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REPORT  
OF THE  
BUREAU OF MINES  
STATE OF COLORADO  
1915-1916

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# Fourteenth Biennial Report

ISSUED BY THE

## BUREAU OF MINES

OF THE

### State of Colorado

FOR THE

YEARS 1915 and 1916

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FRED CARROLL, Commissioner

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EAMES BROS., STATE PRINTERS  
DENVER, COLORADO  
1916



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**LETTER OF TRANSMITTAL**  
**BUREAU OF MINES, STATE OF COLORADO**

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To His Excellency,  
GEORGE A. CARLSON,  
Governor of Colorado.

Sir: In compliance with Section 4268, Revised Statutes of 1908, State of Colorado, I have the honor to submit the fourteenth biennial report of this department upon the condition of the metalliferous mines within the state as reported by the several district inspectors.

Respectfully,

FRED CARROLL,  
Commissioner of Mines.

January 5, 1917.



## PERSONNEL OF THE BUREAU OF MINES OF THE STATE OF COLORADO

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FRED CARROLL, Commissioner.....Denver  
THOMAS DUNSTONE, Inspector District No. 1.....Black Hawk  
M. J. MCCARTHY, Inspector District No. 2.....Cripple Creek  
A. E. MOYNAHAN, Inspector District No. 3.....Alma  
ROBERT INNES, Inspector District No. 4.....Durango  
M. B. TOMBLIN, Chief Clerk.....Denver  
MRS. A. M. NICKERSON, Stenographer.....Denver

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## DISTRICTS OF INSPECTION

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DISTRICT No. 1—Denver, Jefferson, Boulder, Larimer, Jackson,  
Routt, Grand, Gilpin, Clear Creek and Moffat Counties.  
DISTRICT No. 2—El Paso, Teller, Pueblo, Las Animas, Huerfano,  
Custer and Fremont Counties.  
DISTRICT No. 3—Lake, Summit, Chaffee, Park, Pitkin, Mesa, Delta,  
Eagle, Rio Blanco and Garfield Counties.  
DISTRICT No. 4—San Juan, Ouray, Hinsdale, Mineral, Rio Grande,  
Saguache, Costilla, Conejos, Archuleta, La Plata, Montezuma,  
Dolores, San Miguel, Montrose and Gunnison Counties.

# FINANCIAL STATEMENT OF BUREAU OF MINES

## 1915-1916

### RECEIPTS.

Appropriation for the fiscal years 1915-1916:

Salaries of Commissioner, Inspectors, office help.....	\$25,800.00	
Traveling expenses Commissioner and Inspectors.....	10,000.00	
Incidental fund .....	1,000.00	
		<hr/>
		\$36,800.00
Transferred to incidental account.....	5.00	
Sale of Bulletin No. 7.....	57.00	
Exchange of minerals.....	45.18	
		<hr/>
		107.18
		<hr/>
		\$36,907.18

### DISBURSEMENTS.

	Salary.	Expenses..	Incidental.	
Commissioner .....	\$ 5,780.36	\$1,776.66	.....	.....
Inspector Dist. 1.....	3,600.00	1,656.05	.....	.....
Inspector Dist. 2.....	3,600.00	1,758.76	.....	.....
Inspector Dist. 3.....	3,600.00	1,778.33	.....	.....
Inspector Dist. 4.....	3,600.00	1,794.81	.....	.....
Chief Clerk .....	2,945.80	.....	.....	.....
Stenographer .....	2,400.00	.....	.....	.....
Incidental .....	.....	.....	1,001.73	.....
	<hr/>	<hr/>		
	\$25,526.16	\$8,764.61	\$1,001.73	\$35,292.50
Unexpended balance .....	219.64	1,235.39	3.27	1,512.50
Remitted to State Treasurer, sale of Bulletins.....			57.00	.....
Remitted to State Treasurer, exchange of minerals.....			45.18	.....
			<hr/>	<hr/>
				102.18
				<hr/>
				\$36,907.18



# Introductory

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In preparing this report a special effort has been made to meet the demands which are constantly being made upon a department such as this for tabulated labor statistics, and more specific information concerning the metal mining area of this state. The passage of new laws dealing with labor has made it necessary that this department furnish summarized information concerning accidents resulting in injury to workmen, classified, for place of employment, cause of injury, time of disability, etc. This information must be furnished in order that the insurance carriers may adjust workmen's compensation rates intelligently. If such statistics are to be of any value, they must be accurate, and when it is considered that we have almost 2,500 mines and prospects in this state which operate some time during the year, it will be realized what a difficult matter it is to collect data for the purpose explained in the foregoing.

## ACKNOWLEDGMENTS

Acknowledgments are due to the four State Mine Inspectors for their faithful assistance in collecting necessary data; to the Federal Bureau of Mines, for valuable suggestions and the use of blank forms furnished us; to the State Industrial Commission for valuable assistance and the use of accident records, and to the mine operators of this state for prompt and complete pay-roll statements.

## NUMBER OF MEN EMPLOYED

The most difficult portion of the work necessary for the collection of accurate data, has been that of determining the number of men engaged in the metal mines of this state. This work has entailed almost endless correspondence and personal requests. The large employer is always able and willing to furnish promptly accurate information, but some of the smaller operators who keep no books, could only make estimates, but these were checked and rechecked until the figures in the aggregate are considered accurate to within one or two per cent. Another year it is hoped that the mine operators will be better prepared to furnish the required information.

Organized mining operations which include practically all of the larger mines, have almost without exception shown constant improvement during the past two years in their accident experience.

Scattered operations, and those of small companies where it was not practicable to have each branch under the direction of men equipped and trained for that particular work, have shown bad experience, and a great many men have been killed or seriously injured in reopening old mines. This was particularly true during the past year, owing to the revival of the older camps in the state. Many more men have been engaged during the past year than at any other time since 1907.

### ACCIDENT STATISTICS

Previous to the enactment of The Workmen's Compensation Law, which became effective August 1, 1915, most employers reported only the fatal and very serious accidents, and no records were ever kept of disabilities due to injuries. There have been many instances of slight injury which resulted seriously due to blood poison, and in some cases in death. One man pricked his finger with a rusty wire, and died a few days afterward; this accident was not even reported until the man was almost dead.

All these as well as cases of an injured dying of pneumonia, induced by what might ordinarily be considered a slight injury, have been included. Hence it is very evident that only statistical data covering the year 1916, should be considered complete. However, in preparing the statistics for the year 1915, our records have been supplemented, and verified by every means at our command, and the figures given may be considered fairly accurate for comparative purposes, but if in error at all, are low.

The Compensation Law has made it possible for us to follow all injuries to their final result, and the accident statistics given herein, are based upon awards of the Industrial Commission.

### PRODUCTION

The total production of gold, silver, copper, lead and zinc in Colorado in 1915 amounted to \$44,060,521.47, an increase of nearly 30 per cent over 1914. This increase was undoubtedly due to the high price of metals prevailing in 1915, together with an increase in tonnage of about 60,000 tons over that made the previous year.

The total production in these metals in 1916 was but \$49,000,000, an increase of only 13% over the previous year, although the average yearly market price of silver for 1916 was 30.3% higher; that of lead was 45.6% higher; that of copper 55.4% higher, and that of zinc was about the same, being \$13.00 as against \$13.05 in 1915. This condition was the result of a decrease in the gross tonnage mined, and notably a decrease in both quantity and grade of the gold ore mined in the state; especially was this true in the Leadville district.



## METAL MARKETS

The abnormal demand brought about by the European war for metals was beginning to be felt in the early part of 1915, and has almost constantly increased for all of the common metals up to the present time, and the markets have shown an advancing tendency, with the exception of that for zinc, which has steadied and at times reflected a surplus of metal in the market, but not sufficient to reduce the price to where it was under normal conditions. In 1916 the metals fluctuated in value less than during the previous year, and the market for ores was looked upon as more stable, hence the production was uniform throughout the year.

### ZINC

In January, 1915, this metal sold at \$6.21 per cwt. f. o. b. St. Louis, and advanced to an average of \$21.04 in June, and made an average price for the year of \$13.05 per cwt. f. o. b. St. Louis, base market for this territory. In February, 1916, the market averaged \$18.42 per cwt. and declined to \$8.75 per cwt. for August, making an average for the year of \$13.00 per cwt. The average market price for the past sixteen years is \$6.26 per cwt.

### LEAD

Lead advanced steadily during 1915 from the abnormally low price of \$3.73 per cwt. in January to \$5.93 per cwt. f. o. b. New York, base market for lead content in Colorado ores, and made an average for the year, \$4.67 per cwt., which price is the exact average of the market for the past 16 years. A fairly steady advance was maintained during 1916, and a high monthly average was made in December at \$7.75 per cwt. and an average was made for the year of \$6.80 per cwt.

### COPPER

The production of copper has never been of prime importance, as very little ore is produced in this state for its copper content alone, but it serves as a margin value in many ores. The low monthly average was made in January for the year 1915, and a steady advance was made to the end of the year, the average for December being 20.13 cents per pound for electrolytic and an average for the year of 17.28 cents per pound. The lowest monthly price at which copper sold during 1916 was 23.87 cents in July; a maximum price of 33 cents was reached in December, making an average for the year of 26.78 cents. The average selling price since 1900 is 15.58 cents.

## SILVER

The silver market declined during 1915 to an average New York quotation of 47.16 cents per ounce for August of that year, and made an average for the full year of 49.68 cents per ounce, the lowest yearly average in history. The low monthly price of 1916, 56.76 cents per ounce, was made in February, and the highest monthly average of 75 cents was reached in December. The average price since 1900 is 57.34 cents per ounce.

## TUNGSTEN

The most spectacular advance in the price of metal known in recent years, was in tungsten, both metal and ore. Starting in January of 1915 the prevailing price in Colorado was \$5.60 per unit for 60 per cent ore or concentrates; by the end of the year this mineral was selling from \$40.00 to \$50.00 per unit, and three months later it had reached a price of over \$100.00 per unit, such advance being due to the extraordinary war demand for tungsten steel, a self-hardening steel suitable for high speed cutting tools.

During the spring of 1916 the high market caused a number of mining excitements in different parts of the state, notably that of Boulder County, which caused an influx of over 5,000 people within a few weeks. However, the period of abnormal markets was of short duration and by mid-summer a 60 per cent product was quoted around \$20.00 per unit, and by the end of the year, at \$17.00 per unit.

The price and demand for tungsten ore in the United States is governed to a great extent by the amount of foreign ore received, as the latter being produced by cheap labor can be sold here at a price below the cost of production in this country.

The production of tungsten during the year 1915 amounted to \$1,688,000, more than 100 per cent increase over the previous year. The production in 1916 was over \$5,000,000, or nearly 50 per cent of the entire United States production. Colorado has led in the production of tungsten since the year 1900, when the metal was first mined in this state, with the exception of the year 1914, when California made a slightly greater production.

By far the greater part of the production of tungsten is made in Boulder County, but some small per cent of it is made in Gilpin, Ouray and San Juan Counties.

## MOLYBDENUM

There is at the present time a strong demand for molybdenum-bearing ores, and requests are frequently received by this department for information concerning the production of this metal in Colorado.

The mineral of this metal having the principal commercial value is the sulphide ( $\text{MoS}_2$ ), which contains, when pure, 60% molybdenum, and is known as molybdenite.

The oxide, molybdate ( $\text{MoO}_3$ ) and the molybdate of lead ( $\text{PbMoO}_4$ ) known as wulfenite, also have some value commercially, but a number of other known molybdenum minerals are rare and are interesting only as mineral species.

The sulphide ores are purchased on their molybdenum content determined as molybdenum sulphide, while wulfenite and molybdate-bearing ores are settled for on the content figured as molybdenum trioxide.

Molybdenum as an alloy imparts the same quality to steel as tungsten, and is used in varying amounts in combination with tungsten, vanadium, cobalt, nickel, chromium, manganese and other metals, in the manufacture of several kinds of steel adapted for the following uses: high speed machine cutting tools, self-hardening cutlery and wood-working tools, automobile parts and railroad rolling stock, high pressure boiler plate, large cannon and rifle barrels, armor plates, projectiles, permanent magnets and acid-resisting containers. Molybdenum and tungsten may totally replace each other in certain steels, but it is found that the best results are obtained by the use of certain percentages of both.

While at least 90 per cent of the entire production is used in steel manufacture, there are many other uses for this metal, and new uses are constantly being found and developed. A very considerable amount is yearly consumed in the manufacture of chemicals, especially in the production of ammonium molybdate, so universally employed in the determination of phosphorus in iron ore, its products and in fertilizers.

In the metallic form it is drawn into wire and used extensively in dentistry and as supports for the filaments in the incandescent lamp, and in building various electric and X-ray paraphernalia.

Molybdenite is found in varying quantities in nearly every mining district of the state, but in few instances only has any attempt yet been made to develop the veins or mine the ore for their molybdenum content. The deposits near Empire, in Clear Creek County; near Climax, in Summit County; near Pitkin, in Gunnison County, and near Fisher, in the Chalk Creek District of Chaffee County, have been worked for molybdenite and have produced small tonnages of ore. The reported discoveries of molybdenite are as follows:—In Chaffee County: near Fisher, near Monarch, near Salida, and at the head of South Cottonwood Creek, west of Buena Vista; in Conejos County: at Platoro; in Custer County: near Silver Cliff; in Eagle County: near Red Cliff; Fremont County: near Parkdale; in Gilpin County: near Apex; in Gunnison County: near Pitkin, Marble and Tin Cup; in Huerfano County: near Mosca Pass; in Lake County: in the Maid of Erin Mine and at the head of Big Evans Gulch, in the Leadville district, also near Twin Lakes; in Larimer County: near



St. Cloud; in Ouray County: on Engineer Mountain: in Park County: near Alma, Lake George and Guffey; in Pitkin County: 20 miles south of Aspen; San Juan County: near Silverton; San Miguel County: near Ophir; Summit County: on Bartlett, Chalk and Quandary Mountains, also on Peak 2 and 10, near Keystone, and at the head of the Blue River; Teller County: near Cripple Creek; In Boulder County, at the Mountain Lion Mine.

The prices now prevailing for molybdenum will not continue under normal conditions, as, like other war commodities, it is now selling at greatly inflated prices. However, it is safe to say that even under ordinary conditions there will be an ever-increasing demand for certain quantities of this metal, and as one part of molybdenum gives about the same result as two parts of tungsten, it is fair to presume that the market price for molybdenum will remain at least double that of tungsten.

### **RADIUM, URANIUM AND VANADIUM.**

Radium, uranium and vanadium are found associated in nature as carnotite ore in western Colorado, chiefly in Montrose County. The market for radium is mostly in Europe, and as a result of the war this market was destroyed and activity in the carnotite fields ceased at the beginning of the war.

Some production of radium was made in 1915 and 1916, through a co-operative arrangement between the National Radium Institute and the Federal Bureau of Mines, whose reduction plant is located in Denver, and is under the direction of Dr. R. B. Moore. While the exact value of their production is not known, it is said that the radium produced had a value of nearly \$750,000.00 and the uranium and vanadium had a value exceeding \$100,000.00.

In the latter part of 1915 another radium reduction plant was established in Denver, and has made a considerable production, but does not give out the values. Small quantities of carnotite ore were sent outside the state for reduction in 1915.

Toward the end of 1916 the Standard Chemical Company resumed operations on a large scale at their concentrating plant at Naturita, Montrose County. Other smaller concerns became active producers of ore at about the same time. The Denver Reduction Plant, which was erected by the National Radium Institute, operated steadily throughout the year, but passed into the hands of new owners toward the end of 1916.

There was a very small production of pitch blende ores in Gilpin County, but the value probably did not exceed \$10,000.

### **BARITE—Heavy Spar**

Barite, the sulphate of barium, ( $\text{BaSo}^4$ ), commonly known as heavy spar owing to its high specific gravity (4.3 — 4.6) occurs in Colorado as deposits in sandstone and limestone, as

nodules, in clay beds and as veins in the granitic rocks. It is also found as a gangue in many mineral deposits throughout the state.

Barite is used in the manufacture of paints, enamels, rubber, asbestos cement, poker chips and salts of barium; also in the tanning industry and as a sizing for paper and fabrics.

The Western Chemical Company and The Chemical Products Company, both of Denver, purchase and use barite, the latter company started manufacturing barite compounds about a year ago, and is now using large quantities in the production of barium carbonate ( $\text{BaCO}_3$ ), barium dioxide ( $\text{BaO}_2$ ), barium hydrate ( $\text{BaOH}_2$ ), barium nitrate ( $\text{BaNO}_3$ ) and barium chloride ( $\text{BaCl}_2$ ). This company also produces hydrogen peroxide, vanadic acid and the salts of radium of any strength.

The Western Chemical Company is the user of a small quantity of barite.

Most of the barite now mined in Colorado for use at the above named plants, comes from Boulder County, near Sunshine, or Fremont County, near Canon City, but a number of other deposits, which may prove to be of value, have been reported near Hartsel, in Park County; near Buena Vista, in Chaffee County; near Golden, in Jefferson County, and in several of the mines at Leadville, Lake County.

At present the price paid for good barite is about \$10 per ton, f. o. b. Denver, and there is in the neighborhood of 150 tons used monthly by the various concerns of the state.

## THE CLAY INDUSTRY

The clay industry of Colorado is rapidly becoming a valuable asset, and at present about 4,000 persons are employed in the mining, handling and manufacture of clay and its products.

Clay, which may be defined as a naturally occurring material, composed largely of kaolin, which is more or less plastic when wet, and which, when heated to redness or above, becomes permanently hard, is found in many parts of the state and is mined and used in the manufacture of fire, vitrified and common building brick, sewer pipe, various linings, tile, crucibles, pottery and plastic muds used for medicinal purposes. It has been demonstrated that the fire clay in the vicinity of Golden, in Jefferson County, is undoubtedly the most desirable clay of this character in the United States; it is relatively low in alumina and high in silica and does not fuse at temperatures up to  $1400^\circ$  centigrade.

The plastic clay of this locality, relatively high in alumina and low in silica, like the fire clay burns white and is in good demand for many uses. During the year 1916 nearly 100,000 tons of clay were produced in Jefferson County alone.



About the first of January, 1915, the management of the Harold China & Pottery Company, of Golden, Colorado, came into the hands of Adolph Coors, Jr., who, while lacking the slightest knowledge of ceramics, was aware of the need in the laboratories of this country of a good chemical porcelain to take the place of the "Made in Germany" ware, and with his knowledge of chemistry, indomitable will and the assistance of his Brother Herman, set about to develop a chemical porcelain which would subvert the shortage occasioned by the war conditions.

After many months spent in searching for, analyzing, modeling and burning clays of many kinds and from many sources, at the same time acquiring a knowledge of the trade, his efforts have succeeded to such a degree that a chemical porcelain is now made at Golden that is surpassed by none. Comparative tests made on this ware and Royal Berlin, which is the accepted standard of the world, show it to be superior in resistance to both acids and alkalies, while the resistance of the glaze to high temperatures and the stability of the ware when subjected to sudden and wide changes in temperatures, are equal in all respects to the German product.

The plant at Golden, which started with a force of four men less than two years ago, now has sixty-one on the pay-roll, and while manufacturing articles of some two hundred different sizes and shapes, is turning out the work at the rate of 5,000 pieces per day. Not only is all the standard porcelain laboratory equipment manufactured, but many special pieces for different uses throughout the country, especially of the porous ware used in filtration and electrolytic work.

The plant is being rapidly enlarged in an effort to supply the ever-increasing demand and the burning department now consists of four kilns, which are fired with coal. The grinding and mixing machinery is driven by individual motors, using electricity developed by the Jefferson County Light and Power Company.

Clay, to the average mine operator, means nothing and if opened in the mine workings, excepting it will assay in the metals, is passed and soon forgotten, although it may be valuable as clay.

Bulletin No. 8, of the Colorado State Geological Survey, covers this subject in a very comprehensive manner and may be profitably read by all mine operators not familiar with clays and their value, as such.

### **CUSTOM SMELTING AND MILLING**

The smelting plants of the American Smelting and Refining Company, at Denver, Pueblo and Leadville, and of the Ohio and Colorado Smelting and Refining Company at Salida have operated continuously for the entire biennial period upon an ever-increasing

supply of gold, silver, lead and copper-bearing custom ore. The United States Zinc Company at Blende, a subsidiary of the American Smelting and Refining Company, has worked to capacity in the reduction of zinc-bearing ores, which also carry values in gold, silver, lead and copper. The River Smelting and Refining Company at Florence, with a modification of the Bartlett Process, has started operations within the year and is now treating about 100 tons per day of the same character of ore as that handled by the United States Zinc Company.

The Western Zinc Oxide Company, which started a twenty-five ton daily capacity smelting plant at Leadville about two years ago, for the manufacture of a 75 per cent zinc oxide from the low grade zinc carbonate ores of the district, has doubled its capacity and may make a further increase within a short time. The large number of mills for the handling of custom ore, which have embarked in the business within the last few years, indicate that in the near future, instead of there being a small mill installed at the workings of each mine for the treatment of the low grade ore, the tonnage of a district or section will be consolidated and treated at one mill on a custom basis.

## DREDGING AND PLACER MINING

Dredging, wherever the depth and character of the gravel will permit, is gradually replacing other methods of placer mining, but when the gravel beds are shallow or the size and percentage of boulders too great, the older methods of ground sluicing or hydraulic mining are still in vogue; however, in determining the method best adapted for the economical working of any placer deposit, the factor governing is largely that of grade, i. e., the value of the gold contained in a cubic yard of the gravel.

The Tonopah Placer Company, operating three dredges in the Breckenridge district, employs about seventy men on the boats, on the surface and in the machine shops.

Dredge No. 1, which is one of the largest boats operating in this district and which is equipped with buckets of eight and a half cubic feet capacity, is digging gravel to a depth of sixty-five feet near the junction of the Swan and Blue Rivers.

Dredge No. 2, which is a counterpart of No. 1, is digging a depth of about thirty feet in the best grade gravel that is now being mined by this company. This dredge is located on the Swan River, about five miles from Dredge No. 1.

Dredge No. 3, which is a smaller boat and is equipped with buckets of five cubic feet capacity, is digging gravel about thirty feet deep in French Gulch close to Breckenridge.

The French Gulch Dredging Company is employing about fifteen men in the operation of a dredge, which is equipped with

buckets of five cubic feet capacity and which is digging gravel at a point opposite the Wellington Mill in French Gulch. The gravel bed at this point has an average thickness of about thirty feet and carries values higher than ordinary in the area mined this season.

The Derry Ranch Dredging Company during last year installed a dredge in the Arkansas Valley, at a point about twelve miles from Leadville, and has operated very successfully for the past two seasons. This boat, which is equipped with buckets of five and a half cubic feet capacity, is working gravel which has a thickness of about thirty feet.

These dredges, which are all located at an altitude of about 10,000 feet, operate for about nine months in the year and suspend digging during the severest part of the winter, when alterations and repairs are made.

The only hydraulic operations of any magnitude carried on in this state during the past two seasons are those at the head of Tarryall Creek in Park County.

The Fortune Placer Company started operating in the spring of 1912 and has worked every season since then with a force of from fifteen to twenty men. About 30,000 cubic feet of gravel are handled each season with the use of three Number 2 Giants, working under a pressure of from eighty to ninety-five pounds. The gravel now being handled has a thickness of from twelve to eighteen feet.

The Burnhart Placer was worked with a few men this season. A ditch and pipe line were completed and a pit started at a point a short distance above the pit of the Fortune Placer.

The Colorado Gold and Platinum Placer Mining Company has spent a large sum during the summer of 1916 in ditches and placer equipment on their property in the Hahn's Peak district, and is now ready to start actual mining as soon as the season of 1917 opens.

Several other minor placer operations in the state produced small quantities of gold during the biennial period.

## QUARRIES

In the vicinity of Salida there are a number of quarries from which is mined a very high grade monumental gray granite, while limestone is being mined in different parts of the state for use in sugar refining, manufacturing lime and as flux in smelting operations, and marble of excellent grade is being mined at Marble, Colorado.

The Federal Granite Company, nine miles east of Salida, is employing about four men in the quarry and about twenty-five men in the stone-dressing plant, which is located near the quarry. This company is supplying a growing demand from all parts of the United States.

The Salida Granite Company, with a quarry about nine miles northeast of Salida, is working about thirteen men in the quarry and about twenty men in the stone-dressing plant, which is located in the town of Salida.

The Majestic Granite, formerly known as the Standard Granite Company, is working about five men in a quarry northeast of Salida.

The Hathaway Quarry, in the same vicinity, gives employment to about four men.

The stone from the Majestic and Hathaway quarries is shipped in the rough, to be thus used or dressed elsewhere.

The Colorado Lime and Fluxing Company at Newitt, with a force of about forty-five men working by hand, is producing about 200 tons of limestone per day.

The Colorado Lime Rock Company at Thomasville, with about twenty men working with power drills, is producing daily about 200 tons of limestone. This company is operating a quarry at Garfield and also one at Ingleside, Colorado.

The Colorado Yule Marble Company, operating a large marble quarry about four miles from the town of Marble and a stone-dressing plant in the town, has, owing to the lack of demand for building material, employed only a small force of men. The usual force of from 500 to 1,000 men has been reduced to about 200 men, forty-five of which are employed at the quarry and the others are engaged in and around the stone-dressing plant and in the operation of the electric and steam railways used by this company in the transportation of the marble.

The Hugh Murphy Quarry at Lyons, is now operated by John Brodie with a crew of about sixty men, and is producing a red sandstone which is used as building stone, flag stone and crushed rock. Most of the output of this quarry is shipped to eastern cities.

