300' levels in their entirety.

7. Driving the 900' level westward.
8. Driving the 1100' level westward
9. Carrying on all stoping operations in the point 9' foot wall stopes, as well as all stopes between 900' and 900' on the hanging wall streak.
10. Carrying on all stoping operations between 1100' and 1000' and between 1000' and 900'.

#### LEASING OPERATIONS 1912-1915.

Under the leasing operations after company operations ceased, my recollection of amounts obtained by me were as follows:

The Montgomery-Jonas Lease, in which I had a half interest, was from the Crocker Shaft east to the air shaft above the 100' level. This was also known as the Holmes-Montgomery Lease and my recollection of the production here is \$40,000.00.

The Tom Post Lease produced about \$20,000.00 and covered the block from the 100' level to the surface from the main shaft to the Crocker.

The Holmes-Jonas Lease on the 500' level covered a block from the main shaft eastward 300' and produced about \$40,000.00

The Holmes-Pemberton-Jonas Lease on the 600' level ran 200' east from the main shaft and produced about \$30,000.00.

The Mockbee Lease on the 600' level ran west from the main shaft and produced about \$15,000.00.

The Charles Pemberton Lease west of the main shaft on the 700' level produced \$5,000.00 but was probably hindered in its development as it was in operation at the time of the mill fire.

After the writer of this report left the property, from his recollection, later profits in the Searchlight Mercantile Leases, about \$40,000.00 was produced on the so-called Simol-McCormick Leases on the 600' level. This production came from a point about 400' east of the main shaft and it was reached by running west from the No. 3 shaft. This was one of the blocks that was deliberately hidden by the crooked management of the 1903 era, was bulked on four sides and ran over \$200. per ton.

Another block of ore was extracted under the Searchlight Mercantile Company operations by John Hudgens, Sr., from the surface east of No. 3 shaft collar and it is my understanding that between \$30,000.00 and \$40,000.00 was extracted.

A very profitable lease operation was carried on, on the so-called Block Lease located on the 700' level at a point about 300' westward from the airshaft. This block produced between 30,000 and 40,000.

The old files of the Engineering and Mining Journal for the years up to 1909 or 1910 published regularly the bullion returns from the leading mines in the country and it is my recollection that these old records showed a total production from the quartette up to 1910 of a little more than \$4,000,000.00.

The leasing operations which were not reported in the mining Journal would increase these amounts by \$300,000.00.

#### OVERLOOKING ORE

The quartette Mine, for reasons which are more fully explained in the technical report accompanying this historical description of the property, was an easy one in which to overlook ore. I say this because where conditions were correct, mineralization would apparently take place behind a slip just as easily as it would take place in front of the slip.

#### WASTE RAISES IN HANGING WALL

Another reason for ore being passed up in one specific instance that I know of about the 800' level, was that when the hanging wall gouge was stripped that the action of the air on the talc seam would be such that it would start to weather and fall. I know of stope after stope where it was not safe to leave the square sets open for more than two floors. It was common practice to carry the ore shutters bulk-headed and sealed by 8 x 10 post caps and sills. At every third or fourth floor and at every 50 or 60 feet interval incline raises were driven for producing waste fast enough to fill the stopes, when there are not enough available from the development work from the level above or if this development work could not produce the waste fast enough to make it available when needed.

I am interested in the hanging wall because as I look back at it now in view of present value of gold at \$35.00 an ounce instead of \$20.00 an ounce, I can well appreciate what a difference it would make in the width of stopes if these values had governed in the years 1903 to 1910 particularly/

In the preparation of this report covering recommendations, I am commenting quite fully on my impressions of what might be done to recover the values now from the areas that had to be passed up in those days; first, because the ore uncovered was marginal ore or a little better, but in those days with an open space below them requiring immediate filling, it would not have been possible to have recovered these ores with the stopes open below without a tremendous risk of loss of life, and incidental loss of the stope as a whole.

#### CYANIDING AND MILLING OPERATIONS OF THE QUARTETTE MINE

The first mill of the Quartette was a twenty-stamp mill placed at the Colorado River connected with it by a 1 1/2-mile narrow gauge railroad. This mill had a very short run as water was discovered at the mine itself in sufficient quantity to take care of the stamps. The railroad was abandoned in 1903, and a mill set up at the site of the property where it was burned in 1913.

In 1907 the capacity of the mill was changed from 20 stamps to forty stamps and in 1908-1909-1910, forty stamps were dropped more or less continuously.

