

SUBJECT OF THE AURORA DISTRICT

The Aurora, or Esmeralda, District is in Mineral County, Nevada, close to the California line. The nearest railroad station, Thomas, on the Southern Pacific branch line to Tonopah, is 27 miles to the northwest.

Discovery was made in 1890 and the district was one of its producers in 1930 and the two following years, when it started to decline and in 1932 was nearly deserted for many years. The "Aurora" figure, given in a bulletin of the U. S. Bureau of Mines, is certainly in view of the nature of the ore. It is certainly most of the output was from a single mine, the Aurora, averaging over 115 per cent gold and silver, chiefly the former.

REPORT OF THE AURORA DISTRICT

Mineral County, Nevada

by

J. H. FARRELL

August, 1934

From 1915 to 1916 the Aurora District produced \$1,250,000 from its mines. This was a marginal operation and it is estimated that it cost \$1.00 per ton to produce the gold and silver.

The productive area is about 100 acres, and is half mile in extent. The ore is a large number of smaller veins, and is found in the Aurora District. The ore is a large number of smaller veins, and is found in the Aurora District. The ore is a large number of smaller veins, and is found in the Aurora District.

-000-

The veins range in width from a few inches to 10 feet, and many of them are 10 to 20 feet thick. The veins are found in the Aurora District. The ore is a large number of smaller veins, and is found in the Aurora District. The ore is a large number of smaller veins, and is found in the Aurora District.

One strong fault, the Aurora fault, is found in the Aurora District. The ore is a large number of smaller veins, and is found in the Aurora District. The ore is a large number of smaller veins, and is found in the Aurora District.

Early mining was done by hand, and the ore was shipped to the Aurora District. The ore is a large number of smaller veins, and is found in the Aurora District. The ore is a large number of smaller veins, and is found in the Aurora District.

It is possible that large quantities of low grade ore available at present market prices, will be found in the Aurora District. The ore is a large number of smaller veins, and is found in the Aurora District. The ore is a large number of smaller veins, and is found in the Aurora District.

See page 6 for page

SUMMARY ON THE AURORA DISTRICT

The Aurora, or Esmeralda, District is in Mineral County, Nevada, close to the California line. The nearest railroad station, Thorne, on the Southern Pacific branch line to Tonopah, is 37 miles to the northeast.

Discovery was made in 1860 and the district made most of its production in 1863 and the two following years, when it started to decline and after 1869 was nearly deserted for many years. The "bonanza" period production has been variously estimated at from \$12,000,000 to \$27,000,000, the latter figure, given in a bulletin of the U. S. Geological Survey, seems incredible in view of the nature of the mine workings. However, it is certain most of the output was from a small tonnage of high grade ore averaging over \$100 per ton in gold and silver, chiefly the former.

From 1915 to 1918 the Aurora Consolidated Mines Co., produced \$1,842,482 from ore averaging about \$3.50 per ton. This was a marginal operation and high prices in 1918 closed it.

The productive area is about two miles by one and one half miles in extent. Fourteen major veins and a large number of smaller ones, are found in latite and andesite porphyry, a volcanic flow or series known to be at least 900 feet in depth. This formation is covered and surrounded by later rhyolite and basalt flows away from the Aurora area.

The veins range in width from a few inches to 60 feet, and many of them may be followed on outcrop for several thousand feet. Quartz is the chief vein mineral, and gold occurs in ratio varying from 1:2 to 1:40 by weight to silver, the only other metal of importance. Most of the veins strike northeasterly and incline to the south with dips ranging from 25 degrees to vertical, in some localities dips are steep to the north.

One strong fault, with many minor slips, is known to cut the important veins of the north half of the district, and in the old workings stopes are often seen to be cut by faults.

Early mining was unsystematic and consisted in following ore shoots from outcrop until they pinched or were faulted. Very little "dead work" was done in crosscutting or looking for faulted extensions, and it is believed that detailed study of the veins and fault system will result in finding new orebodies, provided reasonable expenditures are made for short crosscuts and extensions of drifts in the vicinity of the old high grade stopes.

It seems possible that large tonnages of low grade ore workable at present metal prices, will be found in the larger veins, also in certain areas of general mineralization which may be readily explored by surface work and crosscuts from old tunnels. Such ore may be mined very cheaply by open pit methods without any costly preparatory work.