The quarries in the vicinity of Ft. Collins have been idle a greater part of this biennial period, but the Josephson Quarry has made a few shipments of building sandstone.



The Colorado Fuel & Iron Company is operating a limestone quarry at Lime, Colorado, in Pueblo County, with a crew of 120 men, and another at Calcite, with a crew of 52 men. This limestone is shipped to the steel works in Pueblo.

D. Gillespie is now operating the quarry at Stone City, formerly known as Turkey Creek. From this quarry is taken the white sandstone used in building the City Hall of Pueblo.

In Fremont County there are a number of silica quarries, two of which are operated by E. Frankenberg, while a third is operated by the Ganister Mining Company with a force of six men. The product of these quarries is hauled to the railroad in wagons and shipped to the steel works in Pueblo.

The Diamond Fire Brick Company operates two silica quarries, the product of which, together with the product of two clay mines worked by this company, is used in the manufacture of brick at a plant in Canon City. The company employs about eighty men.

The Colorado Portland Cement Company at Portland, is quarrying both shale and limestone for manufacturing cement. About 140 men are employed in the quarries and cement plant, which has a capacity of 1,000 tons per day.

The United States Portland Cement Company at Concrete, employs about fifty men in quarry and plant, which has a capacity of 260 tons per day.

Other small quarrying operations are carried on in different parts of the state.

## **THE MINERAL COLLECTIONS OF THE STATE BUREAU OF MINES**

The collection originated through the efforts of the various Exposition Commissions, material having been assembled by them to illustrate at the various fairs the mineral resources of Colorado. Ultimately these collections were turned over to the Bureau of Mines. With this material as a basis, the exhibit was further enlarged by the purchase of the Elsner collection and by gifts from various mining men, until at the time of writing, the number of specimens totals about 20,000. Until March, 1916, the collection was housed in the basement of the State Capitol, when it was removed to the second floor of the State Museum Building. Since then it has been completely reclassified and cataloged, the catalog being cross-indexed to number, locality and donor. When this work is finally complete, information concerning any specimen will be almost instantly obtainable. Furthermore, as each specimen is registered, there will be no danger of loss.



Since the reclassification of the material has been in progress, the collection has found a very much increased use. In the first place, the Bureau has been able to supply definite information concerning the types of ore in certain mines. "Have you any specimens from such and such a mine?" is one of the most frequent questions asked. Furthermore, there are many requests from localities for certain types of material which can often be answered only by specimens. It is much more convincing for the buyer to see a sample than simply to hear of it. Another large class of inquiries are for specimens from mines which are at present under water, or for some other reason are inaccessible; and from which all other specimens have been lost. Thus the transaction of important mining business has often depended upon the specimens in the museum. A third class of inquiries are those from dealers in mineral specimens. It happens all too frequently that fine material which would bring high prices from dealers is sold to the smelter for a nominal sum; this is particularly true of fine crystals of almost any kind. As an advertising feature the collection is also important; about 50,000 people a year look over the exhibits. A large part of this number are prompted by idle curiosity, but there is always a small percentage who are interested from a more vital standpoint.

The collection has also a large educational value. In the first place it helps to remove, in some small way, the ignorance with which the layman regards mining and minerals. To see the importance of this phase, one has but to remember that large quantities of lead carbonate went over the dumps as "Dennison's Glue" in the early days at Leadville.

Of the one thousand (approximate) known species of minerals, the exhibit cases contain about three hundred, including all the more common varieties, which number will probably be doubled by the end of the present biennial period.

Many of the county cases contain a large proportion of material which represents conditions of twenty years ago, while the ores of the present day are altogether lacking.

For these reasons we bespeak the co-operation of the mining men of our state in obtaining representatives of a larger number of species, and increasing the quantity and quality of those we already have. We are at all times glad to receive and care for any specimens sent us, and are especially glad to get well crystallized material.

## MINING LAWS

In February, 1916, this department issued Bulletin No. 7, a compilation of the Federal and State Mining Laws, Mine Rules and Regulations Appended. Since no appropriation was made for this purpose, it has been necessary to make a nominal charge of 50 cents for this bulletin, which, upon application, will be mailed post paid.

# Review of District No. 1

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By THOMAS DUNSTONE, Inspector

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## BOULDER COUNTY

The years 1915-16 showed more activity in the mining districts of Boulder County than any other period in the history of the county. The average production of precious, base and rare minerals for a prior decade aggregated in value a little over \$700,000.00 annually as against a valuation of \$2,042,979 in 1915 and approximately \$5,500,000 in 1916.

While the greater part of this increase came from the tungsten mines, the output of gold, silver, copper and lead-bearing ores showed a substantial improvement over the preceding years and a general revival of mining activity was common to all of the districts. The high prices for tungsten ores which prevailed during the early months of 1916, resulted in a veritable mining boom throughout the county, comparable to the excitement which followed the discovery of precious metals at Leadville, Creede and Cripple Creek in early days.

A marked change in milling conditions took place during this period. Prior to 1915 many idle mills were located throughout the districts, but with the increased activity in the tungsten field, most of them were dismantled and removed to the mines or converted into concentrating plants for the reduction of tungsten ores. Early in 1916, oil flotation was first introduced into the county and is reported to be successfully employed in extracting silver values from ores mined near Caribou.

In 1916 high grade molybdenite was found in the old workings of the Mountain Lion Mine at Magnolia and small shipments were made during the year. More or less regular shipments of fluorspar were made during the biennial period from Jamestown to the Colorado Fuel & Iron Company at Pueblo. Barite was mined near Sunshine in considerable quantities during 1916. Kaolin and pottery clays were mined near Boulder and extensive exposures of shales along the foot-hills were largely utilized for the manufacture of high-grade pressed brick at Boulder, Longmont and Lyons and a considerable output of structural stone and flagging was made from the sandstone quarries at Lyons.

During the period under review, the Grand Island Mining District, the largest in the county, and comprising the greater part of the tungsten field, easily led in mining activity as well as output.

The Primos Mining and Milling Company was one of the largest operators in the tungsten district and with subsidiary companies in the Sugar Loaf and Magnolia Districts, furnished employment, including lessees, to several hundred men. During the early part of 1916, approximately 1,000 men were working on the properties of this company. Two concentrating mills are operated, one at Lakewood, which does more or less custom work and is connected with the various mines in this vicinity by a surface tramway, and the other in the Magnolia district, on South Boulder Creek, near the mines recently opened up in this section.

The Wolf Tongue Mining Company was another extensive operator in the Nederland District, where its concentrating plant for the reduction of tungsten ore is located. The company has large holdings and operates chiefly on a participating leasing system and a large number of men are constantly employed. The company is also a heavy buyer of custom ore.

During 1915, the Vasco Mining Company acquired a 160-acre tract, which was extensively developed by the company and leasers. A concentrating mill was built at Ferberite to treat the ore from this property and a second milling plant acquired at Boulder, chiefly to treat custom ores, of which the company is a large purchaser.

The Boulder Tungsten Production Company during 1915-16 actively developed its mines. A 50-ton milling plant was constructed at Ferberite, near the portal of a tunnel which was driven to cut its properties at great depth. The mill is also operated as a custom plant.

On Beaver Creek, the Long Chance Mining and Milling Company acquired a group of claims and an old mill, which was remodeled and the properties operated with a small crew during 1916.

The Tungsten Mines Company operated a mill on Beaver Creek, to treat tungsten ore mined from a group of seventeen claims owned by the company. A good production was made during the past year.

Near here the Tungsten Mountain Mines Company employed a small force during 1916 in driving a tunnel to develop its property. The company owns a large acreage.

The "Rogers Patent," comprising a large tract in the tungsten district, was extensively operated by leasers during the early months of 1916 and the Clarsdorf Mill, located on the property, was remodeled and operated by the owners for some time on ore taken out by the lessees.

At Boulder Falls, the Luckie 2 Mining Company installed new equipment and extensively developed its property from a tunnel driven from the county road. A concentrating mill for treating the tungsten ores from its mines, as well as custom ore, was built at Boulder, and here a subsidiary company constructed and operated a reduction plant for converting the product of the mill to ferro-tungsten.

A short distance above Boulder Falls, the Mojave-Boulder Tungsten Mines Company, in May, 1916, acquired the April Fool Group, installed a hoisting and compressor plant, and operated the property with a force of about forty men during the remainder of the year.

The Eagle Rock Mining & Milling Company during the summer of 1915 took over the old Eagle Rock Mill and an adjoining group of claims, remodeled the plant, and operated the mine with a large force until the rapid decline in the price of tungsten involved the company, and it was forced to suspend operations.

Early in 1916, the Lord Byron Mining & Milling Company remodeled the old Livingston Mill on North Boulder Creek. Operations were continued with a small force until late in the year on ore taken from the Lord Byron, which had been taken over by this company.

At Wheelman, the Tungsten Metals Corporation made substantial improvements on the Red Signe Group. The surface plant was enlarged, and a concentrating mill was constructed near the portal of the tunnel for reducing the tungsten ore mined from the property.

On North Boulder Creek, near Carrie Nation Park, the Colorado Tungsten Mines Company operated a custom mill for reducing tungsten ore; a small force of leasers were employed in its mines.

The Francis Mitchell Mining Company operated a tungsten property on North Boulder Creek, employing a small force during the year. The ore was sold to custom mills.

Near Sugar Loaf, the Mazda Tungsten Mining Company, with a force of five men, operated a property the greater part of 1916. A good surface plant was installed and work confined principally to development.

During 1915, the Degge-Clark Tungsten Mining, Milling & Reduction Company took over the old Coburn Mill, located six miles above Boulder, and converted it into a 50-ton custom mill



for the reduction of tungsten ores. The company acquired and operated by leasers a large tract on Beaver Creek.

In addition to the foregoing, tungsten mining was extensively carried on by leasers and small operators, employing from two to ten or more men. The work was intermittent and reached a maximum during the early months of 1916, declining with the rapid fall in the price of tungsten, and increasing again with the steady market which prevailed during the latter part of the year.

The old Caribou Mine at Caribou was taken over by the Caribou Mines & Mills Company early in 1915. The oil flotation process was installed in the mill for treating dump ores and stope filling carrying major values in silver. The mine was unwatered to the 1,000-level, and sinking resumed to open up new ore bodies. About fifty men were employed on the property.

The Up-To-Date Mining Company, located about three miles west of Caribou, was continuously operated during 1915-16, producing a good grade of silver-lead ores.

Early in 1916, the Allgrove Mining & Milling Company took over on a lease the Alton Mill and tunnel. The tunnel was extended to connect with the Pine Grove workings owned by this company, and the oil flotation process installed in the mill to recover values from gold, silver and lead-bearing ores.

The Sugar Loaf District during 1915-1916 witnessed the most active period in its history. In addition to tungsten mining, the precious metal output was greater than for many years.

The United States Gold Corporation during 1915, completed the installation of a roaster in their cyanide mill, and since then have continuously operated their mines and mill. This company, in 1916, was the largest producer of gold ores in the county.

In August, 1916, The Hearne-Withrow Mines Company, Inc., took over the Herald Group; a surface plant was installed and a hundred foot lift sunk in the shaft. Promising values are reported on the new level.

The Yellow Pine Mines & Reduction Company took over the Yellow Pine Mine during 1915. Operations were continued under the leasing system and about 50 men were employed. The ore minerals are silver and copper, principally the former, and

During the biennial period, especially while the high price for tungsten prevailed, there was much activity throughout the Gold Hill District in search for pay values in tungsten ores. This

ore, principally in the form of hubnerite, was quite common in various parts of the district, but usually occurred with other minerals. The problem of profitably separating the minerals is still being worked out in various parts of the district. In mining for precious metals, operations were conducted, in the main, by small groups of leasers.

The Gold Hill Concentrating Company during the summer of 1916, took over on a lease the old Slide Dump at Rowena. A 50-ton oil flotation plant was constructed on the ground and the initial try-out was made during the close of the year.

During the greater part of 1916, The Illinois Mining Company operated its mine and mill near Rowena. The values were gold and silver and concentration was employed in the mill.

At Copper Rock, The Moore Mining, Milling & Development Company has for the past two years, developed its property. A small force of men was employed.

Near Summerville, the Universal Refractory Ore Treatment Company took over the Little Fred mine and mill early in 1916. The mill was remodeled and the mine developed throughout the year. Initial operation of the mill commenced late in the year.

At Salina the Fairfax Group was operated by the Fairfax Mining Company with a small force of miners during the greater part of the year. Shipments of a fair grade of ore were made more or less regularly.

Late in the year the Nil Desperandum Mines Company acquired a group of claims near Sunshine, which it operated through a tunnel, shipping the ore to the Boulder sampler.

The Ward District enjoyed great activity during the tungsten boom, induced by mining for tungsten ores, which, in this district are found associated with the sulphides carrying gold and silver values. With the decline in the price of tungsten it was no longer profitable to separate these ores, and tungsten mining practically ceased in the district. Operations at the end of the year were confined to mining for gold, silver, lead and copper ores.

The White Raven Mine, during the biennial period, ranked as the leading producer of silver-lead ores in the county. The mine is worked continuously and the ore shipped to the Denver smelters for treatment.

The property of The Golden Queen Mining Company was operated under a lease during 1916, with satisfactory results to the leasers. The ore minerals are gold, silver and copper.

During 1915 the New Market Mine was operated by The Shirk Mining Company, and the work was chiefly in the way of development.

A small force of leasers were employed on the properties of the Big Five Mining Company.

The Central District is outside of the tungsten-bearing area and operations are confined to mining for gold, lead and copper bearing ores, together with fluorspar, which is shipped in considerable quantities from mines near Jamestown.

The Alice Mine, owned by The Fluorite Mining Company, but operated by leasers, was worked continuously during 1915-1916, producing a good grade of silver-lead ores. About ten men were employed. The ore is hauled to Boulder, a distance of 14 miles, and shipped to the Denver smelter.

In the Magnolia District the Keystone Mining and Reduction Company took over the old Keystone Mine and constructed a mill, which they will place in commission within a short time.

### **CLEAR CREEK COUNTY**

Clear Creek County, during the year of 1915, made a gain in gross production of \$239,610 over the year of 1914. While the production shows an increase in all the metals, the greatest is in the copper, lead and zinc. This is attributed to the opening up and working some of the old mines in the Silver Plume and Argentine sections.

In former years, the mines in this section were worked for silver, with lead and zinc as a secondary consideration, but since the advance in the price of the latter, the old mines have been reopened, and the so-called low grade ore at that time is now mined at a good profit.

The lower Clear Creek County around the Idaho Springs section, comprising the Jackson, Virginia and Corral Districts, had a period of successful mining during the years of 1915 and 1916. The Argo or Newhouse Tunnel, the portal of which is situated within the city limits of Idaho Springs, passes through the Jackson and Virginia Districts of Clear Creek County into the Russell, Quartz Mountain and Eureka Districts of Gilpin County to the Gunnell Vein. An upraise was made at this point to connect with a shaft, making an opening of 1,400 feet in length to the surface, which gives a natural circulation of air and another exit. The producing mines worked from the tunnel in



Clear Creek County, are the Gem, Seaton, Golden Edge and the Sun and Moon; in Gilpin County are the Gunnell, Prize, Burroughs, Kansas and Pozo. The total length of the tunnel is a little over 4 miles.

The Gem Mine, which is one of the largest producers of ore in the tunnel, is worked entirely on the tribute or leasing system. It is connected with the surface by a double skip shaft through which the ore is lowered to the tunnel level, transported through the tunnel and shipped to the Newton Mill, which is owned by the Gem Company. The hoist and air compressor, driven by electricity, are on the surface.

The Seaton Mine was reopened in the early part of 1916 and has developed into a regular producer.

The Golden Edge has been one of the large producers through the tunnel. The workings consist of a 200-foot winze below the tunnel level and an upraise of 300 feet on the west side. Drifting and stoping are carried on in both places.

The Sun & Moon, which has been one of the large producers, has an upraise connecting the tunnel with the surface workings. There has been but little work done lately on this lode, but it is reported that work will soon be resumed.

Some years ago The Argo Reduction and Ore Purchasing Company erected a 60-ton concentrating mill near the portal of the tunnel. The tailings were treated with cyanide until 1915, when the management equipped one unit of the mill with the flotation process, which proved a success and at present another cyanide unit is being replaced with flotation, the regular table concentration being used as before. The mill has in construction an up-to-date sampler where all ores treated are sampled and purchased on their assay value.

The Big Five or Central Tunnel, situated in the Jackson District in the west end of Idaho Springs, is headed for the same territory as the Argo Tunnel and has been driven during the past year 403 feet, and now has a total length of 9,456 feet. It is now within a few feet of the Gilpin County line and is to be continued some 4,000 feet to connect with the Old Town shaft in Gilpin County. A majority of the veins cut are owned by the Tunnel Company and are leased out in blocks. All ores mined are shipped to the local mills and sampler. At the portal of the tunnel, a fire-proof engine house has been erected and an electric driven air compressor installed. The hauling is done by the storage battery system, which is proving very satisfactory.

The Lake Vein, which is leased in blocks to separate firms, has been one of the largest producers in the tunnel. This vein is the same as the Frontenac Vein in Gilpin County and a lateral has been driven east over 2,000 feet with the intention of connecting with the Frontenac shaft. Two winzes have been sunk below the tunnel level, one of which is two hundred and the other one hundred feet deep, and both have made a very creditable production. From the bottom of the 200-foot winze to the surface it is 2,500 feet.

The Edgar Vein has, at present, five sets of lessees at work on the vein, who make a steady production. The Boston Leasing Company has a winze 150 feet below the tunnel level and has opened up a continuous vein of ore. A lateral has been driven east on this vein 1,500 feet and west 500 feet, through continuous ore bodies.

Late in 1916 a company was organized on the Fulton Lode, which is now engaged in driving a lateral west of the tunnel. The Fulton Lode was one of the early producers of the County and the company now operating expects to put it on the list of producing mines again in the near future.

In the Argentine district the Santiago has had a force employed in developing the mine and stoping on the different levels. The mine is developed by several tunnels on the vein and has been a steady producer of good grade ore. The lower level is a cross-cut 1,200 feet long driven north into the mountain intersecting the vein, where levels are driven east and west. A winze in the east drift is down 175 feet, with drifts running east and west from it.

The Wilcox Tunnel, from which the Waldorf lode is worked, was one of the large producers of this district in 1915, but has not produced as heavily in 1916. The mine is equipped with a concentrating and cyanide mill, situated on the line of the Argentine Central Railroad.

The Josephine Mine on the north slope of Mt. McClelland, has been worked steadily during the past two years. A concentrator of the jig and slime table type has been lately built.

The Silver Plume Section will show an increase, both in tonnage and values, greater than any other district in the county, for such producers as the Smuggler, Seven-thirty, Mendota and Terrible, have all been very active during the past two years. This section is equipped with mills suitable to treat its lead and zinc ores.

In the Georgetown section, owing to the higher prices paid for the metals, there has been a marked increase in the tonnage. The Capital Mine has been very active and some shipments of the rich ore have been made. This mine is worked entirely by lessees who lease blocks of a certain number of feet. At the portal of the tunnel is a concentrator to treat the ore. The Capital Mining & Tunnel Company is now engaged in sinking a 200-foot shaft to connect with a 600-foot upraise from the tunnel which will give a natural circulation of air and form a second means of exit.

The Onandago, which is the eastern end of the Capital vein and one of the producers of this section, is worked through the Capital Tunnel, all work being done by a company. Stopping is now done from drifts from upraises made from the tunnel.

The Mineral Chief, situated on Democrat Mountain, has been a steady producer of lead and zinc ores. This mine is developed with drifts on the veins at intervals of 100 feet. It is equipped with a concentrator of the jig and table type.

The Equator, Colorado Central, Centennial and several other old mines that were great producers of silver ore in former years, are being cleaned out and retimbered in preparation for again becoming regular producers.

The Downieville District has improved during the past two years. The Little Giant G. M. & M. Co. has taken hold of the Commodore Tunnel and is at present developing the White Vein. The Joe Reynolds and Climax properties have added to the production of this district during the biennial period.

In the Dumont Section, the Silver King property, which consists of six claims that are cut by an 800-foot cross-cut tunnel, is being developed.

A 40-ton amalgamation and concentration mill to treat the large bodies of low-grade ores that have been opened, is now being completed.

The McClelland Tunnel was taken over by the United Freeland T. & D. Co. early in 1916. This tunnel intersects the Freeland Vein 7,400 feet from the portal and it is the intention of the company to upraise and drain the old workings of the Freeland Mine. This upraise will be used to lower the ore to the tunnel level.

In the Freeland District, the Oneida Stag, New Era, and Gum Tree have been steady producers of ore. The Oneida Stag has a concentration and flotation mill while the New Era has a straight concentration mill.



In the Fall River section the Standard Development Syndicate, operating through a 1,350-foot tunnel, has made quite a production in the past two years. The surface improvements consist of an 80-ton concentrating mill and an air compressor plant which are situated 500 feet south of the portal of the tunnel.

In the Chicago Creek District the Little Mattie Mine has been operated continuously and a 50-ton mill has been kept working 8 hours per day on ore from the mine.

### GILPIN COUNTY

It was in Gilpin County (July, 1859), where the first lode claim in Colorado was discovered and the mines there have been in continuous operation since.

During 1915 and 1916 the county in general was more active than for several years past with more mines starting up and more attention paid to unwatering the deep mines. The discovery of tungsten caused a great deal of activity throughout the northern end of the county, from two miles north of the town of Black Hawk to the Boulder County line.

The Russell District has been more active than any other in the county. In the lower Russell District the East Nottaway, Pittsburg, Pittsburg Extension, Vivian, Nottaway, Hampton, Silver Dollar, Powers, West Nottaway and Chase Mines, are all steady producers. The Two-Forty Mine has lately added flotation to its concentrating mill and is now unwatering the mine.

The Frontenac is operated by a home pool and is making steady shipments to the mills and smelters.

In the upper Russell District some of the larger mines have closed down owing to litigation, while several new mines have resumed operations within the past two years.

The Lake District has been quite active during the past two years. Several new mines started up which are developing, and from the showings will soon be regular producers.

The main workings on the Gunnell vein are below the level of the Argo Tunnel and consist of a winze 200 feet deep with levels east and west at 100 and 200 feet. A connection from surface to tunnel level contains an electric cable carrying 10,000 volts, which, transformed to a lower voltage, operates the hoisting machinery of the several operators. All ores are transported through the tunnel and treated at the Argo Mill.

In the Nevada District the Prize Mine has unwatered and retimbered the shaft with the intention of connecting with an up-

raise in the Argo Tunnel. The Burroughs, Pozo and Kansas properties are being operated through the Argo Tunnel and are making a steady production. The Oronoko and Hawkeye have installed machinery and are now unwatering and retimbering their mines.

In the Enterprise District the Running Lode Mine has been taken over by the Gilpado Mining Co., which is now overhauling the machinery with a view of unwatering the property.

The Four Mile Mining & Tunnel Co. owns forty claims in this district and is expected to become a regular producer soon.

The Independence District has taken on quite a little activity during the past two years. The Smuggler Mine is keeping the mill going steadily. The Jumbo and Seabird have been developing their properties and expect to build mills at the mines this coming year.

The Quartz Mountain District has been a great producer of uranium ore in the form of pitchblende. The Colorado Gilpin Gold & Radium Co. has been working the Wood, German Belcher, and Ethan Allen Mines for pitchblende and sulphide ore, which is treated at the local mills. The Quartz Mill Mine has become a producer of pitchblende as well as a good grade of gold and silver ore.

The Gregory District has not been as active as usual owing to the Fifty Gold Mines Corporation suspending operations and allowing the water to raise, which affected the smaller mines. The Colorado Carr and Sayre Bates are still making a steady production.

The Pine District has shown more activity the past year than for some time. The Evergreen Mine has opened a large deposit of bornite ore of milling grade. Flotation has been installed in the mill and is making satisfactory saving.

A good vein of sulphide from which enough ore to keep the mill going is mined, has lately been opened in the Pioneer Tunnel.

The Penn. Colo. M. & T. Co. has been doing a great deal of development and is now building a mill at the portal of the tunnel.

Michigan Hill was the scene of much excitement during the past year owing to the discovery of tungsten. Several tons of ore were shipped to the Rare Metals Mill at Rollinsville for concentration. Litigation is now pending and all work has been

suspended. The Reform Group of Mines in Silver Creek has just completed a 20-ton mill of the amalgamation and concentration type. The development of the mine consists of a 200-foot tunnel on the vein.

The custom mills of the county have been kept going. The Iron City Mill situated within the city limits of Black Hawk has a daily capacity of 75 tons and has been run steadily with three shifts. The mill consists of jig, Card Table and Diester Slimer concentration.

The Smith Mill, 30-ton capacity, situated within the city limits of Central City and consists of the amalgamation and concentration, burned down in the early part of December, 1916, but is to be rebuilt as soon as possible.

The Polar Star Mill, which is in the city of Black Hawk, is one of the old style Gilpin County mills. This mill has worked at intervals on the free milling ores of the county and consists of amalgamation and bumping tables.

The American Metals Producing Company, whose plant is situated in Black Hawk, has confined its operations principally to the separation of lead, zinc and iron ores. It is the intention of the company to recover at the plant gold, silver, lead and zinc, and to make by-products of sulphur dioxide and ferric oxide.

The Rare Metals Ore Company has within the last year completed the building of a 75-ton concentrating mill to treat the tungsten ores of the northern end of the county. The mill is situated near the town of Rollinsville, on the line of the Denver & Salt Lake Railroad, and has been in operation for the past six months, making a good saving.