The mill practise was very simple. Nothing but simple plate amalgamation using inside and outside plates. From the foot of the table a simple sand pump elevated the entire flow to ordinary flat-bottomed settling tanks. These tanks were frequently allowed to overflow and the sands settling in the bottom were trammed out by a Mexican every day and placed on the dump. The slimes were sluiced out onto the ponds where the residue still remains.

In 1907 the Blaisdell Company took the contract and built a sand leaching plant beside the mill. Belt conveyors carried the sand from the dump where the fremos had hauled it, transported it to the distributor which leveled it off in great large black tanks. After treatment the sands were removed by hand shoveling through trap doors onto a belt conveyor which stacked the sands where the pile now rests.

#### DEPOSITION

The solutions flowed through the simplest sort of zinc boxes. The deposition of copper was so heavy on the zincs that the gold slime was not reduced to the form of bullion but the zinc precipitates were shipped direct to the smelter.

The recovery of gold values on the plates of the mill ran over 79% to 81% of the total gold content of the ore.

The average value of sands that were the heads for the cyanide plant was between \$4.00 and \$5.00 for about 90,000 tons treated.

The extraction in the cyanide plant ran about 80% and the average value of the tailings was about \$0.90 per ton.

I have not been active in the mining profession for twenty years, and make no pretenses of being qualified to judge the advisability or non-advisability of the application of a flotation process. I say this because I have not kept abreast with technical improvements or with the re-agents which may have been introduced in the years since I retired from the profession; but I have never been able to bring myself to believe that the improvements made in any way justify the installation of a flotation plant on the Quartette slime ponds. I say this because there is nothing in the Quartette ore, to my mind, that would function in the flotation process in the place of a sulphide, and there is no considerable sulphide contained in the Quartette ore.

On the other hand, in consideration of \$35.00 per ounce gold instead of \$20.00, the \$3.00 tailings become \$4.50 tailings.

The Quartette cyanide operations were profitable at a time when we bought cyanide for from .25 to .28¢ a pound; and due to imperfect mechanical construction of the various sand and slime plants, the cyanide consumption amounted to as much as four or five pounds per ton of tailings treated.

A modern plant using a pumped solution where the time of contact could be properly regulated, would without fine grinding recover 80% of the value and make a handsome profit from the operation.

#### POSSIBILITY OF CHANGE TO CYANIDE PLANT

I have not seen your plant but if your flotation process, as I anticipate, is a failure, I would be willing to predict that it always will be a failure, due to an imperfect application of a process which was never intended to adapt itself to your particular type of ore.

I would say that you should give very serious consideration to a method by which the equipment now installed for flotation purposes could be re-vamped, proper tank capacity made available, and that you would consider changing your entire flood sheet over to a cyanide operation; and if this were done, in a practical manner with no waste overhead, I believe that you can make a clear return of \$1.00 a ton after paying for the necessary changes in the plant and possibly you could increase this to \$1.25 a ton net.

#### ANTICIPATED RECOVERY

Your laboratory or experimental plant tests would be very simple. Fine grinding is not necessary. Eighty per cent of the values are recoverable from the tailings in their present condition. A diluted



solution under two pounds to the ton of solution will recover 20% of your values. Your only problem requiring careful study is the application of mechanical means that will enable you to expose the ore particles under proper condition to a medium weak solution that can be promptly removed from the contact when you have reached the proper point for ceasing further effort for conditional extractions.

#### CYANIDE LOSSES

A five-pound solution will extract values more quickly than a two-pound, yet loss of cyanide in the five-pound solution makes the operation economically unsound. A four-hour contact of a five-pound solution with the typical quartette tailings will reduce the cyanide content to about a pound and a half. A two-pound solution with a four-hour contact will be reduced to about half a pound or a pound and a quarter.

At the same time, the gold extraction of the stronger solution will in no way compensate for the cost of the extra cyanide.

#### SAND LEACHING PLANT TREATMENT

The old leaching operation involved a six day cycle at the most and generally a five day cycle of complete treatment. We put through a wash of three pounds to the ton, following it by another 24-hour wash of two pounds to the ton and the last three days with another using from one-half to one and one-half pounds of solution for the last three days.

On the last day we gave it one and sometimes two water washes and this would come off showing a half pound to the ton of free cyanide.

#### REGENERATION PROCESS

In our leaching operations we developed a regeneration process, which process was described in the Engineering and Mining Journal in two chapters..