Aurora Summary.

-b-

The Humboldt vein was the source of most of the ore mined by the Aurora Consolidated. It was stoped for widths of 20 to 50 feet, over a length of about 800 feet, and from surface to between the 300 and 400 foot levels. Based on old estimates, there would appear to be something over 60,000 tons of ore left above the haulage tunnel level, averaging from 0.15 to 0.17 ounces gold per ton. The tonnage may be considerably increased marginal to the old stopes and in stope extensions, in view of present metal prices, but nothing is known at present as to the details of location and availability of this ore.

There is no mining or milling equipment available in the district, but there is an electric power line to the camp, water may be obtained from several nearby sources, and such preparatory work may be obviated by use of the old workings, so that any expenditure in the future may go directly into productive work.

GENERAL RECOMMENDATIONS.

It is impossible to make detailed recommendations with information now at hand, but the following procedure is suggested:

1. Detailed mapping of the veins and faults should be carried out in the more important areas, as seen on Last Chance and Middle Hill. This should be followed by an adequate amount of exploration work in the way of systematic crosscutting where the veins are seen to have more than one productive band or streak between walls, and by work to pick up faulted extensions of ore shoots. Such explorations may be carried out from the old stopes, or from the tunnels below them, in Last Chance Hill.

2. Preliminary sampling should be done on outcrop and in accessible stopes of the Last Chance area, to determine the possibilities of open cut operation on low grade material.

3. The Esmeralda vein should be sampled on outcrop and in accessible workings to see if systematic exploration is advisable.

4. The workings on the Prospectus and Humboldt veins should be surveyed, and with some sampling to supplement the existing assay plate, and some new work to further outline the ore shoot extensions, a new estimate of tonnage should be made.

5. The advisability of diamond drilling should be carefully considered, as a means of exploring the downward extension of the Humboldt ore shoot, also for use on the Esmeralda and other large veins.

(Original signed) J. H. Farrell.

August 1, 1934.

REPORT ON THE AURORA DISTRICT
Mineral County, Nevada

No production was made by the Cornish pump with 10 foot stroke, 5 per minute. J. H. Farrell
but it is estimated if run August, 1934

Location. The Aurora District is in Mineral County, in west central Nevada, close to the California line. The nearest railroad point is Thorne, a station on the Southern Pacific railroad, 37 miles to the northeast. The district was known as Esmeralda in early days.

History. The discovery was made in August, 1859, by James M. Brady, J. M. Cory, and E. R. Hicks, who located the Esmeralda and other claims, and carried news of their find to the Mono placer diggings, from which other miners came and helped to organize in the district. The first shipment of ore was made by mule train in November, 1860.

By the fall of 1861 most of the productive area had been staked, three small mills were in operation, and the town of Aurora had a population of 1800. In the spring of 1862 highgrade ore was found on the Antelope claim, and on Last Chance Hill where it was reported that 44 tons of ore yielded \$11,000, or about \$250 per ton. Many references are found in early descriptions of the camp to ore carrying from two hundred to five thousand dollars per ton, chiefly in gold, and it appears that the early production was exceptionally rich ore. No complete and authentic figures are available as to the total output.

Mining was very unsystematic and milling methods were crude, during the period of greatest production from 1863 to 1866. There was divided ownership of the Bonanza area and armed conflict and litigation over the richer claims took much money that should have gone into development. By 1866 the known ore shoots opened at surface were exhausted, and such attempts as had been made to mine below a depth of 100 feet found little ore that could be profitably worked by the methods which had been successful with the Bonanza material on which operations had started.

An account by a contemporary observer says: "My idea of the cause of the decline of the district, and I believe the generally received opinion, is that just at the time (1864-5) the rich surface deposits became exhausted there was a great and general decline in all mining shares, and this, together with the great amount of litigation in regard to conflicting titles, caused stockholders in the various companies to refuse to pay (assessments) or furnish the money necessary to prospect the mines to any great depth below where the surface deposits had given out." (J. S. Jameson, judge of the District Court of Esmeralda County, in a letter written in May, 1878 to Joseph Hanson.)