## GRAND COUNTY

There has been considerable prospecting done throughout Grand County; important strikes at the head of Strawberry Creek and the head of the North Fork of the Grand River were reported.

At the head of the Williams Fork near the line of Clear Creek County, a great deal of prospecting has been done and some promising lodes opened, but this section, like all other sections of Grand County where the lode claims have been discovered, is so far from the railroad and smelters that very little development work has been done.

## MOFFAT COUNTY

Moffat County, whose mineral zones are situated a considerable distance from the railroad, has made few ore shipments,

owing to the high cost of transportation. The mineralized zone is situated on the extreme western border of the county on the boundary line of Utah, about 80 miles from the railroad at Craig. Very promising lead, zinc and copper lodes have been discovered in the Blue Mountain District, which have been developed to some extent. The Douglas Mountain District, situated in the north-western corner of the county near the lines of Wyoming and Utah, has long been known as a copper-producing district. Extensive work has been done on some of the claims and some very high grade copper produced, but owing to the long haul, work on them has been suspended. A great deal of prospecting and assessment work is being done in expectation of the completion of the Denver, Salt Lake & Western Railroad to Utah, which, when completed, will put a majority of the claims within 20 miles of the railroad.

## ROUTT COUNTY

Routt County is generally known as an agricultural and coal-producing county. The mineral-bearing zone is remote from the railroads and smelters, therefore, little work has been done to develop the known lodes. However, the building of a railroad through this part of the state is contemplated.

In the Hahn's Peak District The Royal Flush Mining Company has lately completed a 460-foot upraise connecting the lower or adit level with the upper workings and has opened up a vein of ore of a good value. The mine is equipped with a mill near the adit level, which is now undergoing repairs and when completed will increase the production.

The Colorado Gold and Platinum Placer Company completed the flume late in 1916 and started some placer mining, and is now in condition to make a creditable showing next year.

The Slavonia District, situated at the head of Elk River, has had little attention from mining men owing to its location, but on my visit to this section I was impressed with the vast amount of mineral and the well defined veins, which, with the completion of a railroad through this section, may become producers.

The Fall River Mining Company has let a contract to drive a cross-cut to a vein, which is reported to carry a high grade silver, lead and zinc ore.

The Yarmony District, situated on Yarmony Creek, has, within the past two years, become a regular producer. The Copper King Mining Company decided to build a plant close to the mine and has lately completed a 30-ton mill which recovers the



copper in the ore by leaching with sulphuric acid and electrical precipitation. Shipments of a good grade electrolytic copper have been made.

Analysis of a sample taken from a discovery of mineral on Tow Creek at a point 18 miles from Steamboat Springs and six miles from the railroad, is reported to have shown it to be a good grade asphalt.

The mine operators of District No. 1 have willingly and cheerfully complied with the safety recommendations, both verbal and written, which have been made during the mine inspections, and have rendered all possible assistance in making the inspections thorough and effective.

The Workmen's Compensation Law has been of assistance in having safety devices installed and, generally speaking, has given satisfaction to both employer and employee.

# Review of District No. 2

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By M. J. McCARTHY, Inspector

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District No. 2, during 1915-1916, has shown considerable increase in mining operations. Though it lacks the base metals found in other districts, the high price of which caused so much activity throughout the state, the extremely rich ore found at great depth in several of the mines at Cripple Creek, especially in the Cresson, stimulated operations to a marked degree and the production during the biennial period was greater than that of the preceding period.

## TELLER COUNTY

The Acacia Gold Mining Company reports development since January 1st, 1915, as follows:

Early in January the South Burns Shaft was completed to a depth of 1,250 feet, the last lift being 150 feet. A cross-cut of 30 feet reached the American Eagle's vein, which has been drifted on 300 feet, and about 200 feet of ore opened up and most of it stoped out. This vein had little ore on the 11th level, but the best ore in the mine was in the first 30 feet below the 11th level. The ore stopes on the 12th level extended upwards from 60 to 100 feet, but none of them connected with the ore shoots under the 11th level.

During the year 1916 a winze was sunk 100 feet to the 13th level, making the mine now 1,350 feet deep. A drift has been run on the vein on the 13th level for about 80 feet, 60 feet of it being in ore. Stopes are being started on this level. About 255 feet of drifting was done on the 11th level, but no ore found. About 100 feet of drifting on the 10th level and a 60-foot stope taken out about 40 feet high. 300 feet of drifting was done on the 2nd level, but no ore found.

The Granite Gold Mining Company is one of the steadiest producers of the district. The company is having success on the lowest level which is 1,600 feet in the Dillon shaft. The ore shoots on this level are about 300 feet in length on both the Montana and Bob Tail veins, and extend below the 1,600-foot level, with every indication that the ore will continue to greater depth.

The company is employing about 200 men, including several sets of leasers, some of whom are operating with success through the Gold Coin and Dead Pine shafts.

In the last two years, the Dillon shaft has been sunk 200 feet, new electric hoisting equipment has been installed and a new ore house built.—A cross-cut on the 1,600-foot level of the Dillion shaft has been started to cut the Mohican vein where the company expects to find a larger ore shoot with better values than those which are now being operated on the Bob Tail and Montana veins. The production per month from these two veins averages about 1,500 tons, which does not include that produced by leasers.

Hahnewald & Company, who recently purchased the E. S. Gibbs and Theodore Leland Lease and option, on the Queen Bess on Tenderfoot Hill, are still developing the property on the 700-foot level of the Mollie Kathleen. The Queen Bess shaft is to be connected with the 700-foot level of the Mollie Kathleen. \$30,000.00 was paid to Gibbs and Leland for this lease and are to pay \$17,500.00, which is the option price to C. L. Tutt, of Colorado Springs, the owner of the Queen Bess claim. This strike was made in May, 1916, and 500 tons of ore averaging about \$50.00 per ton has been shipped.

The Shoo Fly, on Womaek Hill, is owned by the Stratton Estate, and operated under lease by Alex Hickman, who, in October, 1916, discovered an ore shoot on the surface and followed the same to a depth of 181 feet. Up to date he has, with 4 men employed, shipped 1,200 tons of ore averaging \$40.00 per ton.

The Roosevelt Deep Drainage Tunnel has reached a length of 21,630 feet and from the portal to Elkton shaft, 19,620 feet. The distance yet to be driven from the breast to its objective—the Golden Cycle shaft—is 5,679 feet.

Depth of the El Paso shaft to the tunnel level, 1,289 feet.

Depth of the Elkton shaft to the tunnel level, 1,640 feet.

Depth of the Cresson shaft to the tunnel level, 1,930 feet.

Depth of the Dexter shaft to the tunnel level, 2,185 feet.

Depth of the Blue Bird shaft to the tunnel level, 2,297 feet.

Depth of the Dillon shaft to the tunnel level, 1,818 feet.

Depth of the Strong shaft to the tunnel level, 1,656 feet.

Depth of the Portland No. 2 shaft to the tunnel level, 2,144 feet.

Depth of the Modoc New shaft to the tunnel level, 2,080 feet.

Depth of the Isabella Lee shaft to the tunnel level, 2,360 feet.

Depth of the Vindicator shaft to the tunnel level, 2,109 feet.

Depth of the Golden Cycle shaft to the tunnel level, 1,966 feet.

This tunnel is now entering the most productive area of the Cripple Creek District and developments will be followed with the keenest interest.

The Portland Gold Mining Company has, during the last two years, sunk Shaft No. 2 two hundred and four feet deeper, opened and partially developed the 1,800- and 1,900-foot levels. The ore measures on these levels show the same strength and continuity as in the levels above this, giving encouragement for deeper mining. At least 40 per cent of the 3,500 feet driven on the 1,800-foot level is in ore, while the 1,100 feet of development done on the 1,900-foot level is practically all in ore. In July of 1915, the entire property of the Stratton's Independence Limited was taken over and will henceforth be operated in conjunction with the Portland Mine. This company, which employs 380 men in the mines, not including about 100 men employed by lessees, has adopted stringent regulations and installed many safety appliances for the protection of the men. The change-room and other conveniences provided for the comfort of the employees are not excelled by those of any other company operating in the state. This company is now operating the Custom Cyanide Mill at Colorado City, the Portland Cyanide Mill at Victor, and is rebuilding the Independence Mill at Victor, which will be of 1,250 tons daily capacity and will be of the same general type as the Portland Mill near by, i. e., combination concentration and cyaniding. The Portland Mill at Victor is of 650 tons daily capacity and is now starting its seventh year of continuous operation and has in that time treated 1,123,316 tons of ore, with a gold recovery of \$2,655,449.00. The recovery in gold of the Portland and Independence Mills at Victor, combined, when the latter is completed and put in operation, will amount to over one million dollars annually and the two plants will give employment to about one hundred men.

The Cresson Consolidated Gold Mining and Milling Company, owner of The Cresson Mine located near the head of Eclipse Gulch, has made an excellent showing in the past two years, and the present condition of the mine is very good as is shown in the following report:

Under date of October 30th, 1916, the Consulting Engineer, Mr. Noble, reported to the Directors of the Company that net profits on ore reserves as of September 30th amounts to \$4,178,124, compared with \$4,162,157 on September 1st. Therefore, development has added to the ore in sight not only the amount extracted during September, but \$15,968.00 additional. During the month the ore shipped yielded a profit of \$167,950.68. The Company has cash in bank today amounting to \$1,177,648.89, and in addition, about 80 cars of ore in transit and at the mill of an estimated net value of \$75,000.00.

Development during October has disclosed high grade ore on both the 13th and 14th levels and from the bottom of a winze, 125 feet below the 15th level, a cross-cut has been driven 80 feet intersecting an ore body 80 feet in width, 40 feet having a value of



from \$7.00 to \$12.00, and 40 feet \$18.00 a ton, none of which is included in the reserves reported above. The shaft is being sunk another lift and a drift will be driven to cut the ore body at the bottom of the winze from the 15th level. The shaft has been sunk a depth of 141 feet since April, 1915, and when this lift is completed will have a total depth of 1,771 feet. This company employs 150 men.

The Mary McKinney Mining Company, during 1915, produced 6,263 tons of ore on company account and 5,145 tons of ore on lease account. This, less the expense of mining, made the company a net profit of \$27,516.96. During the year 1915, electric power was installed throughout, thus reducing operating expenses materially. 2,959 feet of development work was done on Company account and 1,980 feet of work was done by lessees. In 1916, there was 4,864 feet of development work done by the company and 692 feet by lessees. In 1915, owing to the delay caused by the installation of the new machinery and the large amount of development work done, no dividends were paid. The year 1916 was much more prosperous, but the figures will not be available for some time.

The Eagle Ore Company, located on Battle Mountain, employs about thirty-five men in its regular operations. The Manager, Mr. A. W. Oliver, reports that they have had a very good year, having handled something over one hundred thousand tons of ore, averaging better than \$30.00 per ton. While there has been no increase over the tonnage handled in previous years, the grade of the ore at this plant has been of better grade and the company is very optimistic for the coming year. The Eagle Ore Company has recently purchased the property and business of the Copeland Ore Sampling Company. Both plants will be run for a limited time, when the Eagle Plant will be dismantled and the Copeland plant will handle the business on account of its superior railroad facilities.

The Strong Gold Mining Company was one of the early producers of the district; the shaft is 1,450 feet deep and at this time the lowest level is being developed with a system of drifts and cross-cuts. 48 men are employed. This company and its employees have adopted a co-operative accident insurance system. The assessments are very reasonable, as but few accidents occur.

The United Gold Mines Company, owning the Deadwood, Damon, W. P. H., May B and Wild Horse groups of claims, also controlling the Requa Gold and Silver Mining and Milling Company (Trail property), together with other claims, has one of the largest acreage holdings in the Cripple Creek District. The following report reflects the progress of the Company during the past two years:



The Wild Horse Group, on the north slope of Bull Hill, is developed by the Gleason shaft, 1,280 feet in depth, and the Wild Horse shaft 350 feet in depth and by more than 18,000 feet in drifts and cross-cuts. There is a 50-ton cyanide mill on the property which has not been operated for some time. For years development work has been carried on through the Gleason shaft. The Old Wild Horse shaft is being operated steadily by lessees, Hemby and Anderson. They have done several hundred feet of work during the past year and are now mining and shipping ore of good grade. There are about 8 men working on the property. The gross production of the Wild Horse to date is \$2,900,000.00.

On the Deadwood Group, Deadwood No. 1 shaft is 800 feet in depth and the No. 2 shaft 850 feet, with 8,800 feet of drifts and cross-cuts on the property. The Deadwood group has a record production of \$1,500,000.00, which has all come from above the 8th level. This is a very promising feature of the Deadwood as all the surrounding mines have had their richest and best ore bodies at greater depths.

The Damon Group, lying on the northeast slope of Ironclad Hill, adjoining the famous Jerry Johnson and W. P. H. Mines, is in the richest producing area of the District. The Damon shaft has only reached a depth of 381 feet, but good bodies of ore have been mined; the production to date being about \$600,000.00. Lessees are working steadily and making some production.

The W. P. H. Claim, one of the richest spots in the District, lies on Ironclad Hill. The shaft has recently been sunk 200 feet and is now 900 feet in depth. The leasers are producing about 10 cars of ore per month and have good ore reserves broken in the mine. Development work is being carried on three different levels with good results. Ore opened on the bottom levels gives proof that the flat veins of this section are very rich and, that the values go deep.

The May B Group, situated on Squaw Mountain, presumably out of the producing area of the District, has to its credit \$75,000.00 in production. Invariably the ore encountered in the May B has been of good grade. The shaft is 650 feet deep and the Squaw Mountain and Columbine Tunnels have laterals into the property.

Trail Group, adjoining the famous Cresson property, is one of the best pieces of mining property in the District. The Trail shaft is 600 feet deep, the Upper Trail Tunnel cuts the shaft at the 100-foot level and the Lower Trail Tunnel cuts it at the 300-foot level. Several hundred feet of development work has been done on the property during the past year on the 300-foot level and good ore bodies have been opened and are now being mined.

The lessees working the ground below the bottom of the Trail shaft through the Dexter shaft have mined ore on the 11th, 12th and 13th levels. There are about 40 men working on the Trail Group.

The Vindicator Consolidated Gold Mining Company purchased the holdings of the Golden Cycle Mining Company in March, 1914, and now control a total of 130 acres in the very productive section of the camp. The company employs 327 men on company account, besides which there are 174 men working on leases in various parts of the property.

During the past two years there were driven 32,564 feet of drifts and 16,624 feet of cross-cuts. The Golden Cycle shaft has been sunk a depth of 180 feet, or to a total depth of 2,210 feet below the collar, making it the deepest shaft in the Cripple Creek District. The 2,000, or bottom level, being 190 feet below the proposed extension of the Roosevelt Tunnel. The development work as a whole has been very gratifying in results obtained and has added very materially to the ore reserves, the largest added ore being on what is known as the Middle Vein, a hitherto undeveloped and unknown vein system which connects the north and south systems of veins. This vein has proven to be the largest vein on the property and has been developed from the 800-foot to the 1,800-foot level. On the 1,600-foot level, where it has been explored more thoroughly, it shows a length of 400 feet and an average width of 30 feet.

The main veins have been drifted on and stoped to the lowest levels and are practically as strong and as open as above.

A model tool-sharpening shop has been constructed on the 1,600-foot level on the Cycle shaft. This location makes a very cool, comfortable shop with better ventilation than was possible on the surface and has worked very much to the advantage of the men employed as well as to the company. The machine shops have been consolidated under one roof in a modern, well-lighted and heated building.

Three centrifugal pumps of the four stage Roturbo type were installed on the 2,000-foot level to pump to the 1,800-foot level, from which pump station all water is raised to the surface in a single lift, a distance of 1,728 feet. The average amount of water handled at the present time is 340 gallons per minute.

In October, 1914 a rather elaborate crushing and washing plant was put into operation on the reject from the ore house, which has proven very efficient and profitable. The capital expended was returned in excess profits after twelve months operation.

A 25-ton experimental flotation plant was installed and operated for several months during 1916. The results were such as to encourage the installation of a 350-ton unit, which is planned to be increased ultimately to 1,500 tons capacity.

Anderson and Benkleman, successful leasers on the Dexter Gold Mining Company's property, did several thousand feet of development work on the upper levels. In sinking, conditions

improved rapidly, and when they secured a lease on the Trail, part of the United Gold Mines Company's property, the shaft was sunk to 1,100 feet, where the ore bodies increased in length, width and values and still continued to improve down to the 1,300-foot level, where the values are better and the ore bodies larger than at any point between level 13 and surface. The shaft will be sunk to the 1,500-foot level.

A large electric hoist and belt-driven compressor has recently been installed on the Dexter shaft. The greater part of the ore is found on the Trail ground. Fifty-five men are employed.

The Ajax Mine, now owned by E. A. Colburn of Denver, was operated during the year mainly by leasers. A small amount of development was performed on the owner's account. A five-year lease has recently been granted to the Carolina Gold Mining Company, a Massachusetts corporation, who, with William Spence Black of Nevada, as Superintendent, and E. Spencer Hutchinson of Boston, Mass., as Chief Engineer, has started work on the property.

Coriolanus Mine, Alhoho Gold Mining Company owner, was operated by leasers working through the main Ajax shaft during part of 1916 and a light production of milling grade ore was mined and shipped.

The Big Banta and Viola Mines of the United Gold Mines Company, were leased and are now active. Both are milling ore and made small productions.

The Rigi Mine of the Rigi Group Gold Mining Company, Limited, was operated during the early months of the year by leasers and a few cars of medium grade ore marketed.

The Rose Nicol Mine of the Rose Nicol Gold Mining Company, was leased during the year by Edwin Gaylord of Pueblo, Colorado, and associates. Tailings from the Victor Mill of the Portland Gold Mining Company had filled the bottom level. This was cleaned out and the mine has since been producing.

The Modoc Consolidated Mines Company, in the latter part of this year, secured the Ocean View property, which is located in the saddle between Bull Hill and Battle Mountain, on a bond and lease from the Modoc Gold Mining and Milling Company; \$116,000.00 on the purchase price being paid down. This company is now engaged in raising from three levels of the old incline shaft, to connect through to the workings of the vertical shaft on the Battle Mountain end of the claim.



The shaft on the Koyneho Claim of the Cripple Creek Mining Company, located on east Victor Avenue, in the city limits of Victor, south of the Strong and Jefferson properties, was sunk to a depth of 400 feet. Lateral work is now under way. The shaft is equipped with steam hoist and compressor.

The Jefferson Mine, located between the Strong and Koyneho properties was re-equipped with steam hoist and electric compressor during the year and the shaft unwatered, but no mining was done.

The Black Belle Gold Mining Company, on the southeastern slope of the hill, was operated at different times by leasers. One set, now operating through the Island Tunnel, is mining and shipping a good milling grade of ore from the Black Belle No. 2.

The C. K. & N. mine was operated through the company's shaft by leasers for a short time during the year.

The El Paso Consolidated Gold Mining Company operated its property located on the west slope of Beacon Hill, on the leasing system. The McDowell and Shubert lease on the first level of No. 1 shaft is shipping about 360 tons of ore per month, with a value of from \$40.00 to \$80.00 per ton. The company has done considerable development work however, on levels 6 and 7, with very encouraging results. This shaft is connected with the Roosevelt Drainage Tunnel at a depth of 1,330 feet.

The Gold Dollar Consolidated Mines Company was operated during the early part of the year under lease. The operating company, known as the Gold Dollar Lease, surrendered its lease in mid-summer and the property was recently leased for a three-year term to the Union Leasing Company. This company and its sub-lessees are producing. A strike of fair grade ore was made late in November at the 400-foot level north on the main Gold Dollar vein.

The Hiawatha Gold Mining Company, owning a fractional claim, operated through lease for a few months and made a small production.

The Old Gold Mines Company leased its property and occasional shipments of milling grade ore are sent out. Operations are carried on through the Henry Adney shaft.

The Albert-Beacon Mines Company was organized and incorporated to operate the Prince Albert Group of claims on the southern slope of Beacon Hill. An electric hoist and belted compressor have been installed at the Beacon shaft and sinking is in

progress. Considerable ore has been mined during the year by lateral work from the big open cut on the Prince Albert, the Cook-erly Tunnel and on the Eureka, operated by winze from the Island Tunnel on the southern slope.

The Dante Gold Mining Company's Mine on the southwestern slope of the hill, although leased, was idle for the greater part of the year, and but recently started up. No production was made.

The Delmonico Mine, owned by H. J. Gehm of Cripple Creek, and J. B. Neville of Denver, was operated under lease for a few months and light production of low grade milling ore was made.

The Free Coinage Gold Mining Company did little on its Pinto, Pueblo, Wilson and Bison and made only small production.

The Gold Sovereign Mining and Tunnel Company, on the southwestern slope of Bull Hill was active until the early part of October under lease to the Union Leasing Company. The production of milling ore was small in 1916.

The Hondo Gold Mining Company conducted operations through the Sitting Bull shaft and by laterals extended from the 1,000-foot level of the Golden Cycle main shaft, were without ore discoveries. The plant of this company was destroyed by fire caused by defective wiring, during the month of December and the mine is now idle awaiting insurance adjustment.

The Last Dollar Gold Mining Company's property was, for the first half of 1916, under lease to M. B. Rapp and production therefrom was made by sub-lessees. The lease, however, was surrendered by Rapp and the property was recently re-leased to Charles Walden of Victor, former Superintendent for the company, who has organized the Catherine Gold Mine Company to operate the property. A complete electrical equipment with hoist of 2,000 feet capacity has been ordered and the foundations are about ready for its installation. Work will not be started, however, much before February, 1917.

The Blue Bird Gold Mining Company is now active under lease to the Buckeye Mines and Milling Company.

The Findley Mines Company has done no work under ground for more than a year.

The Mountain Beauty Mines Company's property has been operated by one leaser, who has worked from the 5th and 6th



levels of the Specimen into The Mountain Beauty property, which has resulted in opening up a stope of good grade ore about 60 feet long. The property is equipped with a gasoline hoisting plant.

The Trilby Mines Company's property was operated by lease to the former superintendent, Evan J. Williams of Cripple Creek, Colorado. The output of milling grade ore amounted to from 4 to 6 cars a month.

The Victor Mine, owned by the Smith Moffat Mines Company, was operated for about six months by the Osten Leasing Company. This company pulled some of the low grade ore from the filled stopes and shipped the same, which, evidently, was not profitable. The mine has recently been leased again to Math Korf of Cripple Creek. The lease carries permission to operate through the Lee shaft of the Isabella Mines Company and work is now being prosecuted therefrom.

The War Eagle Consolidated Mines Company is operating both the War Eagle Mine and the Happy Year Group on the southwestern slope of Bull Hill. A three compartment shaft is being sunk by the company on the Happy Year and a depth of 350 feet has already been attained. The lessees on the War Eagle are making occasional shipments of milling grade ore.

The School Section has been making light production for several months, of a fair grade of milling ore, but is now idle.

Two properties on Globe Hill, owned by Stratton's Cripple Creek Mining and Development Company, the Deerhorn Mine and Keener Tunnel, were operated the entire year under lease and are still active and producing. The ore is of a fair milling grade.

The Conundrum Mine made a light output.

The Gold Bond Consolidated Mines Company's Group on the southwestern slope of Gold Hill has recently been secured under lease and option by The Tungsten Consolidated Mines Company. This company has installed a compressor at the Hummer shaft and a mill is contemplated. Light production of a good average milling grade of ore was made during the year by other lease operators.

The heaviest producer for the Gold Hill section was from the Howard shaft of the Mary McKinney Mining Company. This shaft, operated by leasers, was a consistent producer and the ore of a good average milling grade. Other blocks of the Mary McKinney Estate on Gold Hill were operated under lease and made

light production. Some development work was conducted through the Anaconda Tunnel, but the output was very light.

The Little Giant, in Squaw Gulch, owned by The Morning Glory Mining and Leasing Company, was equipped with a steam plant and operated by leasers. The same operators held a lease on the Callie Mine of the Stratton Estate adjoining to the west on Gold Hill, and the bulk of the ore marketed was mined from the Callie through the Little Giant workings.

The Last Chance Claim, formerly owned by the Mobile Gold Mining Company, and now owned by Colonel T. B. Burbridge of Denver, was leased and some exploration work was done without favorable results.

The Midget Bonanza Gold Mining Company operated the Midget Mine the entire year, and leasers were also engaged on the Midget and Bonanza Queen, another of the company's properties adjoining. The production was small.

The Yellow Bird Gold Mining Company installed first an electric, and later a steam plant at the Red Bird shaft, on the southern spur of Gold Hill, and west of the Midget and Conundrum Mines. The shaft was cleaned out to a depth of 450 feet. One shipment was sent out by leasers on the west end of the Yellow Bird and was of a fair milling grade.

The Morning Glory Mining and Leasing Company, located on the southwestern slope of Guyot Hill, adjoining the Mary McKinney Mining Company's estate on Raven Hill, was recently leased and the initial shipment was loaded out the end of November.

The Elkton Consolidated Mining and Milling Company operated the Thompson, located south of the Elkton Company's main shaft on Gibbons Hill, during the year and produced heavy tonnage of low grade milling ore of an estimated value of between \$8.00 and \$10.00 per ton. The production was made by the Osten Leasing Company, and, after cleaning out the filled stopes of low grade broken ore, the lease was surrendered. The mine has since been leased to local operators who are making light production of milling grade ore.

The Jerry Johnson Mines Company was active and produced during the entire year. The main shaft to the 650-foot point is under lease to Frank Caley of Littleton, owner and operator of the Caley Mill, located on the property. This mill was in operation during the first half of the year, but is now closed. Mr. Caley is mining low grade ore for treatment in this plant when it resumes operations.

