REPORT OF THE STATE BUREAU OF MINES

DENVER, U. S. A.

HARRY A. LEE, COMMISSIONER

L. N. WHITE, F. H. NYE, } INSPECTORS

COLORADO

FOR THE YEAR 1897

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Letter of Transmittal.

OFFICE OF THE BUREAU OF MINES,
STATE OF COLORADO.

TO HIS EXCELLENCY,
ALVA ADAMS,
GOVERNOR OF COLORADO.

Sir: I have the honor to transmit herewith the official report of the operations of the State Bureau of Mines for the year ending November 30, 1897, together with a brief general economic report of the principal mineral resources of the state.

To give, within prescribed limits, a detail report of the mineral development of each district or county, is impossible. The object, therefore, has been to present a summary of the mining industry of the state as it exists to-day, more from an economic than a technically scientific standpoint.

Respectfully submitted,

HARRY A. LEE,
Commissioner of Mines.

Denver, Colo., January 1, 1898.

COLORADO.

RETROSPECTIVE.

The record of the mining industry has been one of steady increase of production from the first discoveries to the present day. While the territory embraced within the present state boundaries marked the scene of several exploring parties of earlier date, not until the year 1858 were the white pioneers strong enough, numerically, to establish a settlement. The inhabitants even at this late date were mainly Indians of various tribes. White hunters and trappers were sparsely scattered over this section and had for years plied their vocations to advantage. Later they were joined by the prospectors in search of precious metals. In 1858 credence was given to earlier rumors by a small party of prospectors, who reported the discovery of gold in paying quantities. The result of this report was the concentration of the white inhabitants in sufficient numbers to establish the first mining camp. This camp was located near the present site of the city of Denver, and called Montana.

The development of the gold deposits soon demonstrated the same to be of little value under the economic conditions existing at that time. The prospectors began to disband, and the search for gold was continued in the more mountainous sections.

At this time Colorado was far inland, and communication was only possible by wagons "crossing the plains." In this manner the reports of the gold discoveries were conveyed to the Eastern states; the value increasing, and the difficulties to be overcome decreasing, with repetition, time and distance.

The people of the Eastern states, still suffering from the financial crash of 1857, were ready to grasp at any opportunity for retrieving lost fortunes, so the inflated reports of gold in Colorado were accepted as received. This was productive of a tide of immigration which soon made the "Pike's Peak Country" famous.

On January 7, 1859, George A. Jackson discovered gold in paying quantities at a point near the present site of Idaho Springs. Following this, discoveries which yielded fair returns were made in several sections, and the mining industry fairly launched.

In February, 1861, Colorado was organized as a territory, with an estimated population of 65,000. The wisdom of this act of congress was con-

sidered questionable even to as late as 1870. This year marked the advent of a railroad, and was practically the first assurance of a permanent industrial establishment in Colorado.

Aided by railroad connection, the development was more rapid. In 1876, the territory of Colorado was admitted into the Union as a state.

While the record of mining in Colorado has been one of increase of production, the product has been variable. The early mining was for gold alone. The demand for "pay placer beds," under primitive conditions, exceeded the supply. The lodes or veins were discovered to carry gold values, and the oxidized ores near the surface found to yield a profit. Silver at that time was considered detrimental.

The opening of gold-bearing veins soon developed the necessity for mills. Their introduction followed with variable success.

The establishment and successful operation of The Boston and Colorado Smelting Works, at Black Hawk, in 1868, marks one of the most important events in Colorado history. Silver and copper began to have some intrinsic value; a new era in the state's mining progress was opened. Ores which prior to the establishment of this plant were worthless, under new conditions were found to possess intrinsic value. More activity in mining followed. Silver became a commodity to be sought rather than avoided.

Following the advent of a railroad, in 1870, reputed rich finds of gold and silver in the San Juan section, in 1872; the discovery of lead carbonates, carrying silver, in Leadville, in 1874, an era of building railroads and reduction works began, which reached a climax in 1879. By this time the army of prospectors had stopped the search for gold and turned their attention to the discovery of lead-silver properties. In an incredibly short time the mines yielded silver in excess of gold, and the state stood at the head of the list as a producer of silver.

From 1879 until 1889 the search for silver mines continued. Through adverse legislation the market price of silver declined until the demand for new silver mines was practically at a minimum. Prospectors again turned their attention to a search for gold. As a result Colorado, for gold production in 1897, stands the recognized leader.

The transition of the state's production of precious metals from gold to silver, and later from silver to gold, is not only a tribute to the limitless resources of the state, but also to her citizens. It not only demonstrates the ability of both to meet the demand, but to take the lead in supplying the metal demanded.

GEOGRAPHY.

Colorado is situated between latitude 37° and 41° north, and longitude 102° and 109° west. Its average length east and west is 380 miles; its breadth north and south, 280 miles. The state is divided into fifty-six counties. A glance at a map of the United States shows its advantageous location. It occupies the central field of travel and traffic between the Atlantic and Pacific oceans, east and west, and between Mexico and British America, north and south.

AREA.

The state has an area of 104,500 square miles. This statement conveys little conception of Colorado's magnitude to the average mind, and comparison is therefore applied: Colorado's area is in excess of the combined areas of the states of New York, Maine, New Hampshire, Massachusetts, Connecticut, New Jersey and Maryland. Colorado could be divided into eighty counties, each larger than the state of Rhode Island. It exceeds the combined area of England, Ireland, Wales and Belgium, and is three and one-half times the size of Scotland. Add to the above the fact that the natural resources of Colorado are commensurate to the resources of the states and provinces with which the area is compared, and future possibilities can be better imagined than expressed.

TOPOGRAPHY.

The state is divided into two natural divisions—mountains and plains. The plains occupy the eastern one-third of the state, the land possessing a rich soil, which yields sure and abundant return to the farmers. The mountain division occupies the western two-thirds of the state. This section contains the main mineral wealth. The principal mountain chain, known as the Rocky Mountains, or Front Range, has a course practically north and south, and forms the Continental Divide, which divides the waters that flow to the Atlantic and Pacific oceans. The contour of this range is quite rugged, and it reaches in a number of places an altitude of over 14,000 feet above sea level.

Several other mountain chains traverse the state and are known locally by various names, which can be learned by reference to any late altas or map. Within the mountain division, surrounded by mountains and accessible along water courses or low mountain passes, are large parks and valleys. Among the most notable are North park, South park, Middle park, Estes park, together with the San Luis, Wet Mountain and other valleys along the Laramie, Yampah, White, Grand, Gunnison, Uncompahgre, Dolores, La Plata, Rio Grande, Conejos and Arkansas rivers. These valleys, tablelands, mesas or parks range in altitude from 4,500 to 9,000 feet above sea level, and afford large and valuable areas for agriculture or stockgrowing; a large proportion of the products finding a ready market in the adjacent mining camps. In area these sheltered valleys, or valleys strictly within the mountain division, exceed that of the great state of Ohio, or 39,964 square miles.

Colorado by Counties.

A statement in detail of the mineral resources of the state is not possible within the limits prescribed by this report. In order that the space allotted may be best utilized and be convenient for reference, the mineral counties are briefly treated in alphabtical order, followed by a summary of the whole.

ARAPAHOE COUNTY.

PRODUCTION FOR 1897.

Gold.....	102 Ozs. @	$20.67	per oz.....	$ 2,108.34
Silver.....	14 Ozs. @	.5965	per oz.....	8.35
Total				$ 2,116.69

Arapahoe county was organized in 1861, and bears the name of the chief Indian tribe at the time of its establishment. It has always been an important factor in the state's history. While not in a strict sense a mineral county, in it was established the first mining camp of the state. Nearly all the stream beds in the western end of the county, or near the mountains, show gold deposits. In places bars of small extent become enriched enough to yield a profit with washing. To this fact was due the report of 1858, which resulted in the establishment of a mining camp; in starting the tide of immigration westward the following season, and eventually in the development of the state. These placer beds are still worked in a small way, and yield a few thousand dollars annually.

The supremacy gained by the territory now within the boundaries of Arapahoe county over other sections of the state has been maintained to the present day. This has not been due to mineral wealth within the county, but to the fact that it has always remained the main distributing center for outlying mining camps.

Denver is the county seat, as well as the capital of the state. Through the concentration of capital, a trading post has been rapidly transformed into a city in every sense metropolitan. The railroad companies, which have done much to hasten Colorado's development, make Denver a common center. From here the great railroad systems send trains to all sections of the continent, and en route throw out branches which reach nearly all the developed districts of the state.

Under this regime, Denver has developed into a great smelting and manufacturing point, and the leading mining center of the state. Another factor which has aided much in centralizing the general offices of the mining companies in Denver is The Colorado Telephone Company. This system reaches a majority of the leading mining camps in the state and makes it possible for the general management of the various companies to be in direct communication with their mines at all times.

The smelters of Denver are: The Boston and Colorado Smelting Company, The Omaha and Grant Smelting Company, and The Globe Smelting and Refining Company.

The leading public sampling works are: The State Ore Sampling Company and The Denver Public Sampling Works.

All the above plants report a larger business in 1897 than for several years previous, and are an index to the state's ore production.

In all lines of manufacture, reports for 1897 show a marked increase in volume of business, especially in all lines of machinery for mining, milling and ore reduction plants. This indicates not only a marked advance in mining, but also an appreciation of the superiority of Colorado manufactured articles.

ARCHULETA COUNTY.

PRODUCTION FOR 1897.

Gold.....	34 Ozs. @	$20.67	per oz.....	$	702.78
Silver.....	348 Ozs. @	.5965	per oz.....		207.58
Total				$	910.36

This is one of the south-central border counties, with an area of about 1,100 square miles. It is bounded on the east by Conejos county, from which it was segregated by an act of legislature, approved April 14, 1885; on the south by New Mexico, on the west by La Plata, and on the north by Hinsdale and Mineral counties. From a mineral standpoint it can be properly classed as one of the undeveloped assets of the state's wealth.

The principal part of the county is rolling to mountainous, with broad, open valleys, well suited for farming and stockgrowing pursuits. The valleys, with an altitude ranging from 5,000 to 8,000 feet, are well watered by the Rio San Juan and Piedra, with their numerous tributaries. These streams cut into and show the county, excepting east and northeast parts, to be of sedimentary formation, and expose the sandstones, limestones, shales and clays of the Cretaceous period. The east and northeast sections of the county are more rugged and made up of the trachytic overflows that compose the San Juan mountains. These mountains form at this point in the state the Continental Divide, and rise in places to an altitude of 12,000 feet above sea level.

Mining for the precious metals has been advanced little beyond the prospecting stage, and mere prospecting has been indulged in in a desultory

manner. Good values have been discovered in various sections, but the production has been practically nothing. The east and southeast section of the county is covered by one of the old Spanish land grants known as the Tierra Amarilla. Until comparatively recently the question of title has done much to retard prospecting. Sixty thousand acres of this grant have passed into the hands of a domestic corporation. This company has promulgated a set of mining rules, practically in accord with the state regulations, and thrown their territory open to prospectors and, under their regulations, guarantee title. As a result, the past year has found a number of prospectors in the field and, if reports can be credited, their finds are worthy of careful investigation. There were engaged in mining and prospecting an average of seventy-six men during the past year.

This section is composed almost entirely of volcanic rocks, through which large dikes of porphyritic character course. The values reported show about an equal distribution of gold and silver.

The natural resources of the county are: Abundant growth of spruce, pine and cedar timber, building stone, slate banks, gypsum beds, numerous outcrops of coal, iron ores, petroleum and mineral springs. Near Pagosa Springs, the county seat, the waters of the San Juan river carry away the seepage or flow from the petroleum springs. In a crude manner this floating oil is collected and has been used for years for domestic purposes by the residents of that section.

That Archuleta county has not made more rapid advancement is due to its apparent inaccessibility, which is more fancied than real. The Denver and Rio Grande railroad runs daily trains through the southwest section of the county. Nearly any point in the county can be reached by conveyances from the railroad stations in a few hours.

BOULDER COUNTY.

PRODUCTION FOR 1897.

Gold.....	24,802 Ozs.	@	$20.67	per oz.....	$ 512,657.34
Silver.....	138,715 Ozs.	@	.5965	per oz.....	82,743.50
Copper.....	58,474 Lbs.	@	.105	per lb.....	6,139.77
Lead.....	309,115 Lbs.	@	3.38	per cwt.....	10,448.09
Total					$ 611,988.70

Boulder is one of the pioneer counties and has been an important factor in the state's history. While not first to discover gold in paying quantities, it was first to make the discovery known. It bears the distinction of being the scene of the first general excitement following the Arapahoe county *fiasco;* of organizing the first mining district and formulating a code of laws for local government; of locating the first quartz vein, erecting the first stamp mill and having the first steam sawmill; building the first board house and the first school house; constructing the first irri-

gating ditch for agricultural purposes, and the first blast furnace for the manufacture of iron.

Boulder county was organized in 1861; occupies a north-central position in the state, and is thirty-two miles long, east and west, and twenty-four miles wide, north and south; area, 1,133 square miles. The county seat is twenty-nine miles northwest of Denver. The resources are quite diversified. The western three-fifths is mountainous and contains the metalliferous mines. Near the base of the main range, the uplifted sedimentary beds of sandstones, limestone, clay and shales are exposed by a series of ridges or hog-backs, and afford good opportunity for quarries. The eastern part of the county extends outward on the plains and, with irrigation, affords large returns to the agriculturist and horticulturist. In the east and southeast sections of the county, large and valuable coal deposits exist, and are worked extensively.

The drainage of the county is through the St. Vrain, Boulder and Coal creeks and their numerous tributaries. These streams find their source well back toward the Continental Divide, and throughout the mountainous section furnish ample water for mining and milling purposes, and later supply the demand for irrigation.

The mountainous section is made up of the granite-gneiss complex common to the Rocky Mountain range. From the Continental Divide eastward, the county presents a series of hills, with valleys and parks intervening. The granite-gneiss or the country rock of the mountain section is traversed by a series of dikes. The main dikes are large, strong and porphyritic in character. The veins are fissures, and are found to be either closely associated with the dikes or to lie practically parallel thereto. Both dikes and veins show several different periods of formation and course at all points of the compass, the largest and best defined varying in different sections from east and west to northeast and southwest systems. The veins in general do not outcrop for any great distance, but, where exploited, are found to be persistent and well defined. The vein filling not only differs in different districts, but in the same district. In the main, however, the vein filling is largely made up of the altered country rock and accompanied by a comparatively small amount of aggregated secondary material. In several places examined the veins were well defined, with "two smooth walls." Within the so-called walls, the included gangue is practically valueless, and the pay values occur without the walls in the "country rock." In other words, the vein has formed the channel for percolating waters, and the fractured walls have furnished the reservoirs and conditions for replacement, or deposition of values.

In such cases the values are usually found upon the faces or cleavages of the fractured rocks. Investigation has led to the belief that the above condition is more common than is generally supposed, and that attention should be called to it. This is especially so in districts where the values are in the form of sylvanite and calaverite. Common to nearly all fissure-vein sections of the state, the ore occurs in the form of shoots; i. e., the values are concentrated in certain portions of the veins, leaving other parts

practically barren. These shoots are very irregular, both in occurrence and extent. Where two veins intersect, or a vein throws out a spur, at or near this point larger ore bodies usually occur.

Boulder county produces both gold and silver ores, the aggregate values being in favor of gold. It has long been noted for its production of varied telluride ores, and has contributed many thousands of dollars in value to mineral collections. This fact can be better appreciated when it is stated that some of the ores produced have a gold value of $150 per pound, and from a mineralogical standpoint are priceless.

The county is divided into six mining districts, viz.: Gold Hill (Sunshine), Central (Jimtown), Grand Island (Caribou-Eldora), Sugar Loaf, Magnolia and Ward.

In 1897 an average of 1,653 men were employed in mining and milling. The average number of mines working was 265; average number of placers, 5; average number of mills working, 10.

The county records show 784 mining claims, 41 placer claims and 78 mill sites for which United States patents have been obtained.

Since 1871, 186 tunnel sites, 401 placer claims, 322 mill sites and 13,624 lode claims have been located and recorded. Title to a great many of these locations has been lost, and the numbers above include relocations upon same territory. A large proportion, however, of the claims are still retained, and each year title is retained by annual assessment work. Owing to this fact the average number of men employed and properties operating for the year is difficult to determine, but it is believed the averages above given are conservative and just.

For thirty-six years Boulder county has been a constant contributor to the world's store of precious metals. While at different times it has been more active than at others, it has never been inflicted with a "boom." Its mining development has been upon merit and, it may justly be added, the development has been far below what the resources justify. Its location, accessibility and diversified resources have added to and retarded advancement. Close proximity to a ready market, with good and comparatively cheap transportation facilities, have been in its favor. The conditions that have served to retard may be briefly stated as follows: The history of the county shows that while there have always been some big mines and regular producers, owned and managed by those who reduced mining to a business and made that business paramount, the greater portion of mining property has been owned and controlled by those who were engaged in other pursuits and made mining a side issue. This condition, aided by the high grade of ores encountered, has encouraged a spirit to develop the mines for sale rather than for legitimate profit from mining.

Next, if not equal in retarding growth, has been the "process man." Owing to easy access, nearly every device for saving values put on the market is first tested in Boulder county. The results, in the aggregate, have been failures, and lent credence to the belief that the ores were not amenable to treatment. The fact is, these ill-advised mills demonstrate neither that the ore can not be handled nor the worthlessness of the process, but

show conclusively the non-conception of the conditions by both mine and process owner.

Until the past few years, the county's production has been from mines located early in its history. The growing demand for gold properties has again stimulated prospecting. As a result idle properties have been reopened, new ones located, and districts new from age reëxplored. The rediscovery that the geological and mineralogical conditions from Allen's park, on the north, to the Gilpin county line, on the south, are similar to those of Ward, the leading producing camp of the county, has resulted in making this section of the county the center of attraction and the establishment of several new camps.

The systematic prospecting of 1897 throughout this section, together with the infusion of new blood, backed with capital to mine for the profits incident to mining, has done much to eradicate erroneous impressions of long standing regarding Boulder county. The veins in the so-called new districts are, in the main, large, well defined and carry good values in gold. While the work of the past year has not added producers worthy of being called mines, it has been productive of a number of prospects that can produce pay ores, and have every appearance of rapid development into steady producing mines. The renewed vigor at Eldora, Wall Street and in the Allen's Park districts, with promising results, has awakened new interest in all the old districts. The close of 1897 marks the beginning of an era of energetic and systematic mining throughout the county. While Boulder county is old in the state's history, it is young in years and possesses much undeveloped territory that will yield good returns when entered upon, exploited and mined, mine fashion. It is among the best mineral counties in the state and, when considered in the light of economic questions that enter so much into lucrative mining propositions, has few, if any, equals.

The placer beds which first started mining in the county are still worked to a profit. Many are worked spasmodically and in a manner little in advance of methods pursued in pioneer days.

The placers being worked at the present time are the Yosemite and Resumption, in Magnolia district, on South Boulder creek, both equipped with hydraulic appliances; the Woods & Phillips, in Sugar Loaf; Seavier, in Ward, and Beaver, in Grand Island district, equipped for hand sluicing.

One of the most important improvements during 1897 is the building of a railroad up Boulder creek to Ward. This road is known as the Colorado and Northwestern, and will prove a great aid in the rapid development of the county. It will pass through Crisman, Salina, Wall Street, Sunset, and terminate at Ward. Along the entire route the road is near many producing mines, and there is little doubt that this enterprising company will throw out branches to Caribou, Eldora and other outlying camps. While Ward is stated as the terminal point of this road, the character of material and equipment would indicate designs upon the part of the company to eventually extend the line into Grand and Routt counties. Arrangements have been made with the Union Pacific, Denver and Gulf, and the two roads will use the same depot at Boulder, and trains connect. The Union

Pacific, Denver and Gulf is a standard gauge road and runs two passenger trains each way daily through Boulder, Longmont and Northern Colorado. In connection with the Colorado and Northwestern, persons can leave Denver in the morning, visit nearly all sections of Boulder county, and return the same day.

Among other important improvements during the past year may be noted the construction of the Delano chlorination plant at Boulder, fifty tons capacity. This is a model plant in many particulars, and is well managed. The Kilton Reduction Company added a 12-ton chlorination plant to their sampling works at Boulder. The Pennsylvania Mining and Milling Company are constructing a 200-ton amalgamation and concentration plant at Owen's Lake, near Boulder.

Two public sampling works, viz., W. J. Chamberlain & Co., seventy-five tons capacity, and The Kilton Reduction Company, seventy-five tons capacity, are located at Boulder. These, with the reduction plants at hand, furnish a good ore market for all ores produced.

MILLS.

Name	District	Character	Daily Capacity
Delano	Boulder	Chlorination	50 tons
Kilton	Boulder	Chlorination	12 tons
Forest	Boulder	10 stamps; tables	20 tons
Pennsylvania	Boulder	50 stamps; tables	200 tons
Utica	Ward	20 stamps; tables	30 tons
Binford	Ward	10 stamps; tables	20 tons
Ruby	Ward	10 stamps; tables	25 tons
Giles	Ward	10 stamps; tables	25 tons
Madaline	Ward	50 stamps; tables	100 tons
Boston	Ward	40 stamps; tables	75 tons
Modoc	Ward	30 stamps; tables	60 tons
Dew Drop	Ward	Jigs	100 tons
San Blas	Ward	10 stamps; tables	20 tons
Montgomery	Ward	10 stamps; tables	18 tons
Humboldt	Ward	10 stamps; tables	18 tons
Muller	Ward	10 stamps; tables	20 tons
Prince Arthur	Gold Hill	10 stamps; tables	20 tons
Gale	Gold Hill	30 stamps; tables	50 tons
Prussian	Gold Hill	Cyanide	20 tons
Gray Eagle	Gold Hill	Electric Belt	10 tons
Cash	Gold Hill	10 stamps; tables	20 tons
Salina	Gold Hill	10 stamps; tables	20 tons
Wood Tunnel	Gold Hill	10 stamps; tables	20 tons
Orphan Boy	Gold Hill	20 stamps	40 tons
Free Coinage	Gold Hill	5 stamps	10 tons
Monell	Sunset	5 stamps	10 tons
Coburn	Magnolia	Cyanide	30 tons
Nellie Bly	Magnolia	Bromide	20 tons
Livingstone	Sugar Loaf	Cyanide	20 tons

In building stone, the supply in Boulder county is unlimited. A number of quarries from Boulder to Lyons have been opened along the upturned sedimentary beds that flank the main mountain range near its base. The best known, best developed and largest producing quarries are located at Lyons. This camp, also the Allen's Park mining district, is reached by a branch of the Burlington and Missouri system, which is operated from Denver to Longmont and thence to Lyons. Two trains each day carry

passengers from Denver to Longmont. The Lyons quarries produce a great variety of stone, but the principal product is flagging. This can be supplied of almost any desired size, thickness or color. The superiority of this stone not only finds for it a ready market at home, but is creating a growing demand from Eastern cities. Promised data regarding output has not been received.

The clay shales exposed along eastern foothills form a valuable resource little developed, the only use at present being that of the manufacture of brick. Two companies with works in Boulder have worked these products for a number of years successfully, the product being of superior quality.

There are a number of mineral springs in this county. The most noted are the Seltzer springs, at Springdale, and the Boulder springs, near Crisman. Both of these waters are in demand for medicinal properties and are well known. An analysis of the Boulder spring by Dr. J. A. Sewall, of the Denver university, gives: Carbonate of soda, .984; carbonate of magnesia, 6.020; carbonate of lime, 7.480; carbonate of iron, .081; chloride of sodium, 30.217; chloride of potassium, 1.100; sulphate of soda, 3.840; silica, 0.102, making a total of 49.824 grains to a pint of mineral water; carbonic acid gas, 39 cubic inches. This water is in great demand and, in addition to large amounts bottled and sold for table use, is used by nearly all the soda fountains and bars in Boulder county and Denver.

CHAFFEE COUNTY.

PRODUCTION FOR 1897.

Gold	10,979 Ozs. @	$20.67	per oz	$	226,935.93
Silver	53,859 Ozs. @	.5965	per oz		32,126.89
Copper	172,891 Lbs. @	.105	per lb		18,153.55
Lead	1,686,391 Lbs. @	3.38	per cwt		57,000.02
Total				$	334,216.39

The early history of this section reveals that soon after the gold discoveries in other sections of the state, in 1859, the placer bars on the Arkansas river and tributaries in the northern part of Chaffee county were likewise being profitably worked. From 1860 to the present, this section has furnished employment and fair returns to many individuals and mining companies.

By an act of the legislature, Chaffee county was segregated from Lake county and named in honor of Hon. Jerome B. Chaffee. It is located near the central portion of the state and has an area of about 1,150 miles. It is bounded by Lake and Park on the north, Park and Fremont on the east, Fremont and Saguache on the south, and Gunnison county on the west. Its form is quite irregular on account of boundaries. The west boundary line is formed by the Continental Divide of the Saguache range.

This range at this point is quite rugged, and contains the well known land marks of La Plata, 14,311; Haywood, 14,375; Yale, 14,187; Princeton, 14,190; Antero, 14,245, and Shavano, 14,375 feet above sea level respectively. These peaks are distributed along the Front Range within the boundaries of Chaffee county, and present an ideal mountain view. The east boundary follows the Park Range. This range has peaks from 8,000 to 13,000 feet above sea level. The north and south boundaries connect natural monuments on the two mountain ranges. The Arkansas valley occupies the space between the two ranges, and has an altitude of 6,500 to 8,500 feet. This valley near the south-central portion of the county widens out to twelve or fifteen miles, and carries this width for nearly thirty miles. The topographical aspect is, therefore, that of an elongated basin. The lower slopes and valleys are covered with Morainic and local drift deposits. The land of the main valley is comparatively level and, with irrigation, yields good returns to the tillers of the soil.

The drainage of the county is the Arkansas river, to which Cash, Clear, Pine, Cottonwood, Chalk, Brown's, Boyd's, South Arkansas and Poncha creeks are the main tributaries from the west, and Sweetwater, Trout and Badger from the east. The various streams cut into the country rock and show the county to be made up of metamorphic and granitic rocks common to the Saguache range. Along the base of the Park range, in the eastern part, and the cañons of the South Arkansas and other streams in the southern portion of the county, the limestones and shales of the Paleozoic are exposed, and form a valuable resource to the county.

The transportation facilities are unusually good, the county being traversed by three railroad systems. The main line of the Denver and Rio Grande follows the meandering of the Arkansas river throughout the county. At Salida this line sends out branches over Marshall pass to the Gunnison country, and Poncha pass to the San Juan section, with a branch at Poncha Springs leading to the Monarch-Garfield districts. At Hecla Junction another short branch extends to the Calumet iron mines. The Denver, Leadville and Gunnison enters from South park, on the east, and at Schwanders sends out one branch to Buena Vista, the county seat; another branch up Chalk creek, through St. Elmo and the Alpine tunnel to the Gunnison country. The Colorado Midland enters from South park, on the east, to Buena Vista, thence north along the Arkansas river, paralleling the Rio Grande to Leadville and competing for western traffic.

The development of the diversified resources of this county is common to nearly all others in the state. Beginning with the placer beds at Granite, great activity until 1862. Then a period for location of lode claims, mill building and their successful operation until the surface or oxidized ores changed to sulphides, followed by an exodus of a large portion of the population for supposed better fields. The general revival of the mining industry, beginning in 1874 and reaching its zenith in 1880, again filled the county with prospectors. Towns sprang up in all sections and the various districts were vieing with each other for supremacy. The interest aroused by the developments of 1880 was productive of another short era

of smelter and mill building. Notwithstanding these plants, which retarded rather than advanced prosperity, the production of the county increased rapidly until 1885, remained almost stationary for a few years following, and then decreased until within the past few years. With the exception of a few constant producers and the comparatively recent reopening and successful operation of several properties previously killed by mismanagement and mills, little work was being done in the mining districts. In response to the demand for gold mines, prospectors again took the field, and at the close of 1897 the county is found more active than for many years.

Near Granite, the Cash, Bull and Lost Cañon placers continue to yield good returns. During the past year they have been worked on a somewhat extended scale. The results are satisfactory to the owners, and detail is withheld from publication. The lode veins of this section have been attracting increased attention since 1890. Recent development has yielded returns in excess of expectations. The ore bodies are being systematically exploited, found persistent and to carry good values. The Rock Island placer, near Buena Vista on the north, equipped during the past season with a good hydraulic plant, anticipates a good run during the summer of 1898.

The Cottonwood district, lying west of Buena Vista, has until the past few years been prospected and worked in the main for silver. The recent work has demonstrated the various sulphide ores to carry gold values sufficient to yield profit under proper conditions.

The leading producers of the county are located at St. Elmo and Romley. The success attendant to the working of the properties in this district, and the successful milling of the ores, has renewed interest. In the Monarch-Garfield districts, the leading properties report an increased lead-silver output during the year. A number of old properties were revived and interest renewed, especially near Mt. Shavano, which lies between Garfield and St. Elmo.

The district lying between Monarch and Marshall pass has developed some prospects carrying gold values, and a 5-stamp mill is kept busy and yielding good returns to a small number of men employed. Prospectors report favorable conditions throughout the southern end of the county. Bear creek and Cleora are again being systematically prospected.

The districts which have attracted most attention during the year lie north and east of Salida. The camp of Badger was established on the line between Chaffee and Fremont counties, late in 1895. During 1897 the camps known as Turret, Klondike, Jeffrey, Harrington, Manao, Cable City, Cameron and Whitehorn have been added. These are all within a radius of twelve miles of Salida, and near the well known camp of Calumet, famous for its production and deposits of iron ores. The rapid establishment of these embryo cities has had the effect of creating a general belief that the district was being manipulated by townsite boomers, who could not agree, rather than by miners. Like all excitements of this char-

acter, however, the district during the past year has been the scene of much activity and productive of a large amount of development work. The result of the recent development has done much to remove doubt and to create a belief that the prospective future of the district is bright, if not certain.

The conditions surrounding a number of the veins now under development are very favorable for ore deposition. That high grade ore exists in many places throughout the district has been demonstrated. The question as to whether or not the high grade ore exists in sufficient quantities to yield a profit will soon be solved.

The districts lying north of Calumet in the Park Range have been thoroughly overhauled during the year, and many favorable reports received. The county possesses a large amount of undeveloped territory. Metalliferous veins abound. In a general way these are similar to the veins of Clear Creek county. Chaffee county has long been noted for its variety of minerals, which includes a number of gem stones. The economic ores are iron, copper, zinc and lead-sulphides, carrying gold and silver. These ores are in the main low grade, but under surrounding conditions can be handled to a profit.

The iron beds at Calumet have been worked systematically for a number of years, the product being consumed by the iron and steel works at Pueblo. The bed is nearly forty feet thick, and its value can be easily seen by the following analysis of an average lot by Prof. Chauvenet, of the State School of Mines: Silica, 7.04; alumina, 1.90; peroxide of iron, 59.76; protoxide of iron, 26.88; bi-sulphide of iron, 1.14; lime, 1.59; magnesia, 1.70; phosphoric acid, 0.016; tetanic acid, trace, or iron metallic, 63.28; sulphur, 0.61; phosphorous, 0.007.

The county abounds in mineral waters, both hot and cold. Those which have been improved and are utilized for the medicinal properties contained are known as the Hortense, near Buena Vista, and the Poncha and Wellsville springs, tributary to Salida.

In building stone the supply is unlimited, of high grade, and occurs in good form for economical production. At present four limestone, one granite and two marble quarries are operating. The Chaffee county lime has a high standing on the open market. The Leadville and Pueblo smelters draw largely upon the lime beds of the South Arkansas for the supply of limestone, on account of its extreme purity.

The clerk and recorder of Chaffee county reports 541 placer claims, 54 patented; 47 mill sites and 12,398 lode claims, 855 patented; 240 tunnel sites and 5 marble claims of record. The year 1897 closes with 247 mines and prospects in active operation, and 707 men employed in mining.

MILLS.

NAME	DISTRICT	CHARACTER	DAILY CAPACITY
Anna G.	Cottonwood	Concentration; 10 stamps	20 tons
Cora Belle	Cottonwood	Concentration; Huntington	20 tons
Vivian	Red Mountain	Concentration; 10 stamps	20 tons
Mary Murphy	St. Elmo	Amalgamation and concentration; Huntington	100 tons
J. R. B.	St. Elmo	Amalgamation and concentration; 10 stamps	20 tons
Pat Murphy	St. Elmo	Amalgamation and concentration; 10 stamps	15 tons
Springfield	Pass Creek	Amalgamation and concentration; 5 stamps	8 tons
Barrick	Granite	Amalgamation and concentration; 20 stamps	40 tons
Parker	Granite	Amalgamation and concentration; 10 stamps	20 tons

The above mills are at present in active operation. At Buena Vista a pyritic smelter of 150 tons daily capacity is in course of construction.

Chaffee county, as a whole, possesses natural resources far in excess of present development. Its location, accessibility, transportation facilities, climate, together with water and timber supply, have been lost sight of during several excitements lying to the north, west and southwest, and those who, during these excitements, have "crossed over," are now returning. The rapid future development appears bright.

CLEAR CREEK COUNTY.

PRODUCTION FOR 1897.

Gold	37,864 Ozs. @	$20.67	per oz	$ 782,648.88
Silver	1,442,583 Ozs. @	.5965	per oz	860,500.76
Copper	516,034 Lbs. @	.105	per lb	54,183.57
Lead	5,263,116 Lbs. @	3.38	per cwt	177,893.32
Total				$1,875,226.53

Clear Creek, although one of the smallest in area, is one of the most important counties in the state. It was organized in 1861 and bears the distinction of being the scene of the discovery of the first "pay placer beds" in the state. From 1859, the year this discovery was made, at the mouth of Chicago creek, up to the present day, mining has been continually prosecuted and each year productive of important development.

In 1861 the first stamp mill was erected; this was followed by a number of so-called mills, but all met with some success and succeeded in extracting gold. In 1862 the placer beds were considered practically exhausted, except for a few favored ones. In 1864, veins rich in silver were discovered above Georgetown, and the following year found the "placer diggings" almost deserted. In 1866 a blast furnace was erected at Georgetown. This was a complete failure, but was finally made to yield a $500 product. This, with other reduction plants, later gave way

to smelters. In 1867 the county seat was established in Georgetown where it has since remained. The first regular stage line between Denver and Georgetown was established in 1868. The progress from 1868 to 1877 was slow but sure. The completion of the railroad, now owned by the Denver and Gulf, in 1877, marked the beginning of active development of the mining resources. The development from 1877 to 1890 was rapid. The financial panic of 1893 and the fall in the price of silver temporarily stopped mining. The eastern end of the county was first to recover from the shock and put forth new energy to meet the new conditions. Under this impetus, the imaginary line that separated the "gold and silver belts" of the county has been gradually moved back, until to-day gold and silver are found throughout the entire county, and the county as a whole has advanced to the front rank of gold producers.

Clear Creek is one of the central counties of the state. Bounded on the north by Grand and Gilpin; east by Jefferson; south by Park; west by Summit and Grand, and embraces an area of about 391 miles. The west boundary line is the Continental Divide, with mountains like Gray's peak, 14,341 feet; Torrey's peak, 14,336 feet, on the south, and James' peak, 13,281 feet above sea level, on the north for monuments. The south boundary has Mount Evans, 14,330 feet, and Mount Rosalie, 14,340 feet. The north line is defined by a mountain chain that separates Clear Creek from Gilpin county, ending at the Forks of the Creek. The main drainage is through Clear creek. This stream, near the west boundary, divides into North, Middle and South Forks. The main tributaries on the north are Mill creek and Fall river; on the south, Chicago creek. The southeast part of the county is drained by Bear creek and tributaries. The county is made up on the granite-gneiss complex common to Front Range and the general topography is extremely rugged. The valleys are quite narrow and the streams in many places flow through cañons. The main line of travel and transportation is along Clear creek. The Denver and Gulf road passes up this stream, and has made Clear Creek cañon well known to the world by judicious advertising of the scenery and affording the means by which its grandeur can be visited and enjoyed with comfort. Two trains each way daily handle the passenger traffic and afford an easy means of access to the leading mining camps, viz.: Forks Creek, Floyd Hill, Idaho Springs, Dumont, Lawson, Empire, Georgetown, The Loop and Silver Plume.

The formation of the county has passed through several periods of unrest. As a result the rocks are locally contorted and twisted in every conceivable shape. Often many different varieties are found within a very short distance, and afford an interesting field of research for the student of mineralogy and lithology. The county is traversed by a series of porphyritic dikes that have a general strike from northeast to northwest. The mineral-bearing veins of the county are of the true fissure type and were in the main formed subsequently to the dikes. In places the dikes form one wall to the veins and the veins retain their identity. In others, the dike practically becomes the vein. Where two or more

dikes of different age intersect, and later a vein bisects the whole, the vein loses its identity, and the result is a large body charged with sulphide ores, carrying low values. The veins of the county in general comply with the accepted requirements of the miner for "true fissures," viz., "smooth walls," a "selvage or gouge" and "ore in streaks." Accompanying this is usually found a body of "mill dirt," or low grade brecciated material, composed mainly of country rock and due to a reopening of the fissure after having been wholly or partially filled. In the parlance of the district, the veins have two distinct classes of ore, viz., smelting ore and milling ore.