The district declined until 1869, when it was practically deserted, and remained so for several years, except for two short-lived attempts to develop the Juniata vein. In 1877 a group of San Francisco men formed a company and took over the best of the claims on Last Chance Hill. The New Real Del Monte shaft was started and by 1881 was down between 800 and 900 feet, after much difficulty with water below the 500 foot level. A large (17") Cornish pump failed to handle the water, possibly when drifting was started on the 800 foot level, and the attempt was abandoned.

No production was made at that time. (A 17" Cornish pump with 10 foot stroke, 5 per minute, might handle 600 gallons per minute, but it is doubtful if more than half that amount could have been pumped from 800 foot depth with the Del Monte pump. The shaft has two hoisting compartments and the pump compartment, and may still be reached through the water discharge tunnel from the gulch about 100 feet below the shaft collar which is partly caved.)

There is no description of labor work from the Del Monte shaft now available. It is reported that a station was established at 300 feet "where the shaft passes through a six foot body of quartz that assays well". (Quotation from pamphlet entitled "Bodie and Emeralds", by Joseph Nasson, P. 52, published in 1878.) The flow of water was not excessive to a depth of 400 feet as it was handled by hoisting, and some work is reported to have been done at that level several years later. A level at 500 feet is also mentioned in an account of the shaft work as having been abandoned when the shaft was flooded.

Sometime between 1865 and 1887 an English company, name unknown to the writer, reopened the Real Del Monte shaft, but unwatered it to the 800 foot level with steam pumps, but they could not hold the water there and did not get into the level workings. They are said to have driven a crosscut southeast through the Philadelphia claim on the 400 foot level, crossing a wide vein which was not developed, probably because it was low grade, though it had some bunches of good grade ore. A drift was run to the southwest to the Durant shaft where some high grade ore had been mined above but the downward extension was not found.

This company sunk the Humboldt shaft 400 feet and did considerable work on several levels, but little mining as the ore was mostly too low in value to work profitably, the low limit was about \$12. per ton. (Information regarding the English company's operation was given the writer in the course of a conversation, by J. F. Parr in 1934. He was employed by this company for several years as time keeper, assayer, and assistant to the superintendent.) Their work was hampered by shortage of funds, which were supplied intermittently, though a considerable expenditure was made over a period of years, little was accomplished. This was the last attempt at systematic development for a long time, and the camp was again turned over to "coasters", or leasers, who made very complete cleanup of all accessible workings, but opened little new ground.

By 1912 a large number of claims had been gathered in two groups which were consolidated and taken over by Aurora Consolidated Mines Company, afterward controlled and operated under Goldfield Consolidated Mining Company management. From 1915 to 1918 this company mined and milled 633,332 tons of ore yielding \$1,842,462, a little less than \$3 per ton with tailings averaging 50¢. This ore came chiefly from the Humboldt and Prospectus veins at the north end of the district. It was treated in a cyanide plant of 500 tons daily capacity. The operation proved to be a marginal one until the latter part of 1918, when war costs forced a shutdown and the mill was dismantled along with all camp buildings.

The Aurora Consolidated had little money to spare for general exploration of its holdings, which included most of the productive ground of the district. Records show that only 1 foot of development was done for 40 to 50 tons mined. The result was that little was done in the way of investigating the Last Chance Hill area which had most of the bonanza production in early days. No ore was found there, as was to be expected since the old workings are above water level and had been open to leasers for fifty years in 1918. Since then only sporadic work has been done by leasers working over the dumps, or by operators with limited means.

Production. Bulletin 594, U. S. Geological Survey, gives a brief description of the Aurora District, pages 141-150, with the following regarding production: "The records are incomplete. According to a statement of Wells, Fargo & Company the bullion shipped through them up to 1869 had a value of \$27,000,000". This is followed by a statement showing bullion shipped without insurance from 1861 to 1869 amounting to \$2,365,968.82. Others more or less familiar with the camp have estimated the early production at from twelve to sixteen million dollars.

Judge J. S. Jameson, writing to Joseph Wesson in 1878, in reply to an inquiry regarding the camp's production said:

"I was in the (express) office over five years, and made all the reports, but I have forgotten the exact figures. I have no recollection of the amount sent by each company respectively. My recollection is, however, that in the year 1864, between \$7,000,000 and \$8,000,000 were forwarded from the office here, and that about \$12,000,000 altogether was sent away prior to the year 1869".

