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MINING AND OTHER
RESOURCES OF
EUREKA CO., NEVADA

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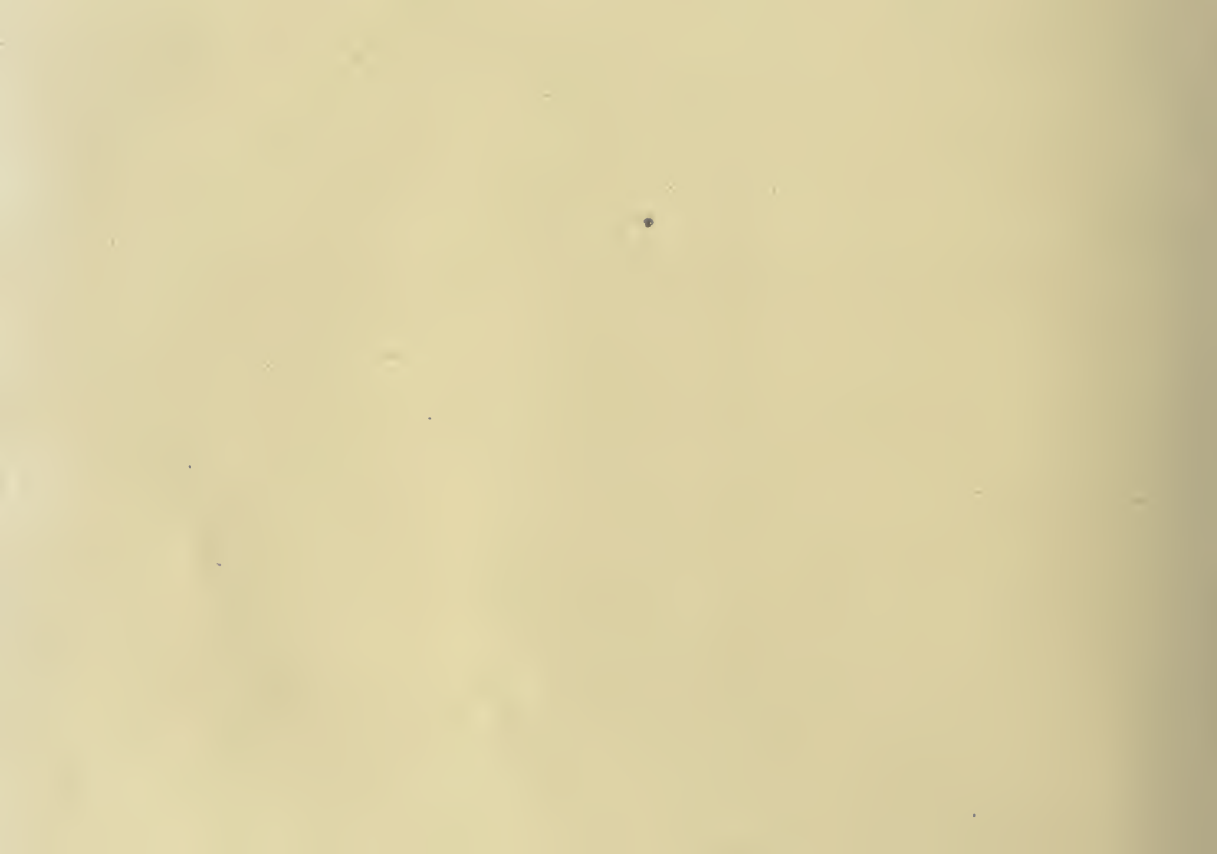
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Tureka County

RESUSCITANT





MINING AND OTHER RESOURCES
OF
EUREKA COUNTY, NEVADA

PRESENTED TO THE
AMERICAN MINING CONGRESS
GOLDFIELD, NEVADA
SEPTEMBER 27, 1909



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Eureka, Nevada, in 1908, looking Southwest

I N T R O D U C T O R Y



HIS BOOKLET is intended, by statistical facts and other truths, to favorably impress, if not convince, the reader that a large portion of the land within the borders of Eureka County is most fertile, capable of producing all the cereals and substantial vegetables, while her valleys and canyons send forth in due time an abundance of nutritious grasses (indigenous to the soil) over and upon which the horse, the ox and sheep roam, feed and fatten without restriction. Besides, and of greater monetary importance, her mountains are heavily mineralized, awaiting only the brain and hand of man to bring forth their metals (gold, silver, lead, copper, zinc and iron) to light, usefulness and profit.

Since Eureka County became an integral part of the State, her years have been as changeful as the changeful moon that each night varies. Adversity and prosperity have alternately filled her cup, and her citizens have ever drunk the draught of bitterness with complaisance, patience, and gracious submission, believing, "without doubt in his heart", that the treasures of her mountains will sooner or later give to them plenty, happiness, and contentment, even unto satiety.

The demonetization of silver, low market value of lead, railroad oppressions, legal controversies, and personal enmity between the principal owners, all combined, soon led to a cessation of work and further development of her mines. The drill and hammer were laid aside, the blast was no longer heard, the fumes of the furnaces ceased, and Eureka quietly passed into a state of lethargy until awakened about three years ago by new and enterprising men.

Reduction in freights and improved machinery NOW permit ten-dollar ore to be reduced at a profit, while prior to the year 1906 ore of less value than twenty dollars would not yield to the owner, compensation for his labors.

The statistical facts and reports herewith submitted are not to ensnare the people, but for their just consideration, judgment, and subsequent action. If true, confirm; if false, condemn. Come! See and judge.



PHOTO, C. H. GORMAN

Lava Beds, Ruby Hill, Nevada. Outcroppings where Eureka Mining District was first discovered

The Mining Resources of Eureka County, Nevada



THE County of Eureka occupies that portion of the State of Nevada lying north-westerly of its geographical center. It lies between the parallels of 39 degrees 10 minutes and 41 seconds and between the meridians of 115 degrees 45 minutes and 116 degrees 35 minutes west of Greenwich. It is bounded on the north by Elko County, on the east by Elko and White Pine Counties, on the south by Nye County, and on the west by Lander County.

The Humboldt River, with a general westerly course, flows through the northern portion of the County. Maggie Creek empties into the Humboldt from the north and Pine Creek from the south. Fish Creek rises in the southwestern portion of the County and flows in an easterly direction, where it sinks. There are also several minor streams, fed by the mountain springs, which sink a few miles from their source.

The Sulphur range of mountains lies partly within the county and along its western boundary, extending from the Humboldt River on the north to the Nye County line on the south. On the east of the County lies the Diamond Range which, diverging southwesterly at its southern extremity, crosses the southeastern portion of the County.

Eureka County lies entirely in the Great Basin, and its surface is divided between great mountains and valleys. The former are pregnant with mineral veins and deposits of gold,



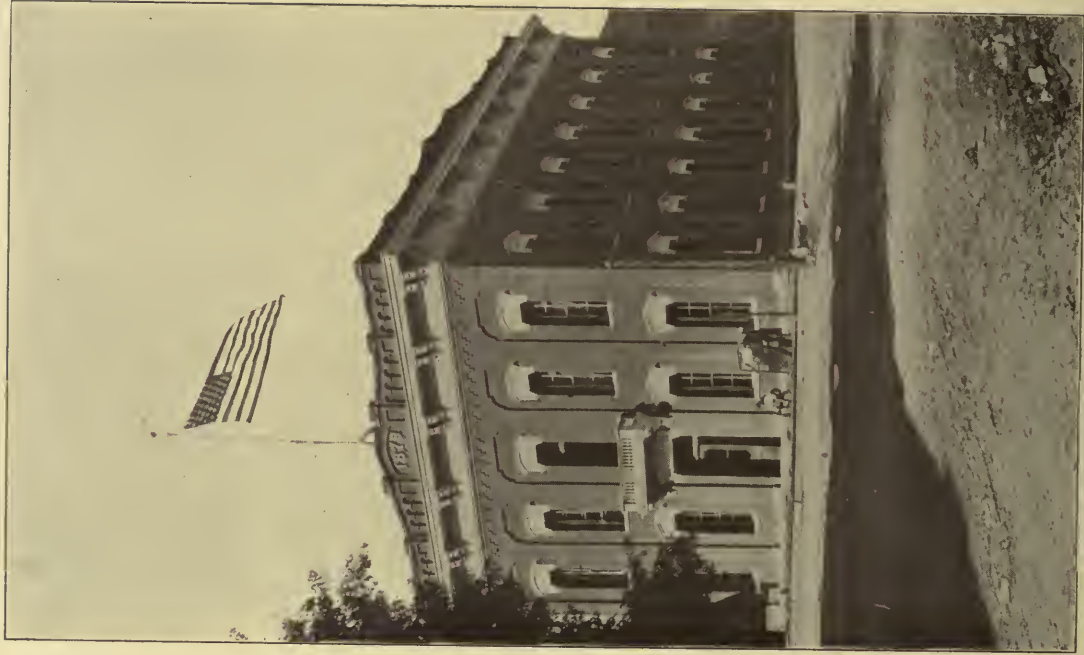
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Eureka, Nevada, looking West

silver and lead, copper, antimony, zinc, etc. The gold and silver-lead deposits have been mined extensively; the copper and antimony are abundant, and zinc but little attention has been paid to, but there are well-known veins and deposits.

Sulphur, niter, salt, borax, soda and other minerals of economic value are abundant in the County; but as little or no attention has been given them, their extent cannot at present be estimated. Bituminous slate, gypsum and kaolin are known to exist in the County, but have received nothing more than passing attention. The question of value of many of those minerals is involved in that of future transportation facilities.