In common with nearly all fissure vein sections the ore values in the veins are found in the form of shoots, i. e., in running a tunnel or drift along a vein, some sections have higher values that others, or some sections are barren of values and other sections are rich in values. The developments of thirty years demonstrate the occurrence of these ore shoot to be frequent enough to yield a good profit to methodical mining and to be unusually persistent in values with depth.

The great number of veins in this section precludes the possibility of individual mention. The county is divided into thirty-two mining districts, viz.: Dailey, Upper Union, Queens, Argentine, Upper Fall Creek, Griffith, Ottawa, Lincoln, Mill Creek, Downieville, Montana, Trail Creek, Cascade, Democrat, York, Lower Fall River, Morris, Empire, Banner, Trail Run, Coral, Jackson, Ohio, Gold, Spanish Bar, Independence, Virginia, Grass Valley, Iowa, Paynes' Bar, Lower Union, Cañon.

A number of mines in the county have reached a high state of development and are equipped with fine plants of modern machinery. Other large properties are so located that development can be prosecuted through tunnels, or by cross-cut tunnels cutting the veins at a depth of several hundred feet. The advantage and economy of working through tunnels and avoiding expensive plants of machinery and their maintenance is obvious. The year 1897 closes upon the active development of ten tunnels. Three of these have for their ultimate ending the large mines of Gilpin county and will be between three and four miles in length. Each will tap the Gilpin county belt at a different point and en route cut many of the strong veins of the district. The other tunnels are for tapping the properties owned by the different companies.

The placer deposits along the beds of the streams still furnish remunerative employment to a number of men. The appliances used are little in advance of those used by the pioneers in 1859. While these beds have been worked over several times, the cradle and sluice box, backed with hard work, will return fair pay and an occasional opening of a bar that more than makes up any deficiency for lean ground.

The records of the county show 930 lode claims, 62 placer claims, 229 mill sites for which United States patents have been obtained. From 1864, to January 1, 1897, the records show 22,201 lode claims duly recorded. The average number of mines and prospects at work during 1897 was 276. The average number of men employed, 1,712.

In ore dressing, or the handling of low grade ores, Clear Creek has made rapid advance in the past few years. The public sampling works buy ores outright and furnish a cash home market or ascertain values by sampling, and sell to the best advantage for their patrons.

SAMPLING WORKS.

NAME	LOCATION	DAILY CAPACITY
Dewey Bros	Georgetown	120 tons
W. J. Chamberlain	Georgetown	100 tons
Kilton Gold Reduction	Idaho Springs	100 tons
State Ore Sampling Co.	Idaho Springs	100 tons
Denver Public Sampling Co.	Idaho Springs	100 tons

MILLS.

NAME	DISTRICT	CHARACTER	DAILY CAPACITY
Dewey Bros.	Georgetown	Concentration	50 tons
Edward's	Empire	Amalgamation and concentration	30 tons
Silver Mt.	Empire	Concentration	20 tons
Pioneer	Empire	Concentration and amalgamation	30 tons
Roberts	Idaho Springs	Concentration	75 tons
Smith	Idaho Springs	Concentration	60 tons
Silver Age	Idaho Springs	Concentration	45 tons
Mayflower	Idaho Springs	Concentration	50 tons
Salisbury	Idaho Springs	Concentration and amalgamation	40 tons
Wilkie	Idaho Springs	Amalgamation and concentration	25 tons
Anderson	Idaho Springs	Amalgamation and concentration	26 tons
Mixsell	Idaho Springs	Amalgamation and concentration	25 tons
Allen	Idaho Springs	Amalgamation	20 tons
Newton	Idaho Springs	Amalgamation and concentration	40 tons
Allan	Chicago Creek	Amalgamation and concentration	20 tons
Old Roberts	Idaho Springs	Amalgamation	10 tons
Buckeye	Idaho Springs	Amalgamation and concentration	20 tons
Mattie	Chicago Creek	Amalgamation and concentration	20 tons
Kitty Clyde	Idaho Springs	Amalgamation and concentration	10 tons
Lincoln	Idaho Springs	Concentration	30 tons
Donaldson	Idaho Springs	Concentration	60 tons
Standard	Idaho Springs	Concentration	60 tons
Osbourne	Fall River	Amalgamation and concentration	10 tons
Turner	Idaho Springs	Amalgamation and concentration	26 tons
Golconda	Idaho Springs	Amalgamation	10 tons
Humboldt	Ute Creek	Amalgamation and concentration	10 tons
Cumberland	Yankee Hill	Concentration	50 tons
Lombard	Yankee Hill	Concentration	35 tons
Spect	Dumont	Concentration	50 tons
Alice	Yankee Hill	Concentration	100 tons

Clear Creek has long been a producer and has added its quota annually to the state's output. Being almost strictly a mining county, mining has been reduced to a business basis and mining properties are largely rated on the basis of what they will produce and not on what they may produce. During 1897 many new prospects were opened, and while the county has been constantly worked for thirty years, it possesses a large amount of undeveloped territory.

At Idaho Springs are located some of the most noted mineral springs in the state. They include hot and cold waters and are equipped with bath houses, tubs, swimming pools and tunnels.

CONEJOS COUNTY.

PRODUCTION FOR 1897.

Gold.....	51 Ozs. @ $20.67	per oz.....$	1,054.17
Silver.....	98 Ozs. @ .5965	per oz.....	58.46
Total		$	1,112.63

What is now known as Conejos county was originally organized under the name of Guadalupe, in honor of the patron saint of Mexico. As originally constituted, it embraced nearly all the territory in the southern portion of the state. It was one of the original seventeen counties organized by an act of territorial legislature in November, 1861. On account of confusion liable to arise, the name of Guadalupe was soon changed to Conejos. The history of the hardships of the pioneers of this section is filled with thrilling episodes, the settlement of the whites being bitterly resented by the Indians. After a considerable season of doubt as to who should gain supremacy, the Indians were compelled to fall back before the advance of civilization. With later development the princely domain of Conejos county has been reduced to an area of 1,200 miles, with the seat of government at Conejos.

The county as now constituted is one of the central border counties of the state. It is bounded by Rio Grande and Costilla on the north; Costilla on the east; New Mexico on the south, and Archuleta county on the west. The east and west boundary lines make the county irregular in form, the former being outlined by the Rio Grande river; the latter by the Continental Divide. The approximate dimensions are forty miles east and west by twenty-eight miles north and south.

The drainage of the county is through the Alamosa, La Jara, Conejos, San Antonita and Los Pinos creeks. These streams, with their numerous small tributaries, find source in the mountains occupying the western portion of the county, and empty into the Rio Grande river, which forms the eastern boundary. The western portion is quite rugged and composed almost entirely of volcanic rocks, the underlying granite only appearing in a few places near the southern border of the county. Near the Continental Divide, Conejos and other peaks reach an altitude varying from 12,000 to 13,000 feet. Traveling eastward, the altitude gradually reduces, and as the valley is approached, the trachytic lavas are in turn covered with basaltic overflows. With the exception of the small section lying north of the point where Alamosa creek enters the mountains, the country rock bordering on the valley is basalt.

The eastern portion of the county is the southwest part of the great San Luis valley, at one time a great inland sea. The valley is unusually level and has an average elevation of 7,500 feet. The principal towns are Antonita, Conejos, La Jara and Alamosa, located on the Denver and Rio Grande railroad. The principal industries are farming and stock raising. That mining does not rank as the leading industry is due

to lack of development and not to lack of mineral deposition. The western portion of the county is strictly a mineral section, from Platora in the north to the Banded Peaks and Antonita districts in the south. While prospected to a limited extent, it can properly be classed as one of the undeveloped reserves of the state, well worthy of careful investigation.

The county records show 1,094 lode claims recorded, 68 being patented; 3 placer claims and 3 tunnel sites. Beyond annual assessment work, little systematic exploring was prosecuted during the past year. An average of forty-six men employed during the year.

COSTILLA COUNTY.

PRODUCTION FOR 1897.

Gold.....	262 Ozs. @	$20.67	per oz.....	$	5,415.54
Silver.....	482 Ozs. @	.5965	per oz.....		287.51
Copper.....	502 Lbs. @	.105	per lb.....		52.71
Lead.....	50,048 Lbs. @	3.38	per cwt.....		1,691.62
Total				$	7,447.38

Costilla is one of the south-central border counties of the state. It has an area of about 1,800 square miles and was organized in 1863. It is bounded by Saguache and Huerfano counties on the north; Huerfano and Las Animas on the east; New Mexico on the south, and Conejos and Rio Grande counties on the west. In form it is quite irregular, its eastern boundary being the summit of the Sangre de Cristo range and the western boundary the Rio Grande river. The section from the Rio Grande river to the mountains is the southeast part of the great San Luis valley. This portion of the county is noted for its agricultural products. The eastern portion of the county is mountainous and embraces the west slope of the Sangre de Cristo range. This portion of the range rises quite abruptly from the valley, which has an average altitude of 7,500 feet; contains such peaks as Purgatory, 13,719; Culebra, 14,079; Trinchera, 13,340; Blanca, 14,464; Baldy, 14,176, and Grayback, 12,387 feet above sea level. Mounts Blanca and Baldy are among the highest peaks in the state. Owing to the level valley, the magnitude and elevation of these, with other peaks, are greatly magnified and present a beautiful view.

The Sangre de Cristo range is made up of metamorphic granite, the western base in Costilla being flanked with Silurian and Carboniferous sedimentary beds. These as a rule have a dip to the west common to the mountain slopes. Within the valley, which is covered with the lake and scattered drift of the Quaternary, are found a few remaining buttes and hill ranges of trachyte capped with basalt. The drainage of the county is is through the Rio Costilla, Rio Culebra and Rio Trinchera, which with their numerous tributaries find outlet through the Rio Grande river.

The county seat is located at San Luis. The other leading towns are Garland, San Paplo, Blanca and Placer. Owing to the topography of the valley all points are of easy access from stations on the Denver and Rio Grande railroad that enters from the east through Veta pass and ends at Alamosa, or from the stations of line running south from Alamosa to Durango.

The history of the county reveals several mining excitements. None of these until within the past years resulted in any systematic exploration of the mineral deposits. This may be largely due to the fact that, the main portion of the county is held under a Spanish land grant. Until within a few years the owners of this land, known as the Sangre de Cristo grant, did not invite prospecting. Comparatively recently a code of rules has been formulated in accordance with and in some respects more liberal than the state mining laws. Under these provisions, prospecting is permitted and titles guaranteed.

In what is known as the El Plomo district, the existence of large ore deposits has been known for many years. Spasmodic efforts of development have been made during the past nine years. During 1896 and 1897, a systematic effort has demonstrated an ore body that bids fair to make mining the leading industry of the county. The ore is low grade, with principal values in gold, and has been developed by a series of cuts and shallow shafts to demonstrate its extent. The main development is a 400-foot drift or tunnel driven into the mass, and a 75-foot winze sunk at end of same. The values have been determined by a series of carefully made tests. During last year a 10-stamp amalgamation mill, with concentrating tables, was constructed. The report from a three months' run shows an average value of $4 per ton, 70 per cent. being amalgamated, and a pay product being obtained on the tables by concentrating twenty-five tons into one. The ore body is quartzite, interlaced with quartz seams and charged with auriferous iron pyrite. The manager, after nine years' exploiting, states as his belief the demonstration of an ore body 1,800 feet wide and 2,600 feet long and 100 feet thick, which may be quarried to suit mill capacity. Further, that he has demonstrated that the ore can be treated to a profit, and the body carries an average gold value of $2.50 to $4 per ton. The magnitude of this enterprise and its importance to both the county and state can not be overestimated.

At Placer, a camp near Veta pass, on the headwaters of Sangre de Cristo creek, many improvements have been made during the past year. The placer bars that have been the seat of several excitements were again worked and yielded fair returns from the sluice box. A group of these claims has been purchased by Eastern capital, which has expended a large amount in the erection of a steam excavation plant, and anticipate large returns during this year.

On Mount Blanca a small number of properties have been operated steadily, and produced small shipments of ore. During 1897 the entire mountain section has been better prospected than for many years. The results of this labor indicate a bright future for this section as a mining district.

The county and grant records show 215 lode claims and 40 placer claims recorded. During the summer months 200 men were employed and 11 properties working.

CUSTER COUNTY.

PRODUCTION FOR 1897.

Gold.....	103 Ozs.	@ $20.67	per oz.....	$	2,129.01
Silver.....	26,842 Ozs.	@ .5965	per oz.....		16,011.25
Copper.....	874 Lbs.	@ .105	per lb.....		91.77
Lead.....2,101,041 Lbs.		@ 3.38	per cwt.....		71,015.19
Total				$	89,247.22

Custer is one of the south-central counties of the state. It was organized in 1877, being by act of legislature segregated from Fremont county. As constituted it has an area of about 720 square miles. The adjoining counties are Fremont, on the north; Pueblo, on the east; Huerfano, on the south, and Saguache, on the west. In form it is somewhat irregular, the western and southern boundaries following natural topographical division lines. The western boundary is outlined by the summit of the Sangre de Cristo range. Near the eastern boundary of the county another range, known as the Wet mountains, traverses the county in a northerly direction and practically parallel to the range on the west. Between these two ranges is the well known Wet Mountain valley, noted for its agricultural products and grazing land. This valley is well watered by Grape creek and numerous tributaries, which waters empty into the Arkansas river. The average altitude of the valley is 7,600 feet. The Sangre de Cristo range rises abruptly and contains numerous peaks, ranging from 12,000 to 14,000 feet. The face of the range is furrowed with deep-cut gorges and cañons, and the whole, from any point of view, impresses one with its magnitude and elevation. This east slope of the range is made up almost entirely of the sedimentary beds of the Carboniferous era. The valley is comparatively smooth, being covered by the local wash or drift. The Wet Mountain range occupies the eastern portion of the county and reaches an altitude of 10,000 to 12,000 feet, but is less rugged. The eastern base is flanked with the sedimentary beds of the Cretaceous and Jura-Trias, and the western base, in various places, by eruptive rocks.

The first permanent white settlers entered the valley in 1869. In 1870 several settlements were established, one being at Rosita Springs and located on account of discovery of ore carrying gold and silver values. The news of this discovery was soon followed by an influx of prospectors from other sections, and the location of a number of lode claims. Rosita continued to grow, and in 1875 was a settlement of 2,000 people and the leading town of the county. New discoveries and excitements kept increasing until 1881. At this time Silver Cliff was the center of attraction, and boasted of a population of 5,000. The early excitement had gradually developed into a "boom," from which the mining industry of that section

has not yet fully recovered. All available territory was located, recorded and held for sale at fabulous prices. Other influences had, however, been at work, that eventually produced an exodus and consequent decline. The ores encountered were different in some respects from those of other camps, and many of the ore bodies too low in values to bear transportation to Denver, the nearest market. These conditions opened the way for mills and new processes. As early as 1875 mill building commenced, reached its zenith in 1880, and closed in 1882. The belief entertained at the beginning of the mill building era was, as the industry advanced, changed to conviction, viz.: That each mine must have a mill. This, with the fabulous prices asked for undeveloped claims, discouraged investment of capital and development of prospects. The result was that both capital and prospectors sought other fields where, from reports received, they had reason to believe less capital or labor was required to gain remunerative returns. The aggregate amount of money expended in mill building in this section was not less than one and one-half million dollars. With a few notable exceptions, the plants erected were total failures. Even some of the exceptions were financial failures if successful from a metallurgical standpoint. The decline in the mining industry, started in 1881, was not only accelerated by one mill failure after another, but also by litigation, that eventually closed the leading developed and regular producing properties. This condition can in no manner be ascribed to the natural mineral resources of the county, but is directly attributable to "boom times" and mills. To the former may be charged: A departure from business principles, a fixing of fictitious values and, later, litigation. To the latter, the destroying of hopes deferred through the introduction of patent processes, based upon principles contra to known and well established laws of chemistry and metallurgy.

The leading mining district of the county is known as Hardscrabble. It occupies the eastern part of the county. The principal mines and mining have been confined to the portion of the district adjacent to Silver Cliff, West Cliff, Rosita and Querida. This portion is made up almost entirely of a complex mixture of eruptive rocks, and was at one time an active volcano confined to small limits. The rocks in the order ejected may be generalized as andesite, rhyolite and trachyte.

The andesite, commonly called porphyry, is of several different types and eras. The first overflow was evidently from both quiet and explosive eruptions, and occurs both massive and in form of tuff and breccia. The next is more massive and makes up a large part of the eastern portion of the district. Both are cut by dikes of a rock type unknown, probably a diorite, and this is followed by another andesitic outflow, carrying a large amount of fine-grained quartz. The rhyolite occurs in the form of lava flows and dikes, the latter cutting through preceding outflows. The rhyolite is cut by another variety of andesite, and this andesite and all preceding rocks are cut by a system of trachyte dikes, the whole being in turn fissured and faulted, and these now contain the veins of the district. The veins are of the fissure type and have a general north and south direction;

are generally narrow, and the vein filling composed mainly of altered country rocks, charged with precious metals. The veins occur generally in system, i. e., occupy two or more parallel fissures. Where one claim covers a system of veins, little or no development has been done except upon one. While the general course of the veins is north and south, east and west veins are not uncommon. Where these systems intersect, the fractured included material affords free access to circulating waters and ore deposition. The district gained much notoriety through the opening of ore bodies of this character. These "chimneys" have been explored to a depth of 800 to 1,200 feet, and little prospecting done for other ore bodies. The fissure and vein formation and ore deposit in this district is in many respects similar to that in the Cripple Creek district, lying forty miles to the north. In the light of more extended development in the latter district, more valuable ore bodies may be confidently developed in the Silver Cliff district by systematic exploiting.

The ores of the Silver Cliff district have principal values in silver and lead, although some ores carry high gold values.

While this district has produced large amounts of valuable ore, it can be said to be little developed. Lying south of Silver Cliff, along the base of the Wet mountains, are several tracts of eruptive rocks, wholly undeveloped and well worthy of systematic prospecting. In the western portion of the county, known as the Verde mining district, a number of well defined lodes have been located, and worked for years in a desultory manner.

The county records show 7,820 lode claims, 225 patented; 128 mill sites, 11 patented; 84 placer claims and 37 tunnel sites, duly recorded. For various reasons, largely litigation, a number of the old mines, able to produce, still remain idle. During the past year the mineral resources of the county have been attracting more favorable notice than for several years past, and all districts are being revived. An average of 318 men were engaged in mining and prospecting during 1897, and 111 mines and prospects working.

MILLS.

Name	Character	Capacity
Terrible	Chlorination; rolls	100 tons
Geyser	Chlorination; 40 stamps	75 tons
Hudson	Chlorination; 10 stamps	18 tons
Bull Domingo	Chlorination; rolls	100 tons
Adelia	Chlorination; 10 stamps	20 tons
Bassic	Chlorination; rolls	100 tons
Boulder	Chlorination; 20 stamps	40 tons
Rock Mt.	Chlorination; rolls	50 tons

Custer is one of the few counties in the state without a railroad, and this has done much to retard its progress. At present travel is by stage from Cotapaxi or Cañon City, on the Rio Grande Railway, twenty-eight miles from Silver Cliff.

DELTA COUNTY.

PRODUCTION FOR 1897.

Gold.....	14 Ozs. @	$20.67	per oz.....$	289.38

Delta is one of the west-central counties of the Western slope, and has an area of about 1,150 square miles. It was segregated from Gunnison county in 1883 by an act of the general assembly. The adjoining counties are Gunnison, on the east; Montrose, on the south, and Mesa, on the north and west.

Horticulture, agriculture and stockraising are the principal industries. The valley lands comprise about one-fourth of the area of the county, and are noted for their productiveness. The altitude varies from 4,500 to 6,500 feet, and the land slope is good for irrigation. The Gunnison river and numerous tributaries drain the county, furnishing ample water for irrigating purposes.

The north boundary line is formed by the Grand mesa, and has an elevation of 10,000 feet above sea level. This section is covered with the remnants of a flow of basalt. In the eastern and southeastern parts of the county, spurs and buttes from the West Elk mountains occur, composed of volcanic rocks. With these exceptions, the county is made up almost entirely of Cretaceous and Tertiary sedimentary stratas.

The mineral resources are practically undeveloped. Coal beds of seemingly good quality outcrop throughout the county, but are not worked beyond supplying local demand. The same is applicable to the building stone. Metalliferous mines occur in the eastern portion of the county, but remain undeveloped and practically not prospected.

Delta is the county seat and principal business center. It occupies a south-central position and is located on a delta at the junction of the Gunnison and Uncompahgre rivers. The Denver and Rio Grande railway passes through the county, giving communication with Colorado points.

DOLORES COUNTY.

PRODUCTION FOR 1897.

Gold.....	2,103 Ozs. @	$20.67	per oz.....$	43,469.01
Silver.....	179,901 Ozs. @	.5965	per oz.....	107,310.95
Copper.....	39,654 Lbs. @	.105	per lb.....	4,163.67
Lead.....	1,093,840 Lbs. @	3.38	per cwt.....	36,971.79
Total				$ 191,915.42

Dolores is one of the important mining counties of Southwestern Colorado. It has an area of 1,000 square miles, and was segregated from Ouray county by an act of the general assembly, approved February 19, 1881. The adjoining counties are San Miguel, on the north; Hinsdale, on

the east; Montezuma, on the south; the east boundary line of Utah forms the western boundary. This territory has been the scene of several mining excitements. The first valid mineral locations were made in 1869. A Mexican adobe furnace was erected in 1872, and an attempt was made to reduce the ores to bullion. Little, however, was known of this section until after the publication of the 1874 report by the United States geological survey, under Dr. Hayden. The first stampede was in 1879, and this year virtually marks the establishment of the district. Owing to inaccessibility, distance from market, high prices for supplies and grade of ore necessary to stand transportation charges, the fall of 1879 marked quite an exodus. In 1880 the Grand View smelter was built, and in the fall of the same year produced some high grade bullion. This afforded assurance of the permanency of the district, and the development was more rapid for a few years following. The grade of ore necessary to bear reduction charges and high prices for supplies were again felt, and progress was slow until the advent of the Rio Grande Southern railroad. This line leaves the Rio Grande system at Ridgway and extends to Durango, via Rico. With transportation facilities the development was rapid until the value of silver and lead reached the low range of prices of 1893. A large number of producers either reduced working force or closed down entirely. Probably no district in the state was as seriously affected as this. The recovery has been slow but sure and, in common with other counties, the year 1897 closes with more activity, fair production and more future promise than at any time in its history.

The principal mining is in the eastern end of the county. This portion is quite mountainous. Along the northern border the San Miguel mountains rise to an altitude of 12,000 to 14,280 feet, and contain the well known peaks of Lone Cone, Dolores, Mount Wilson and Lizzard Head. A short range, with southwest strike, joins the San Miguel mountains near Mount Wilson, and divides the headwaters of the Dolores river and the West Fork of the Dolores. This range reaches an altitude of 12,500 feet in Mounts Elliott and Anchor. The eastern county line is very irregular and formed by peaks of the San Juan mountains and a spur with southwest strike, that divides the headwaters of the Rio Las Animas and Dolores river. Both contain peaks that rise to an altitude of nearly 13,000 feet.

The drainage of the county is through the various branches and tributaries of the Dolores river. The main branch rises in the northeastern part of the county, and has a southwest course. The West Fork rises in the northern part, and has a south course. These branches unite at a station of the Rio Grande Southern railway called Great Bend. At this point the river turns and follows a west and northwest course through the west-central portion of the county.

The general geology of the county is well shown by the numerous exposures along the water courses. With the exception of the mountain peaks, capped with porphyritic trachyte, the formation is composed of sedimentary beds ranging from the lower Carboniferous to the Colorado Cretaceous, inclusive. The principal and best developed mining district is in

the neighborhood of Rico, the county seat and principal business center of the county. Rico is situated on the main branch of the Dolores river, about fourteen miles from where the Rio Grande Southern railroad crosses the divide of the San Miguel mountains, east of Lizzard Head peak.

The ore bodies of this section occur in both "contact and fissure veins." The best developed zone shows two systems of fissures, crossing at nearly right angles, with variable dip, and all faulted to a more or less degree. These are not only intimately connected with each other, but also with the horizontal deposits or "contact veins." In a horizontal direction the ore bodies are unusually persistent and have a variable width, from a few inches to thirty feet. Vertically the values appear to be confined within a few hundred feet of a limestone strata, locally known as the "contact limestone;" the richer ores occurring near the "contact limestone" and decreasing in value with depth. The system of fissures cutting the strata vertically, and with an approximate north and south strike, yield the greater part of the ores produced and carry the highest values.

The ores near the contact are almost "solid," and free from quartz. With depth the percentage of silica gradually increases, until at the limit, quartz, with little value associated, is found. The better ores in shipping quantities yield 500 to 900 ounces silver, and two to ten ounces gold per ton. The principal ores found are native and ruby silver, gray copper, brittle silver and silver glance, associated with galena, zinc blende and iron pyrite.

Nearer the top of the mountain, or in a zone above the "contact limestone," a system of fissures occurs, enclosing veins made up in the main of galena and zinc blende, but low in gold and silver values. This is also true of a zone lying near the base of the mountains. Neither the upper or lower zones are much developed, on account of low grade of ore. The ore deposition in the above zones, is doubtless intimately connected with the intrusive mass of porphyritic diorite that has elevated this section several thousand feet above its normal position. The different character and value of the ores, may be accounted for by different periods of faulting and different times in which certain zones were opened to the circulating waters.

In the trachyte districts, both veins and dikes occur similar to those of San Miguel county. Some of the veins are quite extensively developed and yield good returns in gold, silver and lead.

Erosion has played no small part in shaping the present topography of this county. Along the stream beds and low benches, large deposits of gold-bearing "wash" exist. The existence of placer gold has been long known, but until recently nothing beyond primitive methods on a small scale have been employed. The most prolific beds are on the main stream of the Dolores below Rico, and on the West Fork. These extend well into Montezuma county, and are practically virgin territory. During the past year some of this ground has been equipped with necessary appliances for work on a fair scale, and good returns are anticipated this year.

The prospecting for gold has renewed life at Duncan and, if reports can be credited, the discoveries and development during 1898 will produce good results.

Dolores county is divided into two mining districts by an imaginary east and west line. The northern portion is known as the Lone Cone, and the southern as the Pioneer district.

The county records show 2,817 lode claims, 48 placer claims, 52 mill sites, 39 tunnel sites, 273 patented lode claims, 9 patented placers; 9 patented mill sites and 10 coal claims duly recorded during 1897. An average of 354 men were employed in mining, and 102 mines and prospects were actively at work.

MILLS.

Name	Location	Character	Daily Capacity
Munn	Rico	Sampling works	100 tons
Emma	Dunton	10-stamp conct. and amal.	25 tons
Rico	Rico	Rolls, jigs, tables	50 tons

DOUGLAS COUNTY.

PRODUCTION FOR 1897.

Gold	23 Ozs. @ $20.67 per oz	$	475.41
Silver	10 Ozs. @ .5965 per oz		5.96
Total		$	481.37

This was one of the original seventeen counties organized in 1861 by act of territorial legislature. As originally constituted, the county embraced more territory than at the present time. It occupies a central location in the state, having Arapahoe on the north, Elbert on the east, El Paso on the south and Jefferson county on the west. Its area is about 900 square miles. While the county is usually classed among the plains counties, the west and southwestern portions are quite rugged and are traversed by a spur of the main mountain chain, known as Rampart range. This range is made up mainly of metamorphic rocks, and contains a number of peaks that reach nearly 10,000 feet above sea level. Along the eastern base, the range is flanked with sedimentary beds of sandstone and limestone of the Jura-Trias and Cretaceous.

Plum creek and tributaries afford the drainage for the east slope, and the South Platte river and tributaries the drainage for the west slope of this range. Lying east of Plum Creek valley is what is known as Cherry Creek plateau, drained by Cherry creek and tributaries. This portion of the county is dotted with castellated buttes formed by erosion and capped with eruptive rock, resting upon the sedimentary Post-Cretaceous and Tertiary beds.

The early history of the county reveals it to be one of the first settled in the state, the search for gold being the primitive cause. Some gold was found and removed, and has been every year up to the present time. The beds, however, were never very lucrative. The main mineral resource developed has been the building stone. A number of good quarries have been opened and have for years been extensively drawn upon to meet the demand. Coal beds exist but are undeveloped. The clay beds are likewise undeveloped. Prospecting for petroleum has yielded no returns, although the indications are favorable. Mineral springs, more or less charged, are found in several localities. The one best developed is in the southeast part of the county on Antelope creek, and known as Excelsior springs.

Following the rush into the Cripple Creek district, the Rampart range was the scene of considerable excitement in 1895. During 1896, towns sprang up, and the southwest portion of the county gave evidence of a permanent producing district. The results of development during 1897 have not been as successful as expected. That too much was expected was patent to all who visited the district and were not carried away with the prevalent excitement. The district is in a prospective stage. Ore carrying good values exists, but has not yet been demonstrated in paying quantities. The somewhat recent reports of gold value in the sandstone beds along West creek, if reliable, will soon bring the district to the front as a producer. During the year an average of seventy-seven men were employed.

The leading town and county seat of the county is Castle Rock. The transportation facilities are good, the county being traversed from north to south by several lines of railroads.

EAGLE COUNTY.

PRODUCTION FOR 1897.

Gold.....	1,682 Ozs. @	$20.67	per oz.....	$	34,766.94
Silver.....	46,046 Ozs. @	.5965	per oz.....		27,466.44
Copper.....	2,200 Lbs. @	.105	per lb.....		231.00
Lead.....	1,144,013 Lbs. @	3.38	per cwt.....		38,667.64
Total				$	101,132.02

Eagle county occupies a central position in the state and has an area of about 1,700 square miles. It was segregated from Summit county in 1863 by an act of legislature. The adjoining counties are Routt and Grand on the north; Summit on the east; Lake and Pitkin on the south, and Garfield on the west. While what is now Eagle county had been previously explored, the history of the active development of its natural resources begins with 1879. This year marked the great rush to the Leadville district, which joins on the south. The discovery of ores sim-

ilar in character and occurrence along Eagle river served in a small degree to relieve the pressure at Leadville, and to quickly populate this section. Its establishment, therefore, may be ascribed to the overflow prospectors from Leadville. The first valid locations were made early in 1879. The ore production was limited on account of grade of ore necessary to bear transportation and treatment charges. In 1880 a smelting plant was erected and provided a home market. This plant produced a large amount of lead bullion, but ceased operation soon after the advent of the Rio Grande railway, early in 1882. This county has been a regular annual contributor to the state's production from 1880 to the present time.

The east and southeast parts of the county are very mountainous. The most noted landmark is the Mount of the Holy Cross. This peak rises to an altitude of 14,176 feet. The north slope is quite precipitous and is traversed by two transverse fissures crossing at right angles. These fissures are protected from the sun and are, therefore, constantly filled with snow and ice, making an immense white cross on the dark background. This cross is visible for long distances and accounts for the peak's name. Holy Cross mountain, as well as the range separating Eagle from Summit county, is composed of metamorphic granite. Traveling from the east to the west boundary line of the county, the sedimentary formations from the Silurian to the Colorado Cretaceous, inclusive, would be crossed. At various points throughout the county, small areas of basalt are found capping the Colorado Cretaceous, the largest being near where the Piney joins the Grand river.

The drainage of the county is through the Grand and Eagle rivers and tributaries and the Frying Pan and tributaries. Grand river flows in a southwest direction, through the northwest part of the county. Eagle river rises near Tennessee pass, flows northerly until about ten miles north of Holy Cross mountain, then turns west and flows through the central portion of the county, joining the Grand river a few miles east of the west county line. The Frying Pan flows westerly through the southwest part of the county.

The principal mining districts are: Eagle River, Battle Mountain, Holy Cross, Mount Egley, Fulford, Frying Pan, McDonald and Cattle Creek.

The Battle Mountain district includes Red Cliff, the county seat, and Gilman, the center of mining activity. The mines of this district are the best developed and have produced a large part of the ores.

The geology of the Battle Mountain district is well shown by the Eagle River cañon and tributaries to Eagle river coming in at almost right angles. Three different ore zones have been developed. Along the base of the mountains from 200 to 400 feet of granite is exposed. In this, vertical fissures occur. These fissures are, in the main, small and do not seem to extend into the overlying sedimentary beds. The veins are mainly composed of altered granite carrying gold, silver and lead values.

In the overlying Cambrian quartzites "contact veins" occur. The quartzites lie comparatively level, having a dip 10° to 12° to the northeast. What is known as the "contact filling" is sharply defined and has an almost constant width of five feet. The contact filling is made up of brecciated material or quartzite fragments, loosely cemented with iron oxide and some iron pyrites. The ore occurs in shoots throughout this brecciated material. The shoots seem to have a trend common to the dip of the strata and in many places are connected by small "stringers." They occur at irregular intervals and have no uniform size. They may fill the entire space from floor to roof and have a width of fifty to sixty feet or be confined to very small limits.

There is considerable uniformity in the character of ore-filling in these shoots. The floor is usually rough and covered with a rather tough clay. In this, free gold nuggets are often found of peculiar form and structure. Above this lies a soft ochreous mass varying from a few inches to a few feet, containing galena, with its secondary products, anglesite, cerrusite and minium, all carrying good silver value. Next above is a streak of massive galena from one to ten inches thick, high in silver value, and lastly, four to ten inches of banded aragonite. The foregoing is subject to variation in different shoots, but fairly represents the average ore shoot of this zone.

Some 200 feet above this is another ore zone, in which the large tonnage producers are located. These deposits appear to be wholly within the Silurian limestones, but near the overlying porphyry. The ores in this belt outcrop and occur in oxidized form for considerable distance when sulphide ores are found. The grade is comparatively low, the values being about one-third gold and two-thirds lead, silver and iron. The ore bodies are large and the oxidized ores with good iron excess have always commanded a high price at the smelters, being very desirable for flux. Economic questions and some litigation have retarded the output from this zone. At present the largest interests have been apparently consolidated, and some of the largest tunnel schemes in the state launched.

The Fulford district is in many respects similar to the Battle Mountain district, but less developed. The work during 1897 attracted much attention and it is now spoken of as the gold belt of the county. It is located on Brush creek, about eighteen miles west of Red Cliff.

In the Holy Cross district, the veins are of the fissure type, with principal values in gold. The veins are large and filled with low grade ore bodies. The general character of the veins is comparable to those of Gilpin and Clear Creek counties. This section is somewhat handicapped by physical conditions, but these will be overcome when the field is entered in a proper manner. Were this district located in either Gilpin or Clear Creek counties the production would be large and constant.

The Mount Egley district, lying west of the Holy Cross district, is another promising field and has of late attracted increased attention. The veins are of the fissure type in granite. Main values in gold. Ore bodies large but low grade.

In the Frying Pan and Cattle Creek districts many new properties have been located and some of the old ones revived. They are both advantageously located in the south end of the county and are tributary to the Colorado Midland railroad.

The work during the past year in the McDonald district, lying in the northern part of the county on Grand river, has again attracted attention to the placer beds of Eagle county. This is a placer district and enterprises are floated that bid fair to displace primitive methods with modern appliances, and start placering on a large scale. With few exceptions, the numerous streams of this county have placer beds that will yield good pay with the primitive rocker when operated with will and muscle. There is a large amount of placer ground in Eagle county unappropriated and advantageously located for economical extraction of gold on a large scale.

The county records show 7,146 lode claims, 103 placer claims; 416 lode claims patented and 11 placer claims patented, duly recorded. During 1897 an average of 282 men were employed in mining and sixty-two mines and prospects were continuously operated.

Common to all counties in the state, where the mountain ranges rise up through the sedimentary beds, the county possesses unlimited resources in building stone, clays and gypsum beds. Several quarries have been opened, but during 1897 little was done beyond supplying local demand.

The development of Eagle county is far below what the natural resources and advantages justify. That it has not made better progress and does not occupy a higher rank as a producer among the other mineral counties of the state is largely due to its more fortunate neighbors, viz., Leadville and Aspen. What was first deemed advantageous has proven the reverse. Capital has either stopped in Lake or gone through Eagle to Pitkin county.

EL PASO COUNTY.

PRODUCTION FOR 1897.

Gold.....	490,172 Ozs.	@	$20.67	per oz.....	$10,131,855.24
Silver.....	59,879 Ozs.	@	.5965	per oz.....	35.717.82
Copper.....	1,625 Lbs.	@	.105	per lb.....	170.58
Lead.....	5,492 Lbs.	@	3.38	per cwt.....	185.63
Total					$10,167,929.27

El Paso county has an area of 2,646 square miles, was organized in 1861 and occupies a central position in the state. The adjoining counties are Douglas and Elbert on the north; Elbert and Lincoln on the east; Pueblo and Fremont on the south, and Fremont and Park on the west. In the history of the state this county has always been an important

factor. The state capital was originally located at Colorado City. At that time this town was considered the gateway to the farther West, being located near the entrance to Ute pass, one of the main trails traveled. The eastern and larger portion of the county lies on the great plains. The western section embraces a portion of the Rocky or Front range of mountains, of which the well known monument of Pike's peak forms a part. The name Pike's peak is synonymous with Colorado, for the reason that what is now known as Colorado was in early days known as the Pike's Peak region.