The Cripple Creek Deep Leasing Company of Denver, operates below the 650-foot level of the Jerry Johnson shaft and is mining a good average grade of ore from the 750- and 850-foot levels.

The Rex Gold Mining Company's Group on the southern slope of Ironclad Hill and upon which is located the Ironclad Mill, has recently been leased to local operators under the name of The Ironclad Lease. The mill of 100 tons capacity has been overhauled and treatment of ore was resumed the first of December.

Mineral Hill, northwest of and directly adjacent to the City of Cripple Creek, sprang into prominence during the year with an important discovery on the Little Florence, on the northwestern slope of the hill. Three or more cars of ore mined from an open cut returned values of better than one ounce gold to the ton.

One shipment of about the same grade was also mined at the surface from the Engineer's Luck Claim adjoining.

Ore of shipping grade was found by a prospector on what was thought to be The Rotten Hole Lode Mining Claim, but upon survey the discovery was proven to be on The King Fraction, owned by F. M. Woods. One shipment has been sent out, mined by adit tunnel, and was of a fair average milling grade. Development work is in progress on the property.

A company, known as The Laura Lee Gold Mining Company, was organized and incorporated to operate the Laura Lee claim on Mineral Hill. An electric plant, hoist and compressor have been installed and sinking is now in progress. High grade ore was mined some years ago, but the mine has not yet resumed shipments.

Two mines in the Poverty Gulch section, east of the City of Cripple Creek, the Abe Lincoln Mine owned by the Stratton Estate and the Gold King Mine, owned by The Gold King Mining Company were active under lease and produced steadily.

The C. O. D. Mine, operating in this same gulch, made light production during the year.

The Doctor Jack Pot Mining Company worked on the leasing system and made a very good production. A tram line extending from the main line of the Low Line Electric at Requa to the Doctor Jack Pot is under construction. An aerial tram is now in operation from the Gregory Mine dump to the Morning Glory loading station.

The Elkton Consolidated Mining and Milling Company is connected with the Roosevelt Drainage Tunnel through the Elkton shaft, 1,640 feet deep. The shaft is being retimbered from the collar to the 200-foot level. When this is completed, work will start in the tunnel and the Elkton Mine may be operated under lease.

The Joe Dandy Mining Company operated its property under lease during the entire year, and a production of better than an average grade of ore was made. It is announced that the owning company will operate the mine after the leases now in force, expire by limitation.

The Bertha B, adjoining the Joe Dandy mine to the east, and owned by Carl Johnson of Denver, has been equipped with an electric hoist and compressor, and the owner started in November to sink the shaft.

The dump at the portal of the Columbine Victor Tunnel, known as the Economic dump, was shipped to the Golden Cycle mill at the rate of from 5,000 to 8,000 tons per month.

The Ella W. Mine, last year's sensation, operated under lease producing low grade milling ore for the first nine months of the year. The property is idle at the present time.

The Black Diamond, owned by the Sangre de Christo Mining and Tunnel Company, and located east of the Ella W., was operated by different leasers and a fair tonnage of milling ore was shipped.

The Hoosier Mine of the Grafton Gold Mining Company, at the summit of the hill at Hoosier Pass, was operated for a few months by lessees, but without profit.

On the eastern slope of Tenderfoot Hill about one-third of the way to Gillett, the Jay Gould, a patented claim, was operated by eastern parties.

The Colonial Mines and Investment Company secured a lease from the Stratton Estate on the Reno Group, and has extended the tunnel into the hill to a distance of 800 feet.

The Isabella Mines Company has made good progress in the past two years with both development and improvement and has adopted every safety device possible for the protection of its employees. A continuous and rich shoot of ore below what was formerly considered the bottom of the mine was opened during the past year. This ore averages better than \$100.00 per ton.



and approximately \$100,000.00 gross value has been produced from this body. This shoot was opened 1,275 feet from the surface at an elevation of 9,185 feet and is the deepest good ore yet discovered at the northeastern edge of the mineralized crater. The drainage tunnel will reach the Vindicator, 2,000 feet under surface, at an elevation of 8,060 feet. From the indications at the bottom of the Isabella, the 1,100 feet to the drainage level should be very productive as it has already proven in some of the mines in the neighborhood. During the past year, this company has built a large modern and labor-saving ore house at the Lee shaft, has installed lignite burning Western furnaces under the boilers and equipped both hoists with Welch engine controllers to prevent overwinding and excessive speed. The total production for the present year will be approximately \$400,000.00.

The mill of this company, below the dumps at the Lee shaft, and connected with the mine by a tunnel, is a cyanide leaching plant. The ore is first fed into a 9x15 Blake Crusher, passing by conveyor to a set of 16x36 Davis Rolls, then to an elevator and over 4-mesh bumper screens. The over-size is returned to a set of 14x36 Allis Chalmers Rolls, where it is re-crushed and returned to the screens. The ore through the screens goes either to the finishing bins, 200 tons capacity, or straight to the leaching tanks. The mill has 8 leaching tanks, 6 of which are now in commission for continuous leaching, taking from 5 to 6 days to treat each tank. The tanks are dumped by drop doors from the bottom, and the leached sands shoveled on to conveyors which carry them out to the stack pile below the mill. The mill is further equipped with 2 gold tanks, 5 sets of zinc boxes, 2 pump tanks, one 3½x2½ centrifugal pump; 2 50-ton stock tanks, and 1 50-H. P. boiler for heating purposes. The power equipment used in the mill is electrical, 1 100-H. P., 2 20-H. P., 1 50-H. P. motors and 1 7-H. P. D. C. Generator. There is now being treated about 100 tons of ore a day of \$3.00 grade. Six men are employed in the mill and three tramming ore from the mine.

The Queen Gold Mining Company's property was steadily developed during 1915 and 1916. The Eclipse two-compartment shaft was sunk and timbered from the 500-foot to the 1,000-foot level. Four stations, 125 feet apart, were cut and levels run. The elevation of the shaft collar is about 9,696 feet, showing it to be about 1,600 feet above the Roosevelt Drainage Tunnel. During this period the company has done 5,450 feet of drifting and cross-cutting and 800 feet of raising in addition to the regular mining and stoping of ore. The ore shoots, which are typical sheeted zone deposits, lie from 250 to 350 feet east of the Eclipse shaft, and have made a production of nearly 1,000 tons per month of medium grade ore. The country rock is fine grained breccia.

The Stratton Cripple Creek Mining & Development Company, owning a large acreage in the center of the Cripple Creek Mining

District, operate the property by leasers. An average of ninety-one men were employed for the first ten months of the year, during which time the development work done was 5,488 feet of drifts, 1,730 feet of cross-cuts, 3,080 feet raises, 541 feet of winzes and 287 feet of prospect shafts. From this work a considerable tonnage of average grade ore was produced.

The Shoo Fly discovery, made on a claim of that name on the north end of Womack Hill, just northeast of Cripple Creek, is proving to be of great importance. The rich ore that was opened at grass roots has been followed down 75 feet through the oxidized and into the sulphide zone, where the size and value of the ore streak continues as above.

The Longfellow, which is opened through the fifth and sixth levels of The Golden Cycle, promises to become a producer from a large shoot of ore on each of two separate veins.

The Los Angeles and Six Points are producing some fair grade ore.

Globe Hill produces considerable shipping ore, and could be made to produce a large tonnage of low grade milling ore.

Iron Clad Hill is receiving some attention through the new work being done on the Plymouth Rock Group.

The number of men employed, including the ore haulers in the Cripple Creek Mining District, are as follows:

On company account .....	1,300
Leasers and their employees .....	900
Total .....	2,200

## EL PASO COUNTY

The Portland Gold Mining Company's Mill, located in Bear Creek Canon, near Colorado Springs, is supplied with the ores from the Cripple Creek District, but chiefly from the Portland Mine. One hundred and thirty men are employed at the mill.

The Golden Cycle Mining and Reduction Company's Mill, near Colorado City, operated continuously during the year and treated from 1,200 to 1,400 tons of ore from Cripple Creek District. One hundred and ninety men were employed.

## CUSTER COUNTY

The Passiflora Mining & Milling Company, operating on the Herman, near Silver Cliff, Colorado, is meeting with success. The

ore, which is mostly sulphide, carries fair values in copper, silver and lead and some gold, and is mined at a depth of about 150 feet. The advance in the price of silver is causing considerable activity all through the Hardscrabble District, and especially in the vicinity of Querida and Rosita.

There is talk of the once famous Bassick Mine starting operations soon.

The Stephen and Ben Eaton properties at Rosita, are operating. On the Stephen, the shaft, which is about 30 feet deep, is sunk on the dip of the vein. Values as high as \$80.00 per ton are found.

### **FREMONT COUNTY**

The Copper Girl Leasing & Mining Company has just installed a new compressor and air hoisting engine, and is operating The Green Horn Mountain Copper Company's property, and is mining some fair grade copper ore, which is said to carry some values in molybdenum. The mine is located in Bear Gulch and the work is being done through a tunnel and an incline shaft. Three men are employed.

The Green Mountain Mining Company is operating a mine in Copper Gulch, owned by John L. Farrell, of Salida, Colorado, which is an old producer of copper and silver ore. Six men are employed.

The Empire Zinc Company's concentrating plant near Canon City, Colorado, is operating very successfully, with a capacity of 300 tons per day. They employ 100 men. The ores treated are zinc, lead and iron sulphides.

There are about 600 men employed in mining and milling in Fremont county.

### **PUEBLO, LAS ANIMAS, HUERFANO AND EL PASO COUNTIES**

There is no metalliferous mining done in Pueblo, Las Animas, Huerfano and El Paso counties, excepting a little prospecting.

### **CONCLUSION**

We have had the co-operation of the operators in the installation of the many safety appliances and in the adoption of rules for safe-guarding employees in and around metal mines, mills and smelters, to a greater degree than ever before in the history of the Bureau of Mines, and if this good work is continued, it will have a great tendency to materially reduce the number of accidents.

# Review of District No. 3

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By A. E. MOYNAHAN, Inspector

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District Number Three has, during the last two years, experienced such a revival in mining that at present the activity compares favorably with that of the boom days of the industry in this state.

## LAKE COUNTY

“Leadville” has become almost a misnomer for the great carbonate camp, as the amount of lead-bearing ore now produced is very small in comparison to the large tonnage of zinc, iron, manganese and other ores mined, and the name of Zincville would be much more appropriate at present.

The Down Town Mines Company, having selected the Penrose shaft, which has a depth of about nine hundred feet, as the most advantageous point to unwater the section known as the Down Town District, installed electric driven Providence Centrifugal Pumps and after pumping continuously for a year has succeeded in accomplishing this gigantic undertaking, has re-opened the old levels and drifts, which were so completely filled with a dolomite sand as to almost hide their existence, and is now making shipments of iron-manganese and zinc ores.

Starting from the surface, two two-stage centrifugal pumps, each with a rated capacity of two thousand gallons per minute at a head of four hundred and fifty feet, were placed in the end compartments on each side of the hoisting compartment. When a depth of four hundred feet had been reached, these two pumps were placed in stations and two sinking pumps of the same size and type as the first two were employed, which discharged directly into the intake of the pumps at the stations.

A four-stage Providence Centrifugal Station Pump, with a rating of two thousand gallons per minute at a head of nine hundred feet has now been installed at the lowest level and pumps directly from the bottom to the surface. At present about twenty-eight hundred gallons of water are handled, but when the ground has become drained and the flow becomes normal it will be about fifteen hundred gallons per minute, according to records kept on former steam pumping done in this shaft.

The unwatering of this section has made possible the re-opening of many other properties.



The Edna Mining Company, operating the Cloud City shaft with a force of six men, is shipping about ten tons of iron-manganese ore per day.

The Julia Mining Company, working the Home Extension shaft with about fifty men, is making an output of one hundred tons of iron-manganese ore daily, which is shipped to the steel works at Pueblo.

The Jason shaft is worked by John Stenman and associates, and several other properties are being worked with small forces.

Cramer and Company are working the Star No. 5, Ladder, Waterloo, and Yankee Doodle shafts on Carbonate Hill, with a combined force of about one hundred men. Two hundred tons of iron-manganese ore are shipped daily to Pueblo for steel manufacture.

A jig-plant of fifty tons daily capacity has been erected at the Harg Dump for the treatment of the low grade lead-silver ore therein.

Buchanan and associates have been working the Porter shaft with a small force and are now re-opening the Seneca shaft.

M. A. Nicholson, with about thirty men employed, is making a good output of zinc ore from the Big Chief and Castle View Claims. The Castle View shaft, within the year, has been sunk sixty feet, giving a total depth of seven hundred and thirty-five feet.

The Western Mining Company, operating the Wolfstone shaft with from eighty to a hundred men, has been making a large output of zinc carbonate ore. The workings of this mine below the third level have been under water for a number of years, but the sulphide ore bodies there are now available. The Empire Zinc Company, unwatering these workings under a pumping agreement, installed an electric driven Lane-Bowler Centrifugal Pump, which handled the water to the third level, where it was re-handled to the surface by the Wolfstone's steam station pumps.

The Greenback Mining Company, after an idleness of some years, has become active. Since retimbering the shaft to water level and doing some prospecting in the upper levels a pumping agreement has been made with the Empire Zinc Company to unwater the shaft. A Lane-Bowler Centrifugal Pump, working in connection with the steam station pumps, is now rapidly completing the undertaking.

The Iron-Silver Mining Company, working the South Moyer, North Moyer, Tucson and Blind Tom Shafts with a force of about one hundred and fifty men, has made an excellent record in ore production during this biennial period. Having lately acquired additional territory to the north and west of its former holdings, this company has retimbered the Mikado shaft to water level, erected new mine buildings, installed electric driven compressor, hoist and Worthington Centrifugal Pumps and will make this the main working shaft and pumping station for the new ground.

The Yak Mining, Milling and Tunnel Company, working through the Yak Tunnel and employing about one hundred and fifty men, is operating the Silver Cord, White Cap, Polaris, Dolly B, Diamond, Vega and other sections of its property.

The tunnel, which is in a distance of twenty thousand and four hundred feet from the portal, connects with a number of other producing properties, is equipped with electric haulage and is used as a general outlet for a large number of producing mines. The transportation charges on ore are based upon smelter weights, while those on waste rock are made on the number of mine car loads. About ten thousand tons of ore are handled monthly.

Superintendent Watson has recently inaugurated a number of innovations in regard to the welfare of the employees, such as building and equipping comfortable change houses, organizing rescue teams, providing instructions in the use of first-aid equipment and the adoption of a box for suggestions of the employees for improving conditions in and around the mine, as regards safety and efficiency.

The Ibex Mining Company is operating the Little Johnny Mine on Breece Hill, almost entirely upon the leasing system. There are over two hundred and fifty men employed on the property and only about thirty-five are working on company account. About seven thousand tons per month of a silicious gold ore are produced from Shafts Number One, Two, Three and Four; Shaft Number Five being inactive.

The company, under a scale of fixed charges, does all the hoisting, sharpening and assaying and furnishes machines, power, ventilation and lights.

The Garbutt Leasing Company, under the management of Mr. John Cortellini, is working the Garbutt, Garbutt Extension and certain blocks of Ibex Mining Company's ground. With about one hundred men employed, a daily tonnage of one hundred and fifty tons of ore is mined, which is of the same character as that of the Ibex and carries values in gold, silver and copper.

The Garbutt is the only property at Leadville where tungsten ore has yet been discovered, and this is interesting only for the specimens of crystallized scheelite which occur there.

The Big Four Leasing Company is working the shaft with a crew of eight men. A small streak of high grade copper ore is mined on the third and fourth levels, while some prospecting is being done on the seventh level.

The Fanny Rawlins Leasing Company has a small crew of men employed on exploration work.

The Third Venture Mining Company is producing a good tonnage of zinc ore from above the St. Louis Tunnel and is mining some high grade gold ore from a fissure below the tunnel level, from which some very large specimens of crystallized gold have been produced.

The Harvey Brothers are employing about twenty-five men on the Bobbie Burns property, working through a six hundred-foot shaft and producing about fifty tons per day of an oxidized silicious ore, which carries gold and silver values. This property has produced a considerable amount of good grade copper ore.

The Breece Mining Company, under the management of J. H. Lamphier, is operating the Breece property entirely by the leasing system. The three shafts on the property are worked with a combined force of about fifteen men and a small tonnage of ore is mined.

The Big Six Mining Company's property, under lease to Henry Haakon and Company, is worked with four men.

The President, under lease to Mr. Ike Johnson, is worked with three men and is making a production of one hundred tons per month of gold-bearing ore.

The Little Bertha is worked under lease by Charles Holden and Louis Crecilious with four men and about fifty tons of iron ore, which carries gold and silver values, are shipped to the Arkansas Valley Smelter monthly.

The New Monarch Mining Company, operating north of Little Evans Gulch, is mining a good tonnage of ore from the Cleveland and Monarch shafts. About sixty men are working on the property, all but fifteen of whom are employed by lessees.

The Fortune Mine, owned and operated by Mr. James R. McNeece, has become active after an idleness of several years

and is now making a nice output of zinc and gold ores. From twelve to fifteen men are working for the operator, while about an equal number are employed by lessees.

The Luema Mining Company, under the management of Mr. W. F. Page, has sunk a one-hundred and twenty-five foot winze near the breast of a tunnel, that enters Prospect Mountain for a distance of eighteen hundred feet, and opened a large body of oxidized ore, which had been encountered in a diamond drill hole. While the ore body as a whole is not of shipping grade, from two to three hundred tons of shipping grade ore are mined per month, with nine men employed exploiting the ore body.

The property of this company in Big Evans Gulch is being worked by lessees. The Halkett Lease on the Silver Spoon shaft employing three men and the Cretney Lease on the Luema shaft employing eight men and the Groberg Lease on the Deane shaft employing six men.

The United States Smelting, Refining and Mining Exploration Company (Leadville Unit), having acquired territory in the Fryer Hill section, which has been practically idle for a number of years, has, under the management of Mr. H. S. Lee, erected new mine buildings, installed electric driven hoist, compressor and Krogh Deep Well Centrifugal Pumps and unwatered the Harvard shaft.

The Jamie Lee shaft has been repaired, will be sunk deeper and used as a working shaft, while the Harvard shaft will be used only for pumping. In sinking air-driven Prescott Sinking Pumps will handle the water in the Jamie Lee to a connection between the two shafts, through which it will flow to the Harvard shaft and be pumped to the surface.

The Progressive shaft, which has a depth of about three hundred and sixty-five feet and is situated a short distance west of the Leadville Unit, is being re-opened with a small force of men by W. F. Page and associates.

Between the Leadville Unit and the town of Leadville are a number of properties operated by lessees with from two to six men, among which are the Sliver, Buckeye, Chrysolite, Pittsburg, All-right and Matchless.

The Gambetta Leasing Company has been operating the Ponsardin, the American-Compromise and the Denver City Leases, but at present the last named is inactive. With a working force of thirty men about one thousand tons per month of a complex zinc sulphide ore is mined from the Ponsardin and shipped to the Western Chemical Company, while from two to six hundred tons of oxidized iron ore are shipped monthly to the Globe Smelter from the American-Compromise Lease.



The Alleghany Mining Company, under the management of W. E. Bowden, has re-timbered the Alleghany shaft and started mining.

The Highland Mary, working under lease to Thomas Nielin and Company, is producing a small tonnage of clean iron-pyrite, which is sold to the Western Chemical Company for the manufacture of sulphuric acid. Four men are employed.

The Empire Zinc Company has operated the Col. Sellers property for several years past and made an excellent record in the production of zinc ore, but the property is now worked out and the shaft has been allowed to fill with water. This company has recently purchased the property of the Small Hopes Boreel Mining and Milling Company and will likely use the equipment of the Col. Sellers shaft in working the newly acquired territory. The Small Hopes Company, operating the Robt. Emmet shaft with about thirty-five men, produced forty tons of zinc ore per day from above the sixth level. The Empire Zinc Company expect, through the pumping operations on the Wolftone and Greenback shafts, to entirely unwater the Emmet shaft, which is eight hundred feet deep, and to greatly increase the output of the property.

The La Plata Leadville Mining Company has retimbered the La Plata shaft a distance of 318 feet to water level, has installed electric-driven hoisting machinery and Bryon Jackson Centrifugal Pumps and will unwater the shaft, which is six hundred and twenty-five feet deep.

The Lillian is worked under lease by Mr. Clarence Hersey with a small force of men and is producing a fair tonnage of ore.

The First National Leasing Company has succeeded in unwatering the shaft and is now mining a small tonnage of zinc sulphide ore.

The Louisville, which is being operated by E. A. Hanifen, W. O. Reynolds and the Yak Mining, Milling & Tunnel Company with about thirty men, is producing about sixty tons per day of a good grade silver ore.

The output of the mine, which was formerly taken through the Yak Tunnel, is now taken through the three hundred and twenty-five foot tunnel recently driven from the surface to connect with the shaft.

The Continental Chief Property, at the head of Iowa Gulch, is worked by Mulrooney and associates. Four men are employed driving a deep prospecting tunnel.

The Anderson Tunnel Company, driving a tunnel into Prospect Mountain from the north side, has not worked since the spring of the present year, but expect to start operations again within the near future.

The Jennie June Mine on Tennessee Pass, has been operated intermittently during the last two years, but is now idle.

The Griffin Leasing Company, working the Gerald Griffin Mine, in the St. Kevin District, has about twenty men employed and is making an output of twenty tons of silver-zinc ore per day, which is sent to the River Smelter at Florence.

The Dinero Mines and Tunnel Company in the Sugar Loaf District, for the last five years has produced a large quantity of silver-gold ore, but at the present no work on company account is being done. The property is worked with from twelve to fifteen men by lessees.

The Consolidated Virginus, the Bartlett Tunnel and the Black Iron shaft are worked with small forces.

The Mount Champion Mining Company, in the Half Moon Mining District, has been producing about one hundred and fifty tons of high grade gold ore and about fifteen hundred tons of good grade mill dirt per month. The mill consists of amalgamation and concentration and is of fifty tons daily capacity.

It is reported that this property has changed hands and that the new operators will develop the mine for a period of two years and will then build a cyanide plant to treat the low grade ore. About fifteen men are now working in the mine, and the mill is idle.

In the Twin Lakes District, during the summer and fall of 1915, there was considerable activity at the Gordon-Tiger Mine, but the property has been idle since early spring of 1916.

The Lackawanna Belle is now worked by lessees with four men employed and several other properties were worked in a small way during the summer months.

The mines in the Granite District are idle.

### SUMMIT COUNTY

During the past year the Kokomo District has experienced a very remarkable revival in mining.

The Progress Mining and Milling Company entered this field in the early spring of 1916, took over the old Wilson Mill,

remodeled it and started milling the low grade ores of the district on a custom basis. The mill, which is to be of three hundred tons daily capacity when fully completed, consists of table concentration and flotation.

The Belmont Mining Company, contemporaneous with the Custom Mill, secured leases on the Col. Sellers, Free American, Pearl and other properties and, under the management of Mr. Thomas Teal, started mining ore, which was sent to the Progress Mill.

The Washington Tunnel has been reopened this season by Mr. M. A. Lang and through it a shoot of lead-bearing ore has been opened on the Murray property.

The Michigan Mining and Milling Company has worked steadily during the entire biennial period with from two to eight men and has mined a fair production of lead-silver ore. An electric driven compressor plant was installed at the property during June of 1916.

The Elk Mountain Mines Company has mined a quantity of good grade zinc sulphide ore from the Wilfley property during 1916.

The Mutual Co-operative Mining Company, with a force of about fifteen men employed, has been mining and shipping ore to the Progress Mill, from the John Reed property at Workman.

The Felicia Grace Property, the Columbine, Wintergreen and Boston, have been operated by lessees during the last year, with from two to four men employed at each.

The Montezuma District has been quite active during the period covered by this report, but owing to the temporary suspension of operations by the Montezuma Mines Company, at present there is only one property being operated extensively.

The flotation process has proven to be well adapted to the treatment of the ores of this district, as it not only makes a good saving on the grey copper slimes, but disposes of the heavy spar, which is so troublesome in concentrating these ores by other methods.

The Montezuma Mines Company, having remodeled the mill which was built by Sutton, Steele and Steele, has been mining and milling ore from the Silver Wave, Chatauqua and Princess properties. About sixty men were employed in and around the mines and mill.

The Philadelphia Mines Company operated the Jumbo Mine and the Toledo Mine and Mill during the greater part of 1915 and the early part of 1916, but has discontinued.

The St. Johns Mines (Colorado) Limited, has remodeled the mill on the property and installed flotation. At present the mill is treating about sixty tons of ore per day, which amount will be increased to one hundred tons as soon as an ore house, being erected at the portal of the tunnel, is completed. From thirty to forty men are now employed in and around the mine and mill.

The Ida Belle Property, owned by the Gold Trail Mining Company, has been worked under lease with a small force during the past year by J. P. Childers.

The Breckenridge District, which has been uninterruptedly progressive for a number of years, has, during the past two years, witnessed a decided increase in mining activity.

The Wellington Mines Company is working about one hundred men in and around the mine and mill and is paying large dividends from the shipments of high grade zinc, crude ore and concentrates. The shaft is being retimbered and will be sunk deeper. An additional roaster has been installed in the mill.

The Oro Extension Lease, with a force of from twelve to fifteen men, is sinking a shaft on the Louis D. Placer to prospect for the extension of one of the Wellington veins. An electric driven hoist, compressor and Krogh Centrifugal Pump have been installed.

The Tonopah Mining Company, in the Miller shaft on the Sure Thing property, is prospecting for a vein discovered during dredging operations. About twelve men are employed.