In 1908, 1909, 1910, I was in touch with the cyanide operations for about a year before going underground as foreman and we developed a regeneration process which made it possible to bring a solution showing traces of active cyanide up to a strength of 24 pounds per ton. We then diluted this seven to one and used it for our first wash in the new tanks. We used sulphuric acid as a regeneration re-agent.

#### REGENERATION BY-PRODUCTS

We recovered from this reasonably foul solution a complex chemical product of which we finally accumulated a carload, which brought us several thousand dollars.

As I recall it, one of the large part values was represented by a complex copper radical.

The leaching operations continued at a very handsome profit until all the sands had been treated.

#### SLIME PONDS

At this stage a very careful sampling of the slime ponds was made and as I recall it, our tonnage check-up showed about 90,000 tons of slimes.

#### LEACHING OPERATIONS OF SLIME PONDS

I personally built the first slime plant equipped with Portland Filter Slime Wheels, Akins Classifier, Raddler, Paddle Wheels, Agitator Tanks, Conveyor Belts, etc. This plant was a complete failure because it was a mechanical make-shift. The agitator would not work in a 30' flat bottom tank. Pipes would sand up, and due to mechanical defects I could not get the ore out of contact with the solution quickly enough for the process to be effective and efficient.

After I left the quartette in 1914, my knowledge was only gained by hearsay, but I understand that Barton Brothers from the Florence Goldfield Mill, Geiger from the California Ore Testing Company and several others rebuilt or constructed anew their plants or modifications of this plant, but all of them, I am told, ran into the same difficulty of having makeshift plants that were mechanically inefficient.

## GEOLOGISTS AT THE QUARTETTE MINE

### JAGGAR and PALACHI

While I had charge of the cyaniding operations at the Quartette mine, and while I was doing the underground surveying, I was called upon to spend a considerable portion of my time on the surface and underground with Geologist T. A. Jaggar of the Massachusetts Institute of Technology and mineralogist Charles Palachi of Harvard University.

### STIRLING

A year or so later, I spent a number of days going over the same ground with Professor Stirling. Underground conditions were such in both of these years that these geologists had access to all of the levels then driven from the 700 foot level downward and of course the portions of the 200, 300, 400 and 500 west of the stepped out areas.

I have sat on a muck pile with Jaggar and Palachi and heard them try to reason out the inconsistencies of the wall rock occurrences.

I have spent hours with Professor Stirling, whose observations were highly theoretical, but he was quite a capable geologist in my opinion, and I have heard him try to reason out the same inconsistencies.

### HISTORICAL

The active managers of the mine, at that time, were more or less resentful at the engagement of Professor Jaggar and Professor Palachi, because, as I recall it, their only recommendations for further work involved certain minor exploratory work in the east face of the 500 foot level and the positive driving of the 1300 foot level at a point arbitrarily fixed at 150 feet lower down the incline than the 1200 level.

1300' level SHOULD NEVER HAVE BEEN DRIVEN

Certain convictions had been fixed firmly in my mind by my observations as to how and where and when ores occurred in paying quantities that could not be influenced by scientific discussion by others who argued as to the particular period when solutions deposited their valuable content. I was firmly of the conviction then and have never changed my mind since that the recommendation for the driving of the 1300' level was the reason for the eventual closing down of the Quartette property.

#### 1100' LEVEL

I wanted to see the air shaft connected with the 1100 foot level. I wanted the 1100' level driven eastward a little beyond this 1100' intersection and then I wanted to see a winze sunk 400 or 500' and then exploratory work performed.

#### AIR SHAFT SINKING

I wanted to see the air shaft put down through to the 1100 because it is hard for anyone to realize the working conditions under which this lower development was carried on. The average temperature of the 1200 and 1300' levels while being driven was 105 degrees. The artificial ventilation system was at best a poor equipment. Air drills were installed but the ground was so soft that they were really more of a detriment than advantage in the speed of driving. The circulatory system through the old stopes and half caved raises was not satisfactory.

#### FINANCING OF JAGGAR AND PALACHI

At the time that the Palachi and Jaggar report was made, it is my recollection that the company treasury contained \$65,000.00 and instructions were given that this fund should be conserved for the one and only purpose of getting the shaft to the 1300' level and the drift driven.

Palachi and Jaggar were paid a \$5,000.00 fee through the Boston office of the Company, and their advice was followed in the future work.