The valleys are mostly arid, but where irrigation is applied the soil will produce an average of forty bushels of wheat to the acre, and sixty bushels to the acre have been harvested in the richer soil. Barley and oats have been raised in considerable quantities for home consumption. Alfalfa grows luxuriantly, and two crops harvested during the year will cut from three to five tons to the acre. Good crops are cut in the Humboldt Bottom and in Pine and Fish Creek Valleys. There are a number of small farms watered from the mountain springs that yield good crops of hay, barley, oats, fruit and vegetables of extraordinary fine quality and flavor. Both the mountains and valleys afford good pasturage in winter and summer alike, with only occasional unfavorable seasons, there being an abundance of bunch and other natural grasses in the mountains and white sage in the valleys. Stock raising is a permanent industry out of which a number of persons have become rich, the climate and extent of the ranges being exceedingly favorable. Game is not abundant, but wild rabbits, grouse, sage fowls, doves, etc., breed enough to afford good sporting. Several of the streams are full of trout and German carp (the latter imported), and the Humboldt River affords fine fishing for splendid mountain trout and imported catfish. Timber of various species may be cultivated. Cottonwood trees of natural growth are found along the river bottoms, and dwarf cedar, nut pine and mountain mahogany are plentiful in the mountains and foot hills. Wild flowers and medicinal herbs grow in profusion.



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Court House, Eureka, Nevada
Ranks as second best Court House in the State of Nevada

The average elevation of the valleys above sea level is about 6,000 feet. Prominent mountain peaks arise above the valleys from 2,500 to 4,600 feet.

In 1878 the population of the County numbered 7,896 souls, 6,581 of whom were residents at Eureka, the County seat, and Ruby Hill, the center of mining operations in Eureka County. The average quotation of silver in New York that year was \$1.152 per ounce. Since that year corresponding with the decline of silver, mining and metallurgical operations have steadily diminished, and the population of the County is reduced accordingly.

EUREKA MINING DISTRICT

The Eureka Mining District is situated in the southeastern part of the County, on the west side of the Diamond range of mountains. The town of Eureka, from which the miners and farmers within a radius of twenty-five miles draw their supplies, is connected by the Eureka and Palisade Narrow-Gauge Railroad with Palisade, a town on the Central Pacific Railroad, eighty-eight miles distant as traveled. The town of Eureka lies at an altitude of 6,500 feet above sea-level, in a canyon, which, following a northerly course, enters Diamond Valley six miles distant.

Ruby Hill, which gives its name to the town in that locality, is distant about two miles to the westward. There are situated the Richmond, Eureka Consolidated and Jackson mines, which through their large production of gold, silver and lead, have given to Eureka District a world-wide notoriety. While they have been the most extensively developed, they are by no means the only productive and profitable mines in the district, but they have given the best returns for invested capital.

The Richmond Consolidated and Eureka Consolidated Mining Companies, in addition to large and valuable hoisting and reduction works, have spent immense sums of money in litigation over



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Hotel Zadow and Annex

disputed boundaries, 'representing in all, millions of dollars, yet their combined dividends have reached and passed the ten-million dollar mark.

The smaller mines of the district, several of which upon the investment of the necessary amount of capital for exploration, may prove to be as good as those of Ruby Hill, have heretofore been seriously affected by drawbacks in the sale and treatment of the ores produced, and having been yet more seriously affected by the downward course of silver, their development has been very much retarded. Today the low prices of silver and lead remain the principal impediments. The scientific progress in the methods of reducing ores would now operate effectively in Eureka District if the normal values of those metals were restored.

But little is known of the future possibilities of the Ruby Hill mines below what is called the water level, yet ore has been found at the lowest depths yet attained. There is ample evidence of its continuation downward, as also of a change in its chemical composition where it is affected by water. The development of deeper ore bodies will depend upon the amount of capital to be employed in the future, and possibly upon the joint exploration of all of the companies interested in that locality. The deepest place in Ruby Hill where ore has been mined and brought to the surface in shipping quantities is about the 1400-ft. level of the Eureka Con. mine, where the dip of the lode carried the workings so far to the eastward that it became necessary to sink a new shaft. The Locan shaft, equipped with a new and powerful engine, and huge hydraulic pump, was sunk from a point east of the lode and about 200 feet lower altitude than the top of the Lawton shaft, which has been used as the main working shaft upon the property. The Locan shaft was sunk to a depth of 1,250 feet and at the respective depths of 600 and 1,200 feet crosscuts were driven to intersect the lode. The lower crosscut intersected a vein of ore three or four feet in thickness at about 160 feet lower in main depth than ore had ever been encountered before in the hill, and it is still making on a downward pitch.

The crosscut was continued through the lode and penetrated the quartzite foot wall about three feet when water came in with such force that the miners had barely time to get to the



PHOTO, C. H. GORMAN

High School and Catholic Church. This High School is now supported by Eureka County

station and signal the engineer to hoist them above the danger line. The engine on the shaft had not the capacity' to keep the pumps running and to lift the water and waste rock to the surface, so it had to be replaced with a new one. That also failed in its requirements, through the failure to have the working pump in complete order at the 1200-ft. station and the inability of the lifting pump to raise the water in the volume required. Work upon the Locan shaft, as also upon the levels below the water line in the old workings, was then suspended. No attempt has since been made to drain the main, or to work be'ow the water level.

The future of Ruby Hill below the 1200-foot level of the Locan shaft can only be determined by deeper exploration, which will not probably be considered until after the settlement of the question of bimetallism, when the owners may feel justified in resuming active operations.

Miners continue to tribute in the old workings of the Ruby Hill mines wheresoever they can find paying ore, or believe the chances are good to make a little money. There are numerous acres of unexplored ground in them above the so-called water level, but the companies do not feel disposed to employ miners for day's pay at present, and probably will not do so until the market values of silver and lead are permanently restored to their former status.

The actual water level on the Ruby Hill lode, or ore-bearing zone of limestone, has never been determined. Wherever water has been encountered it has come from seepage from the surface, from sweat of the rocks and percolation through the seams, and also from the shale in the hanging wall and quartzite in the foot wall, in places where those formations have been penetrated by drifting, etc.

Miners are of the general opinion that Ruby Hill contains more ore than has ever been taken out of it, and that whenever the companies interested will renew active operation on an adequate scale they will find it. This expression of opinion is gained from practical experience and derived from the general condition shown on the dip of the lode.

Mr. Clarence King, the eminent geologist, who formerly had the charge and management of the Richmond mine, entertains theories based upon practical and familiar knowledge of the



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Brown Hotel and Opera House

physical and other conditions of the Ruby Hill lode. His opinions not only coincide with those of other practical miners, but have been so freely and lucidly expressed as to leave no doubt that they are also based on close observation and sound reasoning. The writer twice had the pleasure of meeting him, and knows that he has abiding faith in the ore-bearing stability of the Ruby Hill lode below the water level. He was of the opinion that exploration should be carried to a further depth of 1,000 feet, or thereabouts, and that there is no geological reason why ore should not be found if such work were done. He had not the least doubt that ore would be found below the water level in as valuable quantities as it was found above, but thought it would be more concentrated, and that in place of oxidized ore, more or less mixed with limerock, gold-bearing arsenical pyrites and silver-bearing galena would be found in more compact form, and hence richer than that which the lode had yielded above the water level. He said he regarded Eureka as being a gold-bearing camp, in as much as he placed the profits that had arisen from the mines to the production of that metal.

The Richmond Company had been prospecting with diamond drills. Mr. King approved of the drill work, but did not consider a negative result would be conclusive. He said: "Should the drill cores fail to indicate the presence of new ore bodies or the downward continuation of the vein, I would not hesitate to recommend the employment of sufficient capital to sink and explore the ground by actual drifting." Mr. King's opinions, as above quoted, were fully borne out by those of the late Henry ("Hank") Donnelly, formerly Superintendent of the Eureka Con. mine, who frequently asserted that a negative result in prospecting with the diamond drills, through the Ruby Hill limestone, would not satisfy him that ore could not be found by sinking or drifting through it in the ordinary manner. The soundness of his opinion was subsequently demonstrated by the disclosure on the Locan shaft, 1,200-ft. level.

There are a large number of mines in Eureka District that have undergone partial development, and some of them are still under a slow process of exploration, the means of the owners being at present too limited to admit of more extended operations. Although in earlier days,



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Ruby Hill, Nevada

when a reckless spirit pervaded the community, deposits of very rich ore were found at or near the grass roots, the money that was derived from the most of them was squandered; and now that deeper workings are needed to mine the underlying deposits the means are not at hand to reach them; so the operations are principally confined to the places of most promise at or near the surface.

There are large bodies of low-grade ore remaining uncovered or partially developed in the mines, but they are unremunerative under the low prices of silver and lead that have recently prevailed and the more primitive manner of exploration—the only system that can be employed by the poorer classes of miners. There are also large deposits of low-grade material left in the Ruby Hill mines, which could be profitably mined if silver were restored to its old value. On the other hand, to mine the deeper deposits in the smaller properties of the district, deep shafts and long tunnels with lateral drifts are required; but, to justify such extensive explorations, the consolidation of various groups of claims would be advisable, for the work would require the outlay of considerable money. As an example, the Diamond mine may be quoted for illustration. This group of claims had been worked for several years with indifferent success. The Diamond claim was opened in a new place and disclosed a large body of ore, but, in order to mine it to advantage and profit, deep workings were required. The mine was bonded to Salt Lake City, Utah, capitalists, who, after satisfying themselves, by a preliminary line of exploration, of its merits, purchased it for \$60,000. They then employed the requisite machinery, drove a tunnel 1,500 feet into the mountain, and inaugurated an extensive line of exploration. The developments were so satisfactory that they purchased several contiguous claims. Up to the time the first bond was executed the Diamond mine had not yielded ore to exceed the value of \$10,000; but under active exploration and deep mining it has produced ore to the amount of a million dollars—that being the value of the bullion sold in excess of the cost of extraction and reduction of the ore, the net value.