The Colorado Mineral Separation Company operated the Union Mine and Mill during the greater part of 1916, but has now suspended work. Flotation boxes and Electric Separators were installed in the mill.

The Country Boy Leasing Company, under the management of C. A. Allen and O. A. King, has been working the Country Boy Mine with four men.

The Minnie Leasing Company, under the same management as the Country Boy, has been working the Minnie with from four to six men.

The Washington Mining Company, under the management of P. M. Tyler, has operated both the mine and mill this season.



The Dunkin Leasing Company, which has become famous as a producer of free gold ore, has operated steadily with a force of five men.

The Puzzle Leasing Company, with fifteen men employed, has been mining about one hundred tons per month of lead and zinc ore of a shipping grade and about one hundred and fifty tons of mill dirt. The lead ore is sold to the local sampler, while the zinc ore is shipped to the zinc smelter at Blende.

The Cohomaek Mining Company, J. T. Hogan, manager, has built and equipped a fifty-ton daily capacity concentration mill at the portal of the Puzzle tunnel and is treating ore on a custom basis. The mill contains both tables and flotation.

The Jessie Mine, owned and operated by George F. Roth, is employing from twelve to fifteen men on development work and is making tests to determine the best method of treatment for the large low grade ore bodies opened in this property.

The Pioneer Consolidated Mining Company some few months ago took over a group of claims on Gibson Hill, remodeled the Extension Mill and is now mining and milling ore.

The Philo Mino Mining Company has worked the Mountain Gem with two men and mined a small tonnage of gold-silver-lead ore.

The Hamilton Mine, under lease to R. R. Kirk, has been worked with a few men during the last year.

The Lucky Mine has also employed about three men on development work.

The Sally Barber shaft was operated for a short time during the present year by the Wellington Mines Company, but is now inactive.

The Congress Mine, under lease to W. B. Shepard and A. T. Brown, has shown some little activity.

The Governor Leasing Company has reopened the workings of the Governor tunnel, a force of from six to eight men being employed.

The Middlesex Mining and Milling Company, operating near the head of the Blue River under the management of G. H. Gibson, has been carrying on development work with a force of five

The Rilla Mining Company, operating in the same locality under the management of T. R. Griffith, has been carrying on development work with about ten men employed.

### CHAFFEE COUNTY

At Monarch, the Monarch Madonna Mining Company, working the Madonna Mine under the management of Warren E. Burton, has been making a good output of zinc carbonate ore from the upper levels of the mine, which are being worked under the leasing system. The work being carried on by the company in a winze from the sixth level, with about thirty men employed, was suspended during the summer months on account of an excessive flow of surface water. The ore of this mine has gradually increased in gold and silver values from the top of the mountain until the sulphide ore body in the winze carries high values in both of these metals.

The Giant-Eclipse Consolidated Mines Company has been working the lower levels of the Eclipse with a small force of men, while the upper levels have been worked by lessees.

The Silent Friend property, worked under lease by O. J. Wolfram, has produced a small tonnage of zinc-lead ore.

The Hawkeye property has been worked intermittently by lessees.

The Fairplay Tunnel has also been worked in a desultory manner by lessees and has produced a small tonnage of zinc-lead-silver ore.

The Taylor Mining Syndicate has operated its property in Taylor Park with a force of from four to six men. This property produces some good grade copper ore, shipments running from six to ten per cent copper.

The Jewell Tunnel and Mining Company has been mining small tonnages of zinc and silver ore from the New York and Jewell tunnels.

On Pass Creek, the Standard Gold-Copper Mining and Milling Company, working the Springfield Mine, operated both the mine and mill last year, but as the mill, which consisted of amalgamation and table concentration, failed to save the values, it has been shut down and a few men are working in the mine on ore of a shipping grade.

Near Salida, the Hidden Treasure Mining Company reopened the Sedalia Mine last year and is now, with a force of forty men

employed, making an output of fifty tons of ore per day. Shipments of copper ore, which run from five to seven per cent, are sent to the Arkansas Valley Smelter, while shipments of zinc sulphides are sent to the Pingrey Mining Company's flotation mill or sold direct to the zinc smelters.

In the Chalk Creek District the Mary Murphy Gold Mining Company on the Mary Murphy Mine, is working between two hundred and two hundred and twenty-five men. A raise from the Golf tunnel has connected with Number Fourteen tunnel, which is driven from the other side of the mountain and levels are being driven between the two tunnel levels. The flotation and static units in the mill are doing good work.

The Lady Murphy property, which covers the extension of the Mary Murphy veins, was worked this season with about three men by lessees.

The Bright Rays Mining and Milling Company, working five men, has carried on development work on General Custer Group during the past year.

The Flora Belle Mining Company operated the Flora Belle Mine with a small force during the summer season of the past year.

The Colorado Independence Mining and Development Company had a small force of about ten men working on the Allie Belle property, but has discontinued operations.

Elmer McMurray has shipped some very good grade lead-silver ore from a property near Alpine within the last few months.

W. B. Lowry has taken over the Hays molybdenite property and is now operating the same with five men.

The Paramount Reduction Company, has completed a seventy-five ton capacity concentration mill, which will treat the low grade ores of the district on a custom basis. The mill consists of table concentration and flotation.

In the Turret Mining District the Turret Independence Mine was worked in 1916 under lease by J. H. Bemis. With a working force of about four men a monthly tonnage of one hundred tons of a good grade copper-gold ore was mined.

The Turret Copper Mining and Reduction Company started operating last summer with a force of six men and reopened the two shafts on the M. & W. property.

The Stockton Lease, working three men on the Stockton Mine, east of Salida, has produced a few shipments of good grade copper ore.

The Marion Mining and Development Company has operated its property near the town of Buena Vista during the entire biennial period. The cross-cut tunnel has encountered a vein and six men are now employed drifting on the vein to cut an ore shoot which was opened from the surface some few years ago.

The Cotton Wood Gulch Mining Company, during the summer months, worked the Eureka Mountain property, on North Cotton Wood Creek, with a crew of eight men, but has laid off all company account men and is driving a cross-cut tunnel by contract.

The Holy Water property, on the Middle Cotton Wood, has been taken over by J. W. Ady within the last few months and is now being developed by a small force of men.

The Murcer Mercury property on North Cotton Wood Creek, has lately been reopened by the owner, M. J. Hines, and a shipment of ore made, which ran well in gold, silver and copper.

## PARK COUNTY

The Alma District, after a long period of idleness, save for the operations on the London Mine, has, during the past year, attracted some little attention and several mines have been reopened. The old silver mines of this district, of which there are a number having a record in production of from one to five million dollars, are destined to another period of activity as the demand for this metal increases.

Owing to the vacillating demand for tungsten ore, only enough work to demonstrate the occurrence of Hubnerite in commercial quantities has been done on the veins of this mineral, which were discovered last spring in Buckskin Gulch.

The London Mining and Milling Company has operated the London Mine entirely on the leasing system for the last two years. During this period from forty, at the present time, to as many as eighty men have been employed mining gold ore, which averages about one hundred dollars per ton. Since adopting the leasing system, the company has received in royalties, sixty thousand dollars or more. A tunnel, which will cut the vein about six hundred feet deeper than the present lowest workings with four thousand feet of driving, is being driven by the company.

The Weston Gold Mining Company has reopened the Hoek Hocking Mine, has erected a concentrating mill of thirty tons



daily capacity and is operating the mine and mill with a force of about fifteen men.

The Gold Slide Mining Company has let a contract for the sinking of a shaft on the London Fault near the top of Pennsylvania Mountain. A shaft house has been erected and work started with two men.

The Continental Investment Company has been driving the main cross-cut tunnel on the property of the Kennebec Mining Company, but no work is being done at present.

The Three J. Mining Company has about ten men working on the Paris Mine. The mill is to be remodeled and a new adit driven to cut the ore-bearing contact deeper.

The No End Leasing Company has worked the No End property with a small force during the past two years and has made a few shipments of high grade gold ore. Some exceptional free gold specimens have been found during the mining of this ore.

The May Queen Tunnel was worked steadily during this period with from two to four men.

The J. G. Blaine Mine has been worked by lessees during the last half of 1916. A new tunnel is being driven to open a vein, which carries values in both silver and tungsten.

The Kentucky Belle Mine, under lease to H. B. Evans, is now worked with two men.

The Russia Leasing Company has reopened the Russia Mine and has a couple of men employed mining high grade silver ore.

The Calumet and Hecla property, on Mount Lincoln, has been reopened by lessees, who are now employing from three to five men.

The Wheeler Mine near the head of the Platte River is being worked by a leasing company and is making a small output of good grade ore.

The Kansas Mine, under lease to F. H. Clark, is working a small force on a vein of sulphide ore, which runs well in gold and copper.

The Commonwealth Mining Company has taken over the Magnolia property, remodeled the old Eddy Mill, installed a cyanide equipment and has a force of men engaged in the erection of a tramway from the mine to the mill.

The Lanyon Zinc Company operated the Hill Top Mine, in the Horse Shoe District, in 1915 with a force of about fifty men and produced a good tonnage of high grade zinc carbonate ore. The mine is now idle, operations having been suspended early last year.

The Boomer Mine in the Puma District, was worked for a short time in 1915 but has since been idle.

The Red Skin property near Lake George, was worked for a time last summer by John Cortellini and associates, who made one shipment of molybdenite ore. The Schlesinger Radium Company has now taken the property under lease and option.

The Leftwick Mining and Leasing Company, operating in the Hall's Valley District under the management of C. C. Welch, has mined and shipped a small tonnage of ore. The mine is now worked by lessees.

The Home Run property was worked with a couple of men during the summer.

The Limonite, Silver Queen, Monte Rosa, Nimrod, Rainbow, Star and Revenue properties, in the Geneva Gulch District, were worked to some extent last year with from two to five men employed.

Some little prospecting was done on the copper-bearing veins in Platte Canon, but no shipments have been made.

The Mount Guyot Mining Company, operating in the Georgia Pass District, has worked from two to five men driving a cross-cut tunnel.

P. A. Granstrom has also been working a small number of men in this district.

The mining district at the head of Tarry-all River was slightly active in 1915, but nothing has been done in vein mining during 1916.

The Carbonate King and Anderson property, in the Guffey District, are now working about six men each.

### PITKIN COUNTY

The Smuggler Leasing Company has carried on extensive operations at Aspen during this entire biennial period and is now working the Molly, Free Silver and Smuggler shafts and tunnels

No. 2 and No. 3, on Smuggler Mountain, and the Durant and Visino tunnels on Aspen Mountain.

Approximately three hundred men are now employed in and around the mines, mill and sampler, of which number about eighty-five are employed by lessees.

About one thousand tons of shipping grade ore and eight thousand tons of mill dirt are mined per month from the workings on Smuggler Mountain, while about twelve hundred tons of shipping ore are mined monthly from the Aspen Mountain workings. The mill, which consists of jig and table concentration, is making a good recovery. The sampling plant which was destroyed by fire, has been rebuilt and automatic sampling devices of the latest and most approved type installed

The Midnight Mining Company, operating the Contact property with six men, has opened a small streak of silver-lead ore. This property, which is situated in Queen's Gulch, is worked through a tunnel which is now in a distance of about fifteen hundred feet. A well mineralized contact has been cut.

The Hope Mining, Milling and Leasing Company has operated for the past few years with a force of about six men. A cross-cut tunnel, which is now in a distance of six thousand feet from the portal, is being driven to cut the Little Annie Contact, at a point beneath a shaft on the top of the mountain. A large amount of high grade silver ore was mined from the contact through this shaft during the early days of this district. A shale-porphyry contact, which was cut some little distance back from the present breast of the main tunnel, is now being drifted on and is thought to be the Little Annie Contact.

The Aspen Contact Mining Company during the present year has employed three men in the Varner tunnel, situated on Woody Creek at a point about eight miles from the town of Aspen.

C. E. Anderson and associates worked a property near the town of Basalt for a short time and produced some good grade manganese ore, but at present the property is idle.

## EAGLE COUNTY

The Red Cliff District has been quite progressive during the time covered by this report. Several important mining deals have been made, the power line of the Colorado Power Company has been brought into the district and much substantial development work has been done.

The Empire Zinc Company, having purchased the Iron Mask Mine from the Eagle Mining and Milling Company, is now operating both the mine and mill, with about two hundred men, and



is making an output each month of about fifteen hundred tons of zinc concentrates, fifty tons of lead concentrates and six hundred and fifty tons of iron tailings from the mill, while about seven hundred tons of carbonate ore is shipped monthly direct from the mine. At present the property is operated through the Iron Mask, St. Joseph and Chief inclines, but eventually all ore will be taken out through the Newhouse tunnel.

During the last year the company built ten bungalows which will be rented to the employees, built and equipped a new change house at the mine, erected an ore house at the portal of the Newhouse tunnel and constructed a coarse crushing plant near the mill.

The American Zinc Ore Separator Company, operating the Black Iron Mine with a force of about sixty-five men, is making a daily output of one hundred and twenty-five tons of zinc ore, which is of good shipping grade. The property has been equipped with a new electric driven hoist, compressor and ventilation blower.

The Percy Chester Mining Company, with an engineer and blacksmith working on company account, is operating the Mable shaft under the leasing system. About fourteen men are employed on the property and a small tonnage of gold ore is mined from a fissure vein.

The Thompson Leasing Company operated the Tip Top and Star of the West claims through a tunnel in the granite. With a crew of four men a small tonnage of high grade gold ore was mined. A milling plant, consisting of five stamps and two Wilfley tables, has been erected near the portal of the tunnel for the treatment of the low grade ore.

The Garbutt property has been worked under lease by a local company, with two men employed.

The Nuttingham Incline was operated with a force of three men by G. E. Olmstead.

The Rayment Incline was worked by Richards and Tetreault with two men, under a sub-lease from the July Mining Company.

The July Mining Company, operating the Champion Mine, with about five men on company account and an equal number working on the leasing system, has produced a small tonnage of high grade gold-silver ore from the cambrian quartzite.

The Wyoming and Eighty-Four properties have been worked, with three men each, by the Dismant Brothers and have produced a small tonnage of silver-lead ore.



The Horn Silver Mine, worked by Elliott and Company, through the Wyoming tunnel, has also produced some silver-lead ore.

The Aspen and Foster Lodes have been worked with small forces by Carteen and Company.

The Lady Belle Mining and Milling Company, operating in the Eagle District, reopened the Lady Belle Mine under the management of J. O. Kempf and has maintained an output of good grade silver ore. With from eight to fifteen men working about fifty tons per month has ben mined.

The Lady Belle Extension has been worked with a small force of men by lessees and has yielded some ore.

The Fulford District was inactive excepting some prospecting done during the summer months.

### **MESA, DELTA, RIO BLANCO AND GARFIELD COUNTIES**

As the mining district on Elk Creek, near the town of New Castle, has been inactive, little or no lead mining has been done in these counties during the last two years.

Some gold-bearing quartz has been found on the east end of Grand Mesa and some sparingly distributed showings of copper ore are to be found in western Mesa County, within the same belt in which occur the commercial deposits of the Sunshine and Gallaway mines in Montrose County, but as yet no operations of note have been undertaken.

At the present time the large beds of oil shales which occur on Roan Creek and its tributaries in Mesa and Garfield Counties and at Cathedral Creek in Rio Blanco County, and the wurtzilite deposits, which occur in Delta County in the shale cliffs back of the Gunnison and Uncompahgre Rivers, are attracting much attention and it is thought will prove to be of great commercial value.

### **CONCLUSION**

During the past two years there has been a very noticeable improvement in conditions as regards safety and sanitation in and around the mines, mills and smelters of this district.

While we feel that the efforts of this department were somewhat of a factor, the improvement in conditions was largely due to the fact that the operators have reached a state of mind where the wisdom of making their places of employment safe and sanitary at any cost is plainly visible, and to the enactment of the Compensation Law, which started a decided movement along these lines throughout the state.

It is worthy of note that at the present time there is a tendency toward a change in some features of mining practice in this district.

In pumping operations the large, cumbersome steam and electric driven plunger pumps are being replaced by light, efficient electric driven centrifugal pumps.

In mine timbering the filled stope system has been inaugurated in several of the larger mines, where before the square set open stope system was used, and it is said to be giving much better results with but small extra cost.

In ore dressing many of the mines, which have heretofore sorted the ore in the stopes or shipped without sorting, are erecting ore houses and hand sorting the ore on the surface with the result that the extra amount received for the ore shipments more than pays the cost of such handling.

# Review of District No. 4

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By INSPECTOR ROBERT INNES

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A general review of District No. 4 for the biennial period just ended shows that 1915-1916 has been the best years in the history of the San Juan, the production exceeding all previous records. Several good strikes were made, and many mines closed down for twenty years or more have resumed operations.

For several years prior to 1915 the prospectors had practically disappeared from the hills, but with the general rise in the price of metals the prospectors took to the hills again and could be seen everywhere.

This improvement is not all due to abnormal metal prices, as new metallurgy, the flotation process and electric magnetic separation all contribute in a large degree to the revival.

## ARCHULETA COUNTY

Geographically speaking, this county is situated within the San Juan mineral belt. It has no producing mines at the present time, but has many very promising prospects.

## CONEJOS COUNTY

A large portion of this county is strictly a mineral section and has produced considerable good ore.

Platoro, the principal mining district, gives promise of becoming one of the substantial mining districts of the state. The large bodies of developed low grade ore found here could be mined at a profit with proper milling facilities at the mines and reasonable transportation rates to the railroads. With the exception of a few small leasing parties and prospectors very little has been done here in the past two years.

## COSTILLA COUNTY

While agriculture and stock raising are the leading industries in this county, it has vast mineral resources which have never been developed to any extent and practically no mining has been done in this county during the past two years.

## DOLORES COUNTY

The principal mining district of this county is located in the neighborhood of Rico. Prior to 1893 Rico had a population of

several thousand people, but with the drop in the price of silver at that time, the town became almost depopulated and remained so until 1914, when it commenced to take on life again, and several big mines are operating with a large force of men. With the high price in metals, especially copper, Rico is fast coming back to the position it formerly held among the big camps of the state.

The Rico-Wellington Mine, located on C. H. C. Hill about one mile from town, is the principal producer of the county. This property has been operated continuously for the past two years. A large body of copper ore was opened up the past year, which enables the company to profit by the high price of that metal.

The famous Rico Mines, which have been idle for a number of years, resumed operations in the spring of 1916; several sets of lessees are operating blocks of ground and the owners are working a good force of men on development work.

There is considerable activity on Silver Creek; the Rico Consolidated has been a steady shipper for some time and the property is being extensively developed.

The Rico Argentine on Silver Creek, came into the shipping class in 1916 by opening some good ore in the upper workings; since then the property has been a steady producer.

On Nigger Baby Hill, about one-half mile from Silver Creek, is the Yellow Jacket, an old property which has produced much good ore; it resumed operations in June, 1916, repairing the mine and developing the ore bodies.

The Puzzle Mine, operated by the McIntyre M. & M. Co., located in Horse Gulch, has done considerable development work in the past few years.

In 1915, the old Emma Mine, situated at Dunton, on the West Dolores River, was operated in a small way by leasers. In the spring of 1916 a strong company secured a bond and lease on the property and started operations at once on a large scale; the shaft was unwatered and drifts started on the vein. The property is being extensively developed and should be in the shipping class in 1917.

The Smuggler and Rose Bud Mines, also located on the West Dolores, have been inactive during the past two years. These properties contain silicious ores carrying gold and silver.



## GUNNISON COUNTY

During the past two years there has been a great improvement in mining operations all over the county, many old properties have resumed operations, new strikes were made in various places and the outlook for Gunnison is very flattering.

Gunnison county is noted for its variety of minerals. Besides the common minerals such as gold, silver, lead, copper and zinc, molybdenite, graphite and tungsten are found in commercial quantities. The surface showings are equal if not better than most of the old producing counties of the state. But enough development work has not been done in most of the mining sections to determine the extent and value of the ore bodies. Some good ore is being mined.

The Vulcan Mines and Smelter Company secured a lease and option on the old Good Hope Mine situated at Vulcan, 12 miles from Iola. The shaft was unwatered and retimbered down to the 3rd level; several thousand feet of sluice boxes were constructed to catch the copper precipitate from the water. A new hot blast smelter was installed and put into operation in March, 1916. Several thousand tons of dump ore were treated in addition to the ore taken from the mine.

In the Spencer Mining District near by, the Anaconda Mine, owned and operated by a local company, has been producing a good grade of ore carrying gold, silver and copper.

The Doctor Mine, situated about 19 miles N. E. of Almont, has been operated by lessees since December 1st, 1914. In 1915 a large body of carbonate of zinc ore was opened at the bottom of an 80-foot shaft, and has been producing from 10 to 25 tons per day of ore, which is hauled in wagons to the railroad at Almont and shipped to Oklahoma.

The Gunnison Mining Company resumed operations in June, 1916, on the Forest Hill Mine, located in Taylor Park, after an inactive period of nine years.

The O. and P. Group has been active for the past two years doing development.

A small force is employed during the summer months on the property of the Monmouth Mining & Leasing Corp. Development work only, is being done.

The old town of Gothic, once a lively mining camp, is almost deserted; the Dreckshage Mining & Tunnel Company on Copper Creek, about two miles from Gothic, has been operating during the past two summers; a cross-cut tunnel now in about 1,300 feet is being driven to the vein.

The town of Crystal had only one inhabitant in the winter of 1915, but in the summer of 1916 had a population of over 100 people.

The Sheep Mountain Mine, located in the town, put a good force of men to work retimbering the mine and developing the ore while a new mill was being built. The mill is equipped with rolls, a Universal Dry Concentrator and Wilfley tables, with a rated capacity of 40 tons daily.

The Meadow Mountain and Lead King Mines on Rock Creek east of Crystal, and under lease to The Crystal Mining Company, operated from June, 1916, on dump ore, with a new concentrating mill having 40 tons capacity.

The Tin Cup District did little in 1916. Several properties operated in a small way, producing tungsten until the price dropped so low that it could not be operated at a profit.

The Blistered Horn, located five miles from Tin Cup, one of the oldest mines in the district, employs a small force of men on development work.

The Gold Cup Mine on Gold Hill was operated with a force of men in the summer of 1916, and it was reported that a body of high grade gold ore was uncovered in July of the same year.

Lessees operated the Bon Ton Mine on the North Fork of Quartz Creek, for molybdenite; the ore was hauled to the Quartz Creek Mill in the town of Pitkin and treated by the flotation process.

Besides the above active properties, considerable mining operations were carried on by leasers and prospectors.

The Morning Glory Group on North Fork Creek, was operated by leasers in 1916. A recent discovery on the property is reported as a vein 9 feet wide and heavily mineralized, carrying gold, silver, lead and copper.

A small force was employed in 1915-1916 on the Day Star Group, located in the Quartz Creek Mining District one mile from the old town of Sherrod. In July of the past year some very rich ruby silver ore was opened up in the Rainbow vein.

There was considerable activity in the Tomichi Mining District in the neighborhood of White Pine. Some of the ore from the mines was treated in the Akron Mill in White Pine, and the remainder was shipped direct to the smelters.

The Akron Mine, located in the town of White Pine, is the largest producer in the district.

A small force of men employed by lessees on the Spar Copper property have been getting out a good grade of ore carrying gold, silver, and copper, which is shipped direct to the smelters.

The Ensign Mine, adjoining the Spar Copper Group, is operated by the Akron Mines Company under lease, and about 12 tons of ore is hauled daily from this property to the Akron Mill for treatment.

The Victor Mine on Lake Hill, which has been inactive for over 20 years, was started up in May of 1916, by a leasing Company; several cars of lead, silver and zinc ores were shipped during the year.

The Princeton Mining & Reduction Company have been operating their property near White Pine for the past two years. Several cars were shipped during the past year which gave good returns.

There is very little activity in the Bowerman District, a few men being engaged prospecting and doing assessment work.

In the Box Canon Mining District, the Camp Bird Mining, Leasing and Power Company are operating the Brandt Independent Mines Company's property under a long time lease. A shaft was sunk over 300 feet and some cross-cutting done. The shaft will be sunk to 500 feet.

The Gold Creek District, near Ohio City, gave promise of becoming very active in 1916, but failed on account of a scarcity of miners and the closing of the Gold Links Mine.

The Belzora Bassick opened a good body of ore in the contact vein reached through the Mutual tunnel, which is being mined and hauled to the Sandy Hook Mill for treatment.

The Gold Links Unit of the Colorado S. & R. Co., was operated by lessees in 1915; in July of 1916 it closed down, the reason given was adverse litigation.

The Carter Mine shipped some ore in 1915. During 1916 a small force was employed on development work and keeping the property in repair.

A small force was employed on the Revenue Mine in Box Canon during 1916. A cross-cut tunnel is being driven, which,



when completed, will cut the vein 250 feet below the bottom of the shaft. The minerals in this property are gold and silver.

### HINSDALE COUNTY

Mining operations in Hinsdale County did not improve greatly in the past two years. The most notable change was the resumption of operations on the old Golden Fleece which has been practically idle for several years. The property was taken over under lease and option by The Colorado Utah Mines Operating Company, which started operations in the summer of 1915. A new concentrator with oil flotation was constructed at the mine dump. There is said to be about 70,000 tons of good grade ore in the dump which will be treated in the new mill in addition to the ores from the mine.

The Tobasco Mill was torn down and hauled to White Cross, where it will be reconstructed for the treatment of the ores from around Burrows Park, as well as the ores from the Copper Boy Group of claims. The ore minerals on the Copper Boy are chiefly silver and copper and the showing is very good.