BROWN AND WISHON

As for Brown and Wishon's reports- neither of them was underground until after I had left Searchlight in 1914, when most of the drifts and the main shaft were closed.

MY RECOMMENDATIONS FOR REOPENING THE CHARLOTTE MINE WOULD CALL

FOR THE PERFORMANCE OF THE FOLLOWING WORK:

WORK ON 700

A: Open the 700' level westward through the foot wall drift past (9) a, (3)a, and (7) a. Make set-up of your core drilling outfit and prospect toward the hanging wall. By this, I mean carry your exploration through the old fills and then continue for 15 or 20 feet into the porphyry wall that should be found at this point.

CONDITIONS GOVERNING

I recommend this particular piece of work because I have a very definite recollection of the conditions governing at the time that the stoping was done from 600 upward on the surface hanging wall streak in the area below points 6, 7, 9, 10 and 11 on the 700' level. The ore was better than \$20.00 according to the foreman's word at that time. It had a nice streak of shipping ore on the foot wall. The stopes were carried on square sets and the ledge was 2 or 3 sets wide as it was worked.

HISTORY

The management carried the stopes without filling and it suddenly buckled and timbers cracked and it became very dangerous. At this time incline raises were rashed up into the hanging wall and those raises surprisingly enough showed excellent values, the mineralization being a coarse grained porphyry, the stopes continued to cave however, and I recall a particular day when the rumor came up to the surface that it had collapsed and had been abandoned. I know that none of the work in that area had encountered the heavy hanging wall gouge which so definitely marked the boundary of the pay ore in every other part of the mine that I have seen.

RAISED DEVELOPMENTS

With the foot wall drift as your base of operations, raise into the

area to 602 raise. This should open up a block of ore of good profitable milling grade on today's gold valuation. Of course in getting up to this block you would also explore the block west of the 704 raise. Whether you continued the 700 level west further would depend on whether or not you open the 800' level.

#### 800 WEST

I believe that the west 800 is most promising prospect. My partner and I personally financed the driving of this west 800 at the time that our mill burned down, and we were then forced to discontinue with a face of well mineralized porphyritic ore with a good strong slip on the hanging wall side and with valuations of \$3.00 per ton across the face.

#### WORKING CONDITIONS

Of course in opening these old levels you must bear in mind that they were first dug with the slope of the tracks downward toward the main shaft, and this might act as an advantage to you in reopening them as you would slope in the opposite direction and would probably be closer to the backs of the caved drifts as you worked west.

#### 1100' EAST

The most interesting prospect in the whole Smartette Mine was in 1912 and still is today the east face of the 1100 level. This is described in detail in another portion of this report. This of course would call for a different type of development. You would want to be financed to carry through for the sinking of the number 3 shaft to the 1100 level and for doing several thousand feet of lateral work eastward, and excepting for what you might find in this lateral work, there should be no chance to pick up any ore that would help pay expenses of the development.

#### POINT 8 STOPE ON 900

Under the existing prices of gold, I believe it would be possible to recover several thousand tons of \$10.00 ore in and around the so-called point 8 stope on 900. It is, of course, impossible for us to predict what the conditions of these openings might be. The hanging wall stope was worked out even though the map be-

fore me does not show it up to the points underneath points 8m 9, 10 and 11 of the 800 level. The last stull which was 13 or 14 feet long had hardly had the wedges driven behind the head board before the hanging wall came in, but the ore had been cleaned out entirely up to such an extent that the sills of the level about were in sight. However, I believe that the ore, if values had then been what they are today for gold, would have been estimated as having a width at right angles to the hanging walls slip of 40 feet. The web left between the hanging wall streak which was stoped out and the foot wall streak taken out on 5 to 10 feet stulls was mineralized from the foot wall side of the foot wall streak to the hanging wall side of the hanging wall streak.

#### 900 WEST

At the time of the fire which destroyed the Quartette Mill, leasing operations were being carried on which we as then owners of the property, were partially financing and at the time of the fire the 900 foot face had been driven as I recall it, nearly 100 foot further west than is shown on the map and the face was in a good looking vein material assaying about \$3.00 per ton and with a good strong slip on the hanging wall side. (It was in correct position and dip to check up properly with the slip overlying the 701 west and 801 west stopes west and I regarded it as a wonderful prospect for the opening up of a very substantial ore bod.