Colorado City sprang into existence in the fall of 1859 and made rapid advance. This was further accelerated by the establishment of the territorial capital at that point. The removal of the capital to Golden in 1861 marked the beginning of a number of calamities that followed for several succeeding years. The general depression produced by these events was not entirely eradicated until the advent of the Denver and Rio Grande railroad in the fall of 1871. From 1871 to the present time, the advance has been rapid.

Colorado Springs, the county seat, has developed into one of the leading cities of the state; Colorado City into a manufacturing center, and Manitou into one of the leading health resorts of the country on account of its mineral springs. The county, as a whole, has advanced to first place through its great mineral wealth and production.

Cripple Creek is the name applied to the leading mining district of the county. It is located in the southwest corner, nine miles from Pike's peak, and contains about 130 square miles. The development has been phenomenal. While it doubtless played its part in the gold excitement of 1859 and has been the scene of several excitements since, the first valid location was made in February, 1891. At that time this section was in use for stockgrowing purposes and the advent of prospectors was resented by the stockmen, who did all possible to discourage an attempt to transform "a good stock range into a questionable mining camp." Notwithstanding these protests, the tide of immigration continued. Development has been so rapid that detail must be omitted.

The district to-day evidences unequaled prosperity, with a population of 30,000, divided among Cripple Creek, Victor, Goldfield, Altman, Anaconda, Elkton, Gillette, Independence, Lawrence and intervening settlements that blend into the above. Cripple Creek and Victor are the leading centers and are in every sense metropolitan.

The district is the leading gold producer in the state, and the magnitude of the business may be inferred from the following: The gold production for 1897 exceeded that of the remainder of the state. The Florence and Cripple Creek railroad, connecting with the Rio Grande system at Florence, and the Midland Terminal railway (broad gauge), connecting with the Midland system at Divide, are both crowded with freight traffic to and from the camp. Each line runs two trains daily each way for outside passenger travel and suburban trains almost every

hour between Victor and Cripple Creek. An electric railway system is now under construction from Cañon City. A local system, operated by electricity, crosses over the hills between Victor and Cripple Creek and handles both freight and passengers. The telephone service of the district is comparable to that of any large city. Ten copper circuits connect the district with Denver, Colorado Springs, Pueblo and other points throughout the state. The telegraph service compares with the telephone. Both the Western Union and Postal companies have numerous offices throughout the district. All other lines of business are in keeping with the foregoing. The numerous handicaps and hardships incident to six years' rapid growth have passed, the "boom days" are matters of history, and the district has settled down to constantly increasing production.

As seen to-day, the topography of this district consists of low, smooth, rounded hills with narrow valleys. The altitude of the district is from 8,500 to 10,800 feet above sea level. The hill slopes are gentle, easy of access and generally overlaid with a covering of soil that completely hides the character of the underlying rocks.

Near the center of what is known as the Cripple Creek district is a tract locally known as the "Cripple Creek Belt" or "Central Area." This region is three and one-half miles by two and one-half miles, irregular in outline, but somewhat elliptical in form. It is composed of volcanic rocks and debris, with inclusions or islands of previously formed massive, eruptive rocks. The surrounding country is made up of the granite-gneiss complex common to the Rocky mountains, with numerous inclusions of schistose rock fragments. This small area marks the site of an active volcano in Tertiary times. That the sequence of phenomena required by modern scientists before the name of "true volcano" is deemed applicable, should be so complete and confined to an area so limited, is one of its striking features.

The sequence of the various eruptions may be briefly summarized as follows: First, an outflow of augite-andesite, through previously formed fissures, followed by a series of explosive outbursts; a season of quiet and the cementing together of the andesitic-tuff and breccia that forms a large portion of the central area. Second, a phonolitic outflow, through previously formed fissures, forming the phonolite dikes that cut the tuff and breccia, the included rock masses and outlying granites. Third, a basaltic outflow, through fissures, forming the basalt dikes, that in turn cut through the phonolite dikes. Fourth, a period of fissures cutting through all the rocks of the district, followed by the formation of mineral veins. Fifth, erosion, whereby the topography was changed to its present form. This, geologically considered, has been very slight since ore deposition.

The great number and rare composition of the dikes are among the peculiar features of the district. They are more abundant near the volcanic centers and decrease in number with distance from same. They cut the country rocks in nearly a vertical position, traverse the district

at all points of compass, but are most abundant in a northerly and southerly direction.

The veins occur in greater numbers than the dikes, and occupy fissures that seem to occur in systems; i. e., two or more parallel and near together. The rock masses between the main fissures have also been fissured. These fractures are practically parallel to the main fissures, most abundant near same, and may or may not contain veins. They all show movement or faulting, but the throw or distance moved must have been slight, owing to apparent physical conditions.

The appearance of the veins differs in various portions of the district. Where the fissures traverse the massive or harder rocks, the veins may be said to be better defined. In the softer rocks the veins occupy almost closed lines of fracture. In a general way the main fissures of the district parallel the nearest dikes, and therefore traverse the district at all points of the compass, the most prevalent having a northerly and southerly course.

The foregoing may be better understood by those not fully conversant with fissures and vein formation by reference to the following ideal sections:

Fig. 1.

Fig. 2.

Fig. 3.

Figure 1 represents a fissure separating two rock masses; figures 2 and 3, the same fissure faulted in different degrees, i. e., the rock masses have moved different distances after the formation of the fissure. The sliding, creeping or faulting of two rock masses is but a natural result. It would be difficult to so adjust a force sufficient to break large sections of country rock that no faulting or movement would occur. Instead of being detrimental to ore deposition, as seems to be generally regarded, it is the reverse. As shown in Figure 2, the rock masses strike each other

and leave open spaces, wherein secondary minerals may be deposited. Fissures may be held open by pieces of the rock falling between the walls, sufficient in size to resist pressure. These occur often and are called "horses" by the miner. The width of a fault fissure or distance between walls is mainly dependent upon the amount of displacement, the irregularity in the line of fracture, the character and hardness of the rock mass fissured and the force exerted in grinding the walls upon each other.

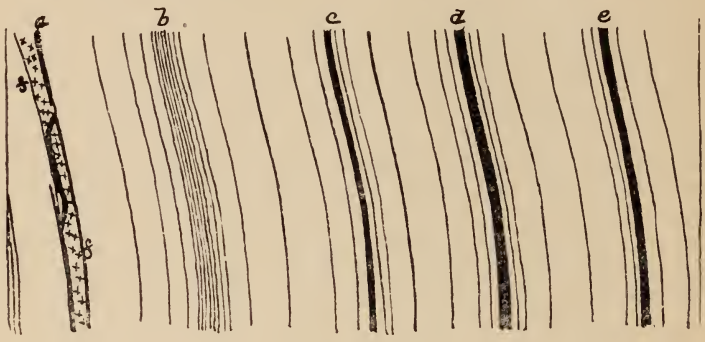

Figure 4.

Figure 4 represents an ideal cross-section of a vein system; a, b, c, d and e represent the main veins, with parallel lines of fracture intervening, that may or may not be mineralized. At a the vein is shown as it often occurs in connection with dikes. The dikes are sometimes fully altered and "become the veins."

The veins of this district are not only remarkable for the manner in which they occur, but for the small amount of secondary minerals found "within the walls." Taken singly, they are narrow; collectively, or in systems, they sometimes make immense ore bodies. In the hard-rock districts the vein filling is composed of a kaolin, the so-called "talc streak," occasional bodies of secondary quartz, but is principally the brecciated and altered country rock. The main values are found upon the fracture planes or in "pockets," where the country rock has been dissolved out and partially replaced by quartz and ores high in gold values. The characteristic ore is locally known as "purple quartz." It may be secondary quartz charged with fluorite sufficient to give it a bright purple color, but is more commonly the breccia or country rock through which the vein cuts, impregnated with and replaced by quartz, tellurides of gold and other minerals. The ores, when viewed in quantities by those unfamiliar, give the impression that rock instead of ore is being marketed. The kaolin or "talc streak" may or may not carry values.

In the section of the district made up of tuff and breccia, or the softer rocks, if a vein be defined as "a body of secondary minerals filling a fissure," the veins proper are little more than streaks of kaolin with associate minerals, that may or may not carry values. If, however, the definition

of a vein be "a mineralized section that yields a profit in mining," large, valuable and prolific veins exist. The ores in this section are almost entirely composed of altered country rock, or the tuff and breccia replaced in part by quartz, fluorite and other minerals. The main fissures have formed the channels for circulating waters. These have permeated, dissolved out and replaced with secondary minerals what may be properly termed the walls of the vein. The higher value usually occurs nearest the wall, and the value decreases as distance from wall is increased. When the veins occur in a system with parallel fractures intervening, the waters have free access and the whole mass becomes charged, and is often mined and shipped for ore. In the surrounding granites the veins are "better defined," but the main values exist without the vein walls, or between two veins often mistaken for walls of a large vein. This error is of common occurrence throughout the district.

Taken as a whole, the veins of the district may be properly classed as fissure veins with impregnated ore bodies associated.

These ore bodies are not continuous, but may be said to occur in the form of segregated bodies or chutes, without form or defined limit. The conditions demand more thorough and systematic cross-cutting than is common to the work of the district.

When two vein systems intersect, large ore bodies or chimneys often occur. These, as a rule, are defined in limit by some of the cross veins. The included material fractured by the first vein system, when cut by the second system, may be described as being shattered. The thermal waters are thereby given free and easy access, and the mass is completely charged and largely kaolinized. If the included territory be not too great, the whole included material can be treated as ore. Otherwise the values are deposited in irregular bodies throughout the shattered mass, and the profits accrued from mining one ore body be consumed searching for another.

The permanency of this district as a mining camp was, in the early days, often questioned. The developments of the past few years have removed doubts from the minds of the most skeptical. The ore bodies of the mines wholly within the outlying granite have proven persistent with depth. In the central area the veins in the breccia have been followed by development through into the underlying granite in a number of places. The conditions are here found practically the same as at higher levels. The veins are seemingly better defined, and in some cases the veins making up the so-called systems have come within closer limits, and the whole included mass, under improved conditions, can now be profitably mined.

In a preceding paragraph four periods of fissure-forming are mentioned. The cause was doubtless that common to volcanic phenomena, viz.: Prior to eruption a series of earthquakes, gradually increasing in intensity; the formation of fissures through which the volcano found vent or vents, forming craters, or through extended fissures to surface, forming dikes. The fact that each succeeding period produced fissures that broke through all preceding rocks indicates the force to have been deep seated.

and leaves little room for doubt that the main fissures, now filled with ores, were formed by a force common to the fissures now occupied by dikes, and will extend to greater depths than will probably ever be attained in mining operations.

Additional weight is given to the above by the fact that both dikes and subsequent fissures are found to occur in greater numbers near the volcanic centers of the district, and to gradually decrease as distance from same is gained. Other conditions, among which may be mentioned the continued presence of kaolin associated with the sulphide ores, indicate permanency. The point of oxidation has been passed in a number of properties. Kaolin is an oxidation product, and its abundant presence below water levels demonstrates it to have been produced by circulating waters from below, and not above. The valuable ores doubtless derive their origin from the same source, and may be confidently expected at much greater depths than yet attained.

The district has been the scene of much excitement and work. The last year has added several regular producers, and more may be expected each succeeding year. The fact that a shaft develops nothing in this section is being realized more and more, and beyond a few shallow shafts and drifts that demonstrate nothing, the larger portion is still virgin territory. The ore occurrence is such that many good mining men from other sections have scored failures in this, and others, absolutely destitute of mining knowledge, have succeeded. The belief that became general a few years ago, that no permanent values could be expected above one hundred feet in depth, has been exploded. Nearly all the developed ore shoots opened at various depths have been traced back to surface, and the old system of trenching on surface is again vigorously resorted to.

The entire central area can be properly called a placer bed, and would yield a profit if water were available. In the valleys the gold is, however, often found more concentrated, and various beds are being worked in a desultory manner with primitive appliances. Much effort has been made by the writer to obtain some crystalline or native gold from this district, but without success. The gold, so far as examined, is without doubt an oxidation product, and was originally in the form of a telluride, either as calaverite or sylvanite.

There are six public sampling works in the district, that furnish a ready market and pay cash for ores. The scale of prices is by schedule based upon value per ton of contents. With the advent of railroads and local mills, the grade of ore necessary to yield a profit over expense of mining, transportation and treatment has been gradually reduced, so that ore thrown over the dump as worthless a few years ago is now marketed.

El Paso county, from the mountains to its eastern border, contains natural resources sufficient to maintain a great commonwealth. The numerous mineral springs at Manitou, nestling at the base of Pike's peak, have a world-wide reputation. It is an ideal summer resort, with unequaled scenic attractions and climate. Manitou is connected with Colorado Springs

by the Rio Grande and Midland railroads, and also by an electric line. The Cog Wheel railroad starts at this point and climbs to the summit of Pike's peak.

The sedimentary beds flanking the base of the mountain range contain some of the most valuable and best developed quarries in the state, and the plains forming the eastern portion of the county are underlaid with valuable coal beds.

In El Paso county there are, besides Cripple Creek, the following mining districts: Front Range, West Creek, Florissant, Woodland Park, Manitou, Cheyenne Cañon and Turkey Creek. All possess more or less merit, and during the past year have received careful attention from prospectors. The Cripple Creek district has been allotted a disproportionate amount of space, both on account of its importance and to comply with the constantly increasing demand upon this department for detail information regarding same.

The county records show 21,404 lode claims, 763 placer claims; 1,149 lode claims patented, and 48 placer claims patented, duly recorded. An average of 5,386 men were engaged in mining during 1897, and 735 mines and prospects were actively developed.

SAMPLING WORKS.

NAME	LOCATION	DAILY CAPACITY
The Midland Ore Sampling Co.	Cripple Creek	150 tons
Cripple Creek Sampling and Ore Co.	Cripple Creek	150 tons
Rio Grande Sampling Co.	Cripple Creek	100 tons
Victor Ore Sampling Co.	Victor	150 tons
Taylor & Brunton Sampling Co.	Victor	150 tons
Gold Ore Sampling Co.	Goldfield	150 tons
Kilton Gold Reduction Co.	Goldfield	150 tons

MILLS.

NAME	LOCATION	CHARACTER	DAILY CAPACITY
Beaver Park	Beaver Park	Amal., 10 stamps	20 tons
Patterson	Gillett	Canvas tables, 20 stamps	40 tons
Hartzell	Anaconda	Canvas tables, 10 stamps	25 tons
Gold Geyser	Cripple Creek	Amal., 10 stamps	20 tons
Brodie	Mound City	Cyanide	100 tons
El Paso	Gillett	Chlorination	50 tons
Colo. Ore Sampling and Reduction Co.	Arequa	Cyanide and chlorinat'n	100 tons
Colorado-Philadelphia	Colorado City	Chlorination	200 tons

N. B.—The mills of Fremont county are tributary to and depend upon this district for ore supply.

FREMONT COUNTY.

PRODUCTION FOR 1897.

Gold.....	623 Ozs. @	$20.67	per oz.....	$ 12,877.41
Silver.....	1,525 Ozs. @	.5965	per oz.....	909.66
Total				$ 13,787.07

Fremont county occupies a south-central position in the state. Since its establishment, in 1861, the original territory has been from time to time reduced by acts of legislature. As now constituted, it has an area of 1,559 square miles. The adjoining counties are Chaffee, Park and El Paso, on the north; El Paso and Pueblo, on the east; Custer and Saguache, on the south, and Saguache and Chaffee, on the west. The Arkansas river, with its numerous tributaries, drains the county. This stream has an east and west course near the middle, and divides the county into two almost equal parts. The main tributaries from the north are Badger, Corral, Tallahassee, Cottonwood, Current, Wilson, Sand, Oil, Eight Mile and Beaver creeks; from the south, Texas, Grape, Oak, Coal, Newland, Adobe and Hardscrabble creeks.

The county in the main is composed of metamorphic and eruptive rocks. In the west end, the sedimentary beds, ranging from the Silurian to the upper Carboniferous, inclusive, flank the east base of the Sangre de Cristo mountains and the west base of a range of hills separating Chaffee and Fremont counties. The southeast part of this county extends upon the great plains, and the mountains are here flanked with the sedimentary beds of the Jura-Trias and Cretaceous.

The county is richly endowed with natural resources, and it has at all times been an important factor in the state's advance. Florence and Cañon City are the leading cities and commercial centers. The seat of government is located at Cañon. This city occupies a valley at the mouth of the Grand cañon, and is noted for its horticultural products and genial climate.

The Denver and Rio Grande railroad parallels the Arkansas river throughout the county, and grants to thousands of tourists annually all stop-over privileges necessary to view the Grand cañon by daylight. The Florence and Cripple Creek railroad, while distinct, is operated in conjunction with the Rio Grande system, and extends from Florence to the Cripple Creek district, lying forty miles north. The Arkansas Valley branch of the Atchison, Topeka and Santa Fe railroad terminates at Cañon City, parallels the Rio Grande system to Pueblo, and sends out branch lines to the south and southeast of Florence.

A new railroad, known as The Cañon City and Cripple Creek Electric Railway Company, is now under construction, and the contract stipulates completion by September 1, 1898. Cañon City and Cripple Creek are the terminal points and, as surveyed, the line will be twenty-six miles

long. The road will be a standard gauge, with 72-pound rails, and equipped for passenger and freight traffic. The power plant is to be erected four miles north of Cañon City. Three-phase Westinghouse system will be used, and the electricity will be generated by steam. The citizens of Cañon City are the promoters and large contributors toward its construction. When completed they propose to establish mills for treating the lower grade ores of the Cripple Creek district, and afford a market for ore having a value of $7 per ton and upwards.

Fremont county has contributed small amounts annually to the state's production of precious metals for many years past, and has been the scene of several short-lived excitements. Active and persistent exploration, however, is subsequent to the unusual developments of the Cripple Creek district, which joins this county on the north. During the past year this section has been very active. The production, while small from each group of properties, is appreciable in the aggregate. The veins receiving most development cut through the granite and the main filling is quartz. Telluride ores, similar to Cripple Creek, occur, but the principal values are in the form of iron and copper sulphide, carrying gold.

The metalliferous mines are chiefly confined to the northern portion of the county, which is divided into the Cripple Creek, Bare Hills, Current Creek, Black Mountain and Badger mining districts, beginning in the northeast corner and occurring in order named to the west. The Bumback and Cotopaxi districts lie eight and twenty miles, respectively, west of Cañon City.

All of the mines in the various districts are in the prospective stage. The development of the past year demonstrates the existence of precious metals, and bids fair to prove the same to exist in paying quantities.

A portion of the Badger Creek district is in dispute between the counties of Fremont and Chaffee. In the description of Chaffee county this district was largely included and is therein referred to. The recent surveys of the state engineer appear favorable to the claims of Fremont county.

Placer beds occur along the various streams, and have been worked in a small way and by primitive methods for many years.

The county records show 9,000 lode claims, 400 placer claims, 100 mill sites; 160 lode claims patented, 30 placer claims patented, 4 mill sites patented, duly recorded. During 1897 an average of 384 men for the year were engaged in mining, and 180 prospects being developed.

One of the important enterprises of the past year is the establishment of an electric plant at Cañon City for the transmission of power into the Cripple Creek district, a distance of nineteen miles. The officers of this company claim to represent unlimited capital, that the full capacity of the plant under construction is already contracted for for power, light and heat, and they are already considering the advisability of duplicating the plant.

The smelter of The American Zinc-Lead Company, at Cañon City, is handling about thirty tons daily of refractory sulphides, carrying a high percentage of zinc. The process in use at this plant is protected by pat-

ents and has been in operation for ten years. The products are copper matte and a zinc-lead pigment, used as a substitute for white lead. For detailed description the reader is referred to volume V., page 619, of "The Mineral Industry."

MILLS.

NAME	LOCATION	CHARACTER	DAILY CAPACITY
Metallic Extraction Company	Florence	Cyanide	400 tons
El Paso Reduction Company	Florence	Chlorination	100 tons
Kilton Gold Extraction Company	Florence	Chlorination	50 tons
London and Cripple Creek	Florence	Cyanide; idle	50 tons
American Zinc-Lead Company	Canon City	Smelter	100 tons

With the exception of the smelting works at Cañon City, the above mills have been built in 1896 and 1897, and make Fremont county, from point of ore reduction, the fourth county in the state.

The coal measures of Fremont county lie in the south corner and cover an approximate area of 20,000 acres. The principal mines are at Coal Creek, Rockdale, Williamsburg, Chandler, Brookside and No. 5 mine. (See chapter on coal beds.)

Fremont county bears the distinction of having the only developed oil fields in the state. About ten square miles have been developed by wells ranging from 1,100 to 2,400 feet deep. The production for 1897 was almost 2,000 barrels crude oil per day. A number of new wells are being drilled to extend the field and augment production. There are thirty-five wells producing at present. Two refineries are located at Florence, with capacity sufficient to handle the product. The demand for residuum for fuel exceeds the supply. The refined oils find ready market in the West and South.

In building stone, marble, lime, clays and gypsum beds the resources of this county are almost unlimited. The granite quarry at Cotopaxi produces a superior quality of granite. This stone is not only extensively used in Colorado, but is attracting the attention of builders elsewhere. The marble beds are quite extensively developed, and the product is of a quality to command a ready market. All of the sedimentary beds may be said to have been developed by nature. The tilting from the mountain upheavals and subsequent erosion have left the faces exposed in a series of hogbacks or ridges, easy of access and ready for removal upon demand.

The mineral springs at Cañon City stand in the first rank for medicinal properties. They occur both hot and cold. These waters are bottled and find a constantly increasing demand from the home market. (See chapter on mineral springs.)

Fremont county enters the year 1898 under the most favorable auspices of its history. All of the varied resources were drawn upon during 1897 in excess of any previous year. More men found employment and more new enterprises destined to affect the whole state were launched.

GARFIELD COUNTY.

PRODUCTION FOR 1897.

Gold.....	15 Ozs. @ $20.67 per oz.....	$	310.05
Silver.....	42 Ozs. @ .5965 per oz.....		25.05
Total	.....	$	335.10

Garfield county is one of the north-central west border counties, organized in 1883, with an area of 3,250 square miles and named in honor of Hon. James A. Garfield. The adjoining counties are Rio Blanco on the north; Eagle on the east; Pitkin and Mesa on the south; Utah on the west. The drainage is through the Grand river and tributaries. This stream enters the east boundary near the center and flows in a southwest direction, passing through the south boundary west of the center. The main tributaries are Roaring Fork, Divide and Maroon creeks from the south; Elk, Rifle, Parachute and Roan on the north. Trappers lake, which forms the head of the White river is in the northeast corner of the county. The streams course through narrow, well settled valleys noted for fertility. The agricultural and horticultural products are among the main resources of the county. The adjoining hills afford good territory for grazing, and stock growing is largely indulged in. The west portion of the county is composed of Tertiary beds, while in the east and northeast portions, beds varying from the Silurian to the upper Carboniferous inclusive, are exposed.

The first mineral discoveries in this county in 1878 were later intensified by reports of 1879. At this time the territory now embraced by Garfield county boundaries formed a part of the Ute Indian reservation and the magnified reports were largely due to the risks incurred in attempting to appropriate a section not open to settlement. In 1880, notwithstanding conditions, prospectors were numerous. The scene of excitement was in the section where the Carboniferous stratas were exposed. The ores discovered occurred both as bedded deposits and small veins coming up through the Silurian limestone. The ore is an argentiferous lead, in form of sulphide and carbonate, carrying low percentage of silver. At that time ores of such low grade were valueless. From 1881 to the present, a small amount of development has been made each year with little or no remunerative returns. During 1897 about fifty prospectors were engaged, and express confidence in yet finding big veins and high grade ores in this county.

The large coal deposits in this section attracted attention in 1882. Accessibility and quality led to development and later to railroad building. The Denver and Rio Grande extended its line down the cañon of the Grand river to Glenwood Springs in 1887, and to Rifle in 1889. The Colorado Midland reached Glenwood early in 1888, and extended the line to Newcastle in 1889. In 1890 the two roads constructed joint

track from Newcastle to Grand Junction. Both lines have spurs running to the various coal mines. The principal mining of the county is for coal.

Following the organization in 1883, by act of legislature, the county seat was established at Carbonate, later it was removed to Glenwood Springs, the present seat of government and main commercial center. This city occupies a valley with beautiful surroundings and, from a scenic standpoint, is one of the finest in the state. Its growth and improvement is largely attributable to the hot mineral springs. The largest group of these springs has been improved with fine bath houses and hotel accommodations, second to none in the state. A swimming pool, 150x600 feet is one of the great attractions. The combined flow aggregates 8,000 gallons per minute. The extreme temperature of the water is 126° Fahrenheit. The medicinal properties are unexcelled and, combined with the climate common to this locality, unequaled.

GRAND COUNTY.

PRODUCTION FOR 1897.

Gold.....	94 Ozs. @	$20.67	per oz.....	$ 1,942.98
Silver.....	85 Ozs. @	.5965	per oz.....	50.70
Total				$ 1,993 68

Grand county occupies a north-central position in the state. It was originally segregated from Summit county by an act of territorial legislature in 1874. The territory then granted has since been reduced by subsequent acts. As now constituted, the county has an area of 2,100 square miles. The adjoining counties are Larimer on the north; Larimer, Boulder, Gilpin and Clear Creek on the east; Clear Creek, Summit and Eagle on the south, and Routt on the west. In form it is very irregular and is outlined almost entirely by the summits of mountain ranges. The north and east boundaries are defined by the Continental divide or Colorado Front range. The Williams range forms a large part of the southern and the Park range the western boundary. The county is drained by the Grand river and numerous tributaries. This stream finds source in the northeast and eastern part of Grand county, through several forks and drains the section from Long's peak on the east to Mount Richtoven in the northeast. These forks unite a short distance below Grand lake and flow in a southwest course through the county and out near the southwest corner. On the north, the main tributaries are Soda, Stillwater, Willow, Troublesome, Muddy, Red Dirt and Stampede; on the south, Frazier river and tributaries and Williams river and tributaries. Lying between Frazier and Williams rivers are the Vasquez mountains. Mountain peaks ranging in altitude from 11,000 to 14,271 feet abound throughout the mountain ranges.

In a general way, the geological formation is common to that of the east slope of the Colorado Front range, viz., the summits of the ranges are made up of a granite-gneiss complex and the base flanked with the sedimentary strata ranging from the Silurian to the Post-Cretaceous, inclusive.

Within this mountain-surrounded county is a broad, well watered valley known as Middle park. This park has an approximate width of fifty miles east and west by ninety miles north and south. The altitude ranges from 7,000 to 8,500 feet. The covering soil is very fertile and yields good returns to the more hardy and quick-growing products.

History reveals this section to have been entered by the white man in 1859. Also that it was a favored spot with the Indians, who were loth to give up this sheltered domain. While this section has been the scene of several mining excitements, its inaccessibility has proven disastrous to development. The county is prolific in mineral resources, but they are almost entirely undeveloped, and will probably remain so until transportation facilities are improved. Several surveys have been made through this section for railroads, but the road construction has not followed.

The mining operations of 1897 were confined almost exclusively to the north slope of the range near Clear Creek county. Some promising developments have been made and small lots of ore produced. To yield a profit over transportation and treatment charges, the ore produced was hand assorted and the grade of values raised to the limit. In doing this, ore that would yield a good profit in either Clear Creek, Gilpin or Boulder counties was of necessity thrown away. The veins and ores in the metamorphic rocks are similar in every respect to those in the adjoining counties, and the county as a whole only requires a change in economic conditions to become a large producer of the precious metals. During 1897 about forty-eight men were mining and prospecting.

Hot Sulphur Springs is the county seat and main commercial center of the county. The hot springs at this point, if more advantageously located, would prove a great health resort.

GILPIN COUNTY.

PRODUCTION FOR 1897.

Gold.....	100,942 Ozs.	@	$20.67	per oz.....	$2,086,471.14
Silver.....	374,417 Ozs.	@	.5965	per oz.....	223,339.74
Copper.....	1,018,595 Lbs.	@	.105	per lb.....	106,952.48
Lead.....	2,007,698 Lbs.	@	3.38	per cwt.....	67,860.19
Total					$2,484,623.55

Gilpin, while the smallest in area, is one of the most important counties of the state. It was organized in 1861 and named in honor of Colorado's first territorial governor. As now constituted, it has an area of 185 square miles and occupies a north-central position in the state. The adjoining counties are Boulder on the north, Jefferson on the east, Clear Creek on the south, and Clear Creek and Grand on the west. This county bears the distinction of being the most prosperous and permanent of all the pioneer districts; the scene of the first lode mining, and placer mining contemporaneous with the first carried on in the mountain districts, and the establishment of the first successfully operated smelting plant.

From 1859 to the present time it has directly and indirectly wielded a great influence in the history and advancement of the state. For many years Central City, Mountain City, Black Hawk and Bald Mountain, though different in name, yet so closely associated as to form practically one city, was the most populous settlement in Colorado. Among the pioneers were men who have since become distinguished in all lines of pursuit, and no review of this county is complete without enumerating the long list of names conspicuous in shaping the affairs of county and state, but limited space forbids personal mention.

The discovery of gold was made in this county early in the spring of 1859, by Greene Russell, on the principal southern tributary of North Fork, that now bears his name. A few weeks later, John Gregory discovered the celebrated lode that bears his name, near the confluence of Gregory gulch and the main branch of North Fork. The news of these "rich finds" soon caused a stampede to the district, and all available placer territory, together with many lode claims, were soon appropriated. The placer deposits along the various stream beds were found to be rich, and have been since worked and reworked many times, producing millions of dollars. Even yet a limited number of men find remunerative employment in reworking portions of this territory during the summer months. While the placer beds were being worked, facilities for working the oxidized ores of the lode claims were introduced. The Mexican arastra soon gave way to the more modern stamp mill and amalgamating plates. A period of more active development followed the introduction of successfully operated stamp mills. With the supposed exhaustion of the oxidized or surface ores, and the encountering of refractory sulphides, this period of activity was followed by one of decline. The introduction of smelting works followed. As noted in "Retrospective," at beginning of this report: "The establishment and successful operation of the Boston and Colorado Smelting Works at Black Hawk, in 1868, marks one of the most important events in Colorado history. * * * Ores which prior to the establishment of this plant were worthless, under new conditions were found to possess intrinsic value. More activity in mining followed." As an immediate result in Gilpin county, sulphide ores were rather sought than avoided; the stamp mills supplemented the amalgamation plates with concentration tables, and the fine sulphides added to

the profit gathered from the plates. From this time to the present, with little variation, the history of Gilpin county reveals steady and constant increasing production.

The county lies on the eastern slope of the Front range and is in the main drained by the North fork of Clear creek and tributaries traversing Gregory, Chase, Eureka, Spring, Nevada, Russell and Lake gulches. Owing to the topography, which is quite rugged, this stream and tributaries find source within the county. The geological structure is the granite-gneiss complex common to the Front range. In places this shows great disturbance and contortion. The bedding is often found tilted to a high angle, and the whole is traversed by porphyritic dikes and irregular masses.

The veins of this section are of the true fissure type, and so far as observed were formed subsequent to the dike eruptions. They vary in size from two to twenty feet, and the filling is in the main made up of the altered country rock through which the fissures pass. Associated with this brecciated and impregnated gangue, regular streaks of "solid ore" are not uncommon near one wall. The "solid ore" streaks usually carry higher values, and are separated and shipped as "smelting ore." The remaining part is mined and transported for "mill dirt." The ores are iron and copper pyrites, galena and zinc blende, with ordinary associated minerals, the principal values being in gold. The ores occur in shoots, which are usually of good length, and their persistency with depth has been demonstrated below 2,000 feet. The gold and silver contents vary in value from a few dollars to several hundred per ton, the native metals occurring in limited quantities. The ores below the point where oxidation ceases appear to have same values at both lowest and highest horizons.

Practically the entire area of Gilpin county is mineral bearing, and is locally divided into twenty-three mining districts, as follows: Bay State, southeast corner of county; Mountain House, eastern portion of the county; Gregory, about Black Hawk; Central City, about Central City; Enterprise, on Maryland mountain, north of Central City; Quartz Valley, north of Central City; Eureka, Gunnell hill and in Eureka gulch; Lake, in Lake gulch; Pleasant Valley, in lower end of Russell gulch; Illinois Central, on Quartz hill, between Russell gulch and Bald mountain; Nevada, north slope of Quartz hill and in Nevada gulch; Vermillion, between Peck flats and Yankee hill, western portion of county; Twelve Mile, western portion of county, between Pine and Wisconsin districts; Wisconsin, west of Twelve Mile district, near Jim peak; Pine, northwest portion of county; Phoenix and Kansas, in northern part of county adjoining Boulder county; Union, better known as Moon gulch, north of Perigo; Independent and Hawkeye districts, about Perigo; Silver Lake, better known as Silver Creek district, portion of Pine Creek country; Fairfield, between Quartz Valley and Pine districts; Central, in Lump gulch, east of Perigo; South Boulder, northern portion of county, adjoining Boulder county.

While all of the above districts have proven more or less productive, a notable feature has been the comparatively small area to which systematic mining operations have been confined until within the past few years, and the large amount of practically undeveloped territory within the county borders. What may be not improperly termed new camps have sprung up all over the county, and some of these promise to soon outrival the old camps. Through the discovery of new and the revival of old properties, the year 1897 was one of the most prosperous in the life of the "Little Kingdom of Gilpin."

Many customs inaugurated with the establishment of this district are still in vogue. For example, all mill ore is estimated by the "cord." A cord in this section contains between seven and eight tons of ore by weight, and is usually estimated at eight tons. The contract system in mining is quite common. Originally all work was let by the "fathom," i. e., six feet; but of late shaft and drift contracts are let by the foot (twelve inches) and ore stoping by the fathom, i. e., six feet along the vein by six feet high. Smelting ore, on the other hand, is transported and sold on the ton basis of 2,000 pounds. To the uninitiated, the combination is somewhat confusing, especially when a mine manager speaks of shipping two-ounce gold ore and milling two-ounce gold ore; the former meaning two ounces per ton, and the latter two ounces per cord or eight tons. Even more is implied in regard to milling ore, viz., two ounces per cord is understood to mean the amount of gold saved by amalgamation, does not include the value of concentrates saved or contained, and, therefore, has no reference to the gross value of contents.

A remarkable feature in this county and worthy of notice, is the low grade of ore in the older districts, made to yield a profit in mining. Nearly all mine managers agree in saying that two-ounce "mill dirt" will leave a small margin of profit. The value of the amalgamated gold varies from $15 to $17 per ounce. Taking an average, the gold value of a cord or eight tons of two-ounce "mill dirt" is $32. This cord of ore will on an average yield in addition 1,000 pounds of concentrated tailings, having a net value of $2.50, making a total value of $34.50 per cord, or $4.31+ per ton. On account of small water supply available, few mining companies own mills, and the ores are subjected to the expense of transportation to, and charges of, custom mills for reduction, in addition to that of mining, tramming to shaft and hoisting. Notwithstanding the oft repeated assurance that "two-ounce mill dirt will pay," it appears an overestimate of possibilities, when all conditions are considered, except, possibly, for short periods and under the most favorable surroundings. Careful estimates have placed the minimum price per ton necessary to offset the expenses incurred, at $5 instead of $4.31+. As previously stated, a large portion of the work is done by contract. Miners receive from $2.50 to $3 per day. Mills charge in accordance with the character of ore; average about $1.25 per ton; hauling fifty cents to $1 per ton, owing to distance.

The mines of this county are easy of access, the Union Pacific, Denver & Gulf passing through the principal towns and terminating at Central City, the county seat. Two passenger trains each way daily are necessary to handle the travel between Denver and this county. A local railroad, with its initial point at Black Hawk, having a twenty-four-inch gauge and a trackage of twenty-one miles, is an important improvement. This road reaches the ore bins of the principal mines and does a large business in the transportation of supplies to the mines and ores to the stamp and concentration mills.

Since 1872, the records of the county show the location of 8,563 lode claims. There are of record, 1,350 lode claims, 22 placer claims and 55 mill sites for which United States patents have been obtained. The numerous locations filed during 1897 indicate the increased research to which the county is subjected. There were actively employed during the past year an average of 2,473 men, and 337 mines and prospects were operated.

MILLS.