The Champion Mine, also located in Burrows Park, 23 miles from Lake City, resumed operations in June, 1916, after a period of 15 years idleness. The shaft was unwatered to the lowest level and retimbered. There is considerable ore blocked out in this mine, and as the ore minerals are silver and copper it will no doubt be a steady producer in 1917.

Operations were started in May, 1916, on the Silver Fleece and a small force employed on development work. In addition a number of lessees in the Henson Creek section have made a good showing and added considerable to the production of the county.

### LA PLATA COUNTY

Owing to the closing down of the May Day and the Idaho Mines in the fall of 1915, the production of this county was considerably decreased. But in 1916 there was a big improvement in mining operations. Several of the old properties which were shut down for a number of years resumed operations. New and important strikes were made, and altogether the district was quite active.

The cross-cut tunnel being driven to cut the Columbus vein on Lewis Mountain encountered the vein 1,080 feet from its portal, when the vein proved to be about 42 feet wide with a streak of ore 12 feet wide running along the center of it. Later on an upraise was driven to the shaft and connections made with the old workings.



The Ten Broeck Mine is another important property in the La Plata District which became active in 1916. This property is located on Lewis Mountain, and is operated by The Lewis Mountain Mining Company. A compressor and machine drills were installed during the year; a new boarding house and other buildings were constructed. A tunnel is being driven to intersect the vein, which is said to have a good showing on the surface. The tunnel is in about 600 feet, and will have to be driven 1,700 feet before the vein is reached.

Lessees on the Bessie G., located about one-half mile from the Columbus mine, shipped a car of high grade tellurium ore to the Durango Smelter in 1916.

The Durango Girl has produced high grade tellurium gold ore at various times, and during the past two years it has been operated under lease and shipped smelting ore regularly.

Operations were resumed on the Bay City in 1916. A compressor was installed at the mine and preparations made to work the property on an extensive scale. Shortly after operations were resumed a new ore body was cut which was said to run high in gold and silver.

A small force of men has been employed for several years in the Lucky Moon and some good ore produced.

The Suene de Oro (Dream of Gold) located on Lewis Mountain, has been operated during the summer months for the past two years, employing a small crew of men on development work. This property is said to cover the extension of the Columbus vein and promises well when thoroughly developed.

### MINERAL COUNTY

Mineral County shows a big improvement in mining conditions in 1915-1916. The Mineral County M. & M. Co. operated the Happy Thought Mine under lease, and produced steadily during the two years under review. In addition to the ore stoped in the mine, considerable ore recovered from old caves was treated in the Humphreys Mill, which has lately been equipped with oil flotation.

During 1915 the Commodore was worked in a limited way by lessees with fair success. The owners took over the property in February, 1916, and increased production rapidly.

The Bachelor Mine has been turning out some good ore under the leasing system. The Carson Mill in Creede was equipped with roasting and chlorination machinery to treat the ores from this property.

The D. M. & Chance M. & L. Co., operating on the Last Chance Mine, has been employing a few men during the past two years. A good grade of silver ore is being taken out of a large cave and shipped direct to the smelter.

On East Willow Creek the lessees on the C. M. and S. opened up a good body of gold ore in 1916 and shipped several carloads to the smelter, which brought good returns.

Several small sets of lessees were scattered over the district, some of them shipping ore and others preparing to start so that if the price of silver remains high Mineral county will be one of the principal producers of the white metal in the state in 1917.

The only producing fluorspar mine in southwestern Colorado, is located at Wagon Wheel Gap Hot Springs in Mineral County. This property is operated continuously by The Colorado Fluor Spar Company, and employs about 25 men, and 50 tons daily is shipped to Pueblo for use as a flux in the manufacture of steel.

### **RIO GRANDE COUNTY**

Summitville is the principal mining camp in Rio Grande County. Several years ago it produced some of the highest grade gold ore that ever was produced in the state.

During the past few years this district has been inactive, but there are considerable bodies of developed ore which would be worked if located nearer transportation.

### **OURAY COUNTY**

The closing down of the Camp Bird Ltd. in June of 1916 had considerable effect on the production of Ouray County. This famous gold mine produced nearly \$26,000,000 in 20 years with an average of 200 men employed. However, the closing down of the Camp Bird was somewhat offset by the resumption of operations on the old Revenue Mine which has been inactive for several years. This property was taken over by an English Company, operations started in May, 1916, and again placed in the producing class.

The Atlas mine is now the principal producer of Ouray County. This property has been operating steadily for a number of years and producing a large tonnage of ore which is treated in the Company's mill, located about one-half mile from the mine.

In 1915 a shaft was sunk on the Klondike vein below the tunnel level which exposed an ore body of about the same size and value of that worked out above. The animal haulage was

supplanted by storage battery locomotives which are now used for hauling the ore 8,000 feet to surface. An oil flotation machine was installed in the mill over three years ago which makes this company the pioneers of oil flotation in Colorado.

Early in the spring of 1916 the Mountain Top Mining Company resumed operations on their property located near the Atlas Mine in Sueffels Mining District.

Considerable development work was done in the mine and an underground mill having 60 tons daily capacity was constructed 900 feet from the portal of the tunnel. This mill is an innovation and, if successful, may overcome many difficulties frequently encountered in this snow-slide section.

The Mount Hayden M. & M. Co. started operations on their property, locally known as the Thistle Down, in April, 1916. The tunnel was retimbered and some development work done in the mine. When the ore bodies are sufficiently developed the Company's mill will be put into operation.

About one mile from the town of Ouray is located the Mineral Farm property which produced some good ore several years ago. The property was inactive for a number of years until the summer of 1916, when a local party secured a lease and operated steadily throughout the year.

In July, 1916, the Camp Bird, Ltd., closed down their mine and mill indefinitely and in January of the same year a new tunnel was started near the mill, which, when completed, will be nearly 11,000 feet in length and cut the Camp Bird vein over 1,400 feet under No. 3, the old adit tunnel. Several other well-known veins will have been cut, but no ore will be mined until the Camp Bird vein is reached and connection made with the shaft and the upper workings. The tunnel is completed about 4,000 feet and advancing at an average of 16 feet in each 24 hours, and at this rate should be completed in a little over one year.

The Legal Tender is a promising prospect, situated about  $2\frac{1}{2}$  miles from the town of Ouray. The owners (mostly local people) have been pushing development on the property for several years. During the past year they drove the tunnel into a diorite dyke which they consider an excellent indication that the ore body is not far distant.

The excellent showing of the Bennaek Mine, located on Engineer Mountain, has encouraged the owners to start a new tunnel from the wagon road, which, when completed, will give about 500 feet additional depth on the vein. A compressor was in-



stalled at the property and the tunnel is being driven with air drills. This property, under the present management, has been shipping a good grade of grey copper ore direct to the smelters for several years.

The Slippery Rock, situated along the Red Mountain road, opened up a good body of ore and shipped some in 1916.

Local parties leasing on the Governor Mine, situated in the Sneffels district, produced some characteristic high grade gold ore.

There was considerably more activity in the Dexter Creek Section during the past year than any time during the past decade. The Caliope Mine, employing a small force of men, shipped several cars of silver-lead ore which brought good returns.

Local parties operating the Bachelor Khedive under lease, opened up a fine body of grey copper ore and shipped to the smelters regularly during the biennial period.

The Wedge, operated by local leasers, was a steady shipper during the past year, both from the dump and the mine.

The Senorita, the Newsboy, the Black Girl and the Pony Express were active in 1916, each employing a few men on ore that was shipped to the smelters.

In 1914 a new development tunnel was started on the American Mining Company's property, located in the gold belt below the town of Ouray. Since then over 4,000 feet has been driven on the property. In the course of this work several large bodies of low grade ore were encountered.

During the year 1915, the Wanakah Mine produced over 100 tons daily which was treated in the company's mill and smelter, located just below the town of Ouray. The property was inactive during 1916.

That part of Red Mountain located in Ouray County, became very active in the past two years. Operations were resumed on several old producers and some new properties were started. The tonnage produced in this district in 1916 exceeded that of any year in the history of the district.

The Davey Leasing Company have a lease on the mine and dump of the National Belle. This property was operated for silver prior to 1893, little attention being given to the copper content of the ore.



Silverton parties secured a lease on the old Crawford Mines at Red Mountain. Some work was done in the Yankee Girl and Gustin Mines and a good tonnage of ore was shipped from the dumps to the smelter. A flotation plant was constructed for the treatment of ores from these properties and will be running early in 1917.

The Mountain King Mining Co. conducted development operations on their property near Ironton in 1915-1916. A large vein of sulphide lead and zinc ore measuring from 4 to 5 feet in width was opened, and several thousand feet of drifting done. This property is now operated by leasers and shipping steadily.

Leasers operating on the Barstow during recent years have been producing a good tonnage of excellent mill ore.

The old South Dakota, located in Grey Copper Gulch, was started up by the Vernon Mining Co. in 1916. A compressor, hoisting machinery and a saw mill were installed at the mine and a number of substantial buildings erected. In August, while the shaft was being sunk, a very rich strike of grey copper ore was reported.

### **SAN MIGUEL COUNTY**

Although the two years just past have been the most prosperous that San Miguel County has ever enjoyed, it cannot be altogether attributed to the high price of metals. The big mines of this county are so well equipped that their production varies but little, and during the past year some new producers have been opened. This county produces much complex ore and the separation of it is accomplished to a high degree in the large mills of Telluride. The Smuggler Union treats, in addition to the output of their own property, that of the Humboldt and Black Bear Mines. The Smuggler Union was the first in this county to adopt the oil flotation process and are now installing flotation equipment in the cyanide mill building.

With the exception of a partial shut-down for a few days in December, 1916, account of pump trouble at the Blue Lakes, from where they get their water, the Smuggler Union properties were operated continuously during the past two years with an average force of about 330 men. During the year 1915 a new vein, parallel to the old Smuggler vein, was opened up on the 11th level. The ore in this vein is a heavy sulphide and amenable to flotation.

In 1915 the Humboldt group was taken over by new management and production started. Connection was made between the adit tunnel of the Sheridan mine and the Humboldt shaft and the ore taken out through the adit tunnel and shipped over

the Smuggler tramway to the Smuggler mills at Pandora for treatment.

The Tomboy mine is worked on the shrinkage method, which naturally affords a large reserve and enables the management to make the production and earnings uniform from month to month.

The Liberty Bell Gold M. Co. has been operating its big mine in Cornet Basin for a number of years with a force of about 250 men. This property is the largest tonnage producer in San Miguel County, treating over 500 tons daily. This large tonnage is hauled out of the mine by an electric locomotive and transported over an aerial tramway to the Company mill, located on the railroad.

The Black Bear Mine, located in Ingram Basin, during the past two years has been producing about 160 tons daily, which is transported over an aerial tramway to the Smuggler Union mill at Pandora for treatment. In November and December of 1916, the property was temporarily closed down while the shaft was being retimbered and equipped with a skip which will enable the management to increase the production.

Lessees on the Carothers property, owned by the Smuggler Union M. Co. and operated through the Sheridan cross-cut, had the misfortune to lose their mill by fire in the winter of 1915. They secured an extension of their lease and built a new mill with 60 tons capacity.

Bear Creek Basin had a number of active properties in 1916.

The Anderson-Lacy Leasing Co. has been working the Ballard Group with a small force. Farrell & King took a lease on the Gertrude Group near the head of Bear Creek and equipped the mine for working air drills.

Lessees on the Nellie Mine are breaking ore which they propose to treat at the Nellie Mill.

The Ophir District has not produced much ore in the past few years. But, judging from the preparation being made on numerous properties, it will give a good account of itself in 1917.

The Alta Mine, operated by the Wagner Development Co., is connected with the Railroad station at Ophir Loop by an aerial tramway, over which, everything except heavy machinery is transported to and from the mine and mill. A new wagon road was built from Ophir Loop to the mill during the past summer,

over which new machinery was taken for the purpose of increasing the capacity of the mill and to install oil flotation.

The Lake Superior Ophir, locally known as the Calumet, was taken over by the Highland Mary Mines Co. in 1916, and operations were started with a good force of men. The property is being thoroughly developed and when the Alta and other well-known veins are reached, this property should begin production.

Lessees on the Santa Cruz, situated on Silver Mountain near Ophir, opened up a good body of ore and shipped several cars in 1916.

The 800-foot upraise connecting the lower tunnel with upper workings in the Silver Bell mine at Ophir Loop, was completed in the early fall of 1916. A good body of tungsten ore was encountered while the raise was being driven.

Lessees on the Butterfly Terrible Mine & Mill made a small production in 1916.

The vanadium industry in this county has been picking up during the past year. The Bear Creek mine of the Primos Chemical Co. was working a large force of men. A caterpillar traction engine is now used to haul the ore from the mine to the mill, a distance of three miles.

This company installed an aerial tramway at their Fall Creek mine near Saw Pit, to transport ore to the railroad.

### **MONTROSE COUNTY**

As previously stated, the year 1915 was a dull one in the mining districts of Montrose County owing to the uncertainties in the market for radium. Some work was done in the neighborhood of the La Salle Copper Mine, by Gordon Galloway and associates, and some selected high-grade copper-silver ore was shipped to the smelters. The Sunrise Mine, on the same vein as the Galloway property and the La Salle Mine, about six miles distant, was active and made some production of ore typical of that produced from this vein. During 1916 the work was not continuous, but about the same production of copper ore was made. In September, 1916, the carnotite producers became very active, more particularly the Standard Chemical Company. Several hundred miners were imported and from 50 to 100 four-and six-horse teams were kept busy freighting between Placerville, a station on the Rio Grande Southern Railroad, and the mines, until bad weather made the roads impassable.

Complete field examinations were made of the carnotite deposits during this biennial period by Mr. Frank L. Hess, of the



United States Geological Survey, and by Dr. R. D. George, of the Colorado Geological Survey, and reports will soon be issued giving the results of their respective investigations. These reports give much definite information, which has been greatly needed since this industry was started in Colorado. A considerable production of very high-grade manganese dioxide, suitable for chemical purposes, was made from the deposits which are widely scattered throughout Montrose and San Miguel counties. Owing to the difficulties of transportation to the railroad, and the high freight charges, this work was forced to suspend. With cheaper and more dependable transportation, this industry should grow rapidly.

### SAN JUAN COUNTY

San Juan County is the center of a district showing the largest veins of low grade milling ore in the state. The question of efficient treatment has been solved by the installation of flotation plants and electrostatic magnetic separation. In former days the mill recovery was in the neighborhood of 60 per cent, but now, with the new processes, the recovery is nearer 90 per cent. The total output of this county was much greater in 1916 than ever before, and it is a safe estimate that at least 15 per cent more profit will accrue to the operators of the mines than in years past on account of the use of oil flotation in treating the ores.

Silver Lake Mill was remodeled to operate as a custom mill in 1916, which was an important factor in improving mining conditions in this county.

The Dora Cons. M. & M. Company's property, located almost within the city limits of Silverton, means a great deal to the local business interests on account of the employees living in town.

The shaft was sunk 100 more feet and considerable ore was shipped to the Silver Lake Mill for treatment.

The Champion Mine is another near the town of Silverton which resumed operations in 1916, and has since been a steady shipper of a good grade of copper ore, carrying some gold and silver.

The S. D. & G. Company, composed mostly of local men, acquired a title to the North Star property on Sultan Mountain in 1916 and started operations immediately. The mine was put in good condition and the mill overhauled and equipped with flotation.

One of the most important strikes announced within the past year was made on the Crown Jewel group on Anvil Moun-



tain, adjoining the town limits. The property is operated by lessees, who opened up a vein of grey copper ore about 20 inches wide running high in silver. Several cars of this ore were shipped to the smelter during the year.

The Lackawanna Group, located on Kendall Mountain, about  $\frac{1}{2}$  mile from Silverton, and inactive for several years, started operations with a small crew of men during the summer of 1916. This property contains good bodies of lead ore and should become a permanent shipper.

On the San Juan County side of Red Mountain a number of properties have been shipping a large tonnage during the past two years. Several sets of lessees operating on the Congress Mine have been shipping regularly from the mine and dump. Some of the ore is shipped direct to the smelters and the remainder to the Silver Lake mill for concentration.

The St. Paul Mine, adjoining the Congress property, is also operated by leasers, who were steady shippers during the year. This ore was also sent to the smelters and Silver Lake mill.

The Summit Copper Mining & Milling Company resumed operations on the San Antonio Group at Red Mountain in 1916.

Leasers operating the Atlantic Group near Red Mountain have been breaking good ore, carrying gold and silver, which is assorted and packed to Sheridan Junction,  $\frac{1}{2}$  mile from the mine and shipped to the smelters.

At Chattanooga, Silver Ledge has been producing a good tonnage of lead and zinc ore, which is treated in the Company's mill. The property is operated by lessees, who are doing well.

The Telescope Mining & Milling Company owns a property  $\frac{1}{2}$  mile from Chattanooga which is well equipped. The management has been pushing development work and making preparations to begin shipping.

The Gold King Mine, near Gladstone, started again in June, 1916, after being idle from January of the same year owing to a snowslide disabling the compressor plant. This property has been operated almost continually by lessees in recent years and it is one of the largest producers in San Juan County.

During the black metal excitement of 1915-16 several good tungsten veins were opened in different sections of the county. Among these is the Dawn of Day claim of the Galty Boy Group, located in Dry Gulch near Red Mountain. This property was

operated under lease by the Colorado Metals Company, who extracted considerable tungsten ore and had it treated in the old Yukon mill on which they also had a lease. Several small properties in the county have similar ores treated in this mill.

Contractors on the property of the Elk Mountain Mining Company, owners of a large group of claims near Cement Creek, have been pushing the cross-cut into the mountain. Several veins have already been cut, but the tunnel will be driven to its objective point, said to be about 2,000 feet ahead.

The Queen City Group, located in Ohio Gulch, is now being operated by local parties under lease and option. During the summer of 1916 a rich strike was made in the Queen City claim. The ore is a heavy galena running high in silver.

In the fall of 1915 the concentrating mill of the Hamlet Mining & Milling Company was destroyed by fire which caused a shut-down for the winter. A contract was given to a Denver company to rebuild the mill, who started work in the spring of 1916, built a new mill and had it in operation within three months. This property has been producing a good tonnage since the mill was reconstructed.

Fire destroyed the compressor plant of the Domingo Mining & Milling Company, located in the town of Eureka, and the property has since been idle. Considerable development work has been done on the property in the past few years.

The Kunz Akers Group of claims, located near the town of Eureka, was taken over by Eastern parties and a force of men put to work on development.

A deal was made in 1916 on the Klondyke Group in Burns Gulch, whereby the title to the property passed to an Eastern company. A force of men was employed during the summer in the mine on development work and constructing new buildings for the accommodation of the men.

The Sunnyside Mines Company never ceases operations. The ore bodies in this great mine seem to be inexhaustible. The management of this property, several years ago, demonstrated that the veins go down in this section when they drove a tunnel into the mountain one mile and cut one of the Sunnyside veins about 2,000 feet from the surface. The vein is composed of gold and silver bearing sulphides of lead, copper, zinc and iron and measures over 12 feet in width.

This property has been operated steadily for over 30 years, but never in its history have the profits been as large as now. Flotation was installed in the mill during the past year.

At the head of Maggie Gulch in the Eastern Gold belt, the Intersection Mine is producing steadily. This property is operated by local business men who appear to be doing well. The ore carries chiefly gold and is treated in a mill at the mine. Some concentrates are made in the mill, but the values are largely caught on amalgamating plates.

The Kittimac, located in Minnie Gulch, resumed operation early in 1916 under new management. The mill was overhauled and equipped with oil flotation, and while this was being done development was pushed to assure sufficient ore to keep the mill going steadily.

A number of men were put to work on the Ben Butler Mine at Animas Forks which resumed operations in July, 1916. Several cars of ore were shipped to the smelters from the dump. A new compressor was installed at the mine and development work will be carried on during the winter.

Cunningham Gulch is the most active section of the county. Nearly all of the old mines are going and several new ones have started up.

An Eastern company secured a lease on the new Green Mountain Mine and Mill and the Pride of the West properties and started operations on a large scale in the summer of 1916. Both mines, when connection is made, will be served through the Green Mountain Tunnel. The Green Mountain mill was remodeled and equipped with flotation.

The Highland Mary, located near the head of Cunningham Gulch, has been operated successfully by leasers for a number of years. When the lease expired in July, 1916, a company, composed of local men, secured a five years' lease on the mine and dump and proceeded at once to build an aerial tramway and to equip the mill with new machinery, including flotation. The dump ore will be treated in addition to the ores from the mine. A shoot of high grade silver ore was opened up in July which yielded a good tonnage.

The American Smelting and Refining Company took a lease and option on the old Green Mountain property in 1916, and carried on operations with a good force of men. The lead and zinc sulphide ores broken in the mine are hauled in wagons to the Green Mountain switch, one mile from the mine, and shipped to the Silver Lake mill for treatment.

The Shenandoah Dives Group, located on the southeastern slope of King Solomon Mountain, has been operated successfully



by lessees for a number of years. The ore broken in the mine is washed, assorted and packed to the Green Mountain switch and shipped direct to the smelter.

A small force of men has been employed continuously for several years in the Garryowen tunnel, which is being driven into Galena Mountain. Several good veins are said to have been cut in the course of development.

The Buffalo Boy Mine, located in the eastern gold belt near Stony Pass, is looked upon as the big mine prospect of San Juan County. It is opened by an adit level driven over 1,500 feet on the vein which shows a continuous body of high grade ore that will compare favorably with any of the famous old mines of the state. The property is tied up in litigation and only a small force of men are employed on development.

In Meadow Creek Basin, near Stony Pass, the Bell Button Mining Co. have been driving a cross-cut tunnel with a small force. In August, 1916, the vein was reached 765 feet from the portal of the cross-cut. Drifts are now being driven on the vein which shows an average width of 12½ feet of ore carrying gold and silver.

In Arastra Basin more men are employed than for several years. Several sets of lessees, operating on the the Silver Lake Mine, have been producing a good tonnage of ore. One of the leasing companies on this property had the distinction of being the largest shipper of crude ore from San Juan County to the Durango smelter in 1916.

The Iowa Tiger Mining and Milling Company's property has been operated by lessees for several years and the old mine never fails to produce a good tonnage. In 1915 a shaft was sunk on the Mellville vein which opened up a fine body of ore. The production of the mine, about 75 tons per day, is shipped over an aerial tramway to the Iowa Tiger mill for treatment.

The May Flower Group is a very promising property, located in Arastra Gulch, which is being operated under lease and bond. In July, 1916, operations were started. An aerial tramway was built to the Iowa Tiger mill where the ore is shipped for treatment. During the summer an unusually large body of rich ore was encountered while upraising from the lower tunnel to an upper level.

The Big Giant Mine on King Solomon Mountain is owned by the Garfield Smelting and Refining Company and operated by leasers. In addition to the ore broken in the mine, the tailings



from the old Big Giant mill, located near the old workings are being transported over an aerial tramway two miles long, to the Contention Mill for treatment.

The Oriental Group in Arastra Gulch, which has been inactive for the past 32 years, resumed operations during the past summer. A new compressor was installed at the tunnel and the mine will be systematically developed, which should put it in the producing class in 1917.

Considerable work has been going on in the South Mineral section for several years. A number of small properties have been operating during the summer months, each with a few men. This district has much heavy sulphide ore in complex form.

The Mears-Wilfley Mill, constructed at the Silverton Northern Railroad tracks a few years ago to treat the tailings of the old Silver Lake mill, which were run into the lake near the mine for a number of years has been treating nearly 500 tons daily. The tailings are pumped out of the lake and run through a flume three miles long to the mill. This enterprise is said to be profitable, although the total value contained in the tailings is less than \$3.00.

## SAGUACHE COUNTY

Bonanza is the principal mining district in Saguache County, but for several years has not been active. At no time in its history has the outlook been any better than now. Several properties located here are undergoing systematic development.

The Rawley Mines Company is the biggest operator in this district. It employed a force of about 45 men during the past summer and shipped about 3,000 tons of ore. In the meantime, sufficient development work was carried on to guarantee steady shipments in 1917.

A force of about 20 men were employed on the St. Louis Mine, mostly on development work and some ore was shipped to the smelters.

Considerable development work was done in the Autora Mine with four men employed.

The Eagle Mines Company and the Empress Josephine each had a few men employed on development work.

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I served as a mine inspector for the Bureau of Mines for 16½ months of the last biennial period. During that time I made 226 recommendations for safety, which, in almost every case, were well taken and cheerfully complied with. I wish to express my thanks to those in charge of the various properties for their courteous treatment at the time of inspections.

# CLASSIFICATION ACCORDING TO CAUSE OF ALL ACCIDENTS IN THE METAL MINING INDUSTRY IN THE STATE OF COLORADO DURING THE YEARS 1915 AND 1916

TABLE NO. 1.