#### WEST STOPES

The .701 west and .601 west stopes were considerably different in their mineral character from the stopes to the east. They were in a coarse grained andesite porphyry quite dark in color. They were no hanging walls or foot wall streaks of smelter ore. They were taken out on square sets because the ground was very blocky and the hanging wall heavy and there were streaks of white quartz running through the fracture seams of the vein filling. I was only in these stopes twice when I went down to measure up some work as I was then employed as Superintendent of the cyaniding operations on the surface. The last time I went in was when the stopes caved and operations were suspended in a hurry. They had attempted to hold them open with



out filling and it just could not be done. I always believe that this portion of the property should have been reopened but the management would never allow this to be done and by the time I had charge of anything and could actually dictate policies the entire drifts were closed from the shaft westward and I figured that the 900 foot level was the best chance to accomplish the objective of finding the major body of ore.

#### BLUE ORE WITHOUT VALUES

A quantity of commonly referred to "blue ore" was in sight east of the air shaft on the 900' level along the drift just back of the east face on the 1000' level and above the 1100 east of the stoped out areas. These faces of blue ore were very misleading. They had the same appearance as ore that went to the smelter and which yielded \$100.00 or more a ton, but this particular ore did not sample over \$2.00 or \$3.00 per ton, and I believe that a great many of the reports as to blocks of ore underground were started as a result of miners talking about the excellent appearance of these certain stoped faces.

#### LEASING ORE BLOCKS

It is true that after the Company's operations ceased and my personal leasing operations started that certain blocks of ore were opened up which gave a very substantial return. The history of these blocks is set forth in detail in the portion of this report called "leasing operations." When analyzed, these leasing operations depended for their success upon secret knowledge held by certain people who had secured this information from the unscrupulous group who operated the mine prior to 1905.

#### SURFACE LEASE BLOCKS

The operations of the so-called Holmes lease and Montgomery leases on the surface at the glory hole around the Crocker shaft was not in this classification. This ore that was discovered as a result of following a barren stringer from the surface down 10 or 15 feet when it suddenly opened up into a mass of stringers which would average 20 to 30 dollars across a 5' surface.

GEOLOGY AND COMMERCIAL ORE POSSIBILITIES OF THE 1100, 1200  
AND 1300 FOOT LEVELS.

1100 EAST FACE

The 1100' level of the Quartette Mine was in my opinion in 1910 and is today, an excellent mining prospect. It was just reaching an area that was very well mineralized, the face was very wet and had a very heavy copper stain. A heavy strong gouge showed on the hanging wall side.

WORKING CONDITIONS

Working conditions were favorable enough to justify the continuance of the work. The point 8 raise was through<sup>to</sup> the 1000 level, giving ventilation reasonably close to the face, but instructions were given to concentrate on the 1200 and 1300' levels and that is where the money was expended.

GEOLOGY MAP OF 1200 and 1300

The geology and mineralization of the 1200 and 1300' levels is very completely indicated on the map prepared by me on November 22, 1933, and shows the conditions existing quite clearly. The 1200 level was well mineralized but values rarely ran above 0.05 of an ounce or \$1.03.

HANGING WALL GOUGE

There is absolutely no question in the world but that we followed the hanging wall slip whenever we wished to and that we were definitely and positively on the vein. The vein was continuous to the 1100 level and the 1200 level was connected with the 1100 by raises at point 4, point 5, point 6, point 8 and point 11. These raises put through to check on

our position and to furnish ventilation to relieve the temperature of 105 degrees, all broke through on the 1100 level exactly as they were expected to do, inasmuch as we followed up under the hanging wall slip. (Note: I note that in tracing the large stopes map which you are using that all of the raises just mentioned are indicated on the map as cross cuts. This should be changed. The correct indication of the work done is shown on the geology map which I have mentioned.)

#### WORKING CONDITIONS

Working conditions in the east faces of the 1200 and 1300' levels were almost impossible. The heat was terrific, the ground was heavy and hard to handle.

The showing on the 1200 east was promising, the vein was open and well mineralized but not enriched.

#### SULPHIDE ZONE

I have stated before that I opposed the driving of the 1300' level even before the main shaft had been sunk. I did so because I was convinced that the future of the Quartette Mine, in a large way at depth, was dependent upon the discovery of the sulphide zone, and I could not see the advisability of sinking the main shaft 150' then driving 1200 or 1400' to reach a point 150' below an area that had proven devoid of pay ore. I wanted, as stated before, to connect the air shaft with the 1100 and then either sink the air shaft or go still further east and put a winze down 500' before doing any lateral work.