Name	Location	Character	Daily Capacity
State Ore Sampler	Black Hawk	Public sampler	100 tons
A.W. Chamberlain & Co.'s Sampler	Black Hawk	Public sampler	100 tons
Penn	Black Hawk	Amal. and conct.	75 tons
Iron City	Black Hawk	Amal. and conct., 25 stamps	50 tons
Randolph	Black Hawk	Amal. and conct., 50 stamps	75 tons
New York	Black Hawk	Amal. and conct., 75 stamps	115 tons
Rocky Mountain	Black Hawk	Rolls & Huntington	75 tons
Gilpin County	Black Hawk	Amal. and conct., 75 stamps	75 tons
Bob Tail	Black Hawk	Amal. and conct., 75 stamps	115 tons
Eagle	Black Hawk	Amal. and conct., 35 stamps	70 tons
Hidden Treasure	Black Hawk	Amal. and conct., 75 stamps	115 tons
Climax	Black Hawk	Amal. and conct., 25 stamps	37 tons
Polar Star	Black Hawk	Amal. and conct., 40 stamps	60 tons
Mead	Black Hawk	Amal. and conct., 40 stamps	60 tons
Brooklyn	Black Hawk	Conct., 15 stamps	30 tons
Vendome	Nevadaville	Amal. and conct., 30 stamps	60 tons
Kansas	Nevadaville	Amal. and conct., 40 stamps	60 tons
Collier	Russell Gulch	Amal. and cont., 2 giant stamps	8 tons
Perigo	Perigo	Amal. and conct., 30 stamps	100 tons
Peterson	Lump Gulch	Amal. and conct., 15 stamps	22 tons
Lindemann	Lump Gulch	Beam roasting furnace, etc.	50 tons
Booster	Pine District	Amal., 15 stamps	20 tons
Elk Park	Pine District	Conct., 10 stamps	20 tons

GUNNISON COUNTY.

Gold	1,972 Ozs.	@ $20.67	per oz.	$	40,761.24
Silver	103,941 Ozs.	@ .5965	per oz.		62,000.81
Copper	2,770 Lbs.	@ .105	per lb.		290.85
Lead	1,013,114 Lbs.	@ 3.38	per cwt.		34,243.25
Total				$	137,296.15

As originally organized, Gunnison county had an area of 10,600 square miles, and embraced a large portion of the central territory west of the Continental divide. Subsequent legislative enactments authorizing the organization of Pitkin, Delta, Mesa and Montrose counties, have reduced original territory to an area of about 3,200 square miles. The adjoining counties are Pitkin on the north, Chaffee and Saguache on the east, Saguache and Hinsdale on the south, and Ouray, Montrose and Delta on the west.

The early history of this section is replete with thrilling incidents. Capt. Gunnison, for whom the county was named, met his death at the hands of the Indians in the fall of 1853, while in charge of a United States engineering corps surveying a favorable route across the mountains to the far west.

In 1861 gold was discovered on Taylor river in what has since been known as the Tin Cup district, the name arising from the character of utensil used to determine the presence of gold. Almost simultaneous with this was the discovery of gold in Washington gulch, in the northern part of the county.

In Washington gulch, the gold found was "coarse" and yielded large returns. The amount removed must have been considerable, but the value is unattainable. One of the pioneers of this gulch says: "As long as it lasted it was the richest in the territory. Five to ten ounces was an average day's work, but I had one pan of dirt that gave me $78 in gold. Twenty-five to $50 to a pan was not at all uncommon."

From 1861 to 1879, various parties entered this county with variable success. During 1879 the reports from prospectors established a belief that the Gunnison country was not only more prolific in mineral wealth than Leadville, but that ore bodies of fabulous richness outcropped so as to require no capital for mining, and that ores could be removed and values realized *ad libitum*. As a result, the "rush" of 1880-81 to this section was second to none in the state's history. Towns sprang up in all districts of the county; the mountains were filled with prospectors, who, through specimen assays, kept the excitement at high pitch; the "boom" was launched and maintained; capital followed and sought investment on the "boom" basis, and smelters and mills were erected at enormous outlay. It was finally realized that the ores, while abundant, were in the main low grade, and that under economic conditions then extant, profits from investments made could not be expected. The exodus during the next few years was almost equal to the rush of 1880. No county in the state, as prolific in natural resources, has suffered from a "boom" so severely as Gunnison. This section, however, did not prove an exception to "mining boom" history, and many good pay mines were discovered and opened. These in a measure served to relieve the general depression, and each year from 1885 to 1892 showed gradual increased activity in all the districts. Until this time, the production of lead-silver ores received almost undivided attention. With the then current price for these metals, profitable mining was impossible except in isolated cases. Prospecting

ceased and small producers closed. As in other counties, attention was turned to prospecting for gold. While the existence of gold was well known, it had, prior to this time, received little attention. The results have been satisfactory, and the year 1897 may, in the light of enterprises undertaken and general advance made, be considered one of the most prosperous in the county's history.

The county records show 22,416 lode claims; 870 placer claims; 160 mill sites; 175 tunnel sites; 1,511 patented lode claims; 45 patented placer claims; 25 patented mill sites, duly recorded. It is safe to assume that a large number of the lode claims located and recorded have been abandoned. A notable feature in the records is the number of claims recorded during the past few years. Their location clearly indicates that especial attention is being given to the development of the gold resource. During 1897, an average of 787 men were engaged in metalliferous mining, and 126 mines and prospects were systematically operated.

The topography of the county is quite rugged. Several mountain chains are within the boundaries, and rise from 10,000 to 14,000 feet above sea level. The intervening valleys are of good width and comparatively level, thereby making all portions easy of access, and furnishing large areas for agricultural and stock growing purposes. The county is well watered, the drainage being through the Gunnison river and numerous tributaries. This section as a whole has passed through several periods of disturbance, and in addition to the metamorphic and eruptive rocks that make up a large portion of the county, the sedimentary rock types of the Silurian, Carboniferous and Tertiary are exposed.

The county seat is located at Gunnison, the natural commercial center and distributing point. The Denver, Leadville & Gunnison railway, better known as the South Park railroad, enters the county through a tunnel near the summit of Alpine pass, on the eastern border, passes westerly down Quartz creek through Pitkin and Ohio City to Parlins, thence down Tomichi creek to Gunnison. From Gunnison this company extends a branch north following Ohio creek to Baldwin and Mt. Carbon. The Denver & Rio Grande railway enters the county from the east over Marshall pass, follows Tomichi creek westerly through Sargent, Crooks, Doyle, Parlins to Gunnison, thence down the Gunnison river through Kezar, Cebolla, Sapinero and the Black cañon of the Gunnison to Grand Junction and the west. At Gunnison, this company extends branch lines north, following East river to Crested Butte, Irwin and Anthracite. Both companies, through their branch lines, tap one of the largest and best coal fields of the state; the coal product being anthracite, bituminous of good cooking quality, and lignites of various grades.

The northeast section of the county is known as the Tin Cup district. This has always been a prominent factor in the county's mineral production, and contains a number of well developed properties. During the past year new enterprises have been started, and the town of Tin Cup has shown more activity than at any time since 1880. Among the most important improvements is the completion of a twenty-mile ditch

and flume for operating the large placer beds in Taylor park, and a shorter ditch for the placer beds in Union park. This has attracted much attention, and prospectors from Aspen on the north, Leadville on the northeast, and Buena Vista on the east have again plied their vocation in this section. The result has been the relocation of many promising properties, both lode and placer. Some of the old mines near Tin Cup are again at work and producing. The veins of this district occur both in the form of fissure and contact veins. The ores are principally sulphides with lead-iron base, with gold and silver values associated.

This district is one of great promise, and although somewhat isolated and away from railroad facilities, may be confidently expected to add materially to the production of the county. The immense iron deposits in the north end of the district are undeveloped, and at present valueless, on account of inaccessibility.

The Quartz Creek district lies south of Tin Cup and extends to the east county line. West of Quartz creek is the Gold Brick district, and south of the Gold Brick the Box Cañon district. These three were originally known as the Pitkin district, but are locally divided as above described. Within this territory are some of the large and steady producers of the county. In common with Tin Cup, this section has been more actively prospected during 1897 than for many years past. The search for gold has developed some new promising properties and revived some of the old ones. The veins occur both as contact and fissures, the best and most permanent, so far as developed, being contact veins. Within this district is a basin, known as Chicago park, in which the metamorphic granite is overlaid with the Silurian and Carboniferous stratas, that bids fair to eventually rival Aspen or Leadville in production. The development of this fact started a small boom just prior to the crash in the silver market in 1893. Several holes were drilled in different sections, and demonstrated the existence of four ore zones at depths ranging from 300 to 800 feet. The necessary expense to reach these ore bodies under prevalent conditions discouraged development, and the owners secured United States patent, and are anxiously awaiting a time when they can commence operation with the assurance of a market price that will justify necessary expenditure.

The Tomichi, better known as the White Pine district, lies south of Quartz creek, on the eastern border of the county. This section, in the early days, attracted much attention through its large bodies of lead-silver ores. It has been the scene of several excitements, but lack of railroad facilities or proper reduction plants, and the main values being in silver, have discouraged progress. The advance in price of lead during the past year had a stimulating effect, and several of the old properties were again started. Prospecting has been indulged in to a limited extent and some prospective properties, with values in gold, silver and copper reported. This district, more advantageously located, or equipped with cheap transporting facilities, would soon be a heavy producer. Large iron deposits occur in this district, but are not being operated.

The southern part of the county, from east to west, contains the Cochetope-Domingo, Willow Creek, White Earth, Beaver Creek and Goose Creek mining districts, and is locally known as the lower end of the Gunnison gold belt. This section has for the past few years been the scene of much prospecting. It is made up almost entirely of metamorphic and eruptive rock types, and traversed by large porphyritic dikes. Fissure veins of variable width traverse the county in different directions. As a rule the veins are narrow and the vein filling a clear, hard flint quartz carrying gold values. The gold is unusually free from associated minerals and occurs in somewhat irregular pockets of extreme richness. A number of properties in each district have produced intermittently during the past year. Litigation on some of the leading mines has been adjusted, and they are expected to continue steady producers. This section as a whole is still in the prospective stage, and is suffering from lack of capital to prosecute systematic development, which the surrounding conditions justify.

In the White Earth district, one of the largest iron deposits in the state is located. While practically undeveloped, its merit will doubtless receive recognition from Prof. Chauevenet in his paper on the Colorado iron deposits, found in another part of this report.

The northwest portion of the county, in what is known as the Ruby, Poverty Gulch, Rock Creek, Russell Gulch, Copper Creek, Brush Creek, Elk Mountain, Washington Gulch and Spring Creek mining districts, has during the past season experienced a very marked revival over the collapse common to the section since 1893. This territory was the scene of the greatest excitement in 1880-81, both on account of the number of veins and the varied character of the ores found.

The Ruby district, noted and named for its fine dark and red ruby silver ores, and always considered a silver camp, has discovered constantly increasing gold values in some of the leading contact veins. Production during the past year has been restricted through a misunderstanding arising between the owners of some of the leading mines. Some of the noted mines of this county are located near Irwin and their values thoroughly demonstrated by years of production.

In Poverty gulch a number of the old properties have been reopened. The veins here are in fissures and carry high grade silver ores. The most important new enterprise is a tunnel projected on one of the large veins to be driven through Cascade mountain. This will not only demonstrate ore bodies at that depth, but furnish means for transporting ores from the numerous cross veins. As this section is very rugged and the expense incident to mining and transporting product very high, the completion of the tunnel will work a revolution in mining in the district.

Each of the districts in this section have distinctive merit, and have during the past year been exploited more systematically than for many years past. The values in ores produced are mainly in lead, silver and copper, and as a whole may be classed as large bodies of low grade ores. What is classed as low grade in this section would in many others be

termed high grade ores, the difference being due to distance from market and lack of transporting facilities.

In coal, iron and building stone, Gunnison county is second to none in the state. The marble beds are of exceptionally find quality and are being extensively worked. The granite quarries supply local demand and their excellence is attracting the attention of foreign builders. There are also a large number of hot and cold mineral springs; Waunita, eighteen miles east of Gunnison, and the Cebolla, on White Earth creek, thirty-seven miles southeast of Gunnison, being the only ones improved.

MILLS.

Name	Location	Character	Daily Capacity
Mona	Gold Brick District	Cyanide, 10 stamps	15 tons
Tomichi	White Pine District	Beam Process	50 tons
Cleopatra	Pitkin	Chlorination	100 tons
Old Lot	Powder Horn	10 stamps	25 tons
Chance	Spencer	10 stamps	15 tons
Mineral Hill	Green Mt. District	20 stamps	40 tons
Empire	Ohio Creek	10 stamps	25 tons
Gold Brick	Ohio City	Cyanide	15 tons
Spencer	Spencer	Concentration	20 tons
Tremain	Irwin	Amalgamation	10 tons
Townsend	Ohio City	Amal. and conct.	15 tons
Brunswick	Tin Cup	Amal. and conct.	50 tons

HINSDALE COUNTY.

PRODUCTION FOR 1897.

Gold	8,136 Ozs. @	$20.67	per oz	$	168,171.12
Silver	243,437 Ozs. @	.5965	per oz		145,210.17
Copper	8,085 Lbs. @	.105	per lb		848.93
Lead	5,550,058 Lbs. @	3.38	per cwt		187,591.96
Total				$	501,822.18

Hinsdale is one of the southwestern counties of the state, better known as "The San Juan Country." It was originally established by territorial legislation in 1874, but later legislative enactments have materially reduced original boundaries. As now constituted, it has an area of about 960 square miles. The adjoining counties are Gunnison, Ouray, San Miguel and Dolores on the north and west; Mineral on the east; Archuleta and La Plata on the south.

The county is quite mountainous. The Continental divide enters the east boundary line about ten miles south of the northeast corner of the county, crosses in a southwesterly direction to west boundary, then turns and recrosses county in southeasterly direction. Upon the eastern slope of this curve or elbow, the Rio Grande river finds source. The Uncom-

pahgre range separates Hinsdale from Gunnison and Ouray counties. Henson creek, one of the main tributaries of the North Fork of the Gunnison, and tributaries, drains the southern slope of the Uncompahgre range and the northern slope of a parallel range that stands between Henson creek and North Fork of the Gunnison. What are known as the San Juan mountains flank the ranges on the west. This range is drained by the Rio Piedra, a tributary to the San Juan river and branches.

While the ranges are rugged, the intervening valleys are comparatively level and are traversed by good wagon roads, with fairly good grades, that make the different sections comparatively easy of access.

Lake City, the county seat and main business center, is located at the junction of Henson creek and Lake Fork of the Gunnison, in what may be termed an amphitheatre. The tributary camps are Capitol, Henson, Carson, Lake Shore and Sherman.

The first valid mineral locations were made in 1874. The reputed finds were followed by a rush of prospectors and rapid progress until 1879. The history of the county from 1879 to 1889 is that common to all in the state located at great distance from markets and generally inaccessible. In 1889 the Denver and Rio Grande railroad constructed a branch line into Lake City, it leaving the main line at Sapinero and following Lake Fork up the cañon. Following the establishment of transportation facilities, many who owned property returned. Old properties were reopened and new ones located.

The development and production increased from 1889 to 1893. The current price of lead and silver during that year had a depressing effect, and this district, with many others, suffered. The readjustment to new conditions was more rapid here than in some sections of the state, aided, doubtless, by the gold values existing in ores mined.

The principal mining of the county is confined to the northern part, the remainder being little explored. The county is made up almost entirely of the eruptive rocks of several lava flows, aggregating a thickness of 6,000 to 8,000 feet, common to the San Juan region, and generally termed trachytes or porphyritic-trachytes. While porphyritic-trachyte is a broad term and covers a large range of possible rocks, it is for all practical purposes near enough correct at this time, where detail must be eliminated.

This lava mass, when viewed along cliff exposures, presents a stratified appearance, with the strata little tilted from the horizontal. The dominating veins of the county are true fissures, that cut the county nearly vertically. They traverse the county at all points of the compass, but the main fissures seem to occur more abundantly in a northerly and southerly direction. As a rule the veins are strong and well defined and the outcrop in places can be seen for long distances. The vein filling is generally of the comb or ribbon structure, lying against a selvage or gouge. Adjoining the "ore streaks" the fissure is often filled with a brecciated material more or less charged with precious metals,

showing gradual ore deposition from aqueous solutions and later movements of the wall rock. The ore occurs in shoots, and one of the strong points in this section is the strength and persistency of the shoots. Common to all sections, the fissures, veins, ore occurrence and ores differ not only in different districts, but in mines near each other, and nothing beyond the conditions most general can be stated. The demand for a "true fissure vein," "smooth walls," "a gouge" and "ore in streaks, near one wall so that the pay ore can be mined easily and with little loss," can be supplied in this section.

The chief ores of the county are lead, copper, iron and zinc in form of sulphides, carrying gold and silver in combination. Telluride in the form of petzite is found in some districts. Gold and silver in native form are not uncommon and the high grade silver ores are often in form of gray copper, brittle and ruby silver. A portion of the ores occur so that they can be removed and shipped direct to reduction works, but the main portion must be concentrated before shipment.

The county is divided into five mining districts, viz.: Lake, Galena, Park, Sherman and Carson. Lake district embraces the northeastern portion of the county. It extends about three miles west and nine miles south of Lake City. The name doubtless came from Lake San Cristobal, four miles from Lake City on the Lake Fork river. This body of water fills a narrow valley between rather rugged mountains and is one of the most beautiful spots in the state. This district was one to first attract attention to the San Juan country. Tellurides in the form of petzite occur on Hotchkiss mountain. The main associate minerals are zinc, lead, iron and copper in sulphide form. (The composition of petzite is gold, 25.5, and silver, 40 per cent.) During the past year this section has shown renewed energy, several power plants have been added and a number of new locations made. A number of the properties, rated among the best in the district, still remain idle for reasons best known to the owners.

The Galena district embraces the northwest portion of the county and lies west of Lake district. As indicated by the name, this district contains large lead producers. Henson creek is the principal stream and finds its source in Engineer mountain. This stream flows through a narrow valley and the mountains rise abruptly on either side. The valley grade is easy and the drive to Capitol City, ten miles west of Lake City, is delightful. On both sides of Henson creek, mines of more or less importance occur. On Engineer mountain, some immense veins and silver-copper ore bodies occur. They are well developed and known to be valuable, are well equipped but have not been operated for several years. Several new enterprises have been launched during the past year in this district and two new 100-ton concentration plants have been erected. The capital and known ability of those having these enterprises in charge, leaves no doubt of ultimate success. This conviction has done more to arouse interest and reëstablish confidence than anything that has occurred for years in Hinsdale county. All property owners on Capitol,

Sheep, Gravel, Sunshine, Dolly Varden, Lime and Excelsior mountains are well pleased with present conditions, and report more active prospecting during 1897 than for some time past.

The Galena and Lake districts are the two principal producers of the county. This, however, is largely due to their development and accessibility. The Burrows Park, Sherman and Carson districts each possess distinctive merit, equal in many respects, but less developed than their more fortunate neighbors.

The county records show 8,144 lode claims, 126 mill sites, 100 placer claims, 302 patented lode claims, 20 patented placer claims, 26 patented mill sites duly recorded.

During 1897 an average of 493 men were employed in mining and 108 mines and prospects were operated.

MILLS.

NAME	LOCATION	CHARACTER	DAILY CAPACITY
Yellow Medicine	Capitol City	Rolls and table buddle	100 tons
Ute and Ulay	Near Lake City	Rolls, jigs, tables	350 tons
Hidden Treasure	Henson Creek	Rolls, jigs, tables	100 tons
Ocean Wave	Lake City	Experimental	40 tons
Shaffer	Lake City	Sampling works	30 tons

In point of scenic attractions, Hinsdale county has few equals among other counties of the state. From point of natural resources it possesses a vast amount of undeveloped territory, the value of which has been and is being daily demonstrated. While high grade ores exist, the main values lie in stock requiring treatment prior to shipment. This requires capital, and money judiciously expended will bring satisfactory returns.

HUERFANO COUNTY.

PRODUCTION FOR 1897.

Gold	35 Ozs. @	$20.67	per oz	$	723.45
Silver	167 Ozs. @	.5965	per oz		99.62
Copper	92 Lbs. @	.105	per lb		9.66
Lead	1,067 Lbs. @	3.38	per cwt		36.06
Total				$	868.79

Huerfano county occupies a south-central position in the state. It was originally organized in 1861 and the boundaries then established were reduced in 1867 by legislative enactment. As now constituted, it has an area of about 1,750 square miles. The adjoining counties are Custer and Pueblo on the north, Las Animas on the east, Las Animas and Costilla on the south and Costilla and Saguache on the west.

In form the county is very irregular, being outlined largely by natural topographical divisions. With the exception of the Sangre de Cristo mountains on the west, the Wet mountains on the north and the Spanish peaks in the south, composed of metamorphic and eruptive rocks, the county is made up of sedimentary rocks, ranging from the Carboniferous to the Tertiary. The county abounds in natural resources, the coal beds being by far the best developed. During 1897, eight coal mines were operated, furnishing employment to 877 miners and producing 361,702 tons of coal. The development of this resource began with the advent of the Denver & Rio Grande railroad in 1875. At Cuchara Junction, one line passes west through the county and across the La Veta pass of the Sangre de Cristo mountains, into the San Luis valley, another branch continues south from Cuchara to Trinidad. Later the Union Pacific, Denver & Gulf railway paralleled the Rio Grande, from Pueblo to Trinidad. Both companies run short branches to the coal mines.

The drainage of the county is through the Huerfano and Cuchara rivers and numerous tributaries, to the Arkansas river. In the valleys and on the low table lands the soil is fertile and yields large returns with irrigation.

The first mining for precious metals was in 1875. Since that time small amounts have been produced annually, but this resource has not yet been developed beyond the prospect stage. Prospects are numerous around the southern end of the Wet mountains, known locally as the Greehorn mountains, in the north, along the eastern slope of the Sangre de Cristo in the west, and around the Spanish peaks in the southern part of the county. In some localities the conditions are very favorable for the deposition of permanent ore bodies carrying gold and silver values.

A large variety of building stone occurs in various parts of the county, but is little developed, beyond supplying local demand. A number of mineral springs are found, the most important being near Walsenburg and La Veta, the former town being the county seat and principal commercial center of the county.

JEFFERSON COUNTY.

PRODUCTION FOR 1897.

Gold.....	399 Ozs. @	$20.67	per oz.....	$	8,247.33
Silver.....	1,614 Ozs. @	.5965	per oz.....		962.75
Copper.....	1,602 Lbs. @	.105	per lb.....		168.21
Lead.....	10,093 Lbs. @	3.38	per cwt.....		341.14
Total.....				$	9,719.43

Jefferson is one of the original counties organized by territorial legislature, in 1861. It occupies a central position in the state, has an area of 725 square miles, and is in form wedge-shaped, being twenty miles

wide on the north, seventy-two miles long, and terminating in a point at southern extremity. The adjoining counties are Boulder on the north, Arapahoe, Douglas and El Paso on the east and southeast, Park, Clear Creek and Gilpin on the west and southwest. History reveals this section to be one of the first settled in the state. Golden, the present county seat and main commercial center, was established in June, 1859, and made phenomenal growth until 1861. This year marked a rapid decline. In 1862, the territorial capital was removed from Colorado City and located at Golden, where it remained until 1867. In 1868 grading for the Colorada Central railway began, and the road opened for traffic in 1870. A season of great industrial improvement followed the advent of the railroad, and until 1878 this section as an important railroad and manufacturing center rivaled Denver. From 1878 to the present, aided by bountiful natural resources, the advance has been slow but sure.

At Golden is located the Colorado State School of Mines. This school was established by an act of territorial legislature, approved February 9, 1874, and is directly under state control. Strictly speaking, this institution is a "School of Applied Science," but in recognition of the leading industry of the state and in accord with the intent of the act authorizing its establishment, the greatest attention is given to the branches embraced in mining and metallurgy. It has grown from year to year in accommodation, appliances and usefulness, until to-day it stands second to no institution of like character. Students not only have the advantages of fine technical training, but have an opportunity, under careful guidance, to test the practicability of knowledge gained, both with the mechanical appliances at the school and by actual field work. All mines, metallurgical and manufacturing establishments are thrown open to the students when upon an inspection tour, and the advantage of this can not be over-estimated. It has been aptly stated that "this school, equipped as it is with a good corps of professors, mechanical appliances and backed up with Colorado's diversified field for research, is in position to furnish students everything essential to success but brains, and that they must take with them."

The county is one of the eastern border counties of the Front range, and is about equally divided between mountains, foothills and prairies, ranging in altitude from 5,000 to 10,000 feet. The drainage is through the South Platte (which outlines the southeast boundery), North fork of South Platte and tributaries in the south, Bear and Turkey creeks in the central, and Clear creek and Ralston creek in the north. All these streams are tributary to the Platte river and flow in a general easterly direction through the county.

The valleys, foothills and almost level strip of territory lying along the eastern part of the county are very productive in agriculture and horticulture. The value of the products is largely enhanced by close proximity to market The immediate country lying between Denver and Golden is largely devoted to small fruits and garden products. The valley along the Platte and Clear creek are traversed by the Denver, Lead-

ville and Gunnison, and the Union Pacific, Denver & Gulf railways, and are during the summer months great places of resort, and abound in small settlements and places of interest. In addition to the roads mentioned, an electric line connects Denver with Golden and cars run every hour.

The placer bars near Golden mark the scene of the first mining in the county and among the first in the state. While somewhat limited in extent, the available territory has been quite productive, and is still worked or reworked in a desultory manner, with primitive appliances. Several attempts by capital have been made comparatively recently to recover the gold and concentrated losses of the mills in Clear creek and Gilpin counties from the stream beds. Although the existence of good values have been demonstrated and some have been recovered, the physical condition of the creek bed has so far proven a barrier to the financial success of the undertaking.

Several minor excitements have been occasioned by reputed finds of gold-silver-copper bearing veins in several sections, but have resulted in little or no production and very slight development.

The coal beds from Golden north were among the first opened in the state. A number of mines have been opened and large amounts of coal produced. During 1897, the production was light, and four mines, employing an average of twenty men, shipped 8,000 tons.

One of the principal industries of the county is the mining and manufacturing of the clays. These beds, while common to the Front range border counties, are unusually developed in this region and of superior quality. The fire brick, pressed brick, tiling, pottery, sewer pipe, etc., manufactured from Jefferson county products lead that of any other part of the state. The Denver Fire Clay Company is working one bed and manufacturing muffles, crucibles, scorifiers, furnace linings, etc., recognized by impartial judges to be equal, if not superior, to similar products manufactured at Battersea, England. The resources in this line are equal to demand for many years to come.

Another great resource is building stone. A number of quarries are developed and the product finds ready market at home and in Denver. The lime beds are almost limitless, and are drawn upon for flux by the Denver smelters and for manufacture. Taken as a whole this county is quietly developing its great resources and building up a line of industrial pursuits that will continue to constantly advance the material welfare of the county and state.

LAKE COUNTY.

PRODUCTION FOR 1897.

Gold.....	99,848 Ozs.	@ $20.67	per oz.....	$2,063,858.16
Silver.....	5,451,317 Ozs.	@ .5965	per oz.....	3,251,710.59
Copper.....	3,146,802 Lbs.	@ .105	per lb.....	330,414.21
Lead.....	23,700,908 Lbs.	@ 3.38	per cwt.....	801,090.69
Total.....				$6,447,073.65

Lake county as now constituted occupies a central position in the state, and has an area of about 360 square miles. As originally organized in 1861, it embraced a large portion of the west-central territory of the state. Through various legislative enactments it has been made to contribute the major part of fourteen new counties. The adjoining counties are Eagle and Summit on the north, Park on the east, Chaffee on the south and Pitkin on the west.

Lake county has contributed to the general welfare of Colorado in greater degree than any county of the commonwealth. The exaggerated beliefs and fond hopes entertained by the pioneers, who joined the tide of immigration started westward by the gold discoveries in 1858, came nearer being realized in California gulch than in any other section. This gulch is one of erosion, well adapted for gold deposition, and the amount extracted with primitive appliances from 1859 to 1865 has been variously estimated at $10,000,000 to $17,000,000. This production was not only gratifying to those actively engaged, but wielded a much wider influence upon the state's welfare, by re-establishing the waning confidence of many, in the possibilities of the "Pike's Peak Country."

Lode claims were located as early as 1861, and in 1868 the large amount of free gold found in the Printer Boy lode, renewed interest in prospecting for veins carrying gold. A number of claims were located in various parts of the county, but the results were unfavorable, many departed for other fields, and those engaged in working or reworking the placer beds were left masters of the situation.

From 1868 to 1872, California gulch was visited by many. During the latter year the attention of some mining men was called to the "heavy sand that clogged up the sluice boxes." In 1874, these parties returned and in due time located Rock, Stone and other properties. The "heavy sand" was found to be lead ore carrying silver, or the now well known "Leadville carbonates." Little was known of this discovery until 1876. This year, and this made known discovery, practically marks the opening of an era in the mining industry that has made Leadville and Colorado known the world over. It also marks the time when the search for gold was changed to a search for lead-silver ores throughout the state.

The phenomenal advance of this county from 1876 to 1880, and its effect upon the mining industry at large have been so thoroughly reviewed

as to not demand repetition in detail. The first practical reduction of the ore was in 1877, in a small plant erected at Malta. This plant was originally erected for working the ores of the Homestake, a location of 1871. For the purpose intended, this plant was a failure, and is one of the few chargable to this section. It was, however, utilized for smelting other ores, and was followed by numerous other plants that kept well abreast the ore production.

The published reports of the opening of one new ore body after another, fabulous in extent and richness, were productive of an excitement and immigration never before equaled. Coming at a time when "money was easy" throughout the nation, the purse strings were loosened and those who could not go, sent representatives. The excitement was intensified by the fact that the field was one of "blind mining; that is, there were no surface indications, and shafts were sunk at random with the hope of encountering ore bodies. The scramble for territory was somewhat relieved by the mining laws of the state, which required "ore in place" necessary to secure a valid location. While the conditions common to this section were not anticipated when the mining laws were framed, and the laws spread upon the statute books were productive of much litigation, they, nevertheless, contributed in no small degree to the rapid development of the district. This was due to the necessity of sinking shafts to ore bodies, and until ore was reached, the possessory rights to territory were questionable. Shaft sinking, therefore, in many places developed a race between parties of interest "to contact," or the horizon where "ore in place" was supposed to exist.

The great financial gains attained by the fortunate, the "blind mining," and finally the sinking race for possession, made as a whole a combination that appealed strongly to the gambling instinct common to mankind, and was productive of an excitement or "boom" never before equaled. This "boom" in turn was productive of incorporated stock companies on an inflated basis, comparable to, if not in advance of the prevalent excitement. The bursting of the bubble in 1880 recalled those engaged to a more careful consideration of investments made and contemplated. While the crash of 1880 stopped the illegitimate gains of a few, and destroyed the hopes of many who could illy afford the loss, it quickly reduced mining to a business basis, and has proven a blessing in disguise to the district at large.

Notwithstanding the steady decline in silver and lead values from 1880 to 1892, the district maintained a steady production of $10,000,000 to $12,000,000 annually. By this time a number of the large producers had attained depths, and encountered water flows that required large and expensive plants of machinery and attendant daily expense to operate same. In 1893, following the rapid slump in price of silver and lead, all of the large producers closed down. A readjustment to new conditions followed—reduction of wages, railroad and smelting charges. The mines were again started with reduced forces and production was largely from ore reserves already "blocked out," little new territory being ex-

ploited. While this was the general condition of all properties producing lead-silver-iron products, the Breece Hill mines, locally known as the "Gold Belt," were opening unprecedented ore bodies carrying high gold values. The discontent of miners at receiving less wages than paid in some other districts was finally "fanned into flame" by some labor agitators, and resulted in one of the most disastrous strikes in the history of the state. This strike was inaugurated June 19, 1896, and "called off" March 10, 1897. It was a clearly defined battle between organized labor and capital. The result was great loss to all interested, great expense to county and state, and the closing down and removal of pumping plants from several of the large "down-town" producers. Several attempts since the settlement of the strike, have been made by the various mine owners to pool issues and thereby pro-rate the great expense that must be incurred to remove the accumulated water. While a general understanding has long since been arrived at, minor detail has so far prevented the placing and starting the great pumps now on the ground. As a result, many of the large producers and employers of labor in the lower district are still idle. Notwithstanding this fact, the increased production in the "Gold Belt" and other districts has practically maintained the average annual output of the county, and demonstrated future possibilities far beyond the expectation of the most sanguine.

The geology, topography, ores and ore occurrence of this section have been so thoroughly entered into by numerous writers, that these subjects will only be mentioned in a most general way. Readers desiring detail are referred to the Monograph on Leadville, by Dr. S. F. Emmons, published by United States Geological Survey, or carefully prepared papers by Messrs. Blow, Boehmer, Campion, Moore, Wood, Noble and others, all of whom have given the public the benefit of their experience derived from professional work in the field. In passing it is but justice to state that Dr. Emmons and his able assistants have, through their work, contributed more to the material welfare of Colorado than can ever be estimated. The unraveling of the complicated geology on the region, and the outlining of the principal features of its underground structure, at a time when development was slight and available points for securing data few, stand to-day as monuments to their great zeal and ability. While other writers of ability have taken exception to some deductions made by Mr. Emmons, the preponderance of evidence, through development, is still in his favor, and the deductions of others remain theories not yet demonstrated.

The topography may be described as a comparatively level basin, through which the Arkansas river and tributaries find outlet and form the drainage of the county. Along the borders of this basin or valley are terraces of sand and gravel, and back of these a series of smooth rounded hills flanking rugged mountain ranges. The west boundary of the county is the Saguache range, with peaks rising over 14,000 feet above sea level. On the east the Mosquito range rises to 13,900 feet and the hills on the north, divide the waters of the Grand and Arkansas rivers. The

Saguache range on the west is granite cut with eruptive dikes of porphyry. The west slope of the Mosquito range on the east and the hills on the north are more or less covered by patches of Silurian and Carboniferous stratas, that have escaped erosion. What is known as the Leadville basin, lying east of the Arkansas and flanking the Mosquito range, is made up of Silurian and Carboniferous stratas over a granite floor. These quartzites and limestones have been subjected to a series of eruptions and numerous porphyritic flows. The porphyry occurs as dikes, injected between the strata in form of large sheets, and as overflowing masses. These eruptions were followed by a period of ore deposition, and ore deposition by the uplifting of the Mosquito range and faulting incident thereto. The strike of the main fault planes is nearly north and parallel to the Mosquito range. The ores are mainly galena, zinc-blende, iron and copper pyrite, carrying gold and silver. When through faulting, these ores are brought within reach of oxidation, the gold and silver are found native, or the latter in form of chloride and bromide, and the lead in form of carbonate and sulphate. These ores occur in the form of shoots in different contact planes in the sedimentary formations. These planes of contact, while subject to rolls, have comparatively uniform dip of 15° to 20° toward the east. The line of contact between the porphyry and the "blue," or lower Carboniferous limestone, is the one most exploited, and from which most of the ores have been produced. The ore bodies are of variable thickness and width. In places the "blue" lime has been entirely replaced, forming bodies of ore 80 to 100 feet in thickness. The ore shoots lie roughly parallel to each other, and have a general northeast strike. Their persistency has been demonstrated for a distance of nearly three-fourths of a mile, without change of horizon or dislocation through faulting.

The comparatively recent developments in the Breece Hill, or "Gold Belt" district, have demonstrated ore bodies even more prolific than in the old or Carbonate districts. An extreme case may be quoted, wherein seven distinct ore zones have been opened in a vertical depth of 800 feet. Some of these zones will doubtless be small producers, but their presence in such number indicates a different and more favorable condition for ore deposition in this section than in others. The fact that porphyry dikes and intrusions are more common here than elsewhere gives good ground to suppose they have performed an active part in ore deposition, and the character of ore with main value in gold instead of silver indicates a different period of eruption from that common to the other sections.

Lake county is divided into two mining districts, viz.: Independence, embracing all the territory on the west side of the Arkansas river, and California, embracing all the territory on the east side of river. The California district is locally divided into various sections—Carbonate Hill, east of Leadville, California on the south and Stray Horse gulch on the north, Adelaide Park on the east; Fryer and Yankee Hill, north of Adelaide Park and Stray Horse gulch; Iron and Rock hills, south of

Yankee hill, including Adelaide park and extending across California to Iron gulch; Breece hill, east of Iron hill and between Big Evans and California gulches; Printer Boy hill and Iowa gulch, south of Breece hill.

In the Independence district, the veins are of the fissure type, and as a rule are closely allied with the porphyritic dikes. Lying west of Leadville in the Saguache range, the different sections are locally known as Temple, Gleason, St. Kevin, Lake Fork and Sugar Loaf districts. In the south part of the county as Lost Cañon and Boswell gulch in the granite district.

The work during the year 1897 has demonstrated great future possibilities for Lake county. While the total production has been great, the territory explored is comparatively limited. The extent of the Breece Hill is not known, and is constantly gaining territory through development. The Iowa Gulch and Printer Boy districts are rapidly coming to the front and enterprises under way, enforced with capital and greater knowledge of the ore deposits, almost insure success. The known extension of the Carbonate hill deposits into the town, and west as far as the lime extends, together with that section lying north of Leadville, opens a greater area than that explored, and future possibilities that can only be measured by past achievements. The various sections of Independence district have evidenced more activity during the year than ever before in their history. Collectively, the general condition of Lake county, barring the section now idle, awaiting pumping arrangements, was never better. Its past production is mainly due to Colorado brains, muscle and capital, and no better guarantee for the future is needed.