An owner of one of the assay offices of the camp stated that about half a million dollars worth of bullion was handled monthly through that office for about eighteen months in succession, presumably in 1863-'4.

These figures are almost incredible in spite of the large number of veins in the district. Neither the dumps nor surficial evidence of the workings indicate the removal of any large tonnage of ore, and it is very certain that most of the mining was done above a depth of 200 feet. Either the production has been greatly exaggerated, or else the ore was exceptionally high grade. Getting at this question from another angle, it is known that there were seventeen amalgamation mills in the district by 1864, most of them small, 5 to 10 stamps, the largest 30 stamps. The total number of stamps is given as over 200, but accounts show that the mills operated intermittently, stamps were light, and stamp duty did not exceed 1 to 1.5 tons per stamp per 24 hours. If we consider the period of maximum production to be 18 months of 1863-4, during which perhaps \$10,000,000 worth of bullion was produced, with 150 stamps on an average, in operation for 500 working days, crushing 225 tons daily total, the total would be 112,500 tons, with an average recovered value of nearly \$90 per ton. As extractions ranged from 60 to 80%, the ore must have been of exceptional grade. Information from contemporary accounts is that much of the production was from a small tonnage of even higher average grade than estimated above.

General Conditions. The town of Aurora is about 7500 feet above sea level, situated near the top of one of the main ridges east of the Sierra Nevada. The climate is good, though there is occasional severe winter weather.

Water. Is available in shallow wells, most of which are dry in the late summer following seasons of light snowfall. Springs at distances of 2 to 5 miles furnish ample water for camp use and for small milling operations. There is a fairly large flow of water from the Prospectus Tunnel at the north end of the district, and the Del Monte shaft would doubtless supply water for a large mill.

Power from the lines of the Mineral County Power Company is now being sold in the district at reasonable rates for small operations, and a large operator would probably be able to obtain a very low rate. The hydroelectric generating plants of the Southern Sierras Power Company are 20 to 40 miles distant.

Roads to Thorne, Bridgeport, and Bodie are all improved dirt roads, kept in good shape by the counties except in winter when they must be kept open by teams or tractors during severe storms.

Geological Conditions. No detailed study of the geology of this area has ever been made. The description in the Geological Survey Bulletin referred to above, was based on a field visit of only three days, and is necessarily incomplete.

The productive formation is a volcanic flow, or series of flows, classed as latite or andesite porphyry, having a known thickness of about 900 feet. It is intruded and capped by rhyolite, which is supposed to be of nearly the same period as the quartz veins. The latest flow is basalt from Aurora crater north of the camp, which covers the productive formation.

The vein system is exceptional, in the number seen on outcrop, their continuity, and the large amount of quartz which they carry. The known productive area is two miles long by a mile and a half wide, within which are 14 major veins, or vein systems. Widths range from a few inches to 80 feet, or more, in the Humboldt and the Esmeralda, at the north and south ends of the district respectively.

The prevailing strikes are N. 45 to 65 degrees E., with dips to the southeast. Exceptions are the Prospectus and Humboldt, dipping 80 degrees north, and the Esmeralda-Radical striking N. 10 degrees E., standing nearly vertical.

The number of smaller veins is very large, and in some localities they form extensive stringer zones which are probably too low grade, over great widths, to have attracted attention in the early period of prospecting, but which merit investigation with the present price of gold.

The origin of the veins appears referable to a period of general penetration of the andesite porphyry by silicious solutions, possibly accompanying the extrusion of the rhyolite. There may also have been a later downward concentration of quartz with enrichment of the metallic content of the ore shoots near the surface.

On the other hand, J. E. Spurr considers these veins to

be typical "vein dikes", forming as the last phase of magmatic differentiation, and very much like other intrusive masses. This theory favors the probability of persistence to considerable depth, as it is difficult to imagine a dike several thousand feet long as exposed on outcrop, disappearing entirely within three or four hundred feet or less.

There is no obvious theoretical reason why the veins of this area should not extend much deeper and continue to be productive well below the present limits of exploration in most parts of the district.