	Fatalities		Permanent total disability		Permanent partial disability		Temporary disability time lost more than 14 days		Slight injury (time lost, 1 to 14 days)	
	1915	1916	1915	1916	1915	1916	1915	1916	1915	1916
UNDERGROUND										
1. Falls of rock or ore from roof or wall.....	13	19	...	1	2	1	83	94	139	157
2. Handling rock or ore.....	1	1	...	...	2	2	20	24	77	81
3. Timber or hand tools.....	1	1	...	...	3	4	19	23	67	78
4. Explosives.....	8	7	...	...	2	4	6	5	26	32
5. Haulage.....	1	4	...	...	4	6	68	79	121	133
6. Persons falling down chute, winze, raise or stope.....	11	4	...	...	2	2	34	39	27	35
7. Run of ore from chute or pocket.....	1	2	...	...	...	...	6	9	10	4
8. Drilling (by machine or hand drills).....	1	...	...	...	1	2	25	31	62	64
9. Electricity.....	...	1	...	...	2	...	...	1	4	6
10. Machinery other than 5 and 8.....	...	...	...	...	...	...	3	...	1	...
11. Mine fires.....	...	...	...	...	...	...	...	...	1	...
12. Suffocation from natural gases.....	...	...	...	...	...	...	...	...	...	3
13. Inrush of water.....	...	...	...	...	...	2	...	6	19	26
14. Nails and splinters.....	...	2	...	...	6	8	35	42	134	146
15. Other causes.....	...	...	...	...	...	...	...	...	...	...
Total.....	36	41	...	1	22	31	299	353	688	765
SHAFT										
16. Falling down shaft.....	9	4	...	1	...	...	6	8	5	7
17. Objects falling down shaft.....	1	3	...	...	...	...	7	11	13	16
18. Breaking of cables.....	...	...	...	...	...	...	...	...	...	...
19. Overwinding.....	2	...	...	...	...	...	...	1	...	...
20. Cage, skip or bucket.....	3	...	...	...	1	...	14	16	15	12
21. Other causes.....	...	...	...	...	...	1	3	5	4	7
Total.....	10	12	...	1	1	1	30	41	37	42
SURFACE SHOPS AND PLANT										
22. Haulage.....	1	...	...	...	1	...	14	17	10	13
23. Railway cars and locomotives.....	1	...	...	...	...	...	1	1	1	...
24. Run or fall of ore in or from ore bins.....	...	...	...	...	...	...	...	1	2	2
25. Fall of persons.....	1	1	...	1	2	...	10	13	13	16
26. Nails and splinters.....	1	...	...	...	...	...	2	1	12	10

27. Hand tools, axes, bars, etc.....	...	...	3	4	4	17	21
28. Electricity.....	3	...	...	1	2	1	1
29. Machinery.....	...	...	6	7	9	14	18
30. Other causes.....	*5	...	...	9	12	34	45
Total.....	9	1	11	48	60	104	126

## PLACER MINES AND QUARRIES

31. Falls or slides of rock or ore.....	...	...	3	4	11	11	7
32. Explosives.....	...	...	1	1	1	1	6
33. Haulage.....	1	...	...	...	...	6	...
34. Steam shovels.....	...	...	1	4	4	4	6
35. Fall of persons.....	...	...	...	...	...	...	1
36. Falls of derricks, booms, etc.....	...	...	...	...	...	...	1
37. Run or fall of ore from ore bins.....	1	...	...	2	2	1	2
38. Machinery (other than 33 and 34).....	1	...	1	1	1	1	1
39. Electricity.....	...	...	...	...	...	9	4
40. Hand tools.....	...	...	...	14	17	15	20
41. Other causes.....	...	...	...	...	...	...	...
Total.....	2	...	6	24	37	50	48

## ORE-DRESSING AND MILLING PLANTS

1. Haulage system.....	1	...	1	...	1	2	6
2. Railway cars or locomotives.....	...	...	...	...	1	1	1
3. Crushers.....	...	...	...	...	3	3	3
4. Rolls or stamps.....	2	...	2	5	2	5	5
5. Tables, jigs, etc.....	...	...	...	1	2	2	2
6. Other machinery.....	2	...	1	9	8	17	33
7. Falls of persons.....	1	...	...	2	9	9	23
8. Suffocation in ore bins.....	...	...	...	1	...	1	1
9. Falling objects (rocks, timbers, etc.).....	1	...	1	7	...	20	10
10. Cyanide or other poisoning.....	...	...	...	...	...	...	...
11. Scalding (steam or water).....	...	...	...	...	...	...	...
12. Electricity.....	...	...	...	2	1	3	2
13. Hand tools, axes, bars, etc.....	...	...	...	4	4	16	9
14. Nails, splinters, etc.....	...	...	...	1	2	2	7
15. Flying pieces of rock from sledge or crusher.....	...	...	...	2	2	2	7
16. Other causes.....	1	...	...	3	6	17	13
Total.....	4	...	2	32	43	97	122

\*Two blacksmiths killed in the shop by a snowslide.

CLASSIFICATION ACCORDING TO CAUSE OF ALL ACCIDENTS IN THE METAL MINING INDUSTRY  
IN THE STATE OF COLORADO DURING THE YEARS 1915 AND 1916—Concluded

SMELTERS	Fatalities		Permanent total disability		Permanent partial disability		Temporary disability time lost more than 14 days		Slight injury (time lost, 1 to 14 days)	
	1915	1916	1915	1916	1915	1916	1915	1916	1915	1916
1. Haulage system.....	2	---	---	---	1	1	30	42	76	90
2. Railway cars or locomotives.....	---	---	---	---	---	---	1	3	3	1
3. Crushers.....	---	---	---	---	---	---	1	---	4	---
4. Cranes.....	---	---	---	---	1	---	---	---	---	---
5. Blowers.....	---	---	---	---	---	---	3	1	---	---
6. Other machinery.....	---	---	---	---	2	1	10	5	1	1
7. Falls of persons.....	---	1	---	---	1	---	13	9	33	44
8. Suffocation in ore bins.....	---	---	---	---	---	---	1	---	1	---
9. Flying or falling objects (rocks, timbers, etc.).....	---	---	---	---	1	1	14	21	62	71
10. Gas (burning or asphyxiation).....	---	---	---	---	---	---	1	---	---	1
11. Scalding (steam or water).....	---	---	---	---	---	---	---	---	1	5
12. Electricity.....	---	---	---	---	---	---	---	---	1	2
13. Hand tools, axes, bars, etc.....	---	---	---	---	---	---	3	4	23	27
14. Nails, splinters, etc.....	---	---	---	---	---	---	2	---	7	6
15. Furnace slips.....	---	---	---	---	---	---	5	2	10	8
16. Burns from matte, slag, or molten metal (pouring or spilling).....	---	---	---	---	---	---	---	---	---	---
17. Hot-metal explosions.....	---	---	---	---	---	---	29	39	40	50
18. Other causes.....	3*	---	1	---	1	---	2	5	11	10
Total.....	5	1	1	---	6	4	125	144	314	355

\* Killed by hot tar account of defective hose connections.





# CLASSIFICATION, ACCORDING TO CAUSE AND OCCASION, OF ACCIDENTS IN THE MINING INDUSTRY OF COLORADO DURING THE

TABLE NO. 2.

## UNDERGROUND.

	Superintendents, Foremen, Bosses	
	1915	1916
1. Fall of rock or ore from roof or wall.....	1	3
2. Rock or ore while loading at working face or chute.....	.....	.....
3. Timber or hand tools.....	.....	.....
4. Explosives.....	2	1
5. Haulage system.....	.....	.....
6. Falling down chute, winze, raise or stope.....	1	.....
7. Run of ore from chute or pocket.....	.....	.....
8. Drilling accidents.....	.....	.....
9. Electricity.....	.....	1
10. Machinery (other than locomotives or drills).....	.....	.....
11. Mine fires.....	.....	.....
12. Suffocation from gases.....	.....	.....
13. Inrush of water.....	.....	.....
14. Nails, splinters, etc.....	.....	.....
15. Other causes.....	.....	.....
Total.....	4	5

## SHAFTS.

16. Falling down shafts.....	1	1
17. Objects falling down shafts.....	.....	.....
18. Breaking of cables.....	.....	.....
19. Overwinding.....	.....	.....
20. Skip, cages or bucket.....	.....	1
21. Other causes.....	.....	.....
Total.....	1	2

## SURFACE SHOPS AND PLANTS.

	Superintendents and Bosses	
	1915	1916
22. Mine cars or mine locomotives, gravity or aerial tramways.....	1	.....
23. Railway cars or locomotives.....	1	.....
24. Run or fall of ore in or from ore bins.....	.....	.....
25. Fall of persons.....	.....	.....
26. Nails, splinters, etc.....	.....	.....
27. Hand tools, axes, bars, etc.....	.....	.....
28. Electricity.....	.....	1
29. Machinery.....	.....	.....
30. Other causes.....	.....	.....
Total.....	2	1

\*Two blacksmiths were killed in the shop by a snowslide.

# CUPATION, OF THE FATALITIES IN THE METAL YEARS 1915 AND 1916—Concluded

Machinemen and Helpers		Miners		Loaders, Shovelers, Muckers and Trammers		Trackmen, Pipemen and Pumpmen		Cage Tenders, Station Cagers		Timbermen, Carpenters and Helpers		Electricians, Motormen and Helpers	
1915	1916	1915	1916	1915	1916	1915	1916	1915	1916	1915	1916	1915	1916
1	4	5	5	2	5	....	....	....	....	4	2	....	....
....	....	....	....	1	1	....	....	....	....	....	1	....	....
4	4	....	1	2	1	....	....	....	....	....	....	1	....
3	....	3	1	3	3	....	....	....	....	1	3	....	1
1	....	....	....	1	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....
9	8	8	7	9	12	....	....	....	....	5	8	1	1
....	....	....	1	2	....	1	....	3	1	2	1	....	....
....	1	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	2	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	2	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	1	....	1	2	4	1	....	3	3	2	1	....	....
Engineers, Firemen and Hoistmen		Blacksmiths and Mechanics		Carpenters, Laborers, Topmen		Electricians		Others					
1915	1916	1915	1916	1915	1916	1915	1916	1915	1916	1915	1916	1915	1916
....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	1	....	....	....	....	1	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	1	....	2	1	2	1	....	....	....	....	....	....	....
....	1	....	2	....	....	....	....	....	....	....	....	....	....
....	1	....	2	2	4	3	....	....	1	....	....	....	....

TABLE NO. 2—Concluded

## PLACER MINES AND QUARRIES

	Drillmen		Laborers	
	1915	1916	1915	1916
Machinery other than .....	1	1	1	1
Others .....	—	—	—	—
Total .....	1	1	1	1

## ORE-DRESSING AND MILLING PLANTS

	Superintendents and Bosses		Grinding Machinery Men		Concentrator Men		Laborers	
	1915	1916	1915	1916	1915	1916	1915	1916
Haulage system .....	—	1	—	—	—	—	1	—
Rolls or stamps .....	—	—	2	—	—	—	—	—
Other machinery .....	—	—	—	—	2	—	—	—
Falls of persons .....	—	—	1	—	—	—	—	—
Falling objects (rocks, timbers, etc.) .....	—	1	—	—	—	—	—	—
Other causes .....	1	—	—	—	—	—	—	—
Total .....	1	2	3	—	2	2	1	—

## SMELTERS

	Superintend- ents and Bosses		Charge Wheelers		Laborers	
	1915	1916	1915	1916	1915	1916
Haulage system .....	—	—	2	—	—	—
Falls of persons .....	—	—	—	—	—	1
Other causes .....	*1	—	—	—	*2	—
Total .....	1	—	2	—	2	1

\*Killed by hot tar account of a defective hose connection.



DAYS OF EMPLOYMENT IN MINES, MILLS AND SMELTERS AND NUMBER OF MEN KILLED  
AND INJURED PER 10,000 DAYS OF EMPLOYMENT DURING THE YEARS 1915 AND 1916.

TABLE NO. 3.

	Days of Employment	Killed		Serious Injury Time lost over 14 days			Slight Injury Time lost 1 to 14 days		
		1915	1916	1915	1916	1915	1915	1916	1916
		No. of Accidents	No. of Accidents	Rate Per 10,000 Days	Rate Per 10,000 Days	No. of Accidents	Rate Per 10,000 Days	No. of Accidents	Rate Per 10,000 Days
Underground .....	1,931,227	45	53	2.330	1.940	428	2.256	725	3.754
*Surface .....	403,039	6	9	1.489	1.786	113	2.243	154	3.821
Mills and ore dressing plants .....	365,878	5	4	1.368	1.096	54	1.302	97	2.653
†Smelters .....	833,587	5	1	.595	.0089	148	1.311	314	3.740
		61	67			743		1290	
						608		1458	

\*Snowslide killed two men in a blacksmith shop in 1916.

†Three men killed by hot tar, account of a defective hose connection, in 1915.

# Name of Mines

## Location Indicated on the Map of Each County by Numbers.

Owing to the scale of these maps it is impracticable to mark the location of more than a few mines in each district, but in many cases the relative position to the well known mines marked will establish the location of other properties. The number, name, metals mined, type of mill, transportation and shipping points are given in the order named.

## BOULDER COUNTY

### PLATE NO. 3.

1. Alice; lead, silver, gold; wagon 14 miles; Boulder.
2. Argo; lead, silver, gold; wagon 14 miles; Boulder.
3. John Jay; gold, silver; old mill; wagon 14 miles; Boulder.
4. Smuggler; gold, silver; wagon 20 miles; Lyons.
5. Buena; gold, silver; roaster, cyanide; wagon 15 miles; Boulder.
6. Golden Age; gold, silver; mill under construction; wagon 15 miles; Boulder.
7. Grand Central; gold, silver; wagon 14 miles; Boulder.
8. American; gold, silver; wagon 7 miles; Salina.
9. Nil Desperandum; gold, silver; wagon 8 miles; Boulder.
10. Inter-Ocean; gold, silver; concentrator, cyanide; wagon 7 miles; Boulder.
11. White Crow; gold, silver; wagon 7 miles; Boulder.
12. Slide; gold, silver; concentrator flotation; wagon 3 miles; Salina.
13. Cash; gold, silver; wagon 2 miles; Salina.
14. Cold Spring; gold, silver; wagon 3 miles; Salina.
15. Big Five Tunnel; gold, silver, copper; amalgamator, concentrator on R. R.; Francis.
16. Utica; gold, silver, copper; amalgamator, concentrator; wagon ½ mile; Ward.
17. Morning Star; gold, silver; amalgamator, concentrator; wagon 2 miles; Ward.
18. White Raven; silver, lead; wagon 1 mile; Puzzler.
19. Modoc; gold, silver, copper; amalgamator, concentrator; wagon ½ mile; Ward.
20. Primos; tungsten; wagon 3 miles; Tungsten Siding.
21. Primos; tungsten; concentrator; surface tram 6 miles, wagon 2 miles; Lake Spur.
22. Wolf Tongue; tungsten; concentrator; wagon 3 miles; Cardinal.
23. Vasco; tungsten; concentrator; wagon 18 miles; Boulder.
24. Red Signe; tungsten, gold, silver; concentrator; wagon 7 miles; Boulder.
25. Eagle Rock; tungsten; concentrator; wagon 8 miles; Boulder.
26. Lucky Two; tungsten; concentrator; wagon 9 miles; Boulder.
27. Roger's Patent; tungsten; concentrator; wagon 14 miles; Boulder.
28. Boulder Tungsten; tungsten; concentrator; wagon 18 miles; Boulder.
29. Colorado Tungsten; tungsten; concentrator; wagon 6 miles; Sugar Loaf.
30. Lord Byron; tungsten, gold, silver; concentrator; wagon 8 miles; Sugar Loaf.
31. Degge Clark; tungsten; concentrator; wagon 6 miles; Boulder.
32. Long Chance; tungsten; concentrator; wagon 2 miles; Rollinsville.
33. Caribou; silver, lead; concentrator, flotation; wagon 3 miles; Cardinal.
34. Emancipation; gold, silver; wagon 2 miles; Salina.
35. Yellow Pine; silver, copper, lead; wagon 1 mile; Crisman.
36. Logan; gold; old mill; wagon 1 mile; Crisman.
37. Livingston; gold, silver; roaster, cyanide; horse tram 2 miles, wagon 2 miles; Sugar Loaf.

38. Mojave; tungsten; wagon 11 miles; Boulder.
39. Gold Nugget; gold; concentrator; aerial tram 1 mile, wagon 14 miles; Boulder.
40. Ben C. Lowell; gold, silver; wagon 8 miles; Boulder.
41. Ke Ke Onga; gold, silver; wagon 10 miles; Boulder.
42. Cash; gold, silver; cyanide; wagon 7 miles; Boulder.
43. Up-to-Date; silver; wagon 5 miles; Cardinal.
44. Lost Lake; gold, silver; wagon 5 miles; Eldora.
45. Primos; tungsten; concentrator; wagon 3 miles; Crescent.
46. National Tungsten; tungsten; wagon 3 miles; Ward.

## CHAFFEE COUNTY

### PLATE NO. 4.

1. Marion; gold, silver, zinc; wagon  $\frac{1}{2}$  mile; Buena Vista.
2. Eureka Mountain; gold, silver; wagon 12 miles; Buena Vista.
3. Holy Water; silver, lead; wagon 9 miles; Buena Vista.
4. Gladstone; silver, lead; wagon  $9\frac{1}{2}$  miles; Buena Vista.
5. Mary Murphy; gold, silver, zinc, lead; aerial tram 1 mile; Romley.
6. Flora Belle; gold, silver, zinc, lead; on R. R.; Romley.
7. Allie Belle; gold, silver, zinc, lead; on R. R.; Romley.
8. Stone Wall; gold, silver, zinc, lead; wagon  $\frac{1}{2}$  mile; Hancock.
9. Sedalia; copper, zinc, gold, silver; surface tram 2 miles; Sedalia switch.
10. Standard; gold, silver, copper; wagon 14 miles; Salida.
11. Madonna; gold, silver, zinc, lead; wagon  $\frac{1}{2}$  mile; Monarch.
12. Giant Eclipse; lead, zinc, silver; wagon  $\frac{1}{4}$  mile; Monarch.
13. Silent Friend; silver, lead, zinc; wagon  $\frac{1}{2}$  mile; Monarch.
14. Hawkeye; gold, silver, zinc, lead; wagon  $\frac{1}{2}$  mile; Monarch.
15. Lilley; gold, silver, copper; aerial tram  $\frac{1}{2}$  mile; Garfield.
16. Jewell; gold, silver, lead; aerial tram  $\frac{3}{4}$  mile; Garfield.
17. New York; gold, silver, lead; aerial tram 1 mile; Garfield.
18. Columbus; gold, silver, lead; wagon 3 miles; Garfield.
19. Uncle Sam; gold, silver, lead; wagon  $3\frac{1}{2}$  miles; Garfield.
20. Stockton; copper, gold, silver; wagon 2 miles; Salida.
21. Turret Independence; gold, copper, silver; wagon 2 miles; Hecla Junction.
22. Turret Copper; gold, silver, copper; wagon 3 miles; Hecla Junction.

## CLEAR CREEK COUNTY

### PLATE NO. 5.

1. Argo Tunnel; gold, silver, lead, copper; concentrator, flotation; on railroad; Idaho Springs.
2. Central Tunnel; gold, silver, lead, copper; on railroad; Idaho Springs.
3. Stanley Tunnel; gold, silver, copper, lead; amalgamator, concentrator; on railroad; Idaho Springs.
4. Champion; gold, silver, lead, copper; old mill; wagon 2 miles; Idaho Springs.
5. Freeland; gold, silver, copper, lead; wagon 7 miles; Idaho Springs.
6. Oneida; gold, silver, copper, lead; concentrator, flotation; wagon 8 miles; Idaho Springs.
7. Lamartine; gold, silver, copper, lead; concentrator, flotation; wagon 12 miles; Idaho Springs.
8. Little Mattie; gold, silver, copper, lead; concentrator; wagon 2 miles; Idaho Springs.
9. Quito; gold, silver, copper, lead; wagon  $1\frac{1}{2}$  miles; Idaho Springs.
10. Big Forty Tunnel; prospect; wagon 6 miles; Idaho Springs.
11. Burns-Moore Tunnel; gold, silver, copper, lead; wagon 8 miles; Idaho Springs.
12. Gem Consolidated; gold, silver, copper, lead; concentrator, flotation; wagon 3 miles; Idaho Springs.
13. Two Brothers Tunnel; gold, silver, copper; wagon 2 miles; Idaho Springs.
14. Lucania Tunnel; gold, silver, copper; wagon 4 miles; Idaho Springs.

15. Freeland Tunnel; gold, silver, copper, lead; on railroad; Dumont.
16. Conqueror Tunnel; gold, silver, copper; wagon 2 miles; Empire.
17. Jo Reynolds; gold, silver, copper, uranium; wagon, 1½ miles; Lawson.
18. Commodore; gold, silver, lead; on railroad; Lawson.
19. Marshall Tunnel; gold, silver, copper; on railroad; Empire.
20. Gold Fissure; gold, silver, copper; wagon 2 miles; Empire.
21. Saxon; gold, silver; amalgamator, concentrator; wagon 2 miles; Georgetown.
22. Mid-Colorado; silver, lead, zinc; concentrator, aerial tram 1 mile; Georgetown.
23. Capital; gold, silver, copper, lead; concentrator; on railroad; Georgetown.
24. Centennial; silver, lead; on railroad; Georgetown.
25. Colorado Central; silver, lead; wagon 3 miles; Georgetown.
26. Waldorf; gold, silver, lead, zinc; concentrator, cyanide; wagon 9 miles; Georgetown.
27. Josephine; silver, lead, zinc; concentrator; wagon 8 miles; Silver Plume.
28. Terrible Dunderburg; silver, lead, zinc; concentrator; on railroad; Silver Plume.
29. Seven Thirty; silver, lead, zinc; concentrator; wagon 3 miles; Silver Plume.
30. Stevens; silver, lead, zinc; concentrator; wagon 6 miles; Silver Plume.
31. Primos; molybdenum; wagon 11 miles; Empire.
32. Lombard; gold, silver, copper; amalgamator, concentrator; wagon 8 miles; Idaho Springs.

## CUSTER COUNTY

### PLATE NO. 6.

1. Racine Boy; silver; wagon 1¼ miles; Westcliffe.
2. Boulder; silver, lead; wagon 1¾ miles; Westcliffe.
3. Geyser; silver, lead, zinc, copper; wagon 1¼ miles; Westcliffe.
4. Silver Bar; silver; old cyanide mill; wagon 1 mile; Westcliffe.
5. Vanderbilt; silver, lead; wagon 2½ miles; Westcliffe.
6. Bull Domingo; silver, lead; old mill; wagon 4 miles; Westcliffe.
7. Bassick; gold, silver, zinc, copper, lead; old mill; wagon 8 miles; Westcliffe.
8. Ben Franklin; gold, silver, lead, zinc; wagon 9 miles; Westcliffe.
9. Hector; gold, silver; concentrator; wagon 9 miles; Westcliffe.
10. Maverick; silver, gold, lead; wagon 9 miles; Westcliffe.
11. Virginia; silver, gold, lead; wagon 9 miles; Westcliffe.
12. Pocahontas; silver, gold, lead; wagon 9 miles; Westcliffe.
13. Humboldt; silver, gold, lead; wagon 9 miles; Westcliffe.
14. Leavenworth; silver, gold, lead; wagon 9½ miles; Westcliffe.
15. Seneca; silver, gold, lead; wagon 9½ miles; Westcliffe.

## DOLORES COUNTY

### PLATE NO. 7.

1. Emma; gold, silver; concentrator; wagon 10 miles; Coke Ovens.
2. Smuggler; gold, silver; concentrator; aerial tram ¼ mile, wagon 10 miles; Coke Ovens.
3. Rose Bud; gold, silver, lead, copper; pack and wagon 15 miles; Coke Ovens.
4. Rico Mines; gold, silver; wagon 1 mile; Rico.
5. Rico Argentine; silver, gold, lead, zinc; wagon 2 miles; Rico.
6. Rico Consolidated; silver, gold, lead, zinc; wagon 2 miles; Rico.
7. Yellow Jacket; silver, gold, lead; wagon 1½ miles; Rico.
8. Rico Wellington; silver, lead, zinc, copper; aerial tram 1 mile; Rico.
9. McIntyre; gold, silver; wagon 2 miles; Rico.



## EAGLE COUNTY

## PLATE NO. 8.

1. Iron Mask; zinc, lead; concentrator, magnetic separator; aerial tram  $\frac{1}{2}$  mile; Iron Mask mill.
2. Black Iron; zinc, lead; aerial tram  $\frac{3}{4}$  miles; Black Iron Switch.
3. Bleak House; zinc, lead; wagon  $\frac{1}{2}$  mile, aerial tram  $\frac{1}{2}$  mile; Iron Mask mill.
4. Mabel; gold, silver, copper; aerial tram  $\frac{1}{2}$  mile; Tip Top Switch.
5. Tip Top; gold, silver, copper; amalgamator, concentrator; aerial tram  $\frac{1}{16}$  mile; Tip Top Switch.
6. Eighty-four; silver, lead; wagon 1 mile; Red Cliff.
7. Wyoming; silver, lead; wagon 1 mile; Red Cliff.
8. Lake Creek; prospect; wagon 8 miles; Edwards.
9. Lady Belle; silver; wagon 8 miles; Eagle.
10. North Dakota; silver; wagon 8 miles; Eagle.
11. Copper King; copper; leaching, electrical precipitation; wagon  $1\frac{1}{2}$  miles; Copper Spur.