The city of Leadville is one of the important trade and railroad centers of the state. Three railroads, namely, the Denver & Rio Grande, Colorado Midland, and Denver, Leadville & Gunnison, compete for the passenger and freight traffic. Two of Colorado's large smelting plants, the Arkansas Valley, 900-ton, and Bi-Metallic, 225-ton daily capacity, are located here. The telephone and telegraph service is equal to that of any city, and the mercantile houses are in keeping with the business of the camp.

The records of the county show upwards of 50,000 mineral locations, of which 1,926 lode claims, 133 placer claims, 6 mill sites are patented and all duly recorded. During 1897, 3,515 persons were actively engaged in mining.

MILLS.

Name	Location	Character	Daily Capacity
Arkansas Valley	Leadville	Smelter	900 tons
Bi-Metallic	Leadville	Smelter	225 tons
Leadville Public Samp'er	Leadville	Public Sampler	100 tons
Venture Mill	Soda Springs	Concentrating	50 tons
Berdilla	St Kevin	Concentrating	20 tons
Fresident		Conct. and Amal	25 tons
St. Kevin		Conct. and Amal	35 tons

LA PLATA COUNTY.

PRODUCTION FOR 1897.

Gold.....	1,426 Ozs. @	$20.67	per oz.....	$	29,475.42
Silver.....	1,409 Ozs. @	.5965	per oz.....		840.47
Copper.....	420 Lbs. @	.105	per lb.....		44.10
Lead.....	857 Lbs. @	3.38	per cwt.....		28.97
Total				$	30,388.96

La Plata is one of the southwest border counties. Since its original organization, by territorial legislation, in 1874, several counties have been segregated. As now constituted, it has an area of 1,840 square miles. The adjoining counties are San Juan on the north; Hinsdale and Archuleta on the east; Montezuma on the west, and New Mexico on the south.

The county is well watered and drains through several streams. The La Plata and tributaries carry the waters in the western, the Las Animas and Florida in the central, and the Las Pinos in the eastern parts of the county. All these streams flow southerly throughout the county and join the San Juan river in New Mexico. They course through valleys varying from cañons in the mountainous section in the north to comparatively broad open parks in the central portion; the latter being noted for agricultural and horticultural products.

The Needle mountains cover the northern part of the county and are quite rugged, containing several peaks that reach an altitude of 14,000 feet. They are made up of metamorphic and eruptive rocks, resting upon a granite floor. Traveling south from the mountains, to the south boundary line of the county, the sedimentary strata ranging from the Carboniferous to the Tertiary, inclusive, would be crossed. In the west part of the county are the La Plata mountains, a small group standing out separate and alone from the main mountain chains that make up the San Juan country. Several peaks rise to an altitude of over 13,000 feet, the most noted being Mt. Hesperus, the boundary between La Plata and Montezuma counties. These mountains mark the scene of one of the late volcanic uplifts in which the lavas did not find vent and overflow on surface, but possessed sufficient force to lift the overlying sedimentary beds to their present position. The uplifting of the sedimentaries 6,000 to 9,000 feet above their normal position was productive first of bending, followed by the breaking of the stratified mass. This afforded relief, and the lavas were injected between the various stratas in form of sheets and filled the fracture planes, forming dikes. Subsequent erosion has exposed the various lavas and given the whole a stratified or banded appearance. The lavas show a series of ejectments, differing more or less in composition and physical appearance, but in a general way may be classed as diorites. In many respects the geological structure of this district is similar to that of Leadville—the difference being that the intrusive beds

or sheets at Leadville occur between older sedimentary stratas than in La Plata district.

Animas City, now almost deserted for its more fortunate neighbor, Durango, was the scene of some excitement as early as 1861; the mining history, however, practically begins with 1873. As a result of several investigations, parties from California and eastern Colorado entered this section almost simultaneously and began a large ditch preparatory to sluicing the placer beds flanking the La Plata mountains. A small degree of success met their efforts, but the fabulous reports and mining excitement further up in the mountains served to retard progress, and has always, until within the past few years, proven a great detriment to the development of the precious metal resources of this section.

This county is locally divided into four mining districts, viz.: Needle Mountain, Cascade, Bowman and California. The first three named embrace the Needle mountain territory in the north part of the county. Mining in this section has been carried on in a desultory manner for many years. The ores are sulphides of lead, copper and iron carrying low values in gold and silver. These occur in fissure veins, associated with a quartzose gangue.

The California mining district embraces the larger part and eastern slope of the La Plata mountains, in the west part of the county. During 1897, this section has shown greater activity than for many years. The veins occur in vertical fissures, cutting through the eruptive and sedimentary rock types, also as "blanket deposits" at points of contact between the intrusive diorite and sedimentary beds. The main development is along the fissures and show some to be of variable width and filled with a quartzose gangue carrying main value in gold. The gold occurs mainly in combination with tellurium, and the value of the ore, in exceptional cases, can be estimated by the pound instead of ton. This character of ore occurs in segregated "pockets" or bunches along the vein at somewhat irregular intervals. The ore value of the vein as a whole is low grade, but from reliable information gained, is sufficient to yield a good profit over expense incident to mining if properly treated. This promising section, while the first entered in the "San Juan Country," has been repeatedly passed over and is to-day practically undeveloped territory. It possesses all the conditions that have been productive of large and permanent ore deposits in other counties, and there is no apparent reason why it should prove an exception to the general rule. The work now in progress and that to be prosecuted the coming season, bids fair to add some more permanent producing mines to the already long list of the state.

The records of the county show 174 patented lode claims; 15 placer claims and 742 lode locations duly recorded. This number of lode claims does not include the pioneer locations, but are those made of record within past few years, the greatest number being in 1897. There were engaged in prospecting and mining during the year in this county an average of 545 men.

La Plata contains a large area of valuable coal beds. This industry was stimulated by the advent of the Denver & Rio Grande railroad, in July, 1881; later, by the extension of a branch line up the Animas river to Silverton, in 1882, and still later, by the completion of the Rio Grande Southern from Ridgway via. Telluride and Rico to Durango. These lines afford a market for the product in all the leading centers of the "San Juan Country." The coal is bituminous of superior quality, and a large portion yields a coke also of superior quality. The supply of this useful commodity is in excess of all demands liable to be made by this or the succeeding generation. Mr. David Griffiths, the state inspector of coal mines, reports 5 mines, employing 146 men and 74,805 tons of coal produced during 1897.

In building stones, clays and like products the county abounds, but these are undeveloped beyond supplying local wants. Mineral springs, hot and cold, are numerous. The most prominent are Pinkerton and Trimble. The latter is well improved, with good bath houses and cottages, and is one of the leading resorts for pleasure and health in this section.

Durango, the leading commercial center and county seat, occupies a central position in the county on the banks of the Las Animas river, and is a natural center for southwest Colorado. The natural resources are prolific, and nothing is lacking that is demanded for the support of a much larger metropolitan city and commercial center than now exists.

MILLS.

Name	Location	Character	Daily Capacity
Omaha & Grant	Durango	Smelter	400 tons
Durango	Durango	Smelter	Idle
Durango Ore Sampler	Durango	Public sampler	400 tons
Little Kate	La Plata	Amal., 20 stamps	60 tons
Cumberland	Cumberland Basin	Amal. and conct. 25 stamps	60 tons
Pret	La Plata	Bromination	10 tons
Baker	La Plata	Amal., 10 stamps	20 tons
Fairfield	La Plata	Amal. and conct., 10 stamps	20 tons
Columbus	La Plata	Amal. and conct.	40 tons
Lewis	Lewis Gulch	Amal. and conct., 20 stamps	50 tons
Oro Fino	Junction Creek	Amal. and conct., 10 stamps	25 tons
Snowstorm	Junction Creek	Amal. and conct., 10 stamps	25 tons
Livinggood	Needles	Concl.	25 tons

LARIMER COUNTY.

PRODUCTION FOR 1897.

Gold.....	144 Ozs. @	$20.67	per oz.....	$	2,976.48
Silver.....	97 Ozs. @	.5965	per oz.....		57.86
Total.....				$	3,034.34

Larimer is one of the original counties organized by the territorial legislature in 1861, and has an area of about 4,100 square miles. It is one of the northern tier of counties and has Wyoming for its north boundary. The adjoining counties are Weld on the east, Boulder and Grand on the south, and Routt on the west.

The eastern part extends upon the great plains, and embraces one of the richest agricultural sections in the state. The north part of this section is drained by the Cache la Poudre river and numerous tributaries, the whole forming one of the main branches of the South Platte river. The south part drains through Big and Little Thompson creeks and tributaries, these waters also joining the South Platte river. The north-central parts of the county embrace the headwaters of the Laramie and North Platte rivers.

This county has always been an important factor in advancing Colorado's welfare. In 1858-59, La Porte, a choice spot on the Cache la Poudre river, was established. In 1862 this point was made a garrison for the United States troops, and the same year the overland stage route was changed so as to pass through it. Two years later, the Fort Collins military reservation, four by four miles, was established four miles below La Porte, and maintained until 1874, when the land was thrown open to settlement. Fort Collins, the county seat, and one of the important trade centers in northern Colorado, now occupies a portion of this old military reserve.

The pursuits of agriculture and stock growing, inaugurated with the county's organization, still maintain a supremacy over mining, although the latter has at all times received more or less attention. The geological structure is in many respects similar to that of Boulder and other counties lying in the main upon the eastern slope of the Colorado Front range.

Flanking the base of the mountains, is a series of hogbacks or ridges with glades intervening, exposing a fine series of building stone of high grade and almost inexhaustible in quantity. This industry has received considerable attention. The Union Pacific, Denver and Gulf railroad has a branch line running from Fort Collins to the well known Stout quarries, which have furnished a large proportion of the stone for street paving to all western cities. En route, this branch passes through Bellvue and by the equally well known red sandstone quarries. This stone is of exceptionally high grade, and, while pronounced "hard to work" by the builders, possesses all the desired qualities of resistance, durability and

beauty, and is through merit alone forcing itself upon the eastern market. Numerous quarries more or less developed occur between Bellvue and Stout. Lying north of Bellvue various stratas of marble occur, but these are almost wholly undeveloped. South of Stout are the Arkins quarries, which have provided large amounts of building and paving stone. These quarries are tributary to Loveland, the second town of importance in the county.

Although the existence of gold, silver, lead and copper ores has been known for many years, no properties in the county can be said to have passed the "prospect" stage. Each year brings forth its ripple of excitement and small production, but until within the past few years no systematic mining effort has been made. In order that the mention possible in the short review may be better understood, a general idea of the topography of this large county is essential. The west boundary line is outlined by the apex of the Park range of mountains, which is quite rugged, reach an altitude ranging from 10,000 to 12,500 feet above sea level, and form the Continental divide in this part of the state and also the west bulwark of North park, a large, practically level plateau, thirty by forty miles, with an average elevation of 9,000 feet. North Park is flanked on the east by the Medicine Bow range, also quite rugged, and reaching in places an altitude of over 13,000 feet. This range has a strike west of north and is nearly parallel to the Park range. It is practically the north end or ending of the Colorado or Front range. On the south of North park a mountain range somewhat less rugged reaches an altitude in places of 11,000 feet. This range has an east and west strike, connects the Front and Park ranges, forms the Continental divide, and separates North park from Middle park in Grand county, which at one time were united. East of Medicine Bow range in the north one-third of the county is a range of hills separating the headwaters of the Laramie and Cache le Poudre rivers. These hills are in the main low and rolling, comparatively easy of access and form in part a southwest portion of the Black Hills. The south two-thirds, west of the Medicine Bow and Front ranges, is more mountainous, the valleys narrower and streams in many places flow through cañons. Small parks, however, occur in various parts of this section, the most noted for beauty and surroundings being Estes park, altitude 7,000 feet, lying ten miles northeast of Long's peak, altitude 14,271 feet. At the eastern base of these mountains lie the great plains, with an average altitude of 5,000 feet. The most abrupt fall is along the south boundary line of the east portion of the county, e. g., from summit of Long's peak to the plains in a distance of twenty-four miles, a fall of 7,200 feet.

As shown above, North park is almost surrounded with rugged mountains. These chains are made up almost entirely of metamorphic and eruptive rocks, flanked along the bases with sedimentary rocks as late or later than the Tertiary. Along the numerous streams, especially near the mountains, placer deposits occur and gold has been washed out with primitive appliances for many years. During the past year, several

companies have entered the field and will attempt to recover the gold on a large scale. The surrounding mountains are traversed with a system of porphyritic dikes, and these in turn have been cut by fissures carrying veins of ore, too low in grade, however, to stand present transportation charges and not enough developed to justify erection of reduction works. Gold is the principal basis of value in the ores, although good bodies of argentiferous lead ores occur, especially in the southeast part of the park where eighteen years ago it attracted much attention. Large coal deposits, undeveloped beyond supplying local demand, is another resource of this section. Also a number of mineral springs, the waters of which are bottled, transported by wagon, and used quite extensively.

In the northeast section of the county, along the North fork of the Poudre, spasmodic mining has been done for many years. The veins in this section are almost entirely in granite, the ores being principally copper with very small amounts of gold and silver associated. Along the northern border of the state in this section, are found in various places immense deposits of gypsum of unexcelled purity.

In the more mountainous section, from the headwaters of the South fork of the Poudre, south to Long's peak and east to the sedimentary beds, veins occur and have been prospected in a desultory manner. In places this section is traversed with porphyritic dikes, and the veins are certainly worthy of systematic exploring. Each year small shipments of ore are made and ores with a liberal amount of native gold discovered. That "pay ores" exist in this county has been demonstrated in many places, but whether they exist in paying quantities is yet an open question. All that can be said is that the conditions in a number of places visited are favorable for the deposition of permanent ore bodies, with main values in gold, and further, that the said conditions are in many respects similar to those surrounding some of the best mines in Gilpin and Clear Creek counties. Inaccessibility and transportation disadvantages will, in this, as in other sections, succumb to successful development, but development can make little headway with an annual expenditure upon each claim less than required by statute, a custom far too common in this section.

The records of the county show 2,337 lode claims, five of which are patented; 968 placer claims and 15 mill sites duly recorded. During 1897 an average of 147 men were actively engaged in mining and working assessments.

LAS ANIMAS COUNTY.

PRODUCTION FOR 1897.

Gold.....	31 Ozs. @	$20.67	per oz.....	$	640.77
Silver.....	9 Ozs. @	.5965	per oz.....		5.37
Total.....				$	646.14

Las Animas is one of the southeast border counties, New Mexico being its southern boundary. The adjoining counties are Huerfano, Otero, Pueblo and Bent on the north, Baca on the east, and Costilla and Huerfano on the west. It was organized in 1866, but subsequent legislative enactments have materially reduced the original territory. As now constituted it has an area of 4,700 square miles. The county is almost strictly a Plains county, made up of low rolling hills, rising gradually from an altitude of 5,000 feet in the east to 8,000 feet at the base of the Culebra mountains, which form the west boundary and rise to an elevation in peaks of over 14,000 feet.

The drainage is through the Apishapa and Purgatorie rivers and their numerous tributaries. The Apishapa rises near the Spanish peaks and flows northeast, joining the Arkansas river in Otero county. The Purgatorie or Las Animas river finds source in the Culebra mountains, has a general easterly course through the center of the county, north and south, to the center east and west, and thence in a northeasterly direction to the Arkansas river in Bent county.

The county is prolific in natural resources, that of coal being the best developed. Mr. Griffiths, the state inspector of coal mines, reports for 1897, 13 mines, employing 2,167 men, and a production of 1,404,155 tons of coal. In metalliferous mines, the south slope of Spanish peaks and east slope of Culebra range are the only sections prospected. The lodes located are reported as well defined fissure veins, carrying ores of too low grade for direct shipment, and not enough developed to justify the erection of a proper reducing plant. Placer beds of small extent are also reported near the foot of the Culebra range along several of the small streams, but are undeveloped.

The county records show 125 lode claims, of which two are patented. The reports for 1897 show 26 men engaged in mining in these sections.

Trinidad is the county seat also the leading commercial center of south Colorado. The Denver & Rio Grande, Union Pacific, Denver & Gulf, and Atchison, Topeka and Santa Fe railroads traverse the county and make Trinidad a common point.

MESA COUNTY.

Mesa is one of the west-central border counties of the state. It was created from west part of Gunnison county by legislative enactment, approved February 14, 1883, and has an area of about 3,000 square miles. The adjoining counties are Garfield on the north, Pitkin, Gunnison, Delta and Montrose on the east, and Montrose on the south. Utah forms the western boundary.

The county is drained by the Grand and Gunnison rivers and numerous tributaries. Both of these streams in this section are the largest in the state. The Dolores river, another large stream, flows through the southwest corner. The valleys along the main streams and tributaries are comparatively wide and very fertile. Near the point where the Grand and Gunnison rivers join is located the county seat and main commercial center of the county, very appropriately named Grand Junction. The valley of the Grand river at this point widens out and is approximately four to fifteen by forty miles; has an average altitude little in excess of 4,500 feet.

Prior to 1881, this county formed a part of the Ute Indian reservation, and after being declared open for settlement, the United States troops were employed in a dual capacity, viz.: Keeping the anxious whites back and urging the Indians to depart for their new reservation. Under the able leadership of the pioneers, this county has become famous as a great fruit growing section. The chief industries may be classified in the order of their development as horticulture, agriculture, stock growing and mining.

In mining, the coal measures may be said to be the best developed, and even these have little advanced beyond local demand. The state inspector of coal mines reports for 1897, 3 mines, employing 52 men, and a production of 27,611 tons. The coal reserves are large. The Grand mesa, which forms the dividing line between Delta and Mesa counties, is underlaid with coal reserves. In the Book cliffs, west of the Grand river, and in the north part of the county, various coal veins out-crop. Immediately north of Grand Junction are what is locally known as the Little Book Cliff mines, connected with the city by a narrow-gauge railroad twelve miles long. All of the coal produced is of good bituminous quality.

In metalliferous mines nothing as yet has been developed beyond the prospect stage. The county records show 102 lode claims and 23 placer claims, 6 placers patented, duly recorded. The county is locally divided into the Elk Basin, Plateau and Copper Creek mining districts. The Elk basin embraces the northeast corner and the Plateau the southeast corner of the county. The Copper Creek district, better known as Unaweep, covers the south-central and southwest parts of the county. This last named district is at present attracting considerable attention, and is said to have strong veins carrying high grade copper ores. It embraces the northern limits of the Uncompahgre and San Miguel

plateaus, the geological structure of which is similar, and is described in a general way in chapter on Montrose county. An average of forty-eight men were engaged in prospecting during 1897.

Grand Junction is a natural commercial center and distributing point for western Colorado and eastern Utah. The Denver & Rio Grande, via the Gunnison river, and the Colorado Midland and Denver & Rio Grande, via the Grand river, form a junction with the Rio Grande Western railway to Salt Lake and afford ample transportation facilities. The county is rich in resource, and in addition to the products of the soil, possesses mineral resources sufficient, with development, to support a large manufacturing center.

MONTEZUMA COUNTY.

Gold.....	371 Ozs. @	$20.67	per oz.....$	7,668.57
Silver.....	105 Ozs. @	.5965	per oz.....	62.63
Total.....$.				7,731.20

Montezuma occupies the southwest corner of the state and was segregated from La Plata in 1889 by an act of legislature, approved April 15, and has an area of about 2,642 square miles. The adjoining counties are Dolores on the north and La Plata on the east. New Mexico forms the southern and Utah the western boundary. The Mancos river finds source in the western slope of the La Plata mountains through two forks, locally known as East and West fork of Mancos, and flows southwest, cutting its way through the Mesa Verde, then more westerly, joining the San Juan river near the southwest corner of the county, and with tributaries drains the east, southeast and south parts of the county. The head waters of the Dolores river drain the northeast section, flows in a general southwest course, then turn west and later north out of the county, forming what is known as the Big Bend of the Dolores and the north drainage. Hovenweep and McElmo creeks and tributaries afford the drainage of the northwest and west central portion and flow in general southwest course through the west boundary line near its center. Nearly all the streams flow through narrow cañons cut deep into the surrounding country. The geological structure is almost entirely the sedimentary beds of the Cretaceous period. The red beds of the Jura-Trias are exposed in a few places where raised above their normal position.

The early history of this section is unwritten, and must remain so until unraveled by the archæologists of this or succeeding generations. That it was inhabited centuries ago by a people possessing traits of industry and civilization far in advance of the American savage, is evidenced by the ruins of their abodes along the cliffs of the various streams, and by the relics so far recovered. That they were Aztecs is generally conceded, but beyond this little is known of their origin or decay.

The county is named in honor of Montezuma, the "Father of the Aztecs," and the present inhabitants, so far as nomenclature can, evidently intend to perpetuate the memory of the ancient race. Cortez is the name of the county seat, and Mancos and Dolores the other principal commercial centers. Stock growing, agriculture and horticulture are as yet the leading industries. In these lines rapid advance has been made, and the products of the fertile valleys, genial climate and "sure crops" under a good system of irrigation is attracting more and more attention. Until within a few years, the development of the mining resource has received comparatively little attention. The general revival in mining and search for gold properties, however, has had a stimulating effect in this section. There are two mining districts in the county, viz., the California and Ute Mountain. The California mining district, in the east-northeast part of the county, embraces the East and West forks of the Mancos river and the west slope of the La Plata mountains. The existence of gold in placer deposits along the streams mentioned has been known for some years, but no work on a scale far in advance of the sluice box, cradle and gold pan has been done. The geological structure, veins and ore deposits are similar to those on the east slope of the La Plata mountains, described in La Plata county. Progress has been retarded somewhat through the introduction of small mills unsuited to the ores, but this era gives evidence of being short lived, and final results equally as good as attained in La Plata county may be confidently expected. The Ute district is in the southwest part of the county and embraces a group of isolated mountains called the Sierra el Late, of which Ute peak is the northern prominent landmark. This section has been the scene of considerable prospecting during the past year, and some development. The ore occurs in fissure veins, but as yet nothing of permanent value has been demonstrated. This isolated group of mountains with Ute peak, having an altitude of 9,884 feet on the north and Hermano peak, 9,016 feet on the south, covers an area of about forty square miles. The peaks are well known landmarks in this section, and stand boldly out some 2,000 feet above the surrounding sedimentary beds. These mountains are in many respects similar in formation and character to the La Plata mountains (see La Plata county), but the eruptive rock is more massive and has seemingly destroyed or absorbed more of the stratas passed through. The placer beds in the north end of the county on the Dolores river have been referred to in chapter on Dolores county.

The county records show 300 lode claims, 7 of which are patented, and 70 placer claims duly recorded. During 1897, an average of fifty-two men were engaged in mining

MONTROSE COUNTY.

PRODUCTION FOR 1897.

Gold.....	317 Ozs. @	$20.67	per oz.....$	6,552.39
Silver.....	851 Ozs. @	.5965	per oz.....	507.62
Total.....$				7,060.01

Montrose is one of the western slope border counties segregated from Gunnison by act of legislature, approved February 11, 1883, and has an area of about 2,300 square miles. The adjoining counties are Mesa and Delta on the north, Gunnison on the east, and Ouray and San Miguel on the south. Utah forms the western boundary. In form the county is somewhat irregular, has an extreme length east and west of eighty miles, an extreme width north and south of thirty-eight miles and is in a general way made up of broad valleys and a series of large level mesas and plateaus, flanking the north base of the Uncompahgre mountains on the south, the southwest base of the West Elk mountains in the northeast, and the east base of the Sierra la Sal mountains in the west. It is generally considered a valley county, noted for its agricultural and horticultural products, complete system of irrigation canals and fine stock ranges. In addition to these, the county possesses large resources in coal, building stone, clays and metalliferous deposits, none of which, however, are very much developed. The county records disclose 129 lode claims, 594 placer claims and 1 tunnel site; 1 patented lode claim, and 35 patented placer claims duly recorded.

The Gunnison river enters near the center of the east boundary and flows northeast through an inaccessible cañon. Cimarron creek enters near the southeast corner and flows north, joining the Gunnison river at the mouth of the cañon. This stream is lined with alluvial deposits carrying gold, and has been mined in a desultory manner for many years. Near the town of Cimarron, located two miles south of the Gunnison river on Cimarron creek, a number of mineralized veins in the metamorphic granite, lying north and east, and in the trachytic capping of the Cretaceous shales, lying west and south, have been located but are little developed.

The Rio Grande railroad leaves the Black cañon of the Gunnison river at Cimarron creek, follows same to Cimarron station, altitude 6,906 feet, passes west over a divide, altitude 7,964 feet, between Tongue and Vernal mesas, and thence down to Montrose in the valley of the Uncompahgre river. Montrose is the county seat and main commercial center of the county, altitude 5,840 feet. The Uncompahgre river flows northwest through one of the most fertile valleys in the state, and joins the Gunnison river in Delta county. Lying west of this stream, a series of mesas and plateaus occur, approximately parallel to each other, having a general northwest and southeast strike and rising to an altitude of 10,000 feet. The first encountered is the Uncomphgre plateau. This

extends into Mesa county, and its northern portion embraces the Unaweep section now attracting attention on account of its copper deposits. Southwest of the Uncompahgre is the San Miguel plateau. This enters from San Miguel county and extends to the east base of the Sierra la Sal mountains on the west. This section of the county is drained by the San Miguel, Naturita and Dolores rivers and tributaries, and embraces the territory most actively mined in this county. The geological structure can at this time only be generalized. Starting on the Uncompahgre river near Montrose, at an altitude of 6,000 feet, one gradually ascends to 10,000 feet, and passes from the Cretaceous into the Carboniferous stratas. In other words, while ascending 4,000 feet in altitude, a geological descent of nearly double that distance is made. This can only be accounted for by a slow uprising, incident to the formation of the Sierra la Sal mountains on the west, accompanied with usual faulting and subsequent erosion; or it may have been the site of a similar eruption local to this section, on a smaller scale, or to both combined. Whatever the cause, the fact exists, that in going up from Montrose across the plateaus to Paradox or Sinbad valleys, one, geologically, goes down to the granite and en route crosses nearly all rock types from the Colorado Cretaceous to the Silurian, inclusive.

Along the various stream beds in this section, placer locations are numerous. For many years hand sluicing has been spasmodically indulged in and small amounts of gold, appreciable in the aggregate, produced. During the past year a few of the placer beds along the San Miguel river have been equipped with hydraulic appliances and larger returns are anticipated in future. In Paradox valley a number of locations have been made upon fissure veins, cutting vertically through the sedimentary beds. The value of the ore found is principally in copper, and its economic importance not yet determined. An average of ninety-four men were employed in mining during 1897.

MINERAL COUNTY.

PRODUCTION FOR 1897.

Gold.....	2,967 Ozs.	@ $20.67	per oz.....	$	61,327.89
Silver.....	3,070,576 Ozs.	@ .5965	per oz.....		1,831,598.58
Copper.....	1,500 Lbs.	@ .105	per lb.....		157.50
Lead.....	6,080,673 Lbs.	@ 3.38	per cwt.....		205,526.75
Total					$2,098,610.72

Mineral, although one of the youngest, is one of the most important mining counties in the state. It was created from Saguache, Rio Grande and Hinsdale by act of legislature, approved March 27, 1893; forms a portion of the "San Juan Country;" has an area of about 860 square

miles and occupies a southwest position in the state. The adjoining counties are Hinsdale and Saguache on the north, Saguache and Rio Grande on the east, Archuleta on the south, and Hinsdale on the west. The county has an extreme length north and south of forty miles, and is twenty-four miles wide. The east, south and west boundaries follow the cardinal points of compass; the north is outlined by the Continental divide.

The early history of this region may be epitomized as follows: An unknown section prior to 1890; a producing camp equipped with a railroad in 1891; created a county early in 1893. This growth and development exceeds in point of time that of any other portion of the state, and was considered phenomenal even in Colorado. Its achievement was possible on account of a combination of most favorable conditions. No winter campaign of "future possibilities in a newly discovered district" was made by the newspapers. The district was entered quietly and the first news to reach the public through the press was "large and regular shipments of high grade ores from Creede." The rush that followed this announcement was second to none in the history of the state, and constantly increasing production gave credence to a common belief in a section "greater than Leadville." Thousands of men flocked to the new fields in the winter of 1891-92, the "boom" reaching its height in February. Accommodations were inadequate and much hardship was encountered. One of the memorable events connected with this district was the scramble for town lots. Creede, the original center, was located on Willow creek, in a narrow gulch with almost vertical walls, and eligible building sites commanded fabulous prices. Later Jimtown was located a little further down where the valley was somewhat wider, grew to a town of considerable importance and was almost entirely destroyed by fire. Notwithstanding hardships and back-sets, the year 1892 was one of great development in the mines and a large amount of prospecting throughout the county. The year 1893 opened under the most favorable auspices, but before its close the outgoing passenger traffic far exceeded the incoming. This condition was due primarily to the slump in the price of silver and lead and later to the fact that the large producing mines had attained depths, encountered flows of water that materially increased operating expenses and at market price for product left little margin or profit. Common to other sections, readjustment followed and cost of labor, transportation and treatment were reduced to meet conditions. During 1894 only the more favored mines were operated and prospecting almost entirely ceased. With more extended development, the changing of ore values from a slight to an appreciable amount of gold per ton of ore and the inauguration of several tunnels projected to cut the veins at greater depths, late in 1895, confidence was in a measure restored. The production and results of labor performed during 1896 gave greater assurance, and as a result the year 1897 marks one of the most successful in the short history of the county. Good reports come from all sections, abandoned prospects are being opened, new ones found, and everything seems to point to a vindication of the wisdom of the state legislature

in creating a county with practically no resources but mining, which for a time was considered an unwise act.

Mineral county is almost wholly a mountainous section and the topography is extremely rugged. On the north the La Garita and Cochetopa hills form the Continental divide, and contain peaks ranging in altitude from 11,000 to 14,000 feet. The Continental divide passes on through Hinsdale to the east border of San Juan county in a general west-southwest course, turns abruptly and follows a general east-southeast course back through the southern part of Mineral county, the summit ranging from 11,000 to 13,000 feet. This portion of the Continental divide is known as the San Juan mountains. The region lying between the mountain ranges on the north and south, or within the big bend of the Continental divide is made up of small parks and plateaus, ranging in altitude from 9,000 to 11,000 feet, and each practically surrounded by ridges rising into mountain peaks. The whole is drained by the Rio Grande river and numerous tributaries. A large number of streams occupy deep cuts and almost entirely inaccessible channels, or narrow cañons, which, with rugged surroundings, produce in many places a scenic effect that beggars description.

The geological structure of the county is almost entirely of the eruptive lavas common to the San Juan country, generalized as trachytic-porphyries. Three successive lava flows, lying conformably one on the other, and differing more or less in composition, are well shown by the various cliff exposures of this region along the Rio Grande river. Between Wagon Wheel Gap and Jimtown and nearer the latter, a small area of nearly horizontal stratified rocks is exposed, by erosion, at different points. This is mainly the Lower Carboniferous, or as better known, the "Leadville blue limestone." These beds, as exposed on Willow creek, near Jimtown, are cut with numerous vertical eruptive dikes and show a high state of mineralization.

The main ore deposits of the county occur in strong fissure veins. While the fissures have no apparent system and appear to traverse the mountains at all points of compass, the best developed have a general north and south direction, varying in most cases to a northwest strike, with a variable dip to the southwest. A very noticeable feature about the mines in this section is the small amount of waste or dump material present. This fact demonstrates that nearly all material broken and hoisted to surface has been marketed, and also accounts for the rapid development of the district. In common with other fissure vein sections, the ore occurs in form of shoots, but the ore bodies within the shoots are unusually solid and free from accompanying barren material.

The characteristic ore of this region is a fine-grained amethystine quartz, carrying silver, gold, lead and zinc. The bulk of the ore marketed has been an oxidized product carrying an excess of silica, with little gold, silver in its native form or as a bromide or chloride, lead in form of carbonate, oxide or sulphate, and zinc in oxidized form. Oxidized ores are found to extend in places to a depth of 900 feet and may be noted

as one of the remarkable features of the district. Where the older mines have penetrated the sulphide zones, the ores are similar to the sulphide ores of other sections, but in this section the increase in gold values has led many to believe that Creede will, with other counties, soon become a gold producer. For this reason the completion of the large tunnel enterprises now driving ahead night and day to tap the veins at greater depths, is being watched with more than common interest.

In some districts sulphide ores are found at or near the surface, and some are working that carry principal values in lead and zinc and only a few ounces per ton in silver. The conditions are favorable for economical mining and milling, and the Creedmore mill is made to produce a lead concentrate carrying a high percentage of lead, also a zinc-blende concentrate carrying a high percentage of zinc. The lead concentrate is a desirable smelter product and the zinc concentrate, under certain stipulations, is selling for a fair gross price on board cars at Jimtown. The separation of the zinc from other sulphides is worthy of note and one that may become more generally utilized.

The county is locally divided into Sunnyside (the best developed), King Solomon, Spring Creek, Royal Arch, Crater, Quartz Creek, Elwood and Deep Creek mining districts.

The county records show 1,896 lode claims, 325 lode claims patented and 10 placer claims of record. During 1897, an average of 495 men were engaged in mining in this county, and 85 mines and prospects were worked.

Creede is the county seat and main commercial center of the county. It is the present terminal of a branch of the Denver and Rio Grande railroad, that leaves the main line at Alamosa and follows up the valley of the Rio Grande river. The other leading towns are Wagon Wheel Gap, Wason, Jimtown, Teller, Spar and Antelope Springs. Wagon Wheel Gap is one of Colorado's scenic attractions, and is located at the mouth of a gorge or gap that barely affords room for roadbed beside the stream and has perpendicular walls rising several hundred feet on either side. Near Wagon Wheel Gap are the somewhat famous hot and cold springs. These springs are well improved and provided with good hotel accommodations, and are a favorite resort for Colorado people who know their virtues. The Antelope Springs, in Antelope park, is also becoming a great resort on account of the hot and cold waters and romantic surroundings.

MILLS.

NAME	LOCATION	CHARACTER	DAILY CAPACITY
Resolution	Antlers Park	Conct. and amal., 10 stamps	20 tons
Creedemore	Amethyst	Wilfley tables	30 tons
Solomon	Amethyst	Concentration	30 tons
United	Amethyst	Conct and cyanide	40 tons

OURAY COUNTY.

PRODUCTION FOR 1897.

Gold	26,746 Ozs.	@	$20.67	per oz.	$ 552,839.82
Silver	2,776,394 Ozs.	@	.5965	per oz.	1,656,119.02
Copper	2,185,084 Lbs.	@	.105	per lb.	229,433.82
Lead	7,784,212 Lbs.	@	3.38	per cwt.	263,106.37
Total					$2,701,499.03

Ouray is one of the central "San Juan" counties in southwest Colorado. It was created by act of legislature in 1877, but has, through subsequent acts, been shorn of the major part of its domain. As now constituted it is one of the small but important counties of the state, in area containing 450 square miles. The adjoining counties are Montrose on the north; Gunnison, Hinsdale and San Juan on the east; San Juan and San Miguel on the south, and San Miguel and Montrose on the west.

The city of Ouray, the county seat and leading commercial point, is located in the southern part of the county in a natural amphitheatre. A direction given to a pioneer so as to enable him to find Ouray may be appropriately quoted: "When you strike the Uncompahgre river, follow it up on the left hand side. Keep goin' until you can't go no further; can't tell how you got in or can't see your way out, and you are at Ouray." This condition, while literally true at the time, has been somewhat modified and the surrounding mining districts made accessible by good wagon roads and trails.

The mining history begins in 1875 with the location of claims now within the present city limits of Ouray. News of the rich discoveries caused many prospectors to enter the field, the majority making additional locations and spending the winter of 1875-1876 in the camp, which was laid out and named Ouray. The next few years witnessed active prospecting, the location of numerous claims and the establishment of several local camps. Owing to the distance from market, the expense incident to transporting ores out and supplies in, development during the next few years was somewhat retarded. This was closely followed by a short-lived and unsuccessful period of mill building and attempts to operate local smelters. Notwithstanding these discouragements, prospecting and systematic development continued; new producing mines were annually added; the field of operations was extended and a system of very expensive toll roads, wagon roads and trails was constructed, and inaccessible portions of the county made accessible. The completion of the branch line of the Denver and Rio Grande railroad in the fall of 1887 from Montrose to Ouray was followed by increased activity in all lines. From 1887 to the present, the record has been one of constant growth. The year 1897 is recognized as one of the most successful in the history of the county, and the production as shown above demonstrates its great importance as a producer of precious metals.

The leading mining districts are in the southern portion of the county, embracing a portion of the Uncompahgre mountains, recognized as one of the most rugged mountain chains in the state. The drainage is through the Uncompahgre river and tributaries. This stream rises in a mountain pass forming the south county boundary and flows approximately north throughout the county. A few miles below its source it enters a narrow valley that gradually widens into a park, one-half mile wide and four miles long. At the south end of this park the stream enters a cañon that has so far defied passage to the Colorado railroad builders, and to any but pioneers and prospectors would have been avoided and accepted as inaccessible for even trails. To-day is it traveled over in safety by a good wagon road, literally cut into one of the cañon walls. In places the cañon walls stand almost vertical and the road appears to "hang over" the stream bed, which is several hundred feet below. This cañon is one of Colorado's scenic attractions, the beauty and ruggedness of which must be seen to be appreciated. The Silverton and Red Mountain railroad enters the county from the south and terminates at Ironton, a mining camp located in the park, at upper end of the cañon. This road coöperates with the branch line of the Rio Grande, terminating at Silverton, and trains are so run that a daylight drive from Ironton to Ouray may be enjoyed.