The metal content of the veins varies rapidly within short distances. All of the quartz carries some gold and silver, according to Spurr, but the high grade ores were localized along narrow sections on either wall, or occasionally toward the middle of the vein. Even within these limits it appears to have been an erratic or "pockety" occurrence for the most part, though one or two of the very rich stopes were "wide enough to swing a wagon", according to one of the mine superintendents of the Bonanza days.

It is probable that much of the ore handled in the early period carried over \$100 a ton in gold and silver. The Humboldt and Prospectus, faulted sections of the same vein, were low grade averaging less than 0.2 oz. gold per ton, and rarely showing samples exceeding one ounce.

The ratio of gold to silver by weight varies from 1:2 at the north end of the district to 1:35 to 45 (Spurr) at the south end. It is not known if this variation is due to differences in the original content of the veins or to secondary concentration of the metals. There is nearly a thousand feet difference in elevation between outcrops in the two localities.

Faulting. One major fault has been recognized, known as the Humboldt Fault, having a strike No. 20 to 30 degrees W., dipping steeply, and with a horizontal displacement of over 600 feet. It has offset the Prospectus and Last Chance veins to the north from the Humboldt and Real Del Monte, which are presumably their respective continuations east of the fault. The Humboldt Fault appears to be the most prominent of a series of more or less parallel faults, and only detailed study and mapping will show the effect of the entire system. Many minor faults and slips are to be seen in the old workings on the Last Chance Hill, and the reports of exploration work by the Aurora Consolidated refer to faulting which interfered with the search for ore in the Humboldt and Juniata veins.

The solution of the various faults, especially in the "highgrade" stope area of Last Chance and Middle Hill, would seem to offer exceptional possibilities of finding new ore bodies.

Mine Development. The earliest work consisted of shafts started in the vein outcrops, from which stoping proceeded as soon as ore was found. In fact, the Wide West and other of the Last

Chance vein system, show stopes which were evidently started as open cuts without any regular shaft sinking. There was very little crosscutting in the course of this mining,--once a "pay shoot" was found, it was followed to its limits and almost no dead work was done either in the walls or along barren parts of the vein.

The next step was to drive tunnels, either for extraction of ore from existing stopes or known ore shoots, or as work by "tunnel companies" for the primary purpose of selling shares, and incidentally to look for "blind" veins. This accounts for the fact that some of the most productive ground was not adequately cross-out, either by the tunnels themselves or by branches.

A still later stage was the sinking of deeper shafts, such as the Humboldt, Juniata, and Durant. These were well away from the most productive area and opened lower grade material, which could not be profitably worked, except for a small body of ore in the Durant.

The deepest shaft in the district, the 900 foot Real Del Monte, made no production, and there is no record of any conclusive lateral exploration from it, though it is close to the area of bonanza production. Difficulties with water and dispersion of funds by the English company seem to have been the causes of failure there.

The last systematic development was done by the Aurora Consolidated, and consisted of several thousand feet of haulage tunnel, opening two low grade veins in the northern section, the Humboldt and Prospectus, and reaching the Juniata a long way from the central productive area. The writer has not been able to learn the extent of the work on the Juniata, but it seems not to have been extensive as it was carried out chiefly during the last year of the Company's operation. One branch of the haulage tunnel was headed toward Last Chance Hill and the Real Del Monte shaft, but it is not known how far it was driven in this direction. If it is true that the ore deposits are essentially shallow zone type, this tunnel and its various branches, at depth of 400 feet or more, are well below the productive horizon, and of little use for exploration purposes.

In summing up, it may be said that the central and northern parts of the district have had development work well started but never carried to a conclusive point, while the southern end of the area has never been adequately explored except as to the search for rich pockets at or near surface.

Available Ore. There is a limited tonnage on the old dumps which may now be profitably handled, but it is doubtful if this would total 50,000 tons carrying 0.15 ounces or over for the entire district.

In the Humboldt and Prospectus workings it appears from figures in the annual reports of the Aurora Consolidated, that there were left between 50,000 and 100,000 tons of grade worked in 1918, or about 0.17 ounces gold per ton, worth now approximately \$6.00. Little is known as to the details of location, or

availability, except that it is above the haulage level, and doubtless includes the extensions of stopes worked in 1918, along with the ground between the level and the first sublevel above. Inspection of such assay plats as are available, suggests that it might be possible to add materially to the tonnage figures given above, in view of the present price of gold. It would not be difficult to make a revised estimate by surveying the sublevels and stopes as far as they are accessible now, using the old assay plats. This would require first cleaning out parts of the crosscut tunnel, which is probably closed where faults were encountered.