In the good times of the district, before the effects of the demonetization of silver were felt in the community, three separate local enterprises, the Prospect Mountain, Eureka and Ruby Hill Tunnel Companies, were organized for the exploration of Prospect Mountain but in the same ratio that silver depreciated, so did the fortunes of the shareholders, and work upon them was practically suspended. The Prospect Mountain tunnel was driven in 2360 feet, penetrating the mountain from the west side, just above the level of Diamond Valley. Lateral explorations were conducted at a depth of 850 feet below the surface with paying results, and the principal product was gold. Operations were suspended, pending the settlement of certain surface rights, but may be resumed at any time under more favorable auspices than were heretofore enjoyed by the company.

The Ruby Hill Tunnel Company was organized May, 1882, for the purpose of consolidating under joint ownership twenty-four mining claims, situated upon the west side of Prospect Mountain, and a tunnel was shortly afterwards started at the western base of the mountain, at a distance of a mile and a quarter from Ruby Hill, and about 1,400 feet northward from the Prospect Mountain tunnel. It was driven in 1,880 feet and lateral explorations were commenced, but for want of means to carry out the plans of the company, active work was abandoned. Recently two men have turned their attention to a prospect 1,700 feet in from the mouth of the tunnel, and, by drifting from that point, have struck ore of the assay value of \$26 in gold to 31 7-10 ounces silver per ton. The vein rises above and dips below the tunnel level, but has not yet been sufficiently explored to say more about it at this writing. It is, however, quite promising and serves to show that the ore deposits at Prospect Mountain pitch down into great depths. The level of the Ruby Hill tunnel is at about 700 feet lower elevation than the Eureka tunnel, and where the ore was first struck it has a depth of about 900 feet below the surface.

The Eureka tunnel was started by General P. E. Connor along in 1878; it penetrates Prospect Mountain from Goodwin Canyon, on the east side, and is in 2,008 feet. Considerable prospect-

ing was done, which resulted in a gross output of about \$300,000. A portion of the money that was realized from the sale of the ore from the tunnel went to purchase surface claims out of which the ore was taken, and large sums were wasted through bad management. The ore averaged over \$100 per ton, and if the mine had been well managed there is no reason why it should not have paid dividends. The company ran in debt, and the property subsequently fell into new hands through the foreclosure of miners' liens and attachments, and the present owners, having no means for development, can only work it under the leasing and tributing system; systematic exploration is therefore impossible at present.

There are about 400 mines in the district now held under valid titles, 250 of which are recorded upon the County Assessor's books as ore producers. The output of quite a number of them has predominated in gold, particularly those which lie in the ore-bearing zones herein referred to as the Hamburg beds of limestone. There are also several mines in the Prospect Mountain limestone beds, situated upon the west side of Prospect Mountain, which yield from two-thirds to three-fourths of their products in gold. There are not over forty mines in the district under development which at this date are recognized as regular ore producers, but work is progressing slowly on a number of others where the ore that is mined is of indifferent quality, or the veins are rich but small, or where the indications of ore are encouraging or the locality seems to justify the owners in employing such means as they possess in exploring them. While the low price of silver, in the main part, seriously deters mining operations in this region, the owners of the smaller mines are encouraged by their unbounded confidence in the ultimate free coinage of silver and the restoration of its normal value, and consequently in the eventual success of their undertakings.

THE MINING DIVISIONS, ELEVATIONS AND TOPOGRAPHICAL ASPECT

The Eureka Mining District embraces several divisions and presents to view a rough, broken mountain region, surrounded on all sides by quarternary valleys. Prospect Mountain ridge

forms its most prominent feature, extending, with its ramifications, from Diamond Valley, at its northwestern extremity, about twelve miles in a southeasterly direction to Fish Creek Valley. South of Prospect Peak it is intricately connected with the Fish Creek Mountains, which trend off to the southeast for several miles. Prospect Mountain presents a sharp, broken outline with bold escarpments and high peaks, and with abrupt slopes to the westward and long, irregular ridges and spurs to the eastward. Ruby Hill stands out as a prominent termination of Prospect Mountain, of which it forms the northwesterly base.

Prospect Peak, centrally located on Prospect Mountain ridge, has an elevation of 9,604 feet, and the highest point on Ruby Hill is 7,291 feet above sea level. The latter rises about 500 feet above Spring Valley, which borders it at its western base. It has a gradual descent toward Eureka. Adams Hill lies in the foothills, separated by a long ravine, and a mile and a half to the northward of Ruby Hill. It has an elevation of 6,950 feet above sea level. Secret Canyon, Page Canyon, Maryland Mountain and Alhambra Hill are embraced in the Secret Canyon and Pinto Mining Districts, but are generally regarded as divisions of Eureka Mining District, and are situated at its southern and southeastern extremities. Secret Canyon occupies the southeast portion of Prospect Mountain, with Page Canyon to the eastward of it, each of them bordering on Fish Creek Valley. Hoosac Mountain rises boldly to the north of Page Canyon and lies west of the Eureka Canyon summit. Maryland Mountain, better known as Silverado, and Alhambra Hill, a foothill to the south of it, are situated southeasterly from the town of Eureka and from spurs of the main Diamond range, just over the White Pine County line. They are situated respectively fourteen and sixteen miles distant from Eureka, and are always referred to as belonging to Eureka District. The reason for that is they are separated from all of the other White Pine County mining locations by Newark Valley, and get their supplies and ship their products at and through Eureka. The ores mined at Silverado and Alhambra Hill are silver-lead-bearing, with a trace or more of gold, and generally very rich.

Newark District, with the Bay State, Nevada, Battery and other mines, which have been productive and profitable at one time or another, is situated about twenty miles to the northeast of Eureka, beyond Alhambra Hill. It also lies in White Pine County, borders on Newark Valley, and procures its supplies from and ships its products by way of Eureka.

Spring Valley and Prospect Mountain Districts lie to the west and southwest of Eureka District and are separated from it by Spring Valley. In the former district are situated the Woodchopper, Reeves and Berry, North Star and other mines, which have produced considerable rich chloride of silver ore; in the latter are the Mountain Boy and Kentuck mines, which have yielded large quantities of rich silver-lead ore. These districts are each of them tributary to Eureka and likewise referred to as belonging to Eureka District.

GEOLOGY

The cambrian, silurian, devonian and carboniferous ages are all represented in Eureka District, but it is only in the limestone of the cambrian period that ore deposits of any great value have been found. The Hoosac, "76" and a few other small mines lie in the Lone Mountain's limestone, and the Bullwhacker in the Pogonip limestone, both of which belong to the silurian age. In the rocks of the devonian and carboniferous ages, in Eureka District, no ore whatever has been found. The following beds of the cambrian age have been distinguished by Mr. Arnold Hague, geologist in the field of this region, of the U. S. Survey of the Fortieth Parallel: Prospect Mountain quartzite, Prospect Mountain limestone, Secret Canyon shales, Hamburg limestone and Hamburg shale.

The rocks of the silurian age, in the order of their succession, are Pogonip limestone, Eureka quartzite, and Lone Mountain limestone. The rocks of the devonian age in the neighborhood are the White Pine shale and Nevada limestone, in the latter of which are situated the mines of Alhambra Hill and some of those of Prospect Mountain District.

The principal mines of Eureka District lie in Prospect Mountain and Hamburg beds of limestone, which run through the district several miles in length, and are bounded on either side by bands of quartzite or argilacious shale. The beds of the Prospect Mountain limestone differ somewhat from the Hamburg beds, the latter containing more silica, and breaking with a sharper fracture than the former; upon the surface it also shows a rough surface where it has been weathered by exposure to the elements. These beds vary in width from 1,000 to 6,000 feet and have a general northerly trend. The dip is to the eastward, except in isolated cases. The Prospect Mountain quartzite bends around the northern slope of Prospect Mountain in the form of a horseshoe; it sinks on the east side just north of the Eureka tunnel, where it is separated by a fault from the Secret Canyon shale. At a point northwesterly, upon the west side of the ridge, it sinks, but crops out at the base of the mountain below and west of the mouth of the Prospect Mountain tunnel. It underlies and forms the foot-wall of the Ruby Hill lode, with an average dip of 40 degrees to the northeast.

The ore-bearing limestone zone of Ruby Hill has been characterized as a "lode" in the rulings of the Court of the Sixth Judicial District of Nevada, upon the evidence submitted through litigation between the Eureka Consolidated Mining Company and the Richmond Consolidated Mining Company of Nevada, and these rulings were sustained by the United States Supreme Court. Hence the term "lode" has been applied to all of that portion of the Prospect Mountain limestone of which Ruby Hill is partly formed. The main feature of the Ruby Hill is the presence of a fault fissure, to which the name of Ruby Hill fault had been given by the U. S. Geological Survey, and which appears to have a very important bearing upon the mineralized zone, as also upon the ore deposits. It strikes in a southeasterly direction and the average dip of its plane is 70 degrees northeasterly. It extends from Ruby Hill through all of the mines to the southeast and has a fault plane along which the whole southwestern country has been raised (as illustrated by the U. S. Survey) from 500 to 2,000 feet.