#### WINZE AT EAST 1100

THE CARRYING OUT OF THIS LAST IDEA IS MY MAJOR RECOMMENDATION FOR THE DEVELOPMENT OF THIS MINE.

#### 1200 and 1300' CROSSCUTS

A further study of the geological map of the 1200 and 1300 levels would not be complete without a study of the cross cut geology shown at the top of the map. In going 300' or 400' into the hanging wall, there was not a single foot of the entire cross cut that would justify the placing of a shot in the side wall. This is merely another confirmation of my belief that when you get beyond the hanging wall slip, you are not going to find any ore values.

#### DEEP DEVELOPMENT

The size of the fracture zone on the 1200 level, the fact that it is more open to the east which is in line with the rake of the major ore bodies above, the mineralization in it, the amount of water flowing out of the faces, all justify the belief that a deep development might lead to the finding of a very considerable ore body.

LESSONS AND CROSS-CUT DEVELOPMENTS OF THE PAST

CROSS-CUTS

At one time or another, I have personally seen hanging wall and foot wall cross-cuts driven at the following points:

At point 4A on the 600 foot level  
Near point 17 on the 600 foot level  
Near point 15 and 16 on the 600  
Into the hanging wall on the 700 near points 1 and 2  
On the 900 level between one and two near point 5  
Into the hanging and foot west of point 7  
Into the hanging wall between points 9 and 10  
Into the hanging wall and foot wall beyond point 12  
On the 1000 level into the hanging and foot east of point 5  
Into the hanging wall at point 18 on the 1000 level  
To the hanging wall between points 2 and 3 on 1100  
Into the hanging wall at point 4  
About 300 feet into the foot wall at point 3 on 1100  
In the hanging wall 300' at point 7 on the 1200 foot  
Into the foot wall between points 3 and 4 on 1200  
Into the hanging wall at point six 1200 unmarked  
Into the foot wall at point 10 on 1200  
Into the hanging wall at point 11 on 1200  
Into the foot wall at a point between 13 and 14 on 1300.

NO FAULTING ON VEIN POSITION

In my capacity of timberman, foreman, or various other capacities, most of these cross-cuts were inspected by me at least every other day. I was always looking for some indication of a displacement especially on the lower levels that might possibly have slipped a block of ground out of place and that the information obtained from finding such displacement would lead to the finding of the downward extension of the pay ore shoots existing above.

NO RESULT FROM HANGING

The net result of all this cross-cut development work has lead me to a very definite conclusion. Every foot of the hanging wall cross cutting which was carried on beyond the point where the hanging wall was encountered represented money wasted. After I was once out into the mill beyond this point, I have never seen a face

of ore in it that would go over \$3.00.

#### WALL DEVELOPMENT

No mineralization solutions ever got through that clay gouge.

#### FOOT WALL CROSS-CUTS

The foot wall cross cuts were always of interest providing they started from a drift located adjacent to the main hanging wall gouge.

#### PT. 9 STOPS 900

This fact was particularly called to my attention in the point 9 stop on the 900' level. No hanging wall gouge was in sight and the stop was started from point 9 raise on the 900' level. We started extracting ore on 3 or 4 foot stulls against a clay gouge, then as we worked west, we had to use 6' stulls and when we got a few feet further west we found that the streak which we were following cut back underneath the 3' stulls and behind two or three feet of apparent foot wall material and behind this we picked up another streak of 4 or 5' of ore even richer than the first one. The net result was that we finally took the whole ore body out of 9 and 10' stulls.

Then in order to fill with waste, we drove inclines back into the hanging wall and there again found a porphyritic andesite with white quartz stringers and under the present price of gold, this entire hanging wall could now be mined at a profit. But even at this point, we had not encountered the hanging wall slip that we were looking for. Later on in the point 10 hanging wall cross cut and about 408 in from the survey line 9 to 10, we finally encountered the hanging wall gouge and underneath this was about a 2' streak of good ore. This streak followed up to the 800 level, finally resulting in the discovery of an ore body measuring 10 and 12 feet across.

HANGING WALL CROSS-CUTS

Then came the same old story. A car through the hanging wall gouge in Pt/ 10 hanging wall cross-cut and cross-cut about 60 feet further and found nothing but hard solid fine-grained andesite.