The average grade is probably somewhat below that maintained in the 1915-'18 operations, as the assay plat of the tunnel level shows three crosscuts which average 0.134 ounces gold per ton, worth \$2.68 at \$20/oz., \$4.69 at \$35/oz. The average width is 30 feet and the known length of the ore shoot is 500 feet. Additional crosscutting would be advisable to determine possible extensions of the ore shoot, and also to check up on possible parallel ore shoots in the walls. It would be easy to prospect below the level to a depth of 200 feet by drilling from existing crosscuts. The only exploration below this level is said to have been a winze well out toward the east limit of the ore shoot, or beyond it.

The importance of ore in sight in the Humboldt vein is not enough to warrant the erection of a new mill, but in connection with the operations elsewhere in the district, it is worth consideration.

Open Pit Ore. There is no information at hand on which to base an estimate of possible tonnage from an open cut operation, but there are two sections of the Last Chance Hill area which ought to be investigated. One of these is the line of the Wide West-Last Chance vein system, together with the Real Del Monte vein east of the Humboldt Fault. These veins are 35 to 50 feet in width, including horizons of mineralized country rock, and as they dip flatly, 25 to 35 degrees, they could be worked by power shovel, or by mill holes to the old haulage tunnels (not the Prospectus Tunnel). It would need a comparatively small outlay to start such an operation, if examination warrants it. As the early work did not include systematic crosscutting of these veins in which there are several "pay streaks" between walls, and possible parallel veins beyond the recognized walls, it is reasonable to expect that the grade of open pit ore might be materially increased by occasional pockets of high grade, and such richer shoots could then be followed below the limits of open cut work, or reached from below.

Another section worthy of detailed study and sampling, is southwest of the Del Monte shaft. Here for a width of 200 to 300 feet or more there is a "stringer zone" mineralization of the porphyry, including some larger veins that were mined in early days. This ground has apparently not been crosscut from any of the tunnels in the vicinity, but it would only require a few hundred feet of crosscutting from the nearest one to prospect a block 600

feet in length by 500 feet across, which may yield a large tonnage of low grade material. This area could be worked very cheaply by side hill open cut.

Future of the District. In the writer's opinion the Aurora District offers excellent opportunities for mining exploration. Even if it is admitted that the deposits are likely to be limited in depth, there is a very large area that has had little work done on it since early days. The faulting in the bonanza stope locality on Last Chance Hill makes it almost certain that the "old timers" did not find all the rich ore shoots.

There is no good reason for the limitation of ore bodies at slight depth. The productive formation is known to be 900 feet deep at least. The mineralization is strong, and the veins are exceptionally persistent along the strike. In other areas of Tertiary volcanics depths of 600 to 1000 feet are common, and in several districts the limit has been close to 2000 feet. It does not seem logical to assume that at Aurora 200 feet must be accepted as the limit with depth. It is more likely that some condition of the faulting or flat rake of ore shoots, not understood in the early period of haphazard development, obscured the downward extension of the rich ores in the Wide West-Last Chance-Del Monte vein system, which was the most productive in the district.

Another development chance is to be found in some of the big quartz veins, such as the Esmeralda-Radical. This vein may be traced several thousand feet with widths of 30 to 50 feet on outcrop. There was an active search for high grade silver ore in the period following discovery, evidenced by many pits and open cuts. Two or three tunnels were driven to cut the vein at depth, but evidently the high values were scattered, or lacking, the vein material was hard, and the size of the vein alone required much work to open it completely. This work was never carried out.

Conclusions. Most of the search for new mines in the Western field has consisted of routine sampling of old workings. If new ore bodies are to be found it will only be as a result of opening new ground.

The Aurora district offers a good chance for this type of work. It has an excellent record of high grade production, old workings are numerous above the water level, and are either open or may be entered with small outlay, giving many points from which properly planned new work may be started without delay. Water and power are available without incurring large expenditures.

It will be possible to determine quickly and at slight cost what the best chances are, and to verify them readily, starting operations on a small scale and ultimately building up an important district enterprise.

(Original signed) J. H. Farrell

August 1, 1934