ORES OF EUREKA DISTRICT

The following minerals have been found among the gold and silver-bearing ores of Eureka District: Galena, anglesite, cerusite, minelite, wolfenite, limonite, pyrite, arsenopyrite, molybdenite, malachite and azurite. The different classes of ore are so varied in their composition that a full description here would be too voluminous for the requirements of this memoir.

Silver occurs in the form of chlorides and sulphides, etc., and is more directly associated with quartz, lead and iron than other components in the ores. Gold occurs in a metallic state and is also chemically diffused through quartz, iron oxide, etc. Antimony is present in many of the ores, but in what state has not yet been determined. Silver is seldom found without an intermixture of gold, and although Eureka is regarded wherever it is known as a "silver camp", gold and silver at their present respective commercial values, occur in about equal proportions in the combined products of the district.

The lead ores of Eureka District have cut a most important figure in the general output; the metallic leads obtained from them have realized no less than \$25,000,000 in the open market. They occur most'y in the form of galena of a coarse and medium grain and more or less mixed with sulphide of lead and iron oxide. The lead frequently occurs in the form of nodules of galena, which are changed at or near the surface into carbonate of lead and in irregular masses distributed with iron oxide throughout the ore.

The products of the mines of Eureka District may be classed as auriferous-argentiferous lead ores, gold as well as silver entering largely into this composition. They are generally of a smelting character, and while lead has always formed the most important factor in their reduction, they also contain sufficient iron, silica, and other reducing agents to make them self-fluxing. They are phenomenally valuable for shipment to distant smelting centers, on account of their iron gangue. Especially where ferruginous ores are scarce and in demand, they command the highest rates paid and frequently realize in the open market more than the full com-

mercial value of their gold and silver contents. The sulphurets, sulphides and carbonates of lead usually contain more silver than gold and carry combined values in both of the precious metals, varying from \$20, or thereabouts, up to \$150 per ton, while ores of similar characteristics, found in the Hamburg limestone beds, frequently run from \$300 to \$500 per ton in value and carry more gold than silver. The chloride ores of the district are sometimes extremely rich, running up into the thousands of dollars per ton, principally in silver. The iron and silicious ores usually carry greater value in gold than silver; especially where the quartz appears in a much crystallized form, it is generally very rich in gold.

Iron ores are plentiful in all parts of the district; they occur in the form of oxide and carbonates and occasionally silicate of iron, and range in value from \$6 or \$8 to \$200 and \$300 per ton in gold and silver. In some of the mines where iron ores predominate the contents average three or four dollars in gold to one of silver, and in many cases might be treated for reduction by the cyanide or other similar processes with extremely profitable results.

Free gold has been found in Prospect Mountain in hematite (sesquioxide of iron) and also in shipping quantities in calcite (crystallized carbonate of lime). Specimens of free gold in hematite and large blocks of calcite have assayed up into many thousands of dollars per ton. Those occurred in some of the mines upon the west side of Prospect Mountain, but in the Hamburg beds of Adams Hill, and that which forms the eastern base of Prospect Mountain for a continuous distance of ten or twelve miles, the ores that were mined generally predominated in gold.

It is estimated that there are millions of tons of low-grade ore blocked out and in prospective in the various mines of the district, the value of which must depend on future appliances for their reduction to marketable material, and which, under such advantages as are enjoyed in the prominent mining camps of California, Utah and Colorado, would realize to the owners many millions of dollars. The time is not far in advance of the present when such advantages may be placed within our reach.

The source of the ore in Eureka District is a matter of conjecture upon which many theories have been advanced. They may have owed their genesis to the eruptive influences of the volcanic rocks in the neighborhood. They may have been deposited by either chemical or mechanical action, possibly by means of the percolation of water carrying mineral solution through the seams in the lime rock from the surface downward, or from the injunction of solutions which came from below. The most generally accepted theory is that of infiltration from below.

The distribution of ore has been determined almost entirely by the physical character of the limestone in which it is found, and it is difficult to classify the ore deposits as regards their forms. The limestone, wherever it is charged with mineral, has been much crushed, fissured and faulted. The crushing and grinding forces have evidently taken place under tremendous pressure, caused by upheaval previous to the disposition of the ore, which has evidently followed the seams, fissures and cavities that were formed by the displacement of the rocks, forming in solution and precipitating in those places that were most favorable for their reception. The varied conditions of the ores are doubtless due to chemical action under solfataric and atmospheric influences. The ore deposits have been found in chimneys, pillars, pipe veins and aggregations in many varied forms, and also in immense chambers, the contents of which have sometimes realized millions of dollars. Some of the chambers in the Ruby Hill mines were many acres in extent. The ore deposits often lie concealed in their bedding, dipping great distances from their croppings, and are usually connected by such phenomena in the country rock as caves, fissures, broken limestone, etc., and by stringers of iron in one form or another.

The manner of prospecting consists in digging and following in any direction along the course or on the dip of the seams or fissures which carry ore or show indications of ore, or in sinking shafts or driving tunnels and drifts and crosscuts. When the developments justify extensive exploration, shafts are sunk or tunnels are driven into the hills from the most convenient points, and from them drifts or crosscuts are run in any desired direction to the ore

channels, which are then explored to the best advantage or according to the judgment of the prospector or miner or the superintendent or foreman in charge of the work.

The usual size of a single compartment shaft is 4x6 feet in the clear, that of a double compartment 5x10 feet in the clear, to leave sufficient room for cribbing, and where larger shafts are required the dimensions are regulated according to the capacity of the mine and the amount of exploration work to be done. Drifts are usually 4 feet wide and 6 feet 6 inches in the clear on the main levels, but the ordinary drift required by a tributer is regulated by the distance he has to run and the character and condition of his prospect, and is usually no larger than it takes space to crawl through.

TIMBERING

The methods employed in timbering shafts and drifts in the mines are similar to those usually employed in other mining regions of the Pacific Slope, but the system adopted to prevent the caving of excavated ore chambers is similar to that adopted in the mines of the Comstock lode. Two or three-inch planks are used in ordinary double or three compartment shafts. As a rule the ground stands well in ordinary shafts or drifts, but there are places where the limerock is crushed to either breccia or fine sand, which requires to be timbered. Where drifts are run along the contact of limestone and shale or quartzite, timbering frequently becomes necessary. In such places 4x4 or 4x6-inch posts and caps and ordinary lagging or two-inch planks are used, but in the stations at the various levels and in the stopes in the chambers 10x10, 10x12 and 12x12-inch timbers are used. These timbers are hewn from the pine trees of the Sierra Nevada Mountains and are usually of the best quality.

REDUCTION AND SALE OF PRODUCTS

The discovery of Eureka District dates back to 1864, but during the first four years thereafter very little progress in mining was made, and it was not until the summer of 1870, when David E. Buel and Isaac C. Bateman bought the Buckeye and Champion mines, upon Ruby Hill, and subsequently, in the same year, sold them to the Eureka Consolidated Mining Company of San Francisco, that active mining and smelting was commenced on a large scale in the district. During the interim, and for some time afterward, a great deal of rich ore was shipped to Austin, Lander County, for treatment.

To the discovery and development of Eureka District, Eureka County for several years owed its growth and prosperity, and to its industrial growth was due the credit for the first successful treatment, by smelting, of silver-lead ores in the United States. The first experiment in smelting in Eureka was made in 1866, and that, like others which followed it, resulted in failure, until 1869 and 1870, when Major W. W. McCoy and Col. G. Collier Robbins commenced the operations of draft and blast furnaces, and the first successful runs were made by them. In 1871 the Richmond Mining Company, of London, England, purchased some claims adjoining those of the Eureka Consolidated Company on Ruby Hill, and soon afterwards commenced the erection of smelting furnaces. In 1878 there were sixteen furnaces running and reducing from 1,000 to 15,000 tons of ore per day from the mines of Eureka District. That number was subsequently reduced to eight or ten, and those were operated by the Eureka Consolidated and Richmond Companies, who, by reason of their superior facilities, succeeded in treating the products of the mines of the smaller companies at cheaper rates than the latter could at their own furnaces. They purchased custom ore from the mines of Eureka and other districts within the county, as also from those of the outlying districts of White Pine and Nye Counties. Eureka District possessed all of the natural fluxes required for the reduction of ore in great abundance, such as iron, silica, lead, limerock, etc., and it became the smelting center for nearly all of the mines within a radius of 90 or 100 miles.

In 1877 the Richmond Company added a large refinery to their plant, using the Luce and Rosan refining process (crystallization by introduction of steam through the molten lead), which enabled them to desilverize base bullion and hold the most of their market lead for the highest price obtainable. The Eureka Consolidated Company also set up a refinery in 1886, with the same object in view, and were greatly benefited by the operation of it. They used a zinc process, said to be a modification of the Pattinson method. The reduction works of both of those companies were continued in operation until December, 1889, when the Richmond Company discontinued the purchase of custom ores and a few months later cleaned up all of their material on hand and suspended work. The Eureka Consolidated Company also suspended operations at their reduction works, but not until the fall of 1891.

In the fall of 1889 the railroad companies, acting under the influence of R. C. Chambers and Richard McIntosh, of Salt Lake, who had purchased the Diamond mine on Prospect Mountain, reduced the rates of transportation on ore to Salt Lake, and it was that, added to the fluctuating and downward tendency of silver and the failure of the big ore bodies above the water level, in the Richmond and Eureka Consolidated mines, which caused those companies to suspend operations at their reduction works, and to ship off their own mining products for treatment elsewhere. Probably some day in the future our local products will be again treated at home, but under more favorable auspices than those which have obtained in the past; the first that recurs to the writer must be reduction in the rates of transportation of fuel and supplies, but other economic reforms will also become necessary. In the meantime new processes may be taken in hand for the treatment of low-grade ores, of which may be found a great abundance in the mines of Eureka District and its neighborhood.