FOOT WALL CROSS-CUTS RECONSIDERED

I repeat again that it is always a good prospect to drive 10 to 20 feet back toward the foot wall anytime that you are located in close proximity to the hanging wall gouge. I do not mean by this that you would be justified in driving 10 or 20 feet when you were east of the air shaft because there is every indication that that area runs into a much tighter formation, and the fracture zone is quite possibly much narrower than the area between the two shafts.

## CROSS - SLIPS IN FRACTURE ZONE

### IMPORTANCE

I have continuously through this report referred to the great importance which I attach to locating yourself in development work on something that you know is the hanging wall slip.

### 900' LEVEL WITHOUT VALUES

As an example of its importance it is interesting to tell you that until the 900 level had gotten to a point between point 9 and point 10, it was generally accepted fact that the Quartette Mine had bottomed. There had not been a face assaying \$5.00 a ton in the entire distance. It was driving on vein material and apparently there was a strong slip being followed.

### RAISES

Raises had been put through to the 800 level known as 901 raise and point 6 raise and these had broken through properly on the 800 level and connected up regularly under the hanging wall slip which overlay the stope above the 800 level.

### 3" STREAK OF ORE

A small streak of good ore about 3" wide was picked up west of point 6 on the 900 level but this 3" of good ore did not come into the drift at all.

### CROSS CUTS

A cross-cut driven into the hanging wall about 40' west of point 6 ran into hard dusty fine-grained andesite.

### CROSS-SLIPS

Later developments carried on from the 1000 level below, showed that the hanging wall slip came up on its regular slope to a horizontal plane about 2' below the level of the 900' level sills at point 6, and at this point an intermediate slip layed almost horizontal, had checked the deposition of the ore bearing solutions coming from below the 900 level.

### ORE BODY BELOW SLIP

At point 6 a stope of ore was discovered starting about 5' toward the hang-



ing wall from the drift timbers and four feet below the drift. This was taken out on square sets and on 5' stulls at the west end and on 12 and 14 stulls at the east end. This ore body, until it got eastward to point 7, never came above the level of the sills of the 900 drift and yet it was continuous for over 500' in length, would average 7' across and assayed with a smelting ore streak added better than \$20.00 per ton.

#### NO FAULTING ON H W SLIP

Local gossip around Searchlight in later years was full of the discussion of the faulting that cut off the ore at this point. It never was a faulting, it was an intermediate slip in the fracture zone, which came over against the main hanging wall gouge and stopped and ran against the foot wall rock and stopped.

#### HANGING WALL SLIP

The hanging wall slip continued upward above it on the correct dip to tie in with the ore bodies on the 800' level above. About point 8 this false slip faded out and from this point eastward the profitable ore bodies were more or less continuous through to the 800 level.

#### INTERMEDIATE SLIPS AT 1060

Similar slip in the stope above point 4, 5, 6 and 7 on the 1100 level about 40' above this level acted as a sill and the pay ore at point 4½ raise only came down to this intermediate slip. From point 6 eastward, the values came down practically to the 1100' level, and if the gold valuation existing today had been in existence in 1910, I believe that the stoping operations could have been profitably carried eastward on the 1100 level considerably further than they were carried. Returning again to this intermediate slip, 40' above 1100, it did not in any way displace the hanging wall gouge on its true course and dip.

## GEOLOGICAL CONCLUSIONS AT THE QUARTETTE MINE

### CONCLUSION

My experience has brought me to the following conclusions:

#### NO GNEISS ORE

That ore is not found in the gneiss.

#### WALL ROCK NO IMPORTANCE-ON ORE DEPOSITS

That ore will occur regardless of whether the wall rocks happen to be of the same constituency in the hanging wall and the foot wall or whether as generally happened they were different types of greenstone or andesite varying only in the type and size of the phenocrysts or feldspar particles. Therefore, except for gneiss, I do not place great value from a commercial standpoint on this factor of adjacent wall rock.

#### COARSE GRAINED ANDESITE ORE

As to the vein content itself the best ore has been found throughout the mine where the vein content is of the coarser grained type of porphyry. This is probably due to its being more brittle, fracturing more easily and allowing deposition from solution to occur more readily.

#### HANGING WALL GOUGE IS CONTINUOUS

To me one of the most interesting features of the geology of the mine is that in driving several miles of drifts and making dozens of cross-cuts into the hanging wall, I do not know of a place where the hanging wall slip is not continuous. It may be rolled over or flattened out a little and it may be confused on account of the violence of these movements, but sooner or later within a few degrees of its correct position it has invariably been picked up.