## GILPIN COUNTY

## PLATE NO. 9.

1. Perigo; gold, silver, copper; amalgamator, concentrator; wagon 3 miles; Rollinsville.
2. Golden Flint; gold, silver, copper; wagon 4 miles; Rollinsville.
3. Victoria; gold, silver, copper; amalgamator, concentrator; wagon 4 miles; Rollinsville.
4. Pine Comb; gold, silver, copper; amalgamator, concentrator; wagon 7 miles; Black Hawk.
5. Reform; gold, silver, copper; amalgamator, concentrator; wagon 7 miles; Black Hawk.
6. Old Kentucky; gold, silver, copper; wagon 8 miles; Black Hawk.
7. Little Melville; tungsten, gold, silver; wagon 18 miles; Rollinsville.
8. Hard Money; silver; wagon 3 miles; Black Hawk.
9. Rough and Ready; silver, gold; wagon 3 miles; Black Hawk.
10. Anglo Celt; tungsten, silver; wagon 4 miles; Black Hawk.
11. North Star; gold, silver; amalgamator, concentrator; wagon 7 miles; Black Hawk.
12. Mackey; gold, silver, copper; amalgamator, concentrator; wagon 8 miles; Black Hawk.
13. Pioneer Tunnel; gold, silver, tungsten; amalgamator, concentrator; wagon 7 miles; Black Hawk.
14. Evergreen; gold, copper; concentrator, flotation; wagon  $7\frac{1}{2}$  miles; Black Hawk.
15. American City; gold, silver, copper; amalgamator, concentrator; wagon 9 miles; Black Hawk.
16. Gold Springs Tunnel; gold, silver; wagon 2 miles; Tolland.
17. Jumbo; gold, silver; concentrator, flotation; wagon 3 miles; Tolland.
18. Sea Bird; gold, silver; amalgamator, concentrator; wagon 4 miles; Rollinsville.
19. Champion; gold, silver, copper; amalgamator, concentrator; wagon 2 miles; Rollinsville.
20. Kansas Burroughs; gold, silver, copper; amalgamator, concentrator; wagon 2 miles; Black Hawk.
21. Gunnell; gold, silver, copper; amalgamator, concentrator; wagon 2 miles; Black Hawk.
22. Fifty Gold Mines; gold, silver, copper; amalgamator, concentrator; on railroad; Black Hawk.
23. Running Lode; gold, silver, lead, copper; wagon  $\frac{1}{2}$  mile; Black Hawk.
24. Saratoga; gold, silver, copper; concentrator, flotation; wagon 3 miles; Black Hawk.
25. Hampton; gold, silver, lead, copper; wagon 4 miles; Black Hawk.
26. Old Town; gold, silver, copper; wagon 4 miles; Black Hawk.

## GUNNISON COUNTY

## PLATE NO. 10.

1. Brant Independence; gold, silver; wagon 3 miles; Pitkin.
2. Day Star; silver; wagon 1 mile; Sherrod.
3. Princeton; silver, lead, copper; wagon 13 miles; Sargents.
4. Akron Tunnel; silver, lead, zinc; concentrator, flotation; wagon 12 miles; Sargents.
5. Erie; lead, zinc, silver; wagon 13 miles; Sargents.
6. Victor; silver, zinc, lead; wagon 13 miles; Sargents.
7. Spar Copper; gold, silver, lead, copper; wagon 13 miles; Sargents.
8. Belzora Bassick; gold, silver, lead; wagon 5 miles; Ohio City.
9. Carter; gold; concentrator; wagon 3½ miles; Ohio City.
10. Revenue; gold; wagon 2½ miles; Ohio City.
11. Gunnison; silver, lead, zinc; wagon 28 miles; Almont.
12. Doctor; zinc; wagon 18 miles; Almont.
13. Bon Ton; molybdenum; flotation; wagon 3 miles; Quartz.
14. Gold Cup; gold; wagon 10 miles; Quartz.
15. Blistered Horn; gold, silver, lead; old mill; wagon 10 miles; Quartz.
16. Gold Link; gold; old mill; wagon 5 miles; Ohio City.
17. Sheep Mountain; silver, lead, zinc; air-concentrator; wagon 6 miles; Marble.
18. Lead King Extension; silver, lead, zinc; concentrator; wagon 8 miles; Marble.
19. Dreckshage; prospect; wagon 10 miles; Crested Butte.
20. Monmouth; prospect; wagon 2 miles; Irwin.
21. Pennington; silver, lead; wagon 3½ miles; Irwin.
22. Good Hope; gold, silver, copper; smelter; wagon 12 miles; Iola.
23. Anaconda; gold, silver, copper; wagon 10 miles; Iola.

## HINSDALE COUNTY

## PLATE NO. 11.

1. Frank Hough; gold, silver, copper; pack and wagon 3 miles; Animas Forks.
2. Highland Chief; silver, lead, zinc; aerial tram 1 mile; wagon 12½ miles; Lake City.
3. Ocean Wave; gold, silver, lead; wagon 5 miles; Lake City.
4. Ute and Ulay; gold, silver, lead; wagon 3½ miles; Lake City.
5. Hidden Treasure; gold, silver, lead; concentrator; aerial tram and wagon 3 miles; Lake City.
6. Black Crook; gold, silver; concentrator; wagon 2 miles; Lake City.
7. Golden Fleece; gold, silver; concentrator, flotation; wagon 2½ miles; Lake City.
8. Copper Boy Group; silver, lead, copper; wagon 22½ miles; Lake City.
9. Champion; silver, lead, copper; wagon 22 miles; Lake City.
10. St. Jacobs; gold, silver; wagon 17 miles; Lake City.

## LAKE COUNTY

## PLATE NO. 12.

1. Little Jonnie; gold, silver, copper; on railroad; Ibex Switch.
2. Garbutt; gold, silver, copper; on railroad; Ibex Switch.
3. Bobbie Burns; gold, silver, copper; on railroad; Ibex Switch.
4. Evening Star; iron manganese; on railroad; Carbonate Switch.
5. Penrose; silver, lead, iron manganese, zinc; on railroad; Leadville.
6. Wolfstone; zinc; on railroad; District Switch.
7. Greenback; silver, zinc, lead; on railroad; District Switch.
8. Iron Silver; gold, silver, zinc, lead, copper; on railroad; District Switch.
9. Yak Tunnel; zinc, silver, gold, lead; old mill; on railroad; Yak Switch.
10. New Monarch; gold, silver, zinc, lead; on railroad; District Switch.
11. Diamond; gold, silver, zinc, lead; through Yak Tunnel 3 miles; Yak Switch.

12. Silver Cord; gold, silver, zinc, lead; through Yak Tunnel 1 mile; Yak Switch.
13. Leadville Unit; silver, zinc, lead; wagon  $\frac{1}{4}$  mile; District Switch.
14. Anderson Tunnel; prospect; wagon 9 miles; Leadville, Colorado.
15. St. Louis Tunnel; gold, zinc; on railroad; District Switch.
16. Chrysolite; zinc; on railroad; District Switch.
17. Ponsardin; zinc, lead; on railroad; District Switch.
18. Dinero; gold, silver; wagon 2 miles; Arkansas Switch.
19. Griffin; silver, zinc, lead; wagon 5 miles; Arkansas Switch.
20. Mt. Champion; gold, silver; concentrator; wagon 18 miles; Malta.
21. Miller; gold, silver; concentrator; wagon 18 miles; Lake Siding.
22. Lackawanna Belle; gold, silver; wagon 17 miles; Lake Siding.
24. Gordon Tiger; gold, silver; amalgamator, concentrator; wagon 5 miles; Lake Siding.
25. Jennie June; gold, silver; wagon 3 miles; Jennie June Switch.
26. Granite Tunnel; prospect; wagon 1 mile; Granite.
27. Lillian; gold, silver; wagon 1 mile; R. R. Switch.
28. La Plata; silver, zinc, lead; wagon  $\frac{1}{2}$  mile; La Plata Switch.
29. Long and Derry; silver, lead; wagon 6 miles; Leadville.
30. David Harum; prospect; wagon 8 miles; Leadville.
31. Derry Ranch Dredge; gold; wagon 17 miles; Leadville.
32. Resurrection; silver, gold, zinc, lead; through Yak Tunnel 4 miles; Yak Switch.
33. Vega; silver, gold, zinc, lead; through Yak Tunnel 4 miles; Yak Switch.
34. Matchless; silver, lead; on railroad; District Switch.

## LA PLATA COUNTY

### PLATE NO. 13.

1. May Day; gold, silver; wagon 1 mile; May Day.
2. Idaho; gold, silver; wagon 1 mile; May Day.
3. Lucky Moon; gold, silver; wagon 3 miles; May Day.
4. Tomahawk; gold, silver; wagon  $4\frac{1}{2}$  miles; May Day.
5. Copper Hill; gold, silver, copper; wagon  $4\frac{1}{2}$  miles; May Day.
6. Bonnie Girl; gold, silver, lead; amalgamator, concentrator; wagon 6 miles; May Day.
7. Tenbroeck; gold, silver; wagon 8 miles; May Day.
8. Columbus; gold, silver; wagon  $10\frac{1}{2}$  miles; May Day.
9. Cumberland; gold, silver; wagon 10 miles; May Day.
10. Bessie G.; gold, silver; wagon  $12\frac{1}{2}$  miles; May Day.
11. Durango Girl; gold, silver; wagon 10 miles; May Day.
12. Neglected; gold, silver; amalgamator, concentrator; wagon 16 miles; Durango.
13. Mastodon; gold, silver; wagon 2 miles; Needleton.
14. Brooklyn; gold, silver; wagon  $2\frac{1}{2}$  miles; Needleton.
15. Whiting; silver, lead, zinc; wagon 4 miles; Needleton.

## MINERAL COUNTY

### PLATE NO. 14.

1. Fluor Spar; fluor spar; wagon 1 mile; Wagon Wheel Gap.
2. Commodore; silver, lead, zinc; aerial tram  $\frac{1}{2}$  mile; North Creede.
3. Happy Thought; silver, lead, zinc; concentrator, flotation; on railroad; North Creede.
4. Last Chance; silver, lead, zinc; on railroad; North Creede.
5. Solomon; gold, silver, lead; concentrator; wagon 2 miles; North Creede.

## OURAY COUNTY

### PLATE NO. 16.

1. Atlas; silver, lead, gold; concentrator, flotation; aerial tram  $\frac{1}{2}$  mile, wagon 7 miles; Ouray.

2. Camp Bird; gold, silver, lead, copper; concentrator, cyanide; aerial tram 2 miles, wagon 5 miles; Ouray.
3. Mountain Top; silver, lead, copper; concentrator, flotation; wagon 10 miles; Ouray.
4. Humboldt; silver, gold; ore milled in Smuggler mill; aerial tram 2 miles; Pandora.
5. American; gold, silver; pack 1 mile; Ouray.
6. Bachelor Khedive; silver, lead; old concentrator; wagon 2 miles; Bachelor Switch.
7. Calliope; silver, lead; wagon 2 miles; Bachelor Switch.
8. Pony Express; silver, lead, copper; old concentrator; wagon 1 mile; Bachelor Switch.
9. Barstow; gold, silver, lead, copper, zinc; concentrator; wagon 2 miles; Joker.
10. Mountain King; zinc, lead, silver; wagon  $\frac{1}{2}$  mile; Joker.
11. National Belle; copper, silver; on railroad; Red Mountain.
12. Yankee Girl; silver, copper, zinc, lead; on railroad; Red Mountain.
13. Vernon; silver, copper; wagon 3 miles; Gladstone.
14. Guston; silver, copper, lead, zinc; on railroad; Red Mountain.
15. Thistle Down; silver, lead; concentrator; aerial tram  $\frac{1}{2}$  mile, wagon 3 miles; Ouray.
16. Revenue; silver, lead, gold, zinc; wagon  $6\frac{1}{2}$  miles; Ouray.
17. Yellow Jacket; zinc, lead; pack 8 miles; Ouray.
18. Mineral Farm; silver, lead; concentrator; wagon  $1\frac{1}{2}$  miles; Ouray.
19. Wanakah; gold, copper; concentrator; wagon 1 mile; Ouray.
20. Bennack; silver, lead, copper, gold; wagon 9 miles; Ouray.

## PARK COUNTY

### PLATE NO. 17.

1. London; gold, lead, silver; old concentrator; wagon 7 miles; Alma Junction.
2. Butte; gold, lead, silver; wagon 7 miles; Alma Junction.
3. Hock Hocking; gold, silver, lead, zinc; wagon  $2\frac{1}{2}$  miles; Alma Junction.
4. Orphan Boy; gold, silver, zinc; wagon 2 miles; Alma Junction.
5. Phillips; gold, silver, zinc; old concentrator; wagon 3 miles; Alma Junction.
6. Paris; gold; amalgamator; aerial tram  $\frac{1}{2}$  mile, wagon  $3\frac{1}{2}$  miles; Alma Junction.
7. J. G. Blaine; silver, tungsten; pack and wagon  $4\frac{1}{2}$  miles; Alma Junction.
8. Kentucky Belle; gold, silver, copper; wagon 7 miles; Alma Junction.
9. Great West; gold, silver; wagon  $3\frac{1}{2}$  miles; Alma Junction.
10. Dolly Varden; silver, lead; wagon 4 miles; Alma Junction.
11. Star-Cresskill; gold, silver; wagon 4 miles; Alma Junction.
12. Moose; silver, lead; wagon 5 miles; Alma Junction.
13. Russia; silver, lead; wagon  $5\frac{1}{2}$  miles; Alma Junction.
14. Magnolia; gold, silver; concentrator, cyanide; tram 1 mile, wagon 6 miles; Alma Junction.
15. Wheeler; gold, silver, lead, copper; pack 7 miles; Alma Junction.
16. Old Sacramento; silver, lead; wagon 6 miles; Fairplay.
17. Mud-Sill; gold, silver, lead; wagon 1 mile; Mud-Sill.
18. Hill Top; silver, lead, zinc; aerial tram 2 miles; Leavick.
19. Continental Chief; silver, lead; pack 4 miles; Leavick.
20. Ruby; zinc, silver, lead; wagon 8 miles; Hayden.
21. Whale; silver; wagon 9 miles; Webster.
22. Leftwick; silver, lead; wagon 8 miles; Webster.
23. Nielsey; copper; wagon  $\frac{1}{2}$  mile; Nielsey Switch.
24. Revenue; silver, lead; wagon 9 miles; Grant.
25. Red Skin; molybdenum; wagon  $8\frac{1}{2}$  miles; Lake George.
26. Carbonage King; copper, silver; wagon 9 miles; Howbert.
27. Fortune Placer; gold; wagon  $\frac{1}{2}$  mile; Peabody.
28. Snowstorm Placer; gold; wagon  $\frac{1}{4}$  mile; Snowstorm.
29. Alma Placer; gold; wagon 1 mile; Alma Junction.
30. Cincinnati Placer; gold; wagon 1 mile; Fairplay.



## PITKIN COUNTY

## PLATE NO. 18.

1. Smuggler; lead, silver; concentrator, flotation; on railroad; Aspen.
2. Molly Gibson; lead, silver; ore milled at Smuggler mill; on railroad; Aspen.
3. Durant; silver, lead; on railroad; Aspen.
4. Midnight; silver, lead; wagon 6 miles; Aspen.
5. Hope; prospect; wagon 8 miles; Aspen.
6. Little Annie; silver, lead; wagon 5 miles; Aspen.
7. Aspen Contact; silver, lead; wagon 4 miles; Woody.

## SAN JUAN COUNTY

## PLATE NO. 19.

1. Congress; silver, copper; wagon 1 mile; Sheridan Switch.
2. Silver Ledge; lead, zinc; concentrator, flotation; aerial tram  $\frac{3}{4}$  mile; Chattanooga.
3. North Star; silver, copper; concentrator, flotation; on railroad; Silverton.
4. Dora Consolidated; gold, silver, lead, copper; amalgamator, concentrator; on railroad; Silverton.
5. Silver Lake; gold, silver, copper, lead, zinc; concentrator, flotation; aerial tram 3 miles; Silver Lake Switch.
6. Iowa Tiger; gold, silver, copper, lead, zinc; concentrator, flotation; aerial tram  $2\frac{1}{2}$  miles to mill, aerial tram 1 mile; Iowa Switch.
7. Mayflower; gold, silver, copper, lead, zinc; ore milled in Iowa Tiger mill; aerial tram  $\frac{1}{2}$  miles to mill, aerial tram 1 mile; Iowa Switch.
8. Highland Mary; gold, silver; concentrator, flotation; wagon 2 miles; Green Mountain Switch.
9. Shenandoah; gold, silver, copper; pack 3 miles; Green Mountain Switch.
10. New Green Mountain; copper, silver, gold, lead, zinc; concentrator, flotation; aerial tram  $\frac{1}{2}$  mile; Green Mountain Switch.
11. Old Hundred; gold, silver, lead, zinc; amalgamator, concentrator; aerial tram 1 mile; Old Hundred Switch.
12. Buffalo Boy; gold; pack 5 miles; Green Mountain Switch.
13. Garryowen Tunnel; gold, silver, lead, zinc; pack 3 miles; Green Mountain Switch.
14. Hamlet; gold, silver, copper, lead, zinc; concentrator, flotation; aerial tram  $\frac{1}{2}$  mile; Hamlet Switch.
15. Intersection; gold, silver; amalgamator, concentrator; pack 3 miles; Middleton.
16. Peerless San Juan; gold, silver, copper, lead, zinc; concentrator; aerial tram  $\frac{1}{2}$  mile, wagon  $1\frac{1}{2}$  miles; Kittimac Switch.
17. Kittimac; gold, silver, copper, lead, zinc; concentrator, flotation; aerial tram 2 miles; Kittimac Switch.
18. Klondyke; gold, silver, copper, lead, zinc; pack 2 miles; Burns Gulch Switch.
19. Ben Butler; silver, copper, lead, zinc; wagon 3 miles; Animas Forks.
20. Columbus; gold, silver, copper, lead, zinc; wagon 1 mile; Animas Forks.
21. Sunny Side; gold, silver, copper, lead, zinc; concentrator, flotation; electrical separator; aerial tram 3 miles; Eureka.
22. Gold Prince; gold, silver, copper, lead, zinc; concentrator; aerial tram  $2\frac{3}{4}$  miles; Animas Forks.
23. Gold King; gold, silver; concentrator, flotation; aerial tram  $\frac{3}{4}$  mile; Gladstone.
24. Grand Mogul; gold, silver, copper, lead, zinc; concentrator; aerial tram  $1\frac{1}{2}$  miles; Gladstone.
25. Bandora; gold, silver, zinc, lead; wagon 8 miles; Silverton.
26. Gold King Extension; gold, silver; wagon 3 miles; Gladstone.

## SAN MIGUEL COUNTY

## PLATE NO. 20.

1. Liberty Bell; gold; concentrator cyanide; aerial tram  $1\frac{1}{2}$  miles; Telluride.

2. Smuggler Union; gold, silver, lead, copper; concentrator, flotation, cyanide; aerial tram 1 mile; Pandora.
3. Tom Boy; gold, silver, lead, copper, zinc; concentrator, cyanide; aerial tram 1 mile; Pandora.
4. Japan; silver, lead, gold; wagon 6 miles; Telluride.
5. Sheridan; gold, silver, lead, copper; aerial tram 1 mile, wagon 3 miles; Telluride.
6. Bob Tail; gold, silver, lead, copper; pack 4 miles; Telluride.
7. Contention; gold, silver; wagon 3 miles; Telluride.
8. Ballard; gold, silver; amalgamator, concentrator; aerial tram 1 mile, wagon 1 mile; Telluride.
9. Colorado Superior; gold, silver, lead, copper, zinc; aerial tram 2 miles; Pandora.
10. Alta; gold, silver, lead; concentrator; aerial tram 3 miles; Ophir Loop.
11. Suffolk; gold, silver, lead; concentrator; wagon 2½ miles; Ophir Loop.
12. Highland Mary; gold, silver, lead, zinc; concentrator; wagon 5 miles; Ophir Loop.
13. Favorite; gold, silver, lead; wagon 2 miles; Ophir Loop.
14. Carbonero; gold, silver, lead; wagon 4 miles; Ophir Loop.
15. Caribeu; gold, silver, lead, zinc; wagon 2½ miles; Ophir Loop.
16. Silver Bell; gold, silver, lead, tungsten; concentrator; on railroad; Ophir Loop.
17. Butterfly Terrible; gold, silver, lead; concentrator; on railroad; Butterfly Switch.
18. Primos; vanadium; caterpillar wagon 3 miles; Vanadium.
19. Primos; vanadium; aerial tram ½ mile; Saw Pit.
20. Silver Pick; gold, silver; pack and wagon; — miles; Vanadium.

## SUMMIT COUNTY

### PLATE NO. 21.

1. Wellington; zinc; concentrator, flotation, electrical separator; surface tram ½ mile, wagon 2 miles; Breckenridge.
2. Oro Extension; lead, zinc; wagon 2 miles; Breckenridge.
3. Country Boy; zinc, lead; wagon 2 miles; Breckenridge.
4. Old Union; zinc; wagon 1½ miles; Breckenridge.
5. Pioneer Consolidated; gold, silver; amalgamator, concentrator; wagon 4 miles; Braddocks.
6. Jessie; gold, silver; amalgamator, concentrator; wagon 3½ miles; Braddocks.
7. Muddy; gold, silver, lead; wagon 5½ miles; Braddocks.
8. Hamilton; gold, silver, lead; amalgamator, concentrator; wagon 6½ miles; Braddocks.
9. Cashier; gold, silver, lead; old mill; wagon 7 miles; Braddocks.
10. Wirepatch; gold, silver; old mill; wagon 5 miles; Breckenridge.
11. Sally Barber; zinc; wagon 4 miles; Breckenridge.
12. Lucky; silver, lead; old mill; wagon 3½ miles; Breckenridge.
13. Washington; gold, silver, lead; amalgamator, concentrator; wagon ¼ mile; Washington Switch.
14. Dunkin; gold, lead; on railroad; Dunkin Switch.
15. Puzzle; gold, silver, lead, zinc; concentrator, flotation; on railroad; Puzzle Switch.
16. Warrior's Mark; silver; wagon 1 mile; Farnham.
17. Governor; silver; old mill; wagon 6 miles; Breckenridge.
18. Monte Cristo; silver, lead; concentrator; wagon 8 miles; Breckenridge.
19. Middlesex; prospect; old mill; wagon 8½ miles; Breckenridge.
20. Rilla; gold, silver, copper; wagon 9 miles; Breckenridge.
21. Robinson; gold, silver, zinc, lead; wagon ¼ mile; Robinson.
22. Michigan; gold, silver, lead; wagon ¾ mile; Kokomo.
23. Col. Sellers; gold, silver, zinc, lead; wagon ¾ mile; Kokomo.
24. Wilfley; gold, silver, zinc, lead; concentrator; on railroad; Kokomo.
25. Uthoff; gold, silver, zinc, lead; on railroad; Kokomo.
26. Queen of the West; gold, silver, lead; wagon 1½ miles; Kokomo.

27. King Solomon; gold, silver, copper; on railroad; Frisco.
28. Excelsior; gold, silver, copper; concentrator; on railroad; Frisco.
29. Toledo; silver, zinc, lead; concentrator, flotation; wagon 7 miles; Keystone.
30. Little Jumbo; silver, zinc, lead; ore milled in Toledo mill; wagon 8½ miles; Keystone.
31. Philadelphia; silver, zinc, lead; wagon 11 miles; Keystone.
32. Shoe Basin; silver, zinc, lead; wagon 12½ miles; Keystone.
33. St. Johns; silver, zinc, lead; concentrator, flotation; wagon 8 miles; Keystone.
34. Princess; silver, zinc, lead; concentrator, flotation; wagon 7½ miles; Keystone.
35. Burke; silver, zinc, lead; wagon 8 miles; Keystone.
36. Chataqua; silver, zinc, lead; ore milled in Princess mill; wagon 9 miles; Keystone.
37. Silver Wave; silver, lead, zinc; ore milled in Princess mill; aerial tram 1 mile, wagon 9 miles; Keystone.
38. Pompeii; gold, silver; wagon 10½ miles; Braddocks.
39. Uncle Sam; gold, silver; wagon 12 miles; Braddocks.
40. Guyot; gold, silver, lead, zinc; wagon 8 miles; Jefferson.
41. French Gulch Dredge; gold; wagon 2 miles; Breckenridge.
42. Tonopah Dredge No. 1; gold; wagon 4 miles; Breckenridge.
43. Tonopah Dredge No. 2; gold; wagon 9 miles; Breckenridge.
44. Tonopah Dredge No. 3; gold; wagon ½ mile; Breckenridge.

## TELLER COUNTY

### PLATE NO. 22.

1. Abe Lincoln; gold, silver; on railroad; Cripple Creek.
2. Anchoria Leland; gold, silver; on railroad; Cripple Creek.
3. Blue Bird; gold, silver; on railroad; Los Angeles.
4. Portland; gold, silver; concentrator, cyanide; on railroad; Victor.
5. Independence; gold, silver; concentrator, cyanide, flotation; on railroad; Victor.
6. Vindicator; gold, silver; concentrator, cyanide; on railroad; Independence.
7. Golden Cycle; gold, silver; concentrator, cyanide; on railroad; Goldfield.
8. Elkton; gold, silver; on railroad; Elkton.
9. Cresson; gold, silver; aerial tram ½ mile; Eclipse.
10. Mary McKinney; gold, silver; on railroad; Anaconda.
11. El Paso; gold, silver; on railroad; El Paso Switch.
12. Prince Albert; gold, silver; wagon ¾ mile; Beacon Hill.
13. Henry Adney; gold, silver; on railroad; El Paso Switch.
14. Wild Horse; gold, silver; concentrator, cyanide; wagon ¼ mile; Altman.
15. Jerry Johnson; gold, silver; concentrator, cyanide; wagon 1 mile; Cameron.
16. C. O. D.; gold, silver; on railroad; Cripple Creek.
17. Molly Kathleen; gold, silver; wagon 1 mile; Cripple Creek.
18. Atlantic; gold, silver; wagon 1½ miles; Cripple Creek.
19. Addie C.; gold, silver; wagon 1½ miles; Cripple Creek.
20. Little Annie; gold, silver; wagon 2 miles; Cripple Creek.
21. Little Florence; gold, silver; wagon 2 miles; Cripple Creek.
22. Laura Lee; gold, silver; wagon 2 miles; Cripple Creek.





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