YIELD OF THE METALS ESTIMATED

The total yield of ore from the mines of the County from 1894 up to the end of 1895 is estimated at over \$125,000,000 gross value. That estimate is based on the tonnage accounted for

upon the County Assessor's books since March, 1873, the ores that were reduced in Eureka previous to that period, the products which were shipped to Austin and other places, and from other sources of information. Up to the latter part of 1882 the estimates of the U. S. Geological Survey placed the total production of the precious metals from Eureka District alone at about sixty million dollars—about one-third gold and two-thirds silver. It also estimated the production of lead at 225,000 tons, which, at \$90 per ton, equals a value of \$20,250,000, making the total yield of the district, up to the latter part of 1882, in round figures, \$80,000,000.

The Eureka reduction companies never paid anything for the iron contained in the ores they purchased, but shippers are paid at the rate of \$15 per ton at the Salt Lake and other distant smelters for all of the iron their ore contains. As some of the Eureka ores carry as much as 60 per cent. (1,200 to the ton of 2,000) of iron, that metal has assumed great importance as a factor of economic value to shippers. At distant smelters it is an important fluxing agent, and not easily obtained.

It is worthy of note that Eureka District has been mainly self-sustaining. It has neither been fostered by loud advertising nor speculation in stocks. The total amount of capital invested for the purchase of mines has not reached two million dollars, and a like amount will cover all of the assessments that have been levied for its support. The shares of her incorporated companies have always been held for legitimate investment at their normal value.

The mines have been only twenty-six years under active development and the lowest depth obtained is only 1,400 feet. That was the depth (or thereabouts) of the Con. Virginia when it commenced to make millionaires of men and show up the apparently limitless richness of the Comstock.

There is a vast acreage of undeveloped mineral land in Eureka District, and the same thing is observable in other localities in the County, which, under favorable auspices, may at any time in the future forge to the front. Eureka County has no doubt a great future yet in store,

having and possessing the substance for making it one of the most important wealth-producing sections of the great western mountain regions.

The County Assessor's books show a total yield from the mines of the County, from the quarter ending March 31, 1873, up to March 31, 1896, of 1,316,170 tons and 1,490 pounds of ore of the net value of \$44,241,016.93. The following is a resume of the yield of some of the prominent mines of the County during the period specified:

District	Name of Mine or Company	Tons	Pounds	Amount
Eureka	Adams Hill Con. Mining Co.'s Mines	1,515	2,433	\$ 15,463 08
Eureka	Albion Con. Mining Co., one mine	7,126	1,963	245,305 39
Eureka	Alexander Mining Co., one mine	1,290	3,130	54,155 00
Eureka	Antelope	208	1,042	8,158 25
Eureka	Altoona	524	3,351	30,479 34
Cortez	Aurora	155	484	14,316 85
Eureka	Bullwhacker	4,117	1,801	116,068 70
Eureka	Barton	583	2,312	16,092 36
Eureka	Banner	1,277	968	44,904 58
Eureka	Bowman	1,094	1,890	51,091 61
Mineral Hill	Barker, Spencer & Co. Mines	31,422	3,691	325,836 63
Secret Canyon	Bertrand Mining Co.	32,081	834	629,468 40
Cortez	Benjamin Harrison	47	872	6,281 00
Eureka	Charleston	131	2,850	6,895 05
Eureka	California & Silver King	1,780	514	40,264 06
Eureka	Connolly	4,657	1,091	166,794 11
Eureka	Delaware	484	2,363	14,365 13
Eureka	Dug Out	510	604	42,502 99
Eureka	Diamond Mining Co. Mines	32,705	673	1,060,874 59
Eureka	Dead Broke	456	591	17,566 67
Eureka	Eureka Tunnel	4,274	2,220	192,475 75
Eureka	El Dorado—Ruby-Dunderberg Co.	605	443	59,802 73
Eureka	El Dorado—Kane, O'Leary & Sullivan	168	1,530	9,977 96
Eureka	Eureka Con. Mining Co.	534,277	1,036	17,404,727 89
Eureka	Ethel	54	242	6,653 28
Eureka	Fraser & Molino	640	1,103	26,873 04
Eureka	Fourth of July	303	1,628	10,988 35
Cortez	Garrison Mine—Wenban's group	63,260	897	3,166,766 35
Eureka	Grant	627	119	38,912 98
Eureka	Industry	539	916	40,550 97
Eureka	Idaho	1,319	473	41,224 30
Eureka	Irish Imbassinder	174		29,187 73
Eureka	Jackson Con. Mining Co.	24,245	1,057	834,230 48
Eureka	King Lear	487	1,879	27,971 97
Eureka	Kentuck	197	141	14,531 77
Diamond	Lincoln	1,953	657	25,085 35
Eureka	Lone Pine	762	553	26,568 20
Eureka	Lord Byron	2,613	380	118,578 46

District	Name of Mine or Company	Tons	Pounds	Amount
Eureka	Lemon Mill Co.	397	1,955	8,431 63
Pinto	Munroe	232	1,138	12,656 18
Eureka	Marguerite	886	1,565	32,923.10
Eureka	Matamoras	1,479	634	80,079 65
Eureka	Macon City	896	1,581	73,407 28
Eureka	Morning Star	103	528	6,355 21
Eureka	Members	1,891	607	31,317 49
Eureka	Maria	100	933	6,431 35
Eureka	Mountain Boy	354	327	29,392 14
Eureka	Mortimer	565	782	18,109 88
Safford	Onondago	597	1,272	30,384 34
Eureka	Oriental & Belmont	1,434	608	27,094 50
Eureka	Orange	101	711	6,047 89
Eureka	Prospect Mountain Tunnel	891	844	29,791 05
Eureka	Paul Pry	742	402	29,929 19
Eureka	Phenix Mining Co.	4,629	2,145	134,077 86
Eureka	Pioneer-Westside P. Mt.	137	454	6,216 91
Eureka	Richmond Mining Co. Mines	459,130	2,172	15,633,831 45
Eureka	Ruby-Dunderberg Mining Co.	51,268	335	1,882,933 89
Prospect Mountain	Rewes and Berry	317	77	8,929 59
Eureka	Seventy-six	269	1,556	10,900 48
Eureka	Silver Cannon	4,626	1,766	158,900 98
Eureka	Silver Lick	4,874	2,374	219,348 71
Eureka	Summit	298	722	12,277 18
Mineral Hill	Swallow	51	385	7,299 94
Union	Star Mining and Milling Co.	491	101	16,519 36
Antelope	St. Peters Con. G. & S. Mining Co.	3,950	1,060	87,380 00
Cortez	Ventura	42	858	6,484 87
Eureka	Williamsburg	2,935	1,550	75,111 88
Eureka	Whip-poor-will (Diamond Group)	950	536	22,173 39

BUILDINGS AND MACHINERY

THE DIAMOND MINE

This is the only property in Eureka District upon which active mining operations are being pushed at present with systematic vigor. About fifty miners are employed at day's pay, opening up long galleries, lateral drifts, crosscuts and connections upon the main levels, as also in sinking, uprising and prospecting. As the management pursues a conservative policy, and the employees are influenced by it, very little information can be gained by the public, but the signs of activity and confidence exhibited indicate that the owners have great faith in their property. The main tunnel of the mine taking a direct westerly course, has been driven in 2,300 feet. From a point 1,500 feet in from the mouth, lateral drifts have been driven—one northerly, 1,000 feet, and another southerly 2,700 feet. From 200 feet further in the tunnel parallel drifts have been driven, the north being 1,000 feet and the south 900 feet long. Those are connected by crosscuts with the first mentioned drifts, and give convenient access and good ventilation. Rail tracks are used throughout the mine. The principal ore chute, as developed through the mine, had its apex about 830 feet above the main tunnel level, and was followed to a depth of 500 feet below it. There are three shafts going down from the main tunnel. The main shaft, No. 1, is down 535 feet, and the lowest level runs off from a station about 28 feet above that point. No. 2 is down 385 feet to the 300 level, and No. 3 is down 200 feet.

The above meager details are all that can be given at present in regard to the mine workings. The system employed for the underground exploration and development is said to be thorough and admirable.

The property is splendidly equipped with machinery and buildings for all of its requirements. At the entrance to the tunnel are on one side a carpenter shop and on the other side a blacksmith



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Prospect, Nevada, in 1907, situated Four Miles South of Eureka

shop, the former being 24x32 and the latter 32x32 feet in the clear, and each of them in their special departments are thoroughly equipped.

There are three hoisting engines in the mine, upon the main tunnel level, each of which is run by compressed air; that upon the No. 1 double compartment shaft is a Fraser and Chalmer, single, spur-gearred double hoist, with 12x20-inch cylinder. It is equipped with iron cages and two flat 3x $\frac{3}{8}$ -inch steel wire ropes. No. 2 prospecting shaft has a small Eastern-made double hoist, with two cylinders of 6 $\frac{1}{4}$ x16 inches. This is a single, spur-gearred hoist, with reversible link motion and one reel with a $\frac{5}{8}$ -inch round steel rope. No. 3 shaft is equipped with a small 8x10-inch cylinder, reversible, link motion engine, with a single reel and one-inch wire rope. There are three 3 $\frac{1}{2}$ -inch Ingersoll drills used in the mine, which are run by compressed air, as in the case of the hoisting machinery, by a No. 7 Burleigh air compressor. The machinery which furnishes the motive power and its equipments are contained in a substantial frame building 37 feet wide by 80 feet long. The compressor room is 37 feet long, 16 feet wide and 16 feet high with tongue and groove floor, ceiling, sides and ends. The equipments, in addition to the air compressors, consist of two sets of 52-inch by 16 feet boilers, with steam drums, etc.; an air receiver 4 feet in diameter and 12 feet high; an 18-inch by 4 feet heater; a Knowles duplex pump, with four 3-inch plungers, and a No. 7 Cameron pump for pumping water from contiguous springs and supplying the boilers and boarding houses with water. There is also a turning department, equipped with a Morgan & Orr 14-foot turning lathe, with all of the necessary paraphernalia, and run by a small upright engine.