#### HANGING WALL GOUGES

I am emphasizing this because I think that the hanging wall gouge, of the fracture zone is continuous and is the top boundary of any and all ores.

#### CONTINUOUS DIP OF HANGING WALL

I have come to a very definite conclusion that the Quartette vein so-called is a zone of fracturing that has not been displaced as to its hanging wall between the point 3 shaft and the mine shaft. That in a general way, excepting for the one roll or change of slope at the 300 foot level in the mine shaft which amounted to something like fifteen degrees steepening and for the change of slope below the 600 level which only amounted to 3 or 4 degrees the dip of the hanging wall is regular.

#### FOOT WALL SOUNDARIES

With my theory as to the hanging wall established in your mind as a fixed plane, the irregular rolls in the foot wall, and the unaltered or uncrushed masses of country rock unmineralized remaining in the zone of fracturing, were continuously the unknown element in determining whether all the ore had been taken off the foot wall and behind these masses there are prospects at a great number of places in the mine for additional ore bodies.

#### SHIPPING ORE ON FOOT WALL

The Quartette mine secured for itself an almost national reputation among mining men on account of the occurrence in it of a certain type of shipping smelter ore that contained the sulphide and molybdate of lead with gold values running into the hundreds of dollars per ton and with a considerable occurrence of chalcocite. This streak generally running from six inches to two feet in width, occurring in a great number of places in the mine from the 400 foot level, to the 1060 level and I know of no place in the mine where any ore was found behind the foot wall side of a streak of this type of ore where it carried a high gold content. In other words, when this type of ore rested on a foot wall it rested on something that was unmistakably foot wall rock in place.

#### GNEISS IN VEIN AND PAY ORE

I never saw pay ore in the property in the vein if it had any signs of being an alteration or crushed remnant of an original gneiss rock.

#### FINE GRAINED ANDESITE IN VEIN

The ore in the neighborhood of the 1001 and 1002 east raise contained in a major way the remnants from the crushing and alteration of a medium fine grained andesite.

#### COARSE GRAINED ANDESITE

On the other hand, the ore that I was familiar with in my limited operation in the vicinity of 601 stops contained the crushed remnants of a coarse grained andesite. The ore which I was familiar with in the stoping operation on the foot wall and the hanging wall of point 9 raise over the 800 foot level contained the crushed remnants and in some cases complete alteration of medium porphyritic andesite.

The area in the stops above 1000 in what was known as point 14 stops was again a rather coarse grained porphyritic andesite.

#### WALLS NEAR ORE

I have seen the richest ore in the mine come from an area where the hanging wall was coarse grained andesite porphyry and the foot wall a fine grained hard andesite porphyritic.

I have seen the area around 1001 raise a very rich ore body with the hanging wall a fine grained andesite porphyritic. I have seen an area around the point 14 stops 1000 where the hanging wall and foot wall were both fine grained.

I have seen a surface working where the unaltered fragment in the vein system itself were practically identical in various places with the country rock of the foot wall and the hanging wall.

#### HANGING WALL NO PROSPECT

I do not regard the hanging wall as a good prospect for developments. I have seen too many hundred feet of dusty cross-cut drifting where the pointing of drill holes could almost be done at random because there were no slips to pull to or to break to with the point of your hold.

In the case of the 700 foot level, I had no connection with the oper-

ations from a directorship standpoint at that time and the true hanging wall slip was never picked up and there is in my opinion a very considerable block of ore left in that area of a good grade.

#### GEOLOGY

I also am not positive as most of the geologists seem to believe that there was an actual separate and distinct intrusion of the porphyritic andesite into the zone of fracturing at all. It is perfectly possible in my mind that the grinding action of the movements and the factors which caused alteration would open up channels in any and all kinds of rock through which the fracture zone passed and that the agency of mineralization was intensive enough in its action to cause alteration of whatever country rock happened to occur below the hanging wall slip and the altering agency could so change the fractured particles within the zone so that it would only resemble to a small extent the wall rocks through which it passed. In any event, the best ore occurred in altered porphyry vein filling and ores of lesser value occurred in finer grained andesite. No pay ore occurred in altered gneiss rocks.

The Quartette Mine is a fracture zone which has had several late movements leading to remineralization of the fracture zone mass. The particular type of walls whether gneiss, greenstone neo-andesite or the coarse grained or porphyritic andesite has little economic bearing on the occurrence of pay ore.