The south end of the county is known as the Red Mountain mining district, the main mining centers being at Guston and Red Mountain. These, with Ironton, are the shipping points for the ores of the district. West of Red Mountain is Commodore gulch, east, Corkscrew gulch. East of Ironton is Grey Copper gulch, and over the intervening range, Poughkeepsie gulch, the upper end lying practically parallel to the park, but later, swinging to the west and joining the Uncompahgre in the cañon. North of Poughkeepsie is Bear creek, a gulch that has until comparatively recently almost defied even the trail builder. This gulch has an approximate east and west strike, and Bear creek dashes into the Uncompahgre river over a 300-foot precipice, forming Bear Creek falls. The wagon road above described passes over the top of these falls.

Cañon creek enters from the west and joins the Uncompahgre near the upper end of the small park occupied by Ouray. This stream drains the Sneffles mining district, and a branch from the south drains Imogene basin. East of Ouray, Cascade creek, a small stream, dashes from a precipitous wall of rock several hundred feet above. This section and that immediately across the river, is locally known as the Gold Belt, and extends north about three miles. The Uncompahgre valley gradually widens below Ouray and at a distance of five miles opens into Uncompahgre park. North of the Gold Belt and east of this park is the Paquin mining district. From Portland, a town in Uncompahgre park, the valley is from one to four miles wide until Ridgway is reached, where the flanking hills close in again and are followed in turn by parks and cañons to the north limit of the county.

At Ridgway, Dallas creek joins the Uncompahgre and drains the Uncompahgre plateau described in Montrose county. Ridgway is the terminal point of the Rio Grande Southern railroad and at this point forms a junction with the Denver and Rio Grande system. East of Ridgway and across the intervening hills is a parallel stream to the Uncompahgre, locally known as Cow creek. This stream heads in the north base of Uncompahgre peak and joins the Uncompahgre below the town of Dallas. The district drained by this stream is known as the Cow Creek mining district.

The general geological structure of this region may be briefly described by following the Uncompahgre river from Dallas south. Between Dallas and Ouray the sedimentary beds from the late Cretaceous to the Jura-Trias, inclusive, are exposed. These beds have a comparatively uniform dip of 15° to the north, but are more or less disturbed by east and west faults with slight throw. Nearer Ouray numerous vertical dikes cut through the beds and in places send out intrusive sheets of lava between the strata. The Carboniferous limestones are exposed at and around Ouray, but these lie unconformable to the uniform stratas on the north. Entering the cañon proper, the section furnished by erosion shows the Carboniferous limestones to be succeeded by a series of distinctly stratified quartzites and shales, 8,000 to 9,000 feet thick, that may belong to the Silurian series. This strata is well exposed by an anticlinal fold between Ouray and Ironton, having an average dip of about 70° on either side, and its exact geological location has caused considerable research. Lying above the stratified or sedimentary beds are the lavas common to the San Juan region, generally known as trachytic-porphyry. These beds form the rugged mountains, and in the various cliff exposures at higher altitudes the various flows are clearly defined. Within the eruptive rock sections, the fissure veins abound. These occur in well marked systems and vary in strike from northeast to northwest. The veins are strong, well defined and the ore bodies are in the main separated from the wall rock by a thin selvage or gouge. The best defined fissure veins occupy fault planes of somewhat extended scale, and the conditions extant, demonstrated by extensive development, indicate they extend into the underlying rock masses and that the ores have originated from circulating waters, arising from deep seated sources, aided to a greater or less degree by lateral secretion. In these veins the ores are mainly clean, white quartz, charged with silver, lead, iron, copper and zinc, in sulphide forms, with low gold value associated.

The Sneffels district is the best developed, and its constant and regular production for a number of years has tided the county over periods of depression and encouraged others to push ahead. The magnitude of the Revenue tunnel operations, located near Porters, is little appreciated. The bore is nearly 9,000 feet long, equipped with good double track tramroad, and the cars are operated by electricity. Near the heading of the tunnel veins are cut and are being mined 2,300 feet below surface, with which connection has been made. The concentration mill at the mouth of tunnel is operated by electricity and has a maximum daily capacity of

400 tons. Between 500 and 600 men are constantly employed by this company alone.

Imogene basin, lying east of Sneffles district, after several years of comparative inactivity, has developed within the past year some high grade gold ores, that seem to assure the county a largely increased gold output for 1898. A modern 20-stamp mill is among the improvements of the past year. This has long been considered a low grade silver-lead district and the recent developments have produced a stampede to that section.

The advance in the lead-copper market has had a stimulating effect upon the Red Mountain district, and a number of properties have been revived. This section is noted for its great variety of ores, copper being the main base. The ore bodies in this section occur in fissures and also in form of pipes or comparatively round lenticular bodies. These latter are doubtless the necks of extinct geysers with ore deposition laterally defined by a system of cross fractures, similar in occurrence to those described in the Cripple Creek district. The inauguration and starting of a tunnel in this section, projected to connect with a similar bore started by same company in San Miguel county, is among the important new enterprises launched in this district during 1897.

In the Gold Belt, the addition of new mines comparable to the old ones that originally gave the district prominence, are among the achievements of 1897. On the west side of the river fissure veins have been opened carrying ores the value of which can be better estimated by the pound than the ton. On the east side, development has resulted in the discovery of new shoots in the old mines equally as rich in gold ores. The ores of this section are in oxidized form with free gold predominating. The ore occurs in the sedimentary beds beneath the intrusive sheets of porphyrite, and in the form of irregular shoots occurring along the shearing planes of a quartzite stratum about forty feet thick.

In the Paquin district another new silver-lead producer has been added and the old mines have continued their regular output. The ores of this district occur both in vertical fissures and as "blanket" veins in the underlying lime stratas. A new concentration plant has been erected in this section.

The county records show 10,074 lode claims; 154 mill sites; 62 tunnel sites, and 561 placer claims duly recorded. During 1897 an average of 1,185 men were engaged in mining and 192 mines and prospects were operated. Reports from all sections show increased activity and great future promise.

In and around Ouray numerous mineral springs occur, varying in temperature from 80° to 150° Fahrenheit. The largest spring occurs in the bed of the Uncompahgre river, just above the city, and is sufficient in volume and temperature to prevent freezing in the river during the coldest weather. Several of the springs are somewhat improved and the waters piped to well equipped bath houses, the swimming pools being popular resorts.

The coal beds in the north part of the county are little developed, but are drawn upon to in part supply local demand.

The building stone supply is large but undeveloped beyond supplying local wants.

MILLS.

NAME	LOCATION	CHARACTER	DAILY CAPACITY
Cleopatra Smelter	Ouray	Austin Process	50 tons
Munn Sampler	Ouray	Public sampler	100 tons
Bright Diamond	Ouray	20 stamps; concentration	50 tons
Badgar	Ouray	10 stamps; amal. and conct.	30 tons
Grand View	Ouray	Huntington; amal and conct.	50 tons
Sky Rocket	Ouray	10 stamps; amal. and conct.	25 tons
Calliope	Dexter	10 stamps; concentration	25 tons
Revenue	Mt Sneffles	40 stamps; concentration	400 tons
Revenue No. 2	Mt. Sneffles	Concentration	10 tons
Camp Bird	Imogene	20 stamps; concentration	50 tons
U. S.	Imogene	10 stamps; concentration	20 tons
Yankee Boy	Imogene	Gates crusher; amal. and conct.	20 tons
Trust Ruby	Mt. Sneffles	20 stamps	50 tons
Micheal Breen	Uncompahgre	Rolls, Huntington; concentration	50 tons

PARK COUNTY.

PRODUCTION FOR 1897.

Gold	7,432 Ozs.	@ $20.67	per oz	$	153,619.44
Silver	199,945 Ozs.	@ .5965	per oz		119,267.19
Copper	58,002 Lbs.	@ .105	per lb		6,090.21
Lead	4,517,614 Lbs.	@ 3.38	per cwt		152,695.35
Total				$	431,672.19

Park county embraces the geographical center of the state, has an area of about 2,100 square miles and is one of the original counties organized by Territorial legislature in 1861. The adjoining counties are Summit and Clear Creek on the north; Jefferson and El Paso on the east; Fremont and Chaffee on the south, and Chaffee, Lake and Summit on the west. It has an extreme length north and south of sixty miles, and extreme width east and west of forty-three miles, and is somewhat irregular in form, northwest and southwest boundaries being defined by mountain ranges.

The mining history of this region begins with the placer beds at Tarryall, in July, 1859. While strenuously asserted that gold was discovered near Fairplay in August, 1858, there is no data to verify this claim. Like all the early scenes of mining, this locality quickly attracted attention and the towns of Hamilton and Tarryall were soon established, with a population variously estimated at from 5,000 to 10,000. The location of gold in several localities soon followed, and the major portion of

the population shifted with each successive excitement. The discovery and location of lode claims in Buckskin gulch and on North Star and Lincoln mountains in the vicinity of Montgomery soon followed, together with the introduction of Mexican arastras and primitive stamp mills. The success attained by these mills and the numerous additional lode claims discovered had a stimulating effect. The exhaustion of the oxidized or "free milling" ores and the encountering of refractory sulphide ores not amenable to treatment with the appliances at hand, marked the beginning of a decline from which the county did not wholly recover until 1873. Although a large part of the population departed for other fields, under the erroneous impression that the placer beds were exhausted and the veins worthless, prospecting and development on a more limited scale were steadily pursued. In common with other sections, those remaining endeavored to overcome obstacles encountered by the erection of local reduction plants, advocated by the "process man," who entered and erected in the various districts the usual number of monuments to misdirected effort. The general depression following the failure of these plants was relieved from time to time by reported rich discoveries, but was practically continuous until the erection of a successful smelting plant at Alma in 1873. With the opening of a home market an era of permanent advancement began and continued until 1893. The decline at this time in the market price of the chief products to a point that made mining in many cases unprofitable, restricted mining operations and production. That adjustment to new conditions followed is evidenced by the annual increase in production from 1894 to the present time.

The county embraces and derives its name from South park, one of the large plateaus of Colorado, lying wholly within the mountains. This basin lies comparatively level, has an area of about 1,200 square miles, with an extreme length northwest and southeast of forty-eight miles. In Paleozoic times this region was connected with Middle and North parks, forming an inland sea or series of connected bays, lying between the Colorado Front range on the east and the Park range on the west. The portion of the range now forming the west boundary of Lake county is at present known as the Saguache range and the name of Mosquito or Park range is given to the mountains, that prior to the Cretaceous times did not exist, but now separate Park from Lake and Chaffee counties. Upon the granite bottom of this inland sea were deposited the successive sedimentary beds of the Paleozoic and Mesozoic ages. Towards the close of the Cretaceous, a series of volcanic eruptions occurred and eruptive rock masses in the form of molten lavas were intruded or forced between the sedimentary beds. These lavas are of special interest for the reason that from them, largely if not wholly, were derived the ore bodies now being extracted at Leadville and in the west part of Park county. The principal ore deposits were formed subsequent to the period of eruptive activity and prior to the great dynamic movement that uplifted the Mosquito range. This range is one of the most rugged in the state and contains numerous peaks reaching an altitude of nearly 14,000 feet. The

highest monument is 14,297 and named Mount Lincoln in honor of the ever-lamented and revered president. The formation of this range was due to lateral pressure evidenced by folds in the strata and great planes of fracture. Its geological date is shown by the exposed strata on the summit of the highest peaks, the consequent tilting of same and the unconformity found in places between the horizontal Tertiary and the uplifted or tilted Cretaceous. A vertical section from the east to west county boundaries would show a large granite basin, with the sedimentary beds ranging from the Silurian to the Laramie, inclusive, lying conformably therein. These various stratified rocks lie practically horizontal in the park, but the slight dip to the east is increased as the summit of the Mosquito range on the west is approached.

Lying northeast of the South park and covering the northeast portion of the county is the Colorado Front range, made up of the granite-gneiss complex common to the mountains of Clear Creek county on the north. Near the north boundary line of the county the mountains are very rugged and reach an altitude nearly equal to the Mosquito range. These mountains, with a series that may be said to connect the Front and Mosquito ranges, form in the north-northwest part of the county the Continental divide and separate the headwaters of the Platte and Grand rivers. South of the park are a series of hills rising in occasional peaks to 11,000 feet, capped with basalt overlying other eruptive rocks. This section evidences the close proximity of a great volcanic center and is too complex to be generalized or described within the limits of this paper. The drainage of the county is through the North, Middle and South Forks of the Platte river and numerous tributaries.

In the northeast sections, the ore bodies occur mainly in the Carboniferous or "blue" limestone at points of contact with the porphyritic intrusions. So far as opened, however, the ore shoots are seemingly not as continuous and persistent as found at Leadville. The two districts being identical in formation and ore deposition, the lack of systematic and extended development in Park county may account for a seeming difference that in fact does not exist. A very noticeable feature throughout Park county is the number of properties working in a small way and the comparatively few mines operated extensively. In the north and northeast sections within the granite-gneiss areas, the veins and ore deposits are similar to those in Clear Creek county. The fissure veins in the south and southeast sections have been more actively exploited during 1897 than ever before, and the indications for permanent producers are favorable. Alma and Fairplay are the mining centers, but locally the county is divided into various mining districts, viz.: Consolidated Montgomery, Buckskin, Gyout, Buffalo Peaks, Mosquito, Sacramento, Twelve Mile, Horseshoe, Weston Pass, Tarryall, Tarryall Springs, Beaver Creek, French Creek, Hall Valley, Hartzell, Mountaindale, Gold City, Fresh Water and Black Mountain.

The placer beds that first brought this region to the front are still being worked to a profit, but owing to the altitude, short seasons and

limited amount of water available, the territory "unwashed" is sufficient for many years to come. The beds near Alma are well equipped with hydraulic appliances and each year are made to yield good returns. The amount of placer gold produced in Park county has been the source of much speculation. The variable estimates indicate an absence of available data, and results are according to the mental caprice of the compiler.

The transporting facilities are good and reach nearly all the commercial centers and mining districts. The Denver, Leadville and Gunnison (South Park) railway enters the county near the northeast and pursues a southwest course to Como. At this point the Leadville branch is sent out, via Breckenridge. The main line extends south into Chaffee county and at Garo sends out branches to Alma and Fairplay, the county seat. At Fairplay a branch is operated to Leavick in the Horseshoe district, and from Alma a branch to the London mine. The south end of the county is traversed from east to west by the Colorado Midland railroad.

At King, four miles southeast of Como, a deposit of good grade semi-bituminous coal exists and in former years was quite extensively worked. Seven slopes are opened and the deposit was developed to a depth of 1,000 feet in one slope. The vein is irregular in thickness, and appears to be pockety. For two years these mines have been inactive.

At Hartzell, on Tarryall creek, and a station on the Colorado Midland railroad, one of the best mineral springs in Colorado is located. The waters are hot and especially efficacious in the cure of rheumatism. In connection with the springs are comfortable hotel accommodations.

During the past year the accessibility, purity and unlimited quantity of clays in South park have attracted much attention and been the cause of considerable research and experiment.

The county records show 977 patented lode claims, 21 patented placer claims and 13 patented mill sites duly recorded. During the year 1897 there were an average of 467 men employed in mining and 72 mines and prospects operated.

While this section has suffered reverses, the general awakening throughout the state is also in evidence in Park county. For 1897 the production is far in advance of 1896. From all districts favorable reports are received and during the year more miners were regularly employed, more prospectors were in the field, a number of old properties were reopened and several extensive enterprises started. The region possesses large and varied resources and that the county does not not occupy a higher position in the list of mineral producers can not be attributed to the lack of reserves existing.

The advance in milling has not been as marked in Park as in other counties, and the inclination to test new processes seems to have preference in many cases over the approved and successful methods adopted elsewhere. Under the same conditions found in many places in Park county now idle, other sections are reaping a fair return for money invested in modern mills.

MILLS.

Name	Location	Character	Daily Capacity
Hill Top	Horseshoe	Crusher and rolls, concr.	50 tons
London	Mosquito	Amal. and concr.	50 tons
Alma	Montgomery	Concentration	40 tons
Cleaner	Buckskin		70 tons
Paris	Buckskin	Crusher and rolls, concr.	40 tons
Phillips	Buckskin	Crusher and rolls, concr.	50 tons
Black Flag	Mosquito	10 stamps	40 tons
Kansas	Montgomery	10 stamps, concr.	50 tons

PITKIN COUNTY.

PRODUCTION FOR 1897.

Gold	7,955 Ozs.	@ $20.67	per oz.	$	164,429.85
Silver	4,599,946 Ozs.	@ .5965	per oz.		2,743,867.79
Copper	8,360 Lbs.	@ .105	per lb.		877.80
Lead	4,456,478 Lbs.	@ 3.38	per cwt.		150,628.96
Total					$3,059,804.40

Pitkin was segregated from Gunnison county and organized by legislative enactment, approved February 23, 1881, with an area of about 950 square miles. The adjoining counties are Garfield and Eagle on the north; Lake on the east; Gunnison on the south, and Gunnison and Mesa on the west. It occupies a central position on the western slope and is very irregular in form, the boundaries being, with the exception of the north, outlined by natural topographical divisions.

Its history begins with 1879 and the location of nearly all of the mines that have since made the district famous. Lying as it does just "over the range" from Leadville, the reputed finds of 1879 brought many prospectors to the new fields during 1880. Ore production began this year, but was limited owing to the necessity of having to transport same by "jack trains" to Leadville at a cost of several cents per pound. Owing to inaccessibility to market and subsequent litigation, caused by ore discoveries never before equaled and under conditions never before encountered, no extended progress was made until the advent of the Denver and Rio Grande railroad in 1887. This line enters the county from the north and is a branch of the main line from Glenwood Springs. The advance following the completion of this line was phenomenal and was soon after increased by the entrance of the Colorado Midland railway from Aspen Junction. With transportation facilities the production grew rapidly until 1893. The leading mines by this time had gained considerable depth and encountered water flows requiring large and expensive plants of pumping machinery. With the slump in price of silver and lead, the

chief products, comparatively few of the mines could be operated profitably and yet could not shut down on account of the necessity of keeping the water removed. It should be noted in this connection that while the high grade silver ores, which gave the camp such prominence, were still being produced, the quantity was little in excess of that marketed in the early days of the district. With railroad facilities the production was practically reduced to a tonnage basis with comparatively small margin per single ton, but large in the aggregate. After a short period of restricted production, during which time a reduction in operating, transportation and treatment expenses was effected, the district resumed former activity and has since endeavored to overcome loss and reduced profits incident to low market price by increased tonnage.

The general topography is quite varied and in a large portion of the county extremely rugged. On the east is the Saguache range of mountains forming the Continental divide and separating Lake from Pitkin county. In the south and west-central portions of the county are the Elk mountains, both of which contain peaks among the highest in the state. Among the most noted landmarks may be mentioned Mount Massive on the east, with an altitude of 14,424 feet, and Castle peak, 14,115 feet; Maroon peak, 14,008 feet in the south, together with a number of peaks from 12,000 to 13,800 feet.

The general drainage of the county is toward the northwest. The headwaters of Frying Pan creek drain the northeast section. The central portion is drained by the Roaring Fork and tributaries, of which Hunter and Woody creeks are the main tributaries from the northeast, and Lincoln, Difficult, Castle, Maroon and Snow Mass from the southwest. Capital, Sopris, Avalanche and Rock creeks carry the waters in the west portion of the county. All the streams mentioned eventually join the Grand river. These streams flow through valleys varying in width from cañons to narrow valleys with occasional parks. Aspen, the county seat and main commercial center, occupies a beautiful park near the central portion of the county at an altitude of 7,874 feet. The streams are all rapid-flowing, and below Aspen the valley widens out and is occupied by small farms very productive in agricultural products.

The general geological structure may be summarized as follows: The Saguache range on the east which formed the west shore of the inland seas or bays of South and Middle parks at some time, formed the east shore of a much larger salt water body lying to the west. The stratified rocks of the Paleozoic and Mesozoic were deposited conformably and later thrown into confusion by the violent eruptions that resulted in the formation of the Elk mountains. Crowding as they did the stratified beds between the center of the uplift and the Saguache range, against the latter, which resisted the pressure, a series of folds and subsquent faulting or breaking resulted. The upturned, uplifted folded and reverse folded stratas were in places separated by lava intrusives forced between in the form of sheets, or massive bodies.

The ore deposits are best developed near Aspen and occur in the same general geological horizon and manner as at Leadville, the only difference being that the large ore bodies at Aspen are not found at point of contact with the eruptive intruded masses as at Leadville, but occur as a replacement product along the jointing planes of the "blue" lime and the underlying "brown" magnesian lime. The ore replaces both forms of limestone, but the greatest concentration is generally near the contact of the two. These lime beds have been raised far above their original position, lie near a great north and south fault plane that extends nearly across the county and stand at all angles, forming a so-called mineral belt, lying roughly parallel to the Saguache range on the east. The largest ore bodies are within a comparatively few miles of Aspen. The ore is in the main what is termed refractory, carrying a high percentage of zinc-blende and barite in connection with argentiferous galena. The main value is in silver.

The west and south portions of the county are metamorphic granite with numerous eruptive dikes and masses. The ores in these sections occur in fissure veins in the usual manner and are made up of the sulphides of iron, copper, zinc and lead, with variable proportions of gold and silver.

The county is locally divided into mining districts. That embracing Aspen is known as the Roaring Fork district; west of Aspen, on Snow Mass, is the Snow Mass district; northeast of Aspen, Woody, on Woody creek; on the east, Hunter, on Hunter creek. Frying Pan embraces the district adjacent to Frying Pan creek in the north part of the county. Independence and Lincoln embrace the headwaters of the Roaring Fork proper, the former joining Lake and the latter the Chaffee county lines. West of Lincoln is the Difficult district on Difficult creek. Immediately south of Aspen is the Highland district on Castle creek. South of Highland, the Columbia district, embracing Ashcroft and joining the Tin Cup district in Gunnison county. Northwest of the Columbia is the Elk Mountain district, embracing the headwaters of Maroon and West Castle creeks.

With the exception of the Roaring Fork district, reports from all other sections show new enterprises started, old mines reopened and general increased activity. In the Roaring Fork district the tonnage has been increased and the output maintained notwithstanding market conditions. A large amount of ore was handled on a very close margin and development work during the year exceeded that of any since 1893.

Taken as a whole, Pitkin county closes the year 1897 with brighter future prospects than at any time since 1893. Among the important enterprises only a few can be mentioned. The Cowenhoven tunnel has been reorganized and resumed work. This great bore is in two miles and it is the expressed intention of the company to push it through Smuggler mountain and connect by a railroad from Lenado to Minturn. This tunnel will en route drain and open for cheap operation a number of the large mines of the district. Work was started on the 3,000-foot tun-

nel driven several years ago by The Pray Mining Company. In the Independence and Difficult districts, known as the gold districts of the county, several enterprises have been started on a large scale. The managers of the large mining companies have decided to concentrate the low grade ores, and to this end several new milling plants are under construction. Experiments along this line have been conducted for some time past and the problem of separating the zinc and lead sulphide ores and make two marketable products instead of one is claimed to have been satisfactorily solved.

The scale upon which mining operations in this section are conducted must be seen to be appreciated. Aspen claims the distinction of being the first to adopt the use of electricity in mining and the first electric hoisting engine. These hoists are original in design and may be said to be indicative of the mechanical appliances throughout the district. They may be briefly described as follows: The winding drum replaces the sheeve wheel and winds the cage direct from the main shaft. The motorman or engineer stands at the collar of the shaft, hoists, lowers, loads and unloads his own cage. They have been successfully operated for several years and seem to possess the merit of both safety and economy. A number of the large mines use electric power extensively. Three large generating plants are constantly at work on Roaring Fork creek and the power is utilized in various ways in and around the mines. Along the various streams gravel deposits carrying gold exist, and each year a few are worked in a small way with primitive appliances. A large proportion, however, are held to maintain valuable territory and surface rights, and indicate no intention to work same for gold contents alone.

Among the important resources of Pitkin county are the coal deposits. These occur in the west end of the county, flanking the west slope of the Elk mountains. The coal is of good quality and a large tract is fairly accessible. During the past year only two mines were continuously operated, and Mr. Griffiths, the State Coal Mine Inspector, reports 209 men employed and 147,461 tons of coal produced.

Extensive marble quarries have been located and partially opened in Conundrum gulch, seven miles from Aspen, during the past year. Machinery is now being placed for quarrying, sawing and polishing. The marble is of good grade and promises to develop into a valuable industry. Large deposits of iron exist in the south part of the county but are little developed and are at present without transportation facilities and, therefore, of little value until thus equipped. In building stone the supply is great, but undeveloped beyond supplying local demand.

The county records show 12,680 lode claims; 265 placer claims; 44 mill sites; 113 tunnel sites; 1,089 patented lode claims; 19 patented mill sites; 26 patented placer claims duly recorded. During 1897 an average of 1,242 men were employed and 196 mines and prospects were actively at work.

MILLS.

NAME	LOCATION	CHARACTER	DAILY CAPACITY
Hunter Pass	Independence	20 stamps, amal. and conct.	60 tons
Smuggler	Aspen	Rolls, conct.	275 tons
Smuggler No. 2	Aspen	Hallett tables, conct.	125 tons
Mollie Gibson	Aspen	Crusher and rolls, conct.	150 tons
Taylor & Brunton sampler	Aspen		200 tons
Aspen Sampling Co.	Aspen		300 tons
Caporalis	Aspen	Concentration	

PUEBLO COUNTY.

Pueblo county occupies a south-central position in the state east of the mountains and embraces an area of about 2,500 square miles, drained by the Arkansas river and tributaries. The adjoining counties are El Paso on the north; Otero on the east; Las Animas and Huerfano on the south, and Custer and Fremont on the west.

The early history of this section is closely allied with Colorado's rapid progress, to which it has contributed in a large degree. The Arkansas river flows through the central portion of the county, the valley having an altitude varying from 3,500 to 4,500 feet. This fact early established one of the favorite routes of travel for pioneers and was known as the lower or Arkansas route. The genial climate and natural advantages caused many to abandon the initial points started for and to locate their homes along the Arkansas river. Where Fountain creek joins the Arkansas river is a point from which all routes diverge, a natural center and distributing point for all sections of Colorado. At the present time this section marks the site of Pueblo, the county seat and one of the most important cities of the state. The same cause that led to its early occupancy has been intensified by the developments throughout the state, and it has gradually grown to a great manufacturing center, second only in the aggregate to Denver, and exceeding even that city in its smelting capacity for ores. Situated as it is at the gateway of all the producing mining sections connected with the Rio Grande system, surrounded with coal and lime deposits and topographically enjoying a down-hill pull from all sources of supply, it can be confidently expected that it will keep pace with future development as it has in the past.

Among the most important manufacturing establishments may be mentioned The Colorado Smelting Company, with a daily capacity of 450 tons; The Philadelphia Smelting and Refining Company, with a daily capacity of 700 tons, and The Pueblo Smelting and Refining Company, with a capacity of 550 tons, making a total of 1,700 tons ore daily. All

these are thoroughly modern plants in every particular, and in the hands of careful, conservative and competent management. The leading public ore sampling works of Pueblo are The Central Ore Sampling Company, capacity 100 tons daily; and The Pueblo Ore Company, with a daily capacity of 100 tons. The above plants give, collectively, employment to an average of 1,685 men.

The Bessemer steel plant of The Colorado Fuel and Iron Company is also located near Pueblo, and its importance to Pueblo county and the state at large is little appreciated. The following brief outline in part shows its magnitude:

In 1879 The Colorado Coal and Iron Company, the stockholders of which were the same as those of the Denver and Rio Grande railroad, made arrangements to build a steel plant at Bessemer, near Pueblo. Work was begun in 1880, and one blast furnace, with necessary stoves, fixtures, etc., a foundry, machine shop, bessemer converter, rail mill, puddle mill, nail plate mill and nail machines were put in.

The machine shop and foundry were completed and operated in 1881, and work was done in both of them for the company itself and for outside parties. The furnace made its first cast in September, 1881, and the first rails were made April 12, 1882.

Ores were obtained from the Breece mine at Leadville and from the company's mines at Placer, Grey Creek, Orient and Calumet; limestone from its own quarries at San Carlos, some eight miles from the works, and coke from its ovens at El Moro.

All the machinery, fire brick, clays and refractories were brought from the East, and even spiegel at first was purchased in Pennsylvania. In 1883 the company began to make its own spiegel from Leadville ores, and has continued to do so ever since.

In 1880 the company bought the Denver rolling mill, a mill at Denver manufacturing merchant iron, and operated it in connection with its Pueblo plant. In 1884 it bought out the Ogden iron works at Ogden, Utah, moved the plant to Bessemer and began the manufacture of merchant iron there. Soon after this time the Denver mill was moved to Bessemer to consolidate the works.

In 1884 it added to its foundry and began the manufacture of cast iron pipe.

A small spike mill was put in in 1882, and a small amount of spikes was made.

In November, 1889, No. 2 furnace was blown in and in 1890 a new furnace was begun, which was blown in in 1892.

The manufacture of nails proved unprofitable owing to the replacement of cut nails by wire nails, and the manufacture of nails was, therefore, abandoned in 1888.

During all this time from 1881 to 1892 the works ran more or less each year, with varying success. The difficulties were great, and the machinery as compared with the modern mills was crude, and, therefore, the plant was run under many disadvantages.

In the fall of 1892 a consolidation was made of The Colorado Coal and Iron Company and The Colorado Fuel Company, the consolidated company being known as The Colorado Fuel and Iron Company. Since that time many important changes and additions have been made. In all, more than $1,100,000 have been expended in improvements since that time. The blast furnaces have been modernized and their output largely increased. The converting mill has had new machinery added to it, the rail mill has been completely changed and modernized, a plate and structural mill added, a large spike mill has been put in, also a new bolt and nut mill, so that now the plant is a modern one, and its products are very diversified.

Its yearly capacity now is 180,000 tons of pig iron; 180,000 tons of rails, billets, structural plates and shapes; 8,000 tons of spikes; 2,500 tons of bolts; 40,000 tons of merchant iron and steel, and 18,000 tons of pipe.

At the present time all of the ore used in the manufacture of pig iron comes from the company's mine at Orient, near Villa Grove, the capacity of the mine being about 1,200 tons per day. The coke comes from the company's ovens at Sopris and El Moro; limestone from its limestone quarries at San Carlos; coal from its different coal mines in Huerfano and Las Animas counties. Manganese ore for speigel is the only raw material which it buys, that being bought from various mine owners at Leadville. All of the raw materials entering into the manufacture of the finished product come from points within the state; nothing being bought outside.

The plant when in full operation employs about 2,500 men, and 1,500 more are employed at the coal mines, coke ovens, iron mine and limestone quarries for furnishing the raw materials for the works.

Common to manufacturing points, Pueblo is a great railroad center, with lines running in all directions. The Denver and Rio Grande and Union Pacific, Denver and Gulf enter from the south; the Atchison, Topeka and Santa Fe and the Missouri Pacific from the east; the Denver and Rio Grande and Atchison, Topeka and Santa Fe from the west, and all, with the addition of the Colorado Midland and Rock Island railways, enter from the north.

RIO BLANCO COUNTY.

Rio Blanco is one of the northwest border counties of the state and embraces an area of about 3,600 square miles. It has an extreme length east and west of 108 miles and an extreme width north and south of 40 miles. In form it is irregular, all boundary lines follow the cardinal points of the compass, but the southern boundary is like an inverted pair of stairs with irregular steps. It was segregated from Garfield county by legislative act, approved March 25, 1889, with the seat of government located at Meeker, the main commercial center of the county. The

adjoining counties are Routt on the north and east and Garfield on the south. Utah forms the west boundary.

The drainage is through the White river and tributaries. This stream divides near its headwaters into North and South forks; after uniting, the main stream flows in a westerly course throughout the county north of the center. The main tributaries are Marvine, Big Beaver, North Elk, Miller, Curtiss, Sulphur, Flag, Strawberry, Pi-ceance, Yellow and Douglas creeks.

The geological structure from east to west is the stratified rocks, ranging from the Silurian to the Tertiary, inclusive. The White river plateau, in the east and southeast parts of the county, is about fifty miles across, divides the waters of the Grand and White rivers and is made up of the sedimentary beds, ranging from the Silurian to the Jurassic, inclusive. These beds are torn and contorted, having been raised 4,000 to 5,000 feet above their normal position by the movements that formed the Park range on the east, and many outlying peaks and plateaus, or a local uplift, with the main center near Trappers lake, covering the district with basaltic overflows, some of which still remain and cap the topographically high ground. The west limit of this upheaval is marked by what is known as the Great Hog Back range. Here the Carboniferous beds dip sharply to the west underneath the overlying strata, exposing the intervening beds to the Laramie, which contain the coal measures. From the Hog Back west, several plateaus occur separated by streams that expose in places the Colorado Cretaceous, overlaid with the strata of the Tertiary.

Rio Blanco county possesses large mineral resources, but up to the present time is best known on account of its stock ranges, agricultural products and as a paradise for sportsmen. In the east portion of the county low grade silver-lead ores exist and have been prospected in a desultory manner for several years. The ore occurrence is in many respects similar to that at Aspen, and there is little doubt that with railroad facilities this region will receive more careful attention and prove productive. The coal measures cover a large area and the coal is of good quality, but undeveloped beyond the demand for local consumption. Practically each coal consumer has his own mine and does his own mining and removes the amount needed when wanted. In building stones, marble, gypsum and fire clay beds, the supply is almost unlimited. Dr. Hayden's corps report large veins of asphaltum and other hydrocarbons in the west end of the county, but these, like other resources, are undeveloped and must await transportation facilities to become valuable.

Rio Blanco is one of the few counties in the state without a railroad. Several lines have been projected, surveys made but none as yet constructed. This region is comparatively easy of access from New Castle or Rifle on the Rio Grande railroad, and there is little doubt that sooner or later this northwest region will have its railroad and development will be as rapid as in other counties when provided with transporting facilities.

RIO GRANDE COUNTY.

PRODUCTION FOR 1897.

Gold.....	1,093 Ozs.	@	$20.67	per oz.....$	22,592.31
Silver.....	8,168 Ozs.	@	.5965	per oz.....	4,872.21
Copper.....	627 Lbs.	@	.105	per lb.....	65.84
Lead.....	12,006 Lbs.	@	3.38	per cwt.....	405.80
Total .....$					27,936.16

Rio Grande county occupies a south-central position in the state, embracing a portion of the San Luis valley in the eastern and the "San Juan Country" in western part. It was originally created by territorial legislative enactment, approved February 10, 1874, but the boundaries then established have been materially changed by subsequent legislative acts. As now constituted, it has an area of about 900 square miles and the adjoining counties are Saguache on the north; Costilla and Conejos on the east; Conejos on the south, and Mineral on the west.

The drainage is through the Rio Grande river and tributaries. This stream enters the west boundary north of the center and flows easterly through the east boundary near the center. The main tributaries on the north are Beaver, Bear and Embargo creeks, draining the south slope of the La Garita mountains; from the south, Park, Abeti, Wolf, Las Pinos and San Francisco creeks drain the west slope of the San Juan mountains. A number of small streams drain the east slope of these mountains, but sink in the San Luis valley before reaching the river.

The east part of the county embraces a portion of the San Luis valley, an almost level basin covered with drift and having an average altitude of 7,600 feet. Along the Rio Grande river this valley is one of the best developed and prolific agricultural sections in the state. The Rio Grande valley up to the South Fork is practically an arm of the San Luis valley, gradually getting narrower as the mountains on the west are approached. The La Garita mountains in the north and the San Juan mountains in the south and west are made up entirely of the trachytic lavas of the San Juan overflows. The La Garita hills are mainly within Saguache county, but rise in peaks from comparatively broad valleys to an altitude of over 10,000 feet. The approach to the San Juan mountains is along streams with comparatively level valleys gradually rising until the west and southwest portions are reached, where the mountains rise in peaks to over 13,000 feet and are quite rugged. While the San Luis valley has long been occupied, the mining history begins with the reputed gold finds of 1870. These were followed the next year by a rush, but the field was not thought good and comparatively few remained. During 1872 a number of locations were made and the following year the region was again more densely populated. The introduction of mills during 1874-1875 followed. Development and production kept hand in hand until 1883, when this region gained the prominence of being the

third largest gold producer in the state. At this time nine stamp mills, with an aggregate of 155 stamps dropping was the record. The saving made by these mills is reported to have been by far the minor part of gross values. The appreciation of this fact, the failure to discover new ore bodies phenomenally rich, which up to this time had been frequent, and various other reasons, caused a gradual but ever increasing cessation in development and production. The mining districts that attracted so much attention and yielded large returns in 1883 were practically deserted until 1893. Following the search for gold instituted in the state that year, a few prospectors returned to this section in 1894, and their numbers have been gradually increased from that time up to the present.