The boarding house is a large, commodious and substantial frame building. It contains a large and well-furnished kitchen, a dining room to seat over 100 men at table, a sitting and wash room, and, upon the second story, a fine, airy sleeping room, furnished with bunks for the accommodation of the employees. The superintendent's compartments, at the southeast and rear end of the buildings, consist of an amply and substantially furnished office and bedroom, and an extra suite of rooms for the foreman, etc.



PHOTO, C. H. GORMAN

Eureka Consolidated Mine and Ore Bin, Ruby Hill, Nevada
This mine is producing over 200 tons of ore per day the year around

Returning to the tunnel, the tracks upon the dumps are enclosed in sheds, which protect the carmen from the inclemency of the weather and the rails from obstruction by snow in the winter season. Solid and commodious bins and assorting floors are constructed below the dumps for the convenient handling of ore from the mine, and one of them is connected with the sheds by a large double box chute, with a convenient grating through which the coarse material falls on to an intermediate floor. There it is broken into small fragments and reshoveled into the box chute and dropped with the balance of the material onto the lower floor. There the ore is thoroughly mixed, weighed and sacked, ready for shipment to Salt Lake, where it is sent for treatment. The very rich ore is kept and shipped separately.

THE EUREKA CONSOLIDATED MINE

Has been worked mainly upon the various levels run off from the Lawton double compartment shaft, upon which the old hoisting works stand. This is a vertical shaft, down about 750 feet from the surface. It has penetrated the quartzite foot-wall about 35 feet below the 9th level. From that level downwards, the mine was worked through an incline winze which was sunk to the 14th level. It is impossible to estimate the lineal measurement of the openings of the Ruby Hill mines, as the most of them are filled with waste rock. Only the most important places upon the main levels remain open. Large blocks of ground are yet unexplored.

The machinery upon the Lawton shaft consists of a double spur-gearred, reversible, link motion, horizontal hoist with 20x60-inch cylinders and two 4x $\frac{3}{8}$ -inch steel wire ropes, each about 1,000 feet in length; one pair (twin) tubular boilers 48-inch by 16 feet, and a single boiler of the same make and dimensions; two safety cages; one No. 1 Burleigh air compressor and Ingersoll drills (used in the mine), and circular saws for cutting timbers.

The machinery upon the Locan shaft is ponderous and powerful, but cannot be fully described, as it is too complicated for the capabilities of any engineer at present in Eureka. Its description must be explained by either the builder or the engineers who supervised its erection. It con-



PHOTO, C. H. GORMAN

Richmond Mine, Ruby Hill, Nevada

sists of three engines. One of them is a compound condensing engine and was used, in connection with a huge accumulator, to inject water into it for the purpose of creating hydraulic power; the second was used for hoisting purposes, and the third for handling the pumps. There are stationary pumps at the 600 and 1,200-foot stations; the latter, however, is not in a complete condition, and a lifting pump was used between stations. The original machinery was built upon the same principle as that upon the Hale and Norcross or Combination shaft on the Comstock. Full information can probably be had by communicating with the Risdon and Union Works, San Francisco, where the machinery was planned and constructed.

THE RICHMOND MINE

The main shaft upon the Richmond mine is a vertical double compartment one and is down to a depth of 1,230 feet, being 30 feet below the 1,200-foot level and the lowest point struck in Ruby Hill. This shaft has passed through the quartzite. The machinery consists of a twin direct acting horizontal hoist, with Coller's bed and 16-inch by 5 feet cylinder; two flat steel 4x $\frac{3}{8}$ -inch steel wire ropes, each 1,500 feet in length; two patent safety cages; one 5x16 feet and two 14x16 feet tubular boilers; one No. 7 Burleigh air compressor to run Ingersoll drills in mine. The whole is covered by a substantial corrugated iron-sheeted building, 40 feet in width by 80 feet long. Within the building, or attached to it, is a carpenter shop fully equipped with circular saws for cutting timbers and all of the necessary tools for mine work. Separate from the hoisting works is a blacksmith shop, 24x16 feet in the clear and well fitted throughout.

THE JACKSON MINE

There are two shafts in this mine. The one in present use has two compartments, with two patent safety cages and is down 600 feet, with three main levels run off and connected with the workings from the old shaft, that through which the mine was formerly worked for the rich and extensive ore deposits which went down from the grass roots. The present main working

shaft is equipped with a spur-gearred reversible, horizontal hoist, with a 12x24-inch cylinder; two reels, with flat 4x½-inch steel wire cables, each about 1000 feet in length, and boilers.

THE PHOENIX MINE

Has a double compartment shaft down about 570 feet, with five main levels and an incline winze down to the 6th level which runs from the quartzite to the lode. The shaft is equipped with a single spur-gearred, reversible hoist, with link motion and 1½x3½-foot cylinders. It has two reels with 6x½-inch wire cables, and two patent safety cages. But one boiler is employed and that is of an extra large size.

THE HAMBURG MINE

Has a double compartment shaft down 860 feet, with main levels run off at the several depths of 150, 250, 450, 600 and 850 feet, combining an aggregate of about two miles. It is equipped with a spur-gearred, reversible hoist, with 14x24-inch cylinders; two reels, each carrying 1,000 feet of steel wire 4x½-inch cable; one horizontal tubular 4½x16-foot boiler, all covered by a large and commodious building, having within well-equipped carpenter and blacksmith shops.

THE DUNDERBERG MINE

Has a double compartment shaft, equipped with a two-spur, geared, double reversible hoist; two reels, each carrying a flat steel wire 4x¾-inch cable; two large horizontal 4½x16 feet tubular boilers, and a No. 1 Burleigh air compressor, with Ingersoll drills. Under the same roof as the hoisting works, in an adjoining wing of the building, is a blacksmith shop, with forge and work bench and also a carpenter bench.

All of the shafts named herein are down vertically, and the hoists are all run by steam, except those at the Diamond mine, which, like that formerly used at the top of the 900-foot

level incline (which goes down to the 14th level of the Eureka Consolidated mine), are driven by compressed air.

There are several other steam hoists in the district which are small and of only temporary use and which, at any time, may be replaced by more substantial plants. Such changes must depend on improvements in the auspices for mine development in Eureka.

There is a fine hoisting plant on the Price and Davis shaft, at present inaccessible. Among the smaller hoists are those on the Matamoras, Banner, Lord Byron, Silver Connor, Kit Carson, Geddez and Connolly. There is also one on the Queen mine at Silverado.

NEIGHBORING DISTRICTS WITHIN THE COUNTY

Outside of Eureka and within the County are several mining districts, any of which may come to the front as great ore producers. In fact, Cortez and Mineral Hill have already yielded sufficient to give them place among the most important mining regions of the County. Safford District, situated on the south side of the Humboldt River, about five miles distant from Palisade, has a number of ore veins in porphyry. The ore is generally very rich in silver, and there is justification in the belief that the veins will pay well to explore on an extensive scale.

Richmond District, which is divided by the line that separates Eureka from Elko County, and Goodhue and Schroeder Districts, in the northerly part of the County, have produced rich ore, but not in such quantities as to give them special distinction. Roberts District has been known for a number of years, but until within the present year it has only received passing attention. Several years ago some claims were worked, but with results so unsatisfactory that they were soon practically abandoned. Early last spring, they having fallen into the hands of R. D. Clark of Reno, his son and others who were associated with them, men were employed by them on the Keystone mine, and they developed a vein or deposit of ore which they feel justified in exploring on a more extensive scale than had previously been attempted. Miners are of the opinion that the prospect is good for the development of a great mine. It is situated about

53 miles northeast of Eureka and 17 miles southwest of Cortez. The mines show bold croppings which are traceable for a half mile or thereabouts. The work recently done there consists of a tunnel 150 feet in length, connecting with a shaft 105 feet deep. Low-grade ore was found on top, but very rich material was encountered in sinking. Recent developments consist of a vein of 15 to 20 feet in width, not all ore, but the paying material assays from 18 to 600 ounces of silver to the ton, and some of it will yield as high as \$120 in gold. The ledge is described as a contact vein, with a porphyry foot-wall and limestone in the "hanging". Messrs. Clark & Co. have secured about twenty claims on the lode. Cuperite and other forms of copper are found in some of the ore, and quantities of it will yield from 12 to 34 per cent. of that metal. Lead and iron sulphides are also abundant. A concentrator has been set up near the mine and a smelter is in course of construction to be used for matting the ore until more definite plans are matured.

Mineral Hill District is situated in the foothills, about five miles east of Mineral Station, on the line of the Eureka and Palisade Railroad. It was discovered in 1869, when several claims were located there upon silver quartz deposits. They were sold in 1870 to George D. Roberts and Wm. Lent of San Francisco, for \$400,000, and the Mineral Hill Mining Company was organized. After mining and milling several hundred thousand dollars' worth of ore, this company sold to an English syndicate for one and a half million dollars. The English people operated the property for some years, but, although some of the ore ran very high in silver, the average of it was too low grade to work, as affected by the downward course of silver. So they sold to the present owners, Messrs. Barker, Spencer & Co., who realized \$60,000 or \$70,000 profit by running tailings through the mill. The ore that has been mined since then was assorted, and lots, valued at from \$100 to \$500 per ton, were shipped to Salt Lake and Eureka. The character of the ore is free milling quartz and chloride. This is doubtless a great property, but it has nowhere been developed below 100 feet in depth. There are several other promising mines and prospects in the district.