The county is locally divided into mining districts known as Decatur, Jasper, Summit, Meyers' Creek, Summer, Coon, Elwood and Cat Creek. Reports from all these districts are favorable and show location of new and the revival of old properties. At Summitville, a large amount of repairing, overhauling and development work was done. This district was the early center of attraction and its awakening has put new life into other sections. Several of the old mills have been thoroughly overhauled and a steady production may be anticipated. At Lookout Mountain a number of properties have been started and a new 10-stamp mill erected. At Jasper, another group of properties is being systematically explored, and the resumption of work upon two large tunnels, projected to cut veins from 1,300 to 2,200 feet below surface are among the important advances for the year.

The veins in this region are of the vertical fissure type, with a general north and south trend. The vein filling is mainly the altered eruptive rocks through which the fissures cut. This is especially true in the strictly gold sections near Summitville. At Jasper, where the predominating value is in silver, or equally divided between gold and silver, the veins are well defined and made up in the main of secondary quartz carrying iron, copper and lead sulphides.

In view of the large mineral resources of this section and its former production, the almost complete desertion from 1883 to 1893 is unaccountable. There are a number of properties known to be valuable and containing fair ore reserves already developed that still remain idle. Were the same ore values present in the veins of this region transferred to some of the other counties of the state they would be made to yield large returns. While the record of 1897 shows an advance over the past few years it is still far below what the district justifies and must, therefore, be reported as one of the most neglected in the state.

The county records show 1,474 lode claims, 14 placer claims and 99 patented lode claims duly recorded. Three placer claims were worked for a short time during 1897 with primitive methods and a combined force of eight men. During the year there was an average of 194 men employed and 57 mines and prospects operated.

MILLS.

NAME	LOCATION	CHARACTER	DAILY CAPACITY
Monte Vista Sampler	Monte Vista		25 tons
Little Annie	Summitville	60 stamps, amal. and concl	100 tons
Aztec	Summitville	20 stamps, amal. and concl.	50 tons
Iowa	Summitville.	40 stamps, amal. and concl.	75 tons
Carpenter	Lookout Mt.	10 stamps, amal. and concl.	25 tons

ROUTT COUNTY.

PRODUCTION FOR 1897.

Gold	473 Ozs. @	$20.67	per oz	$	9,776.91
Silver	7,805 Ozs. @	.5965	per oz		4,655.68
Copper	958 Lbs. @	.105	per lb		100.59
Lead	88,736 Lbs. @	3.38	per cwt		2,999.28
Total				$	17,532.46

Routt county occupies the northwest corner and is the largest subdivison of the state; embraces an area of over 7,200 square miles of territory and was established by an act of legislature, approved January 29, 1877. Hahn's Peak, the county seat, has been the center of gold mining since 1866, and the history of this section, even to a comparatively recent date, is replete with incidents of frontier hardship and exposure, aggravated by the Indians, who bitterly opposed the occupancy of the territory by the whites. The adjoining counties are Larimer and Grand on the east, and Eagle and Rio Blanco on the south. Wyoming forms the north and Utah the west boundaries.

Not only have the vast resources of this region not been developed, but they remain practically unexplored. The park range outlines the east boundary and separates North and Middle parks from the county. This range has a general north and south trend, is composed almost entirely of granite, gneiss and other metamorphic rocks, traversed by a series of porphyritic dikes, is comparatively rugged on the western slope, reaches an altitude of over 12,000 feet in peaks and originally formed the east shore line of the Paleozoic sea. The deposition of the Silurian and Carboniferous strata was in turn followed by the beds of Mesozoic, Post Cretaceous and Tertiary. All of which have since been exposed by subsequent uplifts, forming mountains and plateaus, erosion and the various channels of streams.

The drainage is toward the west through the Yampa or Bear river, one of the largest streams in the state, and its numerous tributaries. The Yampa joins the Green river near the west county boundary, and this

stream, with Vermillion river and tributaries, carry the waters in the northwest part of the county. The main tributaries of the Yampa or Bear river are Little Snake river, Fortification, Elk Head and Elk from the north and Williams Fork and tributaries from the south.

While mining in the east and northeast parts of the county has received the undivided attention of a number of prospectors and mining companies since 1866, the principal industry has been that of stock-raising and to which of late has been added farming. The elevated plateaus and valleys afford the best ranges in the state and are prolific in the growth of fine grass.

That mining has not made greater advance is due to inaccessibility. The county is without a railroad and at the present time ores transported are subject to a charge varying from $30 to $50 per ton, which value alone would be a "bonanza" in some of the more favored sections. Gold is the only product deemed equal to the charges incident to such isolation. In this commodity the resources of Routt county are great, but the largest placer deposits are at comparatively high altitudes, have limited water supply and are subjected to short seasons. Nature has seemingly been as generous in the deposition of other precious minerals as in gold, but for reasons above cited these are comparatively little developed.

The main mining activity is in the east end of the county with Hahn's Peak as a center. This section was the scene of comparatively recent volcanic activity, and is similar in so many particulars to the formation of La Plata mountains and ore deposition that reference is made to the description of same, given under headings of La Plata and Montezuma counties.

Hahn's Peak is also the center of the placer beds. Two of these placers were worked in a small way during the summer of 1897. On the south side of the peak several thousand dollars was expended in ditches and flumes, and a small giant will be used the coming season. The "clean-up" for work done on the north side of the peak in the winter of 1896-1897 is reported as having yielded over $3,600 for four months' work of three men. This bed was entered by a shaft ten feet deep and drifts run along bed rock. Through openings to surface the foot of gravel lying on bed rock was thrown to surface and permitted to freeze and await the spring thaw and water. All of the gulches adjacent to Hahn's Peak are held for placer territory and considered valuable. The Four Mile placers, forty miles northwest of the peak, convey the water through a twenty-three-mile ditch, the head being near Slater cañon on Snake river. Another large placer field is in 20-Mile park, largely owned by an eastern company and being equipped with ditches and hydraulic appliances.

Hahn's Peak is located on the south side of the peak; Columbine on the north side. Adjacent to both camps are a number of properties being systematically developed in a small way. During the year several small shipments were made that yielded a fair profit notwithstanding $30 freight

charge with smelter charge added. The main value is in silver and lead and the ores occur in comparatively large bodies.

There are no mills in this section, but a ten-ton smelting stack has been erected and those having it in charge feel confident of being able, by running a high lead charge, to reduce the ores in the shape of bullion and save transportation.

Five miles north of Columbine is what is commonly known as "Whisky Park," the proper name being Hunter Camp. The veins in this district are of the fissure type in granite, well defined and occur in close proximity to porphyry dikes. This section has developed in one place an ore shoot on surface several hundred feet in length and to a depth of 125 feet by a shaft. During the year about fifty tons of high grade silver-lead ore were shipped. Several other properties have been at work in this neighborhood and report favorable results.

About seven miles northwest of Hunter Camp is the Three Fork district (Honnold, postoffice), near Camel peak and the Wyoming line. This section has attracted considerable attention and resulted in the location of a number of claims and assessment work. The veins and ores are similar to Hunter Camp, but so far as developed, of lower grade.

In the Rabbit Ear mountains, near the south end of the county, an increased amount of activity is reported. This section attracted attention many years ago on account of its large fissure veins and bodies of lead-silver ores. The same conditions that stopped development at that time still exist and comparatively little of the ore can be profitably mined without a local market, on account of grade.

Northwest of this district is Steamboat Springs, the leading commercial center of the county. The town takes its name from the mineral springs, and the springs from the peculiar puffing sound emitted by the confined steam. These springs are about fifty in number, vary in temperature from 60°to 160° Fahrenheit, and are said to be equally variable in medicinal properties. While Colorado abounds in mineral springs, the Steamboat springs are destined to be the site of a great sanitarium.

Routt county is equally abundantly supplied with coal, marble, onyx and building stone. In the western part veins of elaterite, gilsonite and asphaltum exist, but taken as a whole it is one of the large state preserves yet undeveloped.

Special acknowledgment is due Mr. Thomas W. Wilson, of Columbine, for supplying material for above and to him is also due the thanks of the Bureau for representing the department in the capacity of an assistant without pay during the year.

SAGUACHE COUNTY.

PRODUCTION FOR 1897.

Gold.....	665 Ozs. @	$20.67	per oz.....	$	13,745.55
Silver.....	2,482 Ozs. @	.5965	per oz.....		1,480.51
Copper.....	2,975 Lbs. @	.105	per lb.....		312.38
Lead.....	9,266 Lbs. @	3.38	per cwt.....		313.19
Total				$	15,851.63

Saguache county occupies a central position in the state, embraces an area of about 3,240 square miles, and was created by an act of territorial legislature, approved December 29, 1866. The adjoining counties are Gunnison and Chaffee, on the north; Fremont, Custer and Huerfano, on the east; Costilla, Rio Grande and Mineral, on the south; Mineral, Hinsdale and Gunnison, on the west.

In form the county is irregular. The east boundary is outlined by the crest of the Sangre de Cristo mountains, which in this part is very rugged and rises to a maximum altitude of 14,233 feet in Crestone peaks, and contain ten other peaks over 13,000 feet. The north end of the San Luis valley lies at the west base of this range, with an average altitude of 7,700 feet, the rise from the valley to the crest being quite abrupt. The north county boundary marks the north limit of the Sangre de Cristo range, and practically the south limit of the Saguache range in Mount Ouray, 14,055 feet. Between these two terminals is Poncha pass, the gateway to the San Luis valley. The extension of the Saguache range is known as the Cochetopa divide, in which, near north county boundary, are Marshall and Cochetopa passes, the gateways to the Gunnison country. The general trend of the Cochetopa mountains is southwest. The southwest part of the county embraces the La Garita mountains, which reach a maximum altitude of 13,965 feet on the line separating Mineral county. These mountain ranges are made up of metamorphic and eruptive rock masses, flanked at base with remnants of the Silurian and Carboniferous stratified beds.

The intervening valley, enclosed by mountains on three sides, reaches a maximum width of forty miles at south county boundary, gradually grows narrower towards the north, sending out an arm or bay along Saguache creek, where is located the county seat, also named Saguache, and ends at the base of Poncha pass in Homers park, where is located Villa Grove, one of the commercial centers of the county. This region is noted for its even temperature, large amount of fertile lands and agricultural products. The drainage is through the Saguache river, which flows south and enters into San Luis lakes, in north part of Costilla county. These lakes have no visible outlet. Numerous streams, coming from the mountains on the east and west, some carrying considerable volume of water, flow rapidly into the valley, gradually decrease in size, and are lost or sink before reaching the river.

Saguache, the county seat, had gained considerable prominence as a distributing point in 1867-68, but the mining history practically begins with 1879-80, during the great rush to the Gunnison country. Many were attracted by the large silver-lead fissure veins on Kirber creek, and developments seemed to justify the building of the town of Bonanza, that had grown to a place of considerable importance before the fall of 1880. On the west slope of the Cochetopa mountains, the narrow veins of quartz carrying free gold likewise established the camp of Willard on Cochetopa creek (a tributary to the Gunnison river).

From these, prospectors located claims in various parts of the county, attention being about equally divided. During 1881-82, the development and production indicated a new and valuable region. In 1882-83 a number of local reduction plants and mills unsuited for the somewhat refractory and low grade ores were erected. Their failure to overcome the obstacles that led to their construction marked the beginning of a decline from which the county has not yet fully recovered.

The county is locally divided into seventy-four mining districts, but these may be generalized as follows: Alder Creek district, embracing the northeast corner of the county and Poncha pass; west of this is the Cochetopa district, covering the north-northwest parts of the county, Marshall pass, Iris and joining the Gunnison gold belt. The Blake district lies south of Alder creek, embracing Villa Grove, Orient and south along the Sangre de Cristo range to Crestone, the next district south, with the camp of Crestone, near the southeast corner. The Eldorado district covers the southeast part of the county and embraces the Baca Land Grant No. 4 in its northeast corner. Across the San Luis valley from the Eldorado district is the Bidell district, embracing the La Garita mountains. The west-central portion of the county is known as the Upper Saguache district. South of Alder creek and west of Blake is the Kirber Creek district.

Following the demand for gold instituted by national legislation in 1893, pioneers of this county, or their representatives, began to enter the districts known to carry gold. The work of the past year evidences a revival that bids fair to renew former prosperity, but on a more substantial basis. What is now designated as the gold belt extends along the Sangre de Cristo mountains from Orient to the south limits of the county. This belt has been unusually active during 1897, and the only drawback is a question of title to some of the leading mines near Duncan and south of Crestone, located on the property of the Baca Land Grant No. 4. This matter is at present being adjudicated in courts, and when settled a greatly increased rush to this section is anticipated. While there is a large open field both north and south of this land grant, the question of title seems to retard action throughout the belt.

As previously mentioned, this range is made up of metamorphic and eruptive rocks, flanked at the base with remnants of the Silurian and Carboniferous strata. The granites are traversed by porphyritic dikes and the lava has capped and intruded itself in places into the stratified beds at the base of the mountains. The ore occurs both in fissure and as

"flat deposits" in the stratified rocks. The ore deposition in the latter form is comparable to that at both Leadville and Aspen and is along the same geological horizons. In the granitic rocks above these beds, the fissure veins are well defined and occur either adjacent to, near by or roughly parallel to the dikes. The principal ore value is in gold. Several promising properties have been opened to a limited extent, some showing large bodies of low grade ore. One property is operating a 10-stamp mill and claims an average gold saving of $25 per ton from the plates.

The Orient iron mine, in the Blake district, is at present producing 1,200 tons daily, and is the main source of supply for the steel works at Pueblo. Both Alder Creek and the Kirber Creek districts have shown increased activity during 1897 over previous years. The veins here are of the fissure type and carry lead-silver ores. From the Cochetopa, Upper Saguache and Bidell districts come most favorable reports.

In addition to large iron deposits apt to prove valuable with development, the county contains large amounts of building stone, marble beds and mineral springs. The Valley View springs, near Crestone; the Chamberlain springs, southwest of Villa Grove, and the Shaw springs, twenty-eight miles south of Saguache, are the ones best known for medicinal properties.

The county records show 5,007 lode claims, 58 tunnel sites, 229 placer claims; 138 patented lode claims, duly recorded. During the year 1897 there were an average of 264 men employed in mining and an average of 48 mines and prospects operated.

MILLS.

Name	Location	Character	Daily Capacity
Independence	Spanish Creek	50 stamps, amal. and conct.	40 tons
Crestone	Crestone	10 stamps, cyanide	50 tons
Cleveland	Crestone	5 stamps, amal. and conct.	20 tons
Ray	Duncan	Cyanide and bromide	20 tons
Garfield	Duncan	5 stamps, amal. and conct.	20 tons
Parkhill	Bonanza	Smelter, Austin process	100 tons
Sunbeam	Isabella	Roaster, pan amalgamator	25 tons
Bennett	Bonanza	20 stamps, conct.	50 tons

SAN JUAN COUNTY.

PRODUCTION FOR 1897.

Gold.....	33,591 Ozs. @	$20.67	per oz.....	$	694,325.97
Silver.....	1,101,907 Ozs. @	.5965	per oz.....		657,287.53
Copper.....	1,435,203 Lbs. @	.105	per lb.....		150,696.32
Lead.....	8,021,414 Lbs. @	3.38	per cwt.....		271,123.79
Total					$1,773,433.61

San Juan was organized by legislative enactment, approved January 31, 1876, and is one of a group of counties comprising the San Juan region in the southwestern portion of the state. The adjoining counties are Dolores, San Miguel and Ouray, on the north; Hinsdale, on the east; La Plata, on the south, and Dolores and San Miguel, on the west. In area it is one of the smallest subdivisions of the state, embracing about 480 square miles, with a maximum length of twenty-four miles north and south, and a maximum width of eighteen miles east and west. Like its diminutive sister counties, Lake and Gilpin, it is devoted almost exclusively to mining, having practically no other resource.

While the early history of this region dates back to 1861, its mining history practically begins with 1870, when the first locations were made. The record of the following year was, other locations, the construction of a Mexican arastra and the production of $3,000 in gold. During the winter of 1871-72 the reports made of the new district, accompanied with a display of gold produced, were by repetition soon enlarged to stories of fabulous wealth. However fanciful and delusive these stories may have been, this event marks the beginning of an important epoch in the mining history of Colorado, viz.: The opening of one of the greatest mineral sections in the state, now covering several counties. A rush for this region followed and, while not found as bright as painted, a large portion of those entering in 1872 returned the following year, accompanied by others. The years 1874-75 were noted for great activity and prospecting, but the producing mines were suffering from small margins left after paying heavy expenses incident to mining and transportation. This was in part relieved by the construction of a wagon road to Del Norte, across the Continental divide, and later by the "blowing in" of the furnace of the Greene smelter. This occurred in 1875, and to San Juan county belongs the distinction of having the first successful water-jacket furnace in the state. This plant for several years provided the main market for not only the ores of San Juan, but adjoining counties, and made it possible for the small producer to market his product and procure funds to continue development. Speculative investment with accompanying mills, non-suited for the ores to be handled, reached its zenith in 1876. The ill effects were not entirely recovered from until the advent of the Denver and Rio Grande railroad, in 1882. From that time until the present, barring the depression of 1893, and aided by

the Red Mountain and Silverton railroad, finished in 1888, the record has been one of material advance, with the year 1897 the best in the history of the county.

The topography is extremely rugged. The San Juan mountains form the Continental divide and outline the northeast boundary. On the north and northwest, the boundary is defined by the Uncompahgre mountains, and in the south part of the county are the Needle mountains. These ranges, with spurs, leave little else than narrow valleys and small parks, the largest being Baker's park, the present site of Silverton, altitude 9,400 feet. The rugged mountain sides are covered with a heavy growth of timber from base to an altitude of 10,000-11,000 feet, where timber ceases. Surrounding Silverton and throughout this region "timber line" is well defined and shows a large portion of the county to be above that altitude. Numerous peaks exceed 13,000 feet, and a few 14,000 feet. The drainage is toward the south through the Animas river, that finds source in the north and flows through the south boundary in a deep, almost inaccessible cañon. The main tributaries are Cunningham, Cement, Mineral, Hermosa, Cascade, Lime and Elk creeks, all rapid streams and flowing through narrow gulches.

The general geological structure of the county is almost entirely of metamorphic and eruptive rock types, the sedimentary beds being exposed in the southwest along the base of the Needle mountains and a few other points. The eruptive area embraces the main part and is made up of the lava flows of the San Juan region. In the higher altitudes the cliff exposures present a bedded appearance, with the lava beds lying practically horizontal, and clearly define three distinct lava flows, each differing somewhat in composition, but generalized as trachytic-porphyries.

San Juan county is noted for the great number and strength of its fissure veins. These fissures traverse the rugged mountains in all directions, are filled by a rather hard blue to milk white quartz, and are made prominent in places by having withstood the erosion that has removed the adjoining wall rocks and left them standing above the surrounding country, presenting an appearance of a stone wall or fence. The veins are of variable width, ranging from a few feet to as high as sixty or eighty feet. The commercial ores are mainly sulphides of iron, copper, lead and zinc, the arsenical silver minerals, occurring in a quartz gangue with gold associated in variable proportions. Taken as a whole, the ores are low grade and require some system of ore dressing before sending to market. In some sections, notably in the north end of the county, in the mammoth veins "free gold" in quite large quantities is encountered. Native silver is not uncommon. In the regions best developed and equipped, the ore occurrence is practically continuous; that is, continuous in profitable values, some sections, of course, being much higher grade than others, and practically all material between walls is mined, milled and marketed. In the larger veins the ore occurs along several parallel planes or veins in the form of shoots. These shoots are extremely high grade in places, but limited in extent as compared with the immense quartz bodies intervening.

The intervening quartz carries low values throughout and occasional "vuggs" with very rich filling. Owing to altitude and inaccessibility, these veins have only been opened in a primitive manner and the small "streaks" mined. Under more favorable circumstances, or equipped with plants sufficient to overcome surrounding physical conditions, a very large portion, if not all, of these mammoth veins could be mined profitably.

The production of San Juan county is from a large number of prospects and comparatively few mines. These latter have thousands of feet of development, and in places are working an extremely low grade of ore to a profit, made possible by gravity tramways and other mechanical devices, together with close care and good business management. The success achieved by these operators and the demonstration of the persistency of ore deposition has only attracted attention during the past few years, although the present results stand for years of time, toil and capital. During the past year most favorable reports have been received from all sections of the county and a number of new enterprises launched that promise to materially increase the county's annual output of precious metals.

There are six mining districts, viz.: Red Mountain, in the northwestern part of the county, embracing the territory drained by the headwaters of North Mineral and a portion of that drained by Cement creek; Animas district, in the extreme northern end of the county and all that portion lying east of the Animas river to the south line of the county; Eureka district lies south of Animas, and is drained by Cement creek and the gulches tributary to the Animas, in the vicinity of the town of Eureka; Anvil Mountain district, embracing the Red mountain spur, lying between Cement and Mineral creeks, south of Red Mountain district and terminating at Baker's park. This district is in the central part of the county. Ice Lake district, in the northwestern part of the county, in the drainage of the headwaters of South Mineral creek. The San Juan district embraces that portion of the county along the drainage of South Mineral creek, between Ice Lake and Anvil districts.

The mines of the various districts are, owing to topography, mainly opened through tunnels, and require no expensive hoisting and pumping plants, but as a rule must be equipped with trams to transport to mills at lower altitudes. In ore dressing the mine operators are not only up to the general standard, but in many respects excel. Concentration has been systematically pursued for a number of years, free from prejudice against or partiality for any particular method, process or mechanical appliance. The results attained are from an honest endeavor to secure the best methods. Under this system, ores of a grade even lower than worked in more favored sections, with short hauls and low transportation charges, are made "to pay." The application of electricity has reached a high state of perfection in this county. The power is generated on the Animas river above Silverton and transmitted to the mines, where it is utilized for operating mills, compressors, lighting, etc. The mine equipments are thoroughly modern, and in some particulars excel those of other sections. In 1894 a pyritic

smelter, capacity 150 tons, using the Austin process, was erected at Silverton. This plant is thoroughly equipped and has operated successfully for four years.

Silverton, the county seat, is centrally located on the Animas river at Baker's park, and commands the trade of all the surrounding mining districts. It is the terminus of the Denver and Rio Grande railroad, leading to Durango, where the principal part of the ore is marketed. The Silverton and Red Mountain railroad, having its initial point at Silverton, taps the Red Mountain district. This line is operated in conjunction with the Rio Grande system from Durango, and forms an important link commercially in the famous "Circle Route," so popular among tourists. In 1896 the Silverton Northern railroad was constructed from Silverton north to Eureka, a distance of nine miles. These roads have done much to advance the material welfare of the county and rendered profitable a large ore tonnage otherwise valueless.

The county records show 14,900 lode claims, 293 placer claims, 268 mill sites and 151 tunnel sites of record, and 1,003 lode claims, 14 placer claims and 84 mill sites recorded as patented in the county. During 1897, an average of 996 men were engaged in mining and an average of 168 mines and prospects were operated.

MILLS.

Name	Location	Character	Daily Capacity
San Juan Public Sampler	Silverton		100 tons
The Public Sampler	Silverton		100 tons
Silver Lake	Animas district	Concentration	200 tons
Iowa	Animas district	Conct. and amal.	50 tons
Titusville	Animas district	Concentration	85 tons
Crooke	Anvil district	Conct. and lixiviation	50 tons
North Star	San Juan district	Concentration	100 tons
Victoria Consolidated	San Juan district	Conct. and amal.	100 tons
Silver Ledge	Red Mountain	Concentration	50 tons
Ice Lake	Ice Lake district	Conct. and amal.	40 tons
Sunnyside Extension	Eureka district	Concentration	50 tons
Sunnyside	Eureka district	Conct. and amal.	40 tons
Sunnyside (Thompson)	Eureka district	Conct. and amal	20 tons
Gold King	Eureka district	Conct. and amal	65 tons

SAN MIGUEL COUNTY.

PRODUCTION FOR 1897.

Gold.....	70,544 Ozs.	@	$20.67	per oz.....	$1,458,144.48
Silver.....	869,079 Ozs.	@	.5965	per oz.....	518,405.62
Copper.....	354,781 Lbs.	@	.105	per lb.....	37,252.00
Lead.....4,143,767 Lbs.		@	3.38	per cwt.....	140,059.32
Total					$2,153,861.42

San Miguel is one of the west border counties in the southwest part of the state and was segregated from Ouray county by legislative enactment, approved February 27, 1883. It has an area of about 1,300 square miles. The adjoining counties are Montrose and Ouray on the north; Ouray and San Juan on the east; Dolores on the south. Utah forms the west boundary.

The topography of the county is varied. In the southeast the Uncompahgre mountains are equally as rugged as in Ouray and San Juan counties and have the same general geological structure. The east portion of the south boundary is outlined by the San Miguel mountains, composed of several rugged peaks reaching nearly 14,000 feet in altitude. From the base of the mountain ranges north and west, and embracing about four-fifths of the area of the county, plateaus and broad mesas prevail, composed wholly of sedimentary beds. The drainage of the mountains is northwest through the San Miguel river and tributaries. The west or plateau portion drains north through the Dolores river.

The mesa lands and valleys, the latter partially held as gold placers, are sparsely settled and devoted to stock growing and agriculture. The mountainous sections contain the mines. The earliest active operations in both placer and lode claims began in 1875, but owing to remoteness from market, placer mining assumed greater prominence for a few years, and the gravel beds adjacent to the San Miguel river and tributaries were appropriated for a distance of twenty miles. Later capital was generously employed in equipping these beds with expensive appliances for work on a more extended scale. The results were in the main unfavorable, but the exceptions are still being operated in a desultory way and yielding small annual returns.

The history of lode mining has been one of steady advance from the beginning in 1875. Notwithstanding remoteness from market, altitude, short seasons, long and severe winters, development has progressed steadily. Prior to 1880 no good wagon roads entered the county and the nearest railroad station was Del Norte, a distance of about 100 miles. Communication with outside points was maintained over narrow trails, and the ever-faithful, patient and indispensable friend of the prospector and miner, the burro, supplied the motive power for bringing in supplies and taking out such of the high grade ores as would bear the excessive rates existing conditions imposed. Successful milling plants were

early introduced and the ores not adapted to amalgamation were "packed" across the range to the local smelter at Silverton. Following the advent of the Denver and Rio Grande railroad to Montrose and the construction of a wagon road connecting Telluride and Montrose, the output of the mines rapidly increased. Even with this improvement, the cost for transporting ores to markets at Pueblo or Denver at that time was $25 per ton. The smelting charge was correspondingly high, a combination that under present market conditions would close nearly every mine in southwest Colorado.

That material advance could be made under such conditions demonstrates unmistakably an unusual occurrence of ores carrying high values. Progress was further accelerated by the building of a branch line of railroad from Montrose to Ouray and later by the construction of the Rio Grande Southern railway from Ridgway to Durango, with a branch from Vance Junction to Telluride. With direct market connection, thus established, affording cheaper transportation rates for ores out and supplies in, a general revival in all lines followed, and has been maintained to the present time, 1897 having been the most prosperous year in the history of the county.

The eastern part or the mining territory of the county is locally divided into five district, viz.: Upper San Miguel, in the east and northeast; Iron Springs, in the southeast; Trout Lake, in the south and southeast; Mt. Wilson in the south, and Lower San Miguel in the east-central portion of the county.

Saw Pit is a typical mining camp, sixteen miles west of Telluride, that sprang into existence in 1895, on the Rio Grande Southern railway. The mines are at distances from the town ranging from a few hundred yards to a mile or more. The record for 1897 is several new producers and a tonnage nearly treble that of 1896. The ore is in the main oxidized, with lead-silver and gold values, variable in proportion. These ores occur in the form of horizontal ore shoots, as a whole or partial replacement of the limestone bands of the Jurassic. The sedimentary beds were prior to ore deposition covered with the porphyritic outflows or lavas common to the San Juan region, but have since been eroded in this section. The district is traversed by two systems of fissures, having a north and south and an east and west strike. The east and west system is the older and formed the ore deposit; the north and south is later and consists of a system of fault fissures, carrying little or no values. The planes of faulting have a throw varying from a few feet to fifty, the ore shoots dropping to lower horizons when followed from outcrop into the hills.

During the past year, the San Miguel mountains, forming the east part of the south county boundary, have been more actively exploited than ever before. The older properties report a greater output for the year and an increased amount of development work, opening up large ore reserves. A number of promising prospects, producing small amounts of good grade ore were opened and more or less developed. The San Miguel mountains, while adjacent to the Uncompahgre range, differ ma-

terially and mark the scene of an upheaval common in many respects to the isolated groups of the La Plata and Sierra La Sal mountains. The ore mined occurs in fissure veins and is mainly a quartzose gangue, heavily charged with zinc and iron sulphides, carrying gold and silver values. Small shipments of extremely high grade gold ores are not uncommon, but taken as a whole, the large ore bodies are low grade and require some system of ore dressing prior to shipment.

The best developed mines are in the Uncompahgre mountains, covering the east-southeast part of the county. These mountains are extremely rugged and the higher horizons made up of the eruptive rocks common to the San Juan region. The different lava flows are well shown along cliff exposures in the higher altitudes, and while differing in composition are generalized as trachytic-porphyries. The underlying sedimentary beds are exposed near the base, but the principal mining is confined to the eruptive areas. The overlying porphyries present a bedded appearance and are traversed by a series of vertical fissure veins, having a variable strike, but apparently more frequent in north and south than in an east and west direction. The principal veins are well defined, varying from a few feet to fifteen or more in width and occupying planes of fracture or fault fissures. The vein filling is mainly the altered country rock, through which the fissure passes charged with iron, copper, lead and zinc in sulphide form, with gold and the arsenical silver ores associated. Native silver and gold occur, the gold being most frequent and gold and silver in form of electrum is not uncommon.

Like other fissure vein sections, the values are found more or less concentrated near one wall and form the "pay streak." In this region, the "pay streak" when mined alone makes a high grade product and was the commercial ore of the pioneer. While the "pay streak" of the pioneer is not ignored but is still sought and generally separated from the main mass, under improved advantages, the grade of ore necessary to yield a profit has been gradually lowered until the commercial ore of this region to-day is practically "all material between walls." Under this regime, the ore occurrence, while richer in some places than others, is in the best developed mines practically continuous, and all vein material is treated as ore and either sent to smelter direct or to local mills for partial reduction and concentration.

The conditions defined may be best understood by the following: One property, when last visited, was breaking ore, average width of vein six feet, length 1,980 feet, average value, one ounce gold per ton from Huntington mills and a high grade concentrate from tailings on vanners. Another vein developed for nearly 7,600 feet, average breaking width, five feet, profitable values throughout the entire length and ore reserves sufficient to supply the 200-ton mill for twelve to fifteen years.

The magnitude of ore bodies demonstrated by development in a few properties and future possibilities in others equally as good as the present leaders were when no more developed, have apparently not been realized until within the last few years. As a result of this realization,

aided by the fact that gold values of good grade predominate in the ores, the mines of San Miguel county have imbibed an impetus that promises great future returns. It is not probable that all properties, when equally developed with those above cited, will possess equal values, but there are few sections in the state that present as favorable conditions for analogous reasoning and conclusions.

The results attained in the mines of San Miguel county are not the work of a day but represent years of hard, patient toil, backed with ability and money. To those who consider mining a questionable pursuit, a "gamble" rather than a legitimate industry, a visit to this section is earnestly recommended. To those who believe that any man capable of drawing a check and keeping a cash book is competent to manage a mine, a study of this region would be a revelation. To those who are able to save 95 per cent. to 100 per cent. of values by different methods of ore dressing, the field is enticing, and finally to those who view mining as a legitimate industry and a mining investment upon the same basis as that of any other industrial pursuit, the county will prove interesting.

In few sections of the state do the diversified advantages and disadvantages incident to mining present the varied field for research and results possible of attainment that can be found in San Miguel and other San Juan counties.

In the practical application of electric power and its transmission for mining and milling purposes, San Miguel county was among the first. The plant is the largest in the state and thoroughly equipped in every particular. The power is generated from two Pelton wheels, 900-foot water head driving two generators equivalent to 750 horse power each. The switch boards, lighting arrestors, etc., are of special design to meet the conditions incident to high altitude. The dynamos generate a two-phase current which is transformed to three-phase for transmission and again changed to two-phase at mills where used. The longest distance the power is carried is thirteen and one-half miles, at which point a large mill is driven and the mine lighted by electricity. This power is utilized in numerous mills for power and light and in a number of hoisting engines throughout the district, in addition to lighting Telluride and Ophir. That the service is satisfactory is demonstrated by its increased use each year.

Telluride, the county seat and principal commercial center of the county, is located in a small level park, altitude 8,800 feet, surrounded by rugged mountains rising to 14,000 feet and is one of the most picturesque points in the state. The south fork of the San Miguel river and tributaries enters the park over cliffs forming waterfalls that add much to the beauty of the surroundings.

The county records show 5,175 lode claims; 1,012 placer claims: 191 mill sites, and 50 tunnel sites of record, and 378 lode claims; 57 placer claims, and 44 mill sites recorded as patented in the county. During 1897 an average of 1,289 men were engaged in mining, and 204 mines and prospects were operated.

MILLS.

NAME	LOCATION	CHARACTER	DAILY CAPACITY
Smuggler-Union	Upper San Miguel	50 stamps, conct.	200 tons
Gold King	Turkey Creek dist.	40 stamps, amal.	80 tons
Terrible	Iron Springs dist.	30 stamps, amal. and conct	60 tons
San Bernardo	Turkey Creek dist.	Concentration	50 tons
Suffolk	Iron Springs dist.	40 stamps, amal and conct.	80 tons
Valley View	Upper San Miguel dist.	10 stamps, amal. and conct.	25 tons
Japan	Upper San Miguel dist.	Concentration	100 tons
Tom Boy	Upper San Miguel dist.	Amal. and conct.	200 tons
Columbia-Menona	Upper San Miguel dist.	30 stamps, amal. and conct.	60 tons
H. M. H.	Upper San Miguel dist.	5 stamps, amal.	10 tons
Caribou	Iron Springs dist.	10 stamps, conct.	25 tons
Silver Pick	Mt. Wilson dist.	10 stamps, conct.	25 tons
Hector	Upper San Miguel dist.	30 stamps, conct.	75 tons
Alleghany	Upper San Miguel dist.	20 stamps, amal. and conct.	50 tons
Turkey Creek	Upper San Miguel dist.	10 stamps, amal. and conct.	25 tons
Illium	Iron Springs dist.	10 stamps, amal.	25 tons
Telluride Power & Transmission Co.'s	Upper San Mlguel dist.	120 stamps, amal. and conct.	250 tons
Bessie	Turkey Creek dist.	Amal. and conct.	70 tons

SUMMIT COUNTY.

PRODUCTION FOR 1897.

Gold	13,239 Ozs.	@ $20.67	per oz	$	273,650.13
Silver	514,107 Ozs.	@ .5965	per oz		306,664.83
Copper	133,482 Lbs.	@ .105	per lb		14,015.61
Lead	1,748,761 Lbs.	@ 3.38	per cwt		59,108.12
Total				$	653,438.69

Summit county as originally organized by territorial legislature in 1861, embraced northwest Colorado. Through subsequent legislative enactments it has been divided into six subdivisions of which Summit county is the smallest and embraces but a small portion of the southeast part of its original area. As now constituted it has an area of about 690 square miles. The adjoining counties are Grand on the north; Grand, Clear Creek and Park on the east; Park, Lake and Eagle on the south, and Eagle on the west.

The county is without form, being neither round, oblong or square. Its boundaries are outlined by the irregular crests of the Park range on the west; the Williams River mountains on the east and the Continental divide on the south and southwest. These ranges are quite rugged and are composed almost entirely of metamorphic granite, traversed by eruptive dikes and flanked with remnants of the Silurian and Carboniferous strata. The drainage is towards the northwest through the Blue river and numerous tributaries. This stream flows through the central part

of the county in a narrow valley, that gradually widens toward the north end, where it affords a little available ground for "ranching." Along this stream and the various tributaries the gold placers that gave this section much prominence are located.

In mining Summit is one of the pioneer counties. This region was entered during the summer of 1859, and the placer beds located, that have ever since been made to yield good gold returns. During 1860-1861, the original territory on the Blue river near Breckenridge was gradually extended by discoveries in various gulches and flats, until every valley was producing gold in more or less quantity. In the fall of 1861 the same spirit of unrest that led to the location of this and other sections, caused many of the pioneers to seek new fields of supposed better promise, or to cast their lot with either the North or South in the civil war. The result was an exodus, leaving comparatively few in possession of the territory. These continued extracting gold and the numbers were gradually added to up to 1878. In addition to the placer beds, quartz veins were located as early as 1861 in various sections and were worked in a desultory manner, but the products were deemed sufficient in 1874 to justify the erection of a reduction plant. In 1878 prospecting took a new departure and was in line with that being done in Lake county. The discoveries of that year were added to the year following. In 1880, the overflow from the Leadville excitement produced a similar craze in this section on a less extended scale. The completion of the Denver and South Park railroad in 1882 and later a branch of the Rio Grande railway from Leadville changed the district from a gold to a silver-lead producer. From this time until the present the county has had seasons yielding variable results, but the main tendency has been upward, 1897 being recognized as the most prosperous in the history of the county.