Bullion District is situated about twelve miles from Cortez, and contains a number of very valuable prospects, principally of silver-lead ore, ore which would be quite valuable if silver was worth what it used to be.

Cortez District is situated upon Mount Tenabo, east of and near the north end of Toiyabe range, and about thirty miles south of Beowawe. It is there that the first important mining operations in the County were conducted. It was discovered in 1863. The principal mines—the Garrison and others, numbering upwards of sixty claims—are principally owned by Simeon Wenban, who, by his indefatigable energy and shrewdness, has amassed a great fortune out of them. He was among the discoverers and first locators of the district, and in the face of numberless difficulties stood by the great property with strong resolution and indomitable will, through many trying ordeals, over a period of nearly thirty years. Deserved success crowned his efforts and made him a millionaire. These claims are now incorporated in Nevada, under the styling of “The Tenabo Mill and Mining Company”. They are marked by several miles of bold croppings, and are combined in what is probably the greatest mining property, at this date, in the State of Nevada. The ore runs from a few dollars up into the thousands per ton. The principal workings are approached by long tunnels, and but little shaft work has so far been needed. The mines are nearly idle at present, it being understood that Mr. Wenban will not work them, on account of the low price of silver. The ores are treated by a leaching process, and the plant in use for the purpose is said to be one of the finest appointed establishments of the kind in the State.

Union District, situated about four miles eastward from Mineral Hill, has an abundance of low-grade silver-lead ore and considerable of high-grade. It, at one time, bid fair for a position among the favored mining localities; but through unfortunate business management it is practically deserted. Diamond District, situated in the Diamond range, about twelve miles north of Eureka, is in a similar position.

Hope District, situated twenty-five miles north from Eureka, and about a mile west of the E. & P. R. R., is a mining region, the full merits of which have never been determined. Low-grade silver-lead ore may be found there in great abundance, and high-grade material is also encountered. It is, from a geological and mineralogical standpoint, an interesting district where, in addition to silver and lead, zinc, niter and other valuable minerals are found. It is quite probable that the ores of this, as also those of Union and Diamond Districts, would pay well to concentrate, but it is not probable that active steps will be taken in any direction until the circumstances surrounding them become more favorable.

A further resume of Eureka County is hardly necessary at this writing, but should the tide of our national affairs turn in the much-desired direction of the free coinage of silver, Nevada would recover its former importance as a nucleus of mining investment, with Eureka County as one of the principal centers and deserving a summary broader in its scope and more varied in detail.

J. C. POWELL,
Assessor of Eureka County, Nevada.

The foregoing report was published as a part of the biennial report of the Surveyor-General and State Land Registrar of the State of Nevada, for the years 1897-8.



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The \$200,000 Plant of the Richmond-Eureka Mining Company, Ruby Hill, installed in 1906

S U P P L E M E N T A L R E C O R D



SINCE the publication of the foregoing reports and tabulated statement for 1897-8, mining for the precious metals in Eureka County has vastly improved. It is a well-known fact that for twelve or fourteen years prior to 1905, the extensive properties of the Eureka Consolidated and Richmond Mining Companies, situate on the great Ruby Hill lode, were but little worked, notwithstanding their immense production of the precious metals in the past, and the fact that but 1100 feet had been reached in the deepest shaft on the mines.

The practical shutting down of these mines did infinite harm, as it had the effect of discouraging prospecting and investment in the properties of lesser note, and accounts in part for the greatly reduced ore tonnage between 1892 and 1905.

Happily for the future of mining enterprise in Eureka County this cessation of work is now a thing of the past. The properties which produced, before 1000 feet of depth had been reached, over forty million dollars, and which include a large number of mines along the great lode, are now consolidated and under the able and vigorous exploitation of Superintendent A. P. Mayberry and his urbane assistant, H. C. McTerney, the output of ore is only limited by the capacity of our narrow-gauge to handle the same.

RICHMOND-EUREKA, EQUIPMENT AT PRESENT

About the end of 1905, the Eureka Con. and Richmond (including the Albion) properties were taken over by the Richmond-Eureka Mining Co., and work was immediately commenced to get the mines in shape for shipping the immense bodies of low-grade ores left by the old companies as too low for profit in the earlier days, and to unwater and sink further the Locan shaft. The Locan shaft, or as it is familiarly called the "New" shaft, is now equipped



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Richmond-Eureka Mining Company's Office Buildings, Ruby Hill

with a 1400 H. P. Stirling boiler plant, a 30-drill compressor, a large Norberg hoist, pumps, etc., for unwatering and sinking the shaft from the present depth of 1200 feet to a depth of 2000 feet, with machine, blacksmith and framing shops complete in every detail.

With the buildings and other accessories it is said the plant is now the most modern and complete plant in the State. Before the end of 1906, the mines were opened up in shape to handle a large output, and the tonnage has increased from 50 tons per day, when shipping was begun, to over 200 tons per day at this date, with enough ore in sight to ship a much larger tonnage for many years.

THE WINDFALL MINES

The "Windfall" and five other adjacent mines constitute the now well-known group of claims which are being watched with feverish anxiety, and boundless hope by the owners and all who are interested in the mining industry of Eureka County. The discovery of the Windfall, by Eugene Geraty, dates back but a few years. Situate some five miles to the southwest of the town of Eureka, on what might be called a spur of Prospect Mountain, and about one and a half miles southeast of the "Diamond" series of mines, which have given to the world their millions, the Windfall series promise great results in the near future.

For forty years the claims had been located and re-located by prospectors, but until their re-location by the present owners little more than preliminary location work had been done on them.

Geraty located in with him his brother-in-law, C. S. Greenwood, and subsequently included Dan. Morrison, as an equal owner. The three are every-day miners, married, and with wives and babies in their happy family circles. At the date of the discovery, the triumvirate were working for The Diamond Co. for daily wages, and it is said the first discoverer, Geraty, picked up the piece of rock that led to the taking up of the claims, whilst combining the serious business of prospecting, with the lighter business of sage hen hunting, as a relaxation from



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Windfall Mine, in October, 1908, \$40,000 in Sacks on the Dump

his daily labor. That piece of rock assayed about \$50 in gold and brought unenvied prosperity to the trio of owners.

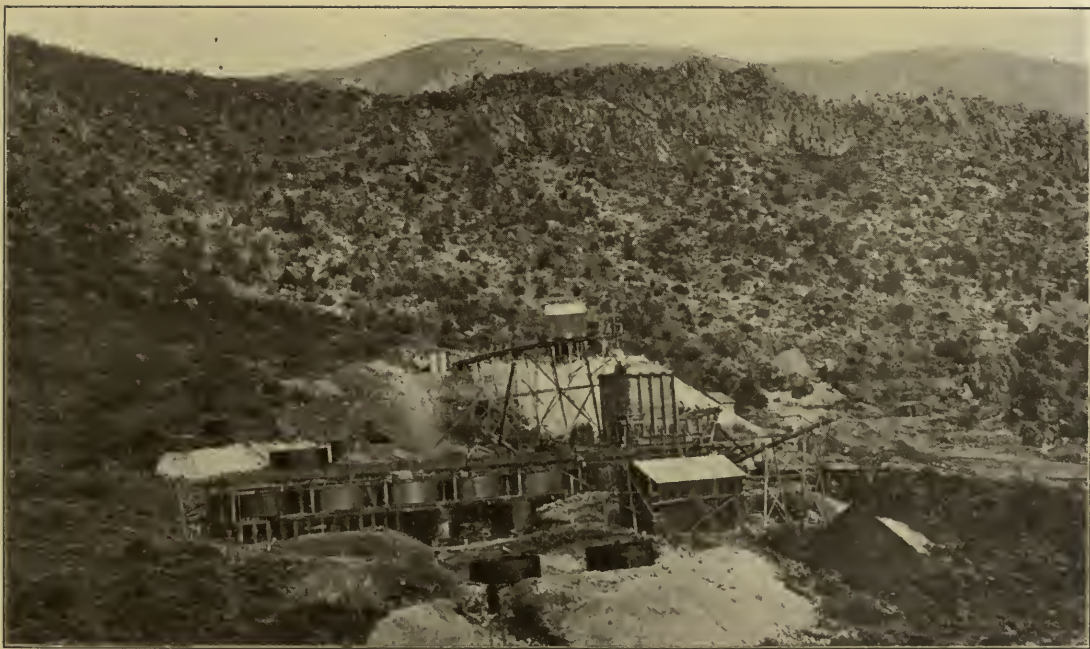
For the first two years following the find but desultory work was done on the claims, and mostly by Greenwood, whose confidence in the ground never wavered. From the date of location in the fall of 1904, the owners from time to time mined and shipped from the property about \$30,000 worth of ore, and in September, 1908, bonded their interests to the Windfall Mining Co. for the sum of \$200,000.00, receiving a first payment down of \$25,000.

The product of the mines is gold, silver and lead, with a high preponderance of gold. The formation in which the ore makes is lime, what is called, by geologists, "Hamburg" lime, a character of rock traceable for a distance of 14 miles from beyond the Hamburg mine to the south, to the end of Adams Hill on the north. It is a high-grade ore averaging \$150.00 to the ton, with choice specimens running as high as \$25,000.00 to the ton. The ground is being worked through a double compartment shaft, at present some 350 feet in depth, with drifts, winzes and tunnels as accessories. There is on the property a 45 horse-power gasoline engine with hoisting works of modern construction and capacity.

The company is preparing to sink the shaft, or a new shaft, some 500 feet deeper than the present lowest level. During the winter of 1908, the company began the erection of a reduction plant capable of treating 150 tons per day. The mill has been in continuous operation since the fifth of June last, or a little over two months, and from it has been shipped five bars of bullion approximating the sum of \$70,000. It is the intention to increase the plant's capacity in the near future by 50 tons per day. The plant cost in the neighborhood of \$30,000 and is pronounced by experts a prime success in the saving of the precious metals.

ADAMS HILL .

No more interesting stretch of mining ground can be found than that which is included in Eureka Mining District proper and known as Adams Hill. This so-called "Hill", or rather



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Windfall Cyanide Mill, capacity 165 Tons per Day

series of hills, is separated from Ruby Hill and Prospect Mountain by a ravine of moderate dimensions. Its highest elevation above sea level is about 6,900 feet. It is composed chiefly of Hamburg limestone with a band of Secret Canyon shale, from east to west along its southern extremity and a belt of Hamburg shale bordering the limestone to the north. North of the Hamburg shale and east of the Hamburg limestone, Pogonip limestone is exposed. It is needless to say that in the limestones the ore makes as a general proposition. North of the Hamburg shale in the Pogonip limestone there is an extensive outcrop of quartz porphyry. This quartz-porphyry, especially in the Bullwhacker mine, contains considerable quantities of gold, silver and lead, and is surmised by some geologists to be the main source of the ore in its immediate neighborhood.

Though separated from the great lodes of Ruby Hill, only by a ravine of moderate size, the character of the ore in the two localities in many respects differ. The most marked difference is the prevalence of quartz ores in many of the mines. Adams Hill ores, as a rule, carry a high percentage of gold. Lead, in carbonate and sulphide form, has been produced in large quantities by the Bullwhacker and Williamsburg mines, the former having to its credit, in gold, silver and lead, an output of over \$2,500,000.

Adams Hill has been but little exploited, as its many claims are owned by poor men or equally poor companies, who have contented themselves with extracting the rich rock found on or near the surface. The deepest shaft, that of the Bullwhacker, does not exceed 450 feet. A few weeks ago, what was known as the Fraser interests, in several of the claims, was disposed of to J. S. McQuillan, of Tonopah, who, with his partner, C. F. Wittenberg, purpose sinking at once a shaft to a depth of 500 feet for exploration purposes. The Auro, Cyanide, West Cyanide and Western Union claims, their interests in which Alex. Fraser and wife sold to McQuillan, have, within a brief period, produced \$90,000.00 with but a force of two men scratching the ground. The last named properties are believed to be the "connecting link" between them and the Silver Lick, on the west, and the Macon City, Lone Pine, Morning Star,



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Holly, looking South, showing Ruby Hill in the Distance

Fraser and Molino, Marguerite, Wide West, May Lode, Altoona, Barton, Oriental and Belmont, Bowman, Democrat and other claims to the east, all of them more or less ore producers.

One of the most promising claims on Adams Hill is the Holly mine.

THE HOLLY MINE

This mine, which was formerly known as "The Idaho", produced by tributing in the early days, \$41,000.00. Owing to the depth attained, 200 feet, and the lack of machinery, work was discontinued. In 1907 this property was purchased by the Nevada Development and Mining Company. Work was commenced rehabilitating this property in July, 1908, since which a complete set of buildings has been erected, consisting of Superintendent's residence, bunk house, boarding-house, office, change room, stable, shop, power-house and powder-house. The power-house contains what is conceded to be one of the best gasoline equipments in the State of Nevada, comprising one 60 h. p. F. M. engine, one 25 h. p. F. M. hoist, one two-drill F. M. compressor, one six-drill Ingersoll compressor, one 4 h. p. F. M. special electric engine, one 50 light dynamo.

The shaft has been carried to a depth of 425 feet. There has been developed in the past year, 50,000 tons of milling ore, which is awaiting the erection of a mill for treatment. Extensive tests are now being made to determine the best method of recovery. This company owns a 350-acre ranch on which ample water rights are situated for the operation of a 300-ton concentrating mill. They also own the "Queen Annie", a copper prospect located in the Hobson District and comprising five claims. The Holly mine is located two miles and the Holly ranch four miles from Eureka. Values are gold, silver and lead, lead predominating.

SAFFORD DISTRICT

Located at Palisade, has a mineralized area of about 70 square miles. There has been taken out of this district about \$500,000.00 in minerals. No systematic mining has been done



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Holly Shaft House. One of the most complete gasoline plants in Nevada

except by the West Mining Co., which is shipping fifty tons of fluxing ores per day. The ores in this district are lead, silver, gold and iron. Silver and lead predominate. One car of ore taken from the Zenoli Mine, at a depth of 90 feet, netted \$7,000.00. The ore taken from lesser depths by leasers goes about \$59.00 net per ton.

MINERAL HILL DISTRICT

Located five and one-quarter miles east of Mineral Hill on the E. & P. Railway. The mineralized area of this camp is about two miles long by 3500 feet wide. There has been mined about \$7,000,000.00. Mineral was discovered in this camp in 1869. Mining and milling were carried on continuously until 1890; most of the work has been tunnel work, the deepest shaft being two hundred feet in depth. Longest tunnel is 750 feet. Most of the work, with the two exceptions above noted, has been practically surface work. There is but one company operating in this district at present, i. e., The Big Three Mining Company, which has been operating here about two months on a bond and lease. The Mineral Hill Consolidated Mining Company, who own the best properties in this camp, have not operated their mines or mills for eighteen years, except by tributers. The character of the ores are lead, gold and silver, silver predominating.

ANTELOPE DISTRICT

Located three and one-half miles east of Ceder Switch on the E. & P. Railway. Little work has been done in this district to the present excepting assessment work on locations. The Nevada Central Copper Company has recently installed a complete power prospecting and developing outfit on their ground, consisting of 21 claims, and it is the intention of the management of this company to develop their property in a systematic manner. They already have an incline down 185 feet. They also have a double compartment shaft down about 100 feet. The mineralized area of the copper belt of the Antelope District is nine miles long and 3000 feet wide. Character of ore is a carbonate, carrying silver, gold and copper, copper predominating.

CORTEZ MINING DISTRICT

Located 35 miles from Beowawe. The Garrison mine, located in this district, has produced in its day about \$9,000,000.00. Ore was worked by the "Hypo-Sulphite" process. The Garrison mine was closed in 1904. There is still abundance of low-grade ore left in this property, but the method used in extracting values from the ore proved too expensive, which was the direct cause of suspension of work. There is estimated to be 15 miles of underground workings in this mine. Property consists of thirty-three patented and nine location claims, and is owned by the Wenban Estate. Values are lead and silver, high in silver. At present, the Cortez Metals Recovery Company is working over the Garrison Mill dump with a 100-ton cyanide plant. Mill Canyon, located in this district, has several minor companies operating. As this article is being written, a new company has acquired, and is acquiring, several of the minor companies, with the intention of consolidating and carrying the work on a much larger scale than heretofore. Already a town has been platted, and quite a boom is being experienced. The Shultes Brothers own a property at this camp consisting of four full claims, from which they have shipped ore of the value of \$25,000.00.

RAILROAD MINING DISTRICT

Located east of the Raines ranch near Palisade. A great deal of prospecting has been done in this district, but mining has not been carried on to any extent. Very good values have been found in prospecting. In this district is an undeveloped asbestos property, also an undeveloped asphaltum property.

HOBSON DISTRICT

This district is located five miles east of Oak on the E. & P. Railway, and never has been developed. Considerable prospecting and assessment work has been done, and some very fine copper showings disclosed, copper ore having been found which assayed as high as 43 per cent. copper.

ROBERTS DISTRICT

Located twenty-five miles west of Mineral Hill Station on the E. & P. Railway. The Keystone mine, located in this district, was discovered in the early 70's but was never worked systematically. 2000 feet of tunnel have been run on this property, and a shaft 150 feet in depth has been sunk. This property consists of nine claims of which two are patented. There is a good mining equipment at this mine, consisting of a steam plant, electric light plant, air drills, compressor, etc. No mining has been done here for many years, though the machinery was installed early in 1907. This property is owned by E. D. Walti

Fletcher and Jamison own a very promising zinc prospect in this district from which several shipments of zinc ore have been made. This zinc property is located nine miles west of Alpha on the E. & P. Railway.

ORE PRODUCTION FROM DECEMBER, 1897, TO JUNE, 1909

By order of the Board of County Commissioners of Eureka County, Mr. H. C. McTerney, the County Assessor, has furnished from his record books the following summary of the ore production of the County, given him as provided by law, between December, 1897, and June 1909.

Gross yield, 478,472 tons.

Gross value of ore, \$4,205,160.20.

This sum is less the cost of transportation, from the mines to the Salt Lake Smelters, as well as the cost of smelting, all of which until the last two years was onerous in the extreme and practically prohibited the mining and working of rock at a profit which did not assay at least \$18 per ton.

The charges of transportation and reduction are now, happily, more moderate.

Improved machinery, more reasonable transportation and reduction charges, the invention and discovery of more economical processes, for the extraction and saving of the precious metals, new discoveries of valuable ore deposits, and returned confidence, have lifted us out of the "slough of despond", and at this writing it would be difficult to find within the mighty mineral domain of Uncle Sam, mining districts of brighter prospects than those to be found within the boundary lines of the County of Eureka, State of Nevada.

For further information regarding the resources of Eureka County, address the following

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