Summit county is better known on account of its nuggets and crystalline gold production than from its large bodies of smelting and milling ores. For beauty the crystalline specimens from this region can not be excelled, and are admired and sought by the mineralogist.

Being unique and peculiar to this region, the enterprising citizens of that section have exhibited them at various expositions, and always secured first prize. In addition to this, nearly every inhabitant is a walking advertisement in always having about his person a fine specimen of gold, taken from the adjacent bars or mines. For these reasons, an erroneous impression prevails that Summit county is strictly a gold district, while as a matter of fact its greatest gold production is derived from comparatively low grade silver-lead ores, with which it is combined. The amount of gold produced from the placer beds of this county is merely a matter of estimate, but it is safe to assert that it is but a very small portion of that remaining. The major part mined from 1859 to the present time has been surface work, bed rock having been reached in but a few places, and that mainly near the head of some of the small feeders to the main river. The primitive "100-foot claims from bank to bank and 200 feet to the discoverer" have passed into history. This territory has been gradually ab-

sorbed by individuals and corporations into large holdings, some at present time controlling several thousand acres or several miles along the streams. Within a comparatively short time developments have shown these beds to range as high as seventy feet in depth and, so far as exploited, the gravel increases in value as bed rock is approached. That these beds have practically not been explored until recent years is due to altitude, consequent short seasons, lack of water supply, except where transported by ditches, lack of fall in the stream beds or dumps, and the beds so permeated with water that sinking and drifting can only be prosecuted in winter or with extensive pumping plants. During the past year, in addition to the usual amount of placering, several companies have prepared to overcome these obstacles. Ditches, flumes and mechanical appliances have been added, and among them a dredging plant is in course of construction, similar in design to those being successfully used in California and other sections. The success of these companies the coming season will be watched with interest.

In the hills and mountains surrounding are the lodes, ledges and deposits from which the placer beds derived their values, and the permanent source of production for this and future generations. The ore occurrence is so variable in this section that it can only be generalized. The upturned, faulted and metamorphic sedimentary beds of the Silurian, Carboniferous and Triassic formations, flanking the mountain ranges, have been traversed by a series of eruptive dikes and separated and contorted by intrusive sheets and masses. The main ore deposits in these sections occur in a bed of Upper Carboniferous limestone at point of contact with a micaceous sandstone. This is a higher geological horizon than at Leadville, but the ore deposition is similar, being a replacement in the lime or wholly replacing the lime. The ores are mainly sulphides in form of pyrites, galena and zinc-blende, with gold and silver associated. While the above is the common occurrence, ore bodies are developed in direct contact with the porphyry dikes and sheets, and also as impregnations in quartzite. In the latter case the main value is in gold. The porphyries are doubtless the source of values, although connection is not as yet fully established in some places. In the higher mountain portions veins occur in the granites, but these are not known to be extensively developed, although these sections have received more than ordinary attention during the past year. The reports from the lode miners show increased activity, the installing of several new companies, with extensive development started.

Summit county, although one of the earliest entered in the history of the state, possesses a large amount of undeveloped and promising mineral territory.

Ore dressing has not kept pace in this county with other sections, but has shown a material advance during the past year over previous years, and the new mills instituted will doubtless exert a good influence over others and cause needed improvements.

Breckenridge is the county seat and main commercial center of the county. It is a well built, substantial town at the base of the mountains,

altitude 9,500 feet, on the Denver, Leadville and Gunnison railroad. The other important camps tributary to this line are Dwyer, Argentine, Mayo, Braddock, Dickey, Keystone and Dillon. From Dillon both the Denver, Leadville and Gunnison and the Denver and Rio Grande railroads parallel each other to Leadville, and pass through Frisco, Kokomo, Wheeler and Robinson. These lines are near the inland camps and afford good and ample transportation facilities to the county.

Locally the county is divided into numerous mining districts, deriving their name from the contiguous streams or mountains. During 1897 an average of 426 men were engaged in mining, operating 12 placers and 86 mines and prospects.

MILLS.

NAME	LOCATION	CHARACTER	DAILY CAPACITY
Wilfley	Kokomo	Rolls, Wilfley tables	50 tons
Jack	Kokomo	Electric cyanide	50 tons
Eldorado	Kokomo	10 stamps, conct	10 tons
West Side	Breckenridge	Pulverizer, conct	50 tons
Detroit	Breckenridge	Amal. and conct	15 tons
Kilton	Breckenridge	Sampler	100 tons
Lucky	French Gulch	Rolls, amal	35 tons
Delaware	North Star Mt	5 stamps, amal	15 tons
Carrie	North Star Mt	10 stamps, amal. and elec. cy	25 tons
Tyler	North Star Mt	5 stamps, amal	15 tons
Woodford	North Star Mt	30 stamps, amal. and conct	100 tons
Penna	Frisco	Amal. and conct	50 tons
Stevens	Montezuma	Amal. and conct	50 tons
Peruvian	Montezuma	Concentration	50 tons
Wapita	Farnscomb Hill	Amalgamation	20 tons
Wire Patch	Farnscomb Hill	Amalgamation	20 tons
Minnie	Mineral	Rolls, amal	30 tons
Oro	Mineral	Concentration	50 tons
Jessie	Mineral	Amal. and conct	125 tons
Jumbo	Mineral Hill	30 stamps, conct	30 tons
Extention	Mineral Hill	20 stamps, amal	20 tons
Hamilton	Mineral Hill	10 stamps, amal. and conct	25 tons
Golden Eagle	Bald Mt	15 stamps, amal. and conct	35 tons
Washington	Kokomo	20 stamps, amal	20 tons
Juniata	Hamburg	10 stamps, amal	10 tons

SUMMARY OF COUNTIES.

In the preceding chapters, under the general caption "Colorado by Counties," the purposes aimed at may be briefly stated as follows:

To afford those contemplating a visit to any of the various counties a general idea of the conditions extant in that particular section at the present time, by furnishing a brief historical sketch, the causes that led to present development and calling attention to future attainments possible.

To furnish the business man interested in the mines of Colorado with a general idea of the geological surroundings, vein formation and ore deposition of the various counties, so stated that without technical

knowledge he can, on reading various chapters, arrive at satisfactory analogous conclusions.

To supply the demand for a ready reference book, so arranged that a general idea of mining in any particular section desired, may be obtained in brief form.

As stated in "Letter of Transmittal," the subjects have been treated more from a commercial than a technical standpoint, because of limited space; technicality and brevity being scarcely compatible on subjects so diversified and comprehensive as the ones treated of in this report.

It was intended to summarize the counties by districts, but space will not permit.

A careful reading of the foregoing chapters consecutively will discover a sameness in some respects, but of a character that bodes well for Colorado's future welfare. This repetition may be summarized as follows:

For 1897—Numerous new discoveries.
Old mines revived.
New enterprises launched.
New mills and capacity of old mills increased.
Comparatively small area developed.
Large amount of territory remaining undeveloped.
Increased activity in mining.
Increased production.
Wholly undeveloped resources.

IRON ORES OF COLORADO.

By Regis Chauvenet, President State School of Mines.

The iron ores of Colorado are divided between the three main classes which constitute the great bulk of all the ore mined in the United States, viz.: Hæmatite, Magnetite and Limonite. Hæmatite, however, is relatively quite unimportant in the deposits so far discovered or developed, and little mention will be made of it. In passing, it should be said that Limonite is frequently spoken of as "brown Hæmatite," and even as "Hæmatite," an erroneous usage which needs no further mention.

Coming to the ores which must mainly engage our attention for the present, we are struck with the general fact that known localities are small in number, and that the geographical area in which Magnetite of proper composition is found in quantity is very limited. Taking Mt. Harvard as a center, a circle of thirty miles' radius will embrace the deposits above Ashcroft, all of Leadville's ores, the Calumet mine in Chaffee county, the deposits in the southeast part of Gunnison county, near White Pine, and a number of prospects similar in general character, and probably of the same geological position and origin.

The iron and manganese ores of Leadville, included in the above circle, but not in the Magnetite class, have been so thoroughly exploited and described that it is needless to repeat the descriptions in this paper. Breece hill is notable as containing the only deposit of Hæmatite of commercial importance (or, at least, of present importance) in the state. This Hæmatite has been sent to Pueblo in large quantities in the past, and is excellent ore, of true "Bessemer" composition. During the existence of the Colorado Coal and Iron Company, this ore was sold to the Pueblo blast furnaces, but with an ever decreasing value in the product, the price was found to be prohibitive. Probably the reduction works at Leadville can to-day better afford to pay for it as "flux" than can the iron works as ore. The ore is quite free from phosphorus (that is, free enough for a steel works) and is also non-sulphurous. The writer is not informed as to whether the non-manganiferous ore of Leadville is at present shipped as flux—certainly none is being used for iron production. Manganese ore is found in the Leadville district quite abundantly, and in several localities outside of Breece hill. These deposits are of interest as furnishing all the ore needed for Spiegel and Ferro-Manganese at Pueblo, and many thousand tons have been shipped to Chicago and elsewhere. The market for these ores depends upon their silver assay. They are good "Spiegel" ores, but an assay value of $5 silver is sufficient to change them (commercially) from iron "ore" to lead "flux." It is, however, to the iron works that the ores richest in manganese always find their way.

Here may be incidentally noted, as an item of information for many prospectors, that a small percentage of manganese in an iron ore adds nothing to its value, and indeed, within certain limits, actually detracts from it. At the School of Mines many specimens are received, with requests for estimation of manganese, also for data giving value of manganiferous ores "per unit." Space does not allow full explanations, in a technical sense, of all the reasons why manganese can not be paid for "by unit," nor paid for at all, in lean ores. In ores of very low percentage, it may assist the fluxing somewhat, but would hardly be paid for. In quantity a little higher, it passes into the pig iron, merely to be wasted again if the latter is converted into steel, or adding nothing in any case to its value.

We may now take up briefly the Magnetite deposits *outside* of the above circle, not, however, for discusion, but rather for dismissal. So far as known to the writer they may all be classed as of no economic importance. There are certainly great deposits of magnetic ore in the southern part of Gunnison county but they appear to be too high in titanium to be considered as of either present or future value. At other points (certainly three, probably many more) are beds or veins of Magnetite similarly contaminated. One of these, situated in Fremont county, near Soda Springs, was once worked by the Colorado Coal and Iron Company, but although not exceedingly high in titanium (8 to 12 per cent. titanic acid), its use was found to be unprofitable. At other points the local tradition, naturally enough, regarding the iron and the quantity of

the ore, neglects or is ignorant of the impossibility of using it, so that here, as elsewhere, the fiction of vast available stores of ore, to be developed at some future day, finds currency even with intelligent citizens of localities in the vicinity of such deposits.

The localities included in the above circle, certain undeveloped prospects being omitted, are as follows:

First—A vein, evidently of great extent and certainly of great purity so far as outcrop is concerned, is found above Ashcroft, Pitkin county, about sixteen miles southeast of Aspen. This ore gives 63 to 64 per cent. metallic iron, is non-titaniferous, and is low both in sulphur and phosphorus. So far as investigation has gone, it would seem to be the best of the known Magnetite deposits in Colorado. Its great altitude (nearly eleven thousand feet), the distance from rails, and the abundance, at present of more fusible ores, nearer Pueblo, are factors which combine to arrest its development. It is owned by the Colorado Fuel and Iron Company.

Second—A great, but almost wholly undeveloped body of Magnetite is found near White Pine, Gunnison county. A number of claims have been laid out, under various ownerships. The composition of the ore varies. Near White Pine a few hundred tons have been mined and the vein has been cross-cut, showing variation in iron percentage from 66 downward. This vein is from fifty to seventy feet in width. Very large quantities could be taken by rough selection, to average 60 per cent., while probably three times as much could be mined much more cheaply were the requirement not over 50 per cent. of iron in shipped ore. It should be remembered that statements of this kind are subject to the necessary limitations imposed by a very trivial development. At other points on the outcrop of this vein, whose extent is hardly known, but which has been traced for over two miles, various results as to average composition have been obtained. Rarely sulphurous, it varies nevertheless in phosphorus and in titanium, indicating that selection would have to be made in mining on a large scale. Ore from this deposit could go "down grade" to Gunnison or some similarly situated point in the valley, and be smelted with Gunnison county coke. In coming eastward, ex. gr., to Pueblo, it would be carried over Marshall pass. Too little is known of it to warrant great predictions; enough is known to justify more serious exploitation.

Third—The deposit at Calumet, Chaffee county, is well known, and was mined for a number of years, the product being smelted at Pueblo. Recently, shipments have ceased from this mine, which in places showed a percentage of sulphur so high as to render roasting necessary. The expense of this process was probably the chief reason for closing the mine. It is understood that the shipments for a series of years showed between 50 and 60 per cent. of iron, for the most part nearer the former figure. Thus, great in quantity as the various deposits are, it so happens that at the present time no ore from any of them is either used or sold by the owners. So far as the Colorado Fuel and Iron Company is concerned, this is not greatly to be wondered at. The great deposits of more tract-

able ore, to be presently described, which the company owns in another locality, acts naturally to restrict, if not altogether to prevent, the production of Magnetites, which for various reasons are less desirable for the blast furnace than other varieties.

In any description of the iron ores of the state, which must necessarily include prospects far more than developed mines, mention of the curious deposits in the southern part of Gunnison county could hardly be omitted. These are found for the most part on White Earth or Cebolla creek or in the hills in its vicinity, at distances varying from three to ten miles from the line of Hinsdale county, but chiefly (so far as proved up) in Elkhorn hill, about midway between these limits. Only passing mention need here be given to the great diffusion in this same region, of titaniferous iron ore, once supposed to be of great value. Elkhorn hill contains a mass of manganese ore (Psilomelane, chiefly) of unusual extent, passing in one direction into brown ores, all probably more or less manganiferous, but occasionally approaching true Hæmatite in appearance and composition. Neighboring hills, partly exploited, show a similar character, and the numerous openings which have been made reveal a total tonnage whose figures would easily mount into hundreds of thousands, on any reasonable deduction from the prospects, though, of course, no claim is made of ore strictly "in sight" to that extent. The general grade is not high, and this, with total lack of transportation facilities, operates to keep the ore out of the market. No region in the state shows greater general evidence of deposition of iron and manganese on a large scale, and no one who has inspected these prospects can doubt that they are but examples of many others to be discovered by future exploration.

The largest working deposit of iron ore in Colorado lies in the northeast part of Saguache county, about twelve miles from the village of Villa Grove. It is known as the "Orient" mine, and is owned by the Colorado Fuel and Iron Company. This is by very far the most important body of Limonite hitherto discovered in the state, and as it is in some respects a very peculiar one, some attention may be paid to its chemical characteristics as well as to its economic importance.

The ore lies in the foothills of the Sangre de Cristo range, and one hill may be especially mentioned in which the mass of ore may be conservatively estimated at two million tons. The combined water in the ore, together with moisture, brings the iron percentage to a low figure as compared with many regions, yet this fact is discounted by three others, rendering the whole operation not only feasible but profitable. These are: The cheap mining, low phosphorus, and easy treatment. It is a common, but far too broad, an assumption that high grade ores are the most profitable to reduce. Here is no place for metallurgical disquisitions, but it may be said of the Limonite of Saguache county that the main drawback in its working qualities is not revealed at the furnace, but is found in the freight bills. It is not pleasant to pay freight on say one hundred tons of water a day; yet this is what the Colorado Fuel and Iron Company does, and still finds it better to do so and to expel this

water in their furnaces, than to treat the (superficially) more promising Magnetites.

The peculiarity alluded to is the fact (unusual in Limonites) that the phosphorus is so low in this ore as to render it a remarkably good one for the manufacture of Bessemer pig. We have here, then, a case of exceptional interest as regards composition of ore, transportation and treatment. The low phosphorus and easy fusibility of this ore overcome in practice the handicap of freight on an useless (indeed, worse than useless) constituent, and enable the Pueblo works to utilize it in preference to material which might at a first glance be considered as its superior.

In concluding a sketch necessarily brief and imperfect of our iron ore resources, a few words should be said as to the probabilities of future discoveries. These may fairly be said to be very great. Few prospectors are attracted by iron, and not all of them know iron ore when they see it. Dozens of samples have been sent to the writer as possible ores of various metals, which were one and all merely iron oxides in different forms. The iron and manganese deposits of Elkhorn hill would never have been discovered by outcrop, for only a rather scanty "float" indicated either metal. The same is true of several other localities. The ores hitherto found have been quite abundant enough to supply all local demand, and more than enough. There are well grounded reasons for the expectation that such will be the case for a much longer future than would greatly interest the present generation.

COAL.

Mr. David Griffith, State Inspector of Coal Mines, has kindly prepared a statement for this Department that shows for 1897: Production, 3,565,660 tons of coal and 320,738 tons of coke; average number of men employed, 7,018; average number of mines working, 107, the same being tabulated as follows:

Counties.	Number of Mines.	Number of Men.	Tons of 2,000 lbs.
Arapahoe	1	2	413
Boulder	25	1,202	607,890
El Paso	6	105	27,906
Fremont	14	1,142	319,641
Gunnison	11	724	319,116
Garfield	6	299	237,277
Huerfano	8	877	361,702
Jefferson	4	20	7,650
Las Animas	13	2,167	1,406,455
La Plata	5	146	74,805
Larimer	1	10	6,000
Mesa	3	52	27,611
Pitkin	2	209	147,461
Weld	8	63	21,733
	107	7,018	3,565,660
Tons of coke made in 1897			320,738

Various estimates, based upon official surveys, have placed the coal-bearing area of Colorado at figures ranging from 25,000 to 40,000 square miles. Dr. R. C. Hills, who is recognized authority upon this subject, places the area at 18,100 square miles, based upon actual geological measurements and divided as follows:

ESTIMATED AREA OF COLORADO COAL FIELDS.

	Square Miles.
Grand river (Western Colorado)	6,950
Yampa river (Northwestern Colorado)	1,100
La Plata (Southern Colorado)	1,250
Raton (Southeastern Colorado)	1,300
Northern Colorado	6,800
North park	300
South park	100
Southwestern Colorado	300
Total	18,100

The available coal area, i. e., the area accessible to mining and transportation, in accordance with present facilities, is as follows:

ESTIMATED QUANTITY OF AVAILABLE COAL IN COLORADO FIELDS.

Location.	Accessible Area. Square Miles.	Available Gross Tonnage.
Grand River field (in Colorado)	1,116	26,384,800,000
Yampa field	440	5,961,500,000
La Plata field (in Colorado)	300	3,387,200,000
Raton field (in Colorado)	473	4,490,200,000
South Platte field	405	2,568,600,000
North Park field	80	1,806,500,000
Cañon City, South Park and Tongue Mesa districts	49	429,000,000
Dakota Cretaceous measures	50	169,300,000
Total	2,913	45,197,100,000
Total net tonnage, or 75 per cent. of gross tonnage		33,897,800,000

With a few exceptions the Colorado coal measures are found in the Laramie group of the Upper Cretaceous. In the Carboniferous strata, which contains the great coal measures of Pennsylvania and the East, no coal seams having commercial value exist in Colorado.

The various coal mines through the state are well managed and equipped, and are under the general supervision of the State Coal Mine Inspector.

Where the coal seams lie comparatively level, the methods of work are similar to the mines of the East, but where dipping at a high angle the point of attack is chosen with a view of utilizing the power of gravity from the points the coal is broken to the main trams or "entrys." The coal product is of almost every known variety, the character not only

being variable in different sections, but subject to great variation within the same regions. These changes are due to proximity to volcanic eruptions and intrusions, together with the general movements incident to mountain building or uplifting, thereby producing a series of coals ranging from a lignite to an anthracite. These same causes, without entering into detail, account for the existence of anthracite in Laramie beds of the Upper Cretaceous, and the Colorado coal measures, while very much younger, may be said to have lived faster than the coal seams of the East, formed in the Carboniferous strata.

The amount of anthracite coal, in quantity to have commercial value, is comparatively limited, but the product being marketed from the mines in Gunnison county compares favorably with the best anthracites. The area of good coking coal is much larger and is found in a number of counties. The coarse coal finds ready market for use on locomotives and other steam consumers, the fine coal or screenings being converted into coke. The general grade of the coke is high and finds ready market at the numerous reduction works throughout the state. The largest amount of coal used is an altered lignite or a slightly coking variety, known as domestic coal and used for heating, steam and other purposes. The coal seams being worked are of variable thickness and will average about five feet.

The large increase of production from year to year corresponds with the general development of the state, and while but a comparatively small portion of the total area is producing, it is safe to assume that the future production, as demonstrated by the past, will keep pace with the growing demand.

Acknowledgment is here made of the courtesy of Prof. Arthur Lakes in preparing, at the request of the department, an exhaustive paper upon Colorado coal resources, which for lack of space had at this time to be omitted.

CYANIDE AND CHLORINATION IN COLORADO.

By Robert B. Turner.

CYANIDE.

Colorado was the first state to introduce the cyanide process through a company known as The Gold and Silver Extraction Mining and Milling Company, owners of patent for the McArthur-Forrest process, obtained in May, 1889, and in May, 1890. In November, 1893, the above Colorado company sold to The Gold and Silver Extraction Company of America, Limited, a corporation organized under the laws of Great Britain, with home office in Glasgow, Scotland, and the American agency in Denver.

A second cyanide company was organized in September, 1894, known as The American Cyanide Gold and Silver Recovery Company, which is strictly an American and state organization, being incorporated under Colorado laws, with headquarters in Denver. This company operates what is generally known as the American dioxide-cyanide process, which is the addition of sodium dioxide to a potassium cyanide solution.

A third company, The General Gold Extraction Company, Limited, has headquarters in Denver, and represents the Pelatan-Clerici process, under the United States patents issued in 1894, 1895 and 1896. The mode of treatment of the crushed ore is by agitation with a dilute solution of potassium cyanide in a large pan, and while such agitation is in progress, the gold is precipitated by an electrical current and mercury on copper plates.

At present time the writer knows of no mill in operation in Colorado using the Pelatan-Clerici process, but the company has an experimental or testing plant in Denver. Therefore, all the cyanide mills working in the state are using either the American dioxide-cyanide or the McArthur-Forrest process.

The Cripple Creek district has been one of the best in the state for the treatment of its ores by the cyanide process, and has five mills, as follows: The Colorado Ore Reduction Company, Elkton, chlorination, 50 tons; cyanide, 60 tons per day. The Brodie Gold Reduction Company, Mound City, cyanide, 100 tons per day. The Metallic Extraction Company, Cyanide, cyanide, 400 tons per day. The American Reduction Company, Florence, cyanide, 50 tons per day. The London, Florence, cyanide, 50 tons per day.

As all the above mills are custom plants, it becomes necessary to sample the ores in a well equipped sampling works, so as to establish their values for purchasing purposes before going to the fine crushing department of the mill. Therefore, all the Cripple Creek mills have their own sampling department and storage bins ahead of the cyanide mills, and ores are held until satisfactory settlements are made.

From the samplers' storage bins the ore, which has been crushed to one-fourth inch size, is drawn into cars and trammed to the automatic feeders of the revolving dryers. After passing through the dryers the ore is elevated to the sizing screens; the oversize from the screens passes to the fine crushing rolls, and, after passing through the rolls, the ore is screened and the oversize returned and screened until all passes through the screens and is conveyed to the finishing pulp bins. Considerable care is given to the crushing of the ore, so as to produce as granular a product as possible for the leaching tanks, and a number of dust appliances are now in use to collect the dust that is made in fine dry crushing.

The cripple creek oxidized ores are treated without roasting, but the sulphide and telluride ores require it; therefore, some type of mechanical roasting furnace is used. It has been a serious question to decide between the merits of the roasters in use, which are the Ropp, Pearce, Turrett, Argal and Improved Buckner, as all are capable of doing the

work required in ores of this district, that is, reducing sulphur from 3 per cent. to less than two-tenths of 1 per cent.

At the present time only two mills in the district cool the roasted ore automatically. The Metallic Extraction Company, at Cyanide, uses a scraping conveyor which scrapes the ores over a water jacket bottom. The same style is in use at The Colorado Ore Reduction Company's mill at Elkton. The same leaching department is used for either class of ore, raw or roasted.

The leaching tanks are generally made of three-sixteenth-inch steel plates, and are from twenty to fifty feet in diameter, and from four to six feet in depth. In each leach tank a false bottom, or filter bed, is made to suit the fancy of the man in charge. The style of piping and arranging the solution tanks, storage tanks and precipitating boxes is governed by location of plant as regards ground and engineer having plant under construction.

The following items give an idea of what is needed in the cyanide department of a mill: Standardizing tanks, leach tanks, gold solution tanks, zinc boxes, sump tanks, vacuum tanks with vacuum gauge, ejector or vacuum pump, solution pump, necessary piping and valve, vacuum slime filter, zinc lathe, muffle and bullion furnace, and a number of small items too numerous to mention.

The ore after being properly crushed and roasted, if necessary, is placed in the leaching tanks, and a weak cyanide solution is added, either from the bottom or top and allowed to saturate the pulp and rise above the top about one inch. The time this solution is allowed to remain before drawing away and a continuous circulation started is governed by the treatment found necessary to obtain the quickest results on the particular ore in question. After the leach has been completed, washing of the pulp becomes necessary. This generally consists of about three washes. The quantity of water required for this purpose should be sufficient to displace as much of the remaining gold solution as possible, and in some cases a vacuum is used to dry the pulp to about 15 per cent. moisture.

After the ore has been leached and thoroughly washed, it is sluiced out of the leaching tanks over some style of fine concentrating plant. At the present time two styles of such plants are in use, one having the Wilfley tables, the other, riffles and blankets. The idea of concentration is to recover the coarse gold which has not had time to be affected by the cyanide, and also any sulphides carrying values.

If a mill be located so it is short of water for sluicing purposes, it becomes impossible to concentrate after leaching, and the general custom is to shovel the waste material from the tanks.

The solutions containing the gold are then allowed to pass through zinc shavings, which are made as needed at the mill, from sheet zinc, the gold and silver being precipitated by the zinc.

The "clean-up" of the zinc boxes is very simple, and the zinc slimes which contain the gold and silver are treated, as a rule, at the mill and the bullion shipped direct to the mint.

In most of the cyanide mills of the state, a weak solution of cyanide of potassium is used ranging from two-tenths of 1 per cent. to four-tenths of 1 per cent., and a chemical and mechanical loss of cyanide from one to two pounds per ton of ore is made. The loss of zinc varies considerably, and ranges from one-quarter to two-thirds of a pound per ton of ore.

Below is the approximate treatment cost per ton of ore for a 50-ton plant, running twenty-four hours:

	Per ton.
Labor in crushing department	$0.52
Fuel for dryer and steam purposes	0.48
Labor in leaching department	0.22
Chemicals consumed	0.74
Repairs, including screen wear	0.10
General wear	0.07
General expense	0.08
Insurance and taxes	0.07
Assay office and chemist	0.10
Office and management	0.17
To concentrate after treatment	0.15
Total	$2.70
If ore needs roasting, add to above	0.75
If ore is sampled before treatment, add to above	0.45
Making a total cost of	$3.90

The cost given herein will vary considerably owing to wages paid and price of fuel, this estimate being based on $3 per day wages and coal at $5 per ton, which is the average cost in the mountains.

All the cyanide plants working on crude ore in Colorado are crushing between twenty and thirty mesh. The time consumed in loading, leaching, washing and discharging a tank containing sixty to seventy tons of pulp varies from four to twenty days; some of the important reasons for such a difference in time being the strength of solution used, value of ore, fineness of the gold to be dissolved, amount of silver and state it is in, condition of pulp, whether of a granular or slimy product.

The concentrates are generally rich enough to treat by smelting. If they are of too low grade or too expensive shipping, it is possible in some cases to roast and retreat by cyanide.

The cyanide process is being used in various ways and in connection with other methods of treatment, viz.:

Dry roasting and leaching.

Sampling, dry crushing, roasting, leaching and concentrating.

Sampling, dry crushing, leaching, only partially concentrating, making a low grade concentrate, roasting the concentrates, and retreating by leaching the roasted concentrates.

Dry crushing coarse, leaching, regrinding, amalgamating and concentrating.

Wet crushing, amalgamating, cyaniding the tailings and waste.

Wet crushing, amalgamating, concentrating and treating the concentrate by cyanide.

The cyanide process is used in a number of places to treat old tailing dumps, and has proven a great success. In some sections tailings are treated for $1 per ton, total cost, and in one place as low as 60 cents per ton. The mode of treatment is similar to that used in leaching crude ore, but as a rule some neutralizing agent must be used.

Up to the present time the treatment of slimes or a very slimy ore in large quantities by the present mechanical arrangements now in use has been a commercial failure, nor have we now in actual running shape a mill which has installed a system that can be considered or called a continuous method of agitating and filtering, thereby giving a continuous flow of ore treated, like that coming from a stamp or concentrating mill. Such an experimental plant, located in Denver, is now being thoroughly tested, and if found to be successful will be capable of handling slimes, also be a continuous process, and therefore will become a great addition to the future success of the process.

CHLORINATION.

The Cripple Creek and Boulder county telluride ores are at present the best in the state for the chlorination process. The largest mills are:

	Tons per day.
The Colorado-Philadelphia Reduction Company, Colorado City	250
The Gillett Reduction Company, Gillett	75
The Kilton Reduction Company, Florence	40
The El Paso Reduction Company, Florence	100
The Delano Reduction Company, Boulder	50

It requires about the same kind of crushing machinery as mentioned for the cyanide dry crushing plant, but instead of crushing as fine, twelve to twenty mesh is all that is required, and by keeping the crushing coarse, the washing of the pulp in the chlorination barrel is more perfect.

Every chlorination plant must roast the ore before treatment, and the same roasters are used as those employed in cyanide mills or smelters, with the same methods of cooling the ore before going to the hoppers over the chlorination barrels. The barrels in use vary in size from the five-ton barrel, which is about five feet in diameter and nine feet long, weighing complete about ten tons, to the ten-ton barrel, six feet in diameter and fourteen feet long, weighing about eighteen tons. The shell of the barrel is made from heavy steel plate, with cast iron heads, well

bolted, all lined with heavy chemical sheet lead. In the barrel is a filter which consists of a sheet of perforated lead, wooden segments and asbestos cloth, all put in to please the man in charge.

The roasted ore is charged into the barrel with water to make it of the proper consistency, and the required amount of chloride of lime and sulphuric acid added. After the barrel is charged it is closed and revolved slowly from three to eight hours, then the solution containing the gold is drawn off through the filter into lead-lined settling tanks. The filtering and washing is assisted by air or water pressure.

Sulphur dioxide and hydrogen sulphide gas are used by some of the mills to precipitate the gold from the solution, and the liquor is passed through a filter press, where the gold slimes are collected, then dried, roasted and finally reduced into almost pure gold by melting with proper fluxes.

The other method used to precipitate the gold from the solution is to pass the liquor through pulverized charcoal, which is finally taken from the precipitating boxes and spread on large roasting pans made of cast iron, and the charcoal burnt off, leaving a gold residue, which is mixed with fluxes, melted and run into bars.

The chlorination mills use the same methods of concentrating the tailings as the cyanide mills.

The chemistry of both processes has been avoided, as this article is intended to touch only the practical and commercial sides of the subject.

The percentage of saving by the cyanide process compares favorably with the saving made by the chlorination, which is 85 and 95 per cent. of the assay value, some advantage being in favor of the cyanide process if the ore carries any silver, as the cyanide will recover from 70 to 80 per cent. of the silver values, where chlorination saves no appreciable percentage of the silver.

The custom at the present time in the majority of the Colorado cyanide and chlorination mills, is to build them of large capacity and to treat custom ore.

The general impression is that the day is not far distant when the question of roasting will be better understood, and the mining public will become better acquainted with the two named processes. Then the mine owner will build a mill of small capacity adapted to the mine, as is now practiced by the mine owner who builds and owns his own stamp or concentrating mill.

AMALGAMATION.

A large proportion of the gold ores susceptible to amalgamation, in whole or in part, is reduced by stamps, with centrifugal mills of variable patterns a good second. While no radical changes have occurred, the old custom of feeding the battery by hand is almost wholly replaced. New equipment of crushers, rolls and automatic feeders at the "head" of the

mill being quite common, and is now considered an essential part of the modern mill. The stamp battery as a reducing device has stood the test of generations, but its operation is almost as variable as the mills operated.

The old reliable slow-drop Gilpin county mill still holds sway in that region, and the question of utility as compared with the more modern compromise or quick-drop mills still remains unsettled except with the various patrons. What is known as the Gilpin county mill uses a 500-pound stamp, dropping sixteen inches, thirty times per minute. The mortar is deep, with high issue, and a large proportion of the gold is amalgamated within the mortar before reaching the plates. Notwithstanding adverse criticism and the charge of doing poor work and little of it, these plants continue business and the operators and patrons express their sympathy for their modern brethren who have followed recent customs. In this particular section there is grave doubt of the quick-drop, coarse-crushing mill making as high a saving as the slow-drop, fine-crushing mills. This can only be stated as a matter of opinion based upon somewhat extended investigation, owing to the fact that the different mills operate upon different ores so that absolute comparison can not be made. A number of stamp mills have been erected during the past year in various sections of the state and as previously stated differ materially in their method of operation. The tendency is, however, towards heavier stamps, faster drop and depending more upon the outside plates (the inside plates being often omitted) to collect the gold and the appended devices for concentration to recover the remaining values. The weight of stamps vary from 650 to 1,100 pounds, the drop from four to twelve inches and screens from twenty to sixty mesh. The amalgamation plates are with few exceptions silver plated, but vary in size and pitch to suit the ideas of the operator. An increase in use of plates in "launders" transmitting the ore from the plates to the concentrating tables is worthy of mention. As a rule these plates are placed in the bottom and sides, but occasionally wing plates are set in so that the pulp is partially stopped by each and thrown from one to the other. The recovery upon these secondary plates is variable, the most notable instance being an amount equal to operating expenses of the mill and claimed to have been entirely lost previous to their introduction.

The fact that absolutely free milling ores are very rare in Colorado is becoming more and more appreciated, and more attention is given to the recovery of values after the portion susceptible has been amalgamated, also to the commercial proposition as to whether a higher recovery from fine crushing and small tonnage is preferable to a lower recovery from coarser crushing and increased tonnage. In a number of cases the financial gain has been found favorable to the lower saving and increased tonnage, and values that ought to be recovered are thereby turned into the stream beds, not through ignorance but inability to increase milling capacity and necessity of making money to satisfy the stockholders.

CONCENTRATION.

The system of ore dressing known as concentration is one of the most important of all processes applied to the treatment of ores carrying low values in gold, silver, lead and copper. There is probably no other line of ore dressing so universally used or that has engaged the time, energy and means of so many persons of inventive tendencies. Each year is productive of a long series of new systems and mechanical devices calculated to save the gross mineral contents of low grade ores. Some inventors go so far as to claim their ability to recover, by a combination, even more than the values per ton, determined by fire assay to exist in the stock. It is but just to add that these inventors believe their statements to be true and at all times evince a desire for the opportunity to prove them.

Notwithstanding the immense sums expended and new devices introduced, all are in line with the early and original designs, differing only in the manner of application of principles involved. All, therefore, may be said to have merit, and their failure to make a fair success is largely due to over-confidence, a belief that all ores are amenable to the same treatment, and the neglect of the main features essential to success in concentration.

The theory of concentration is based upon the variable specific gravity of the different minerals. Its application is to separate the various metals, collect those having value and reject the remainder. The most simple of all processes to understand, the most difficult and exasperating to successfully manipulate. A pursuit paradoxical from beginning to end. A well designed plant may be a technical success and a financial failure—a financial success and a technical failure. All mills are good for some ores, but some mills are not good on all ores. In design and method of manipulation the mills must be as variable as the ores, and each mill must be adjusted and equipped to meet the requirements of one particular class of ore to meet with success. A successful concentration plant may be defined as one that converts a worthless ore into a product that will yield a profit over and above interest on investment, taxes, insurance, mining, transportation and operating expenses.

Under the above definition, numerous successful concentration plants are operating in various portions of the state. These practical results are attained in various ways. In some cases the mills are very simple, save a low percentage, but treat a large tonnage. In others the mills are more complicated and aim at a high percentage of saving from a low tonnage. These methods have been arrived at mainly through experience and embrace the most difficult problems to be solved in concentration. During the past decade these vexed questions have received more than ordinary attention from leading mining engineers, and comparative tables of results obtained from variable ores treated by different methods have been carefully compiled. These show practical results and afford those who make this research a business, a good ground for intelligently ad-

vising mills of proper design for the ores to be treated. While the past year in Colorado shows a marked improvement over former years, there is still a tendency to erect plants upon superficial investigation and results. The pioneers were largely excusable for mistakes made, but at the present time good counsel may be had upon reasonable terms. An individual may act as his own attorney and through the wisdom of the court succeed upon the ground of equity, but in concentration his case is one of belief, and a wrong guess means failure and a heavy financial loss.

A description in detail of the various methods employed in different sections of the state can not be entered into. A large proportion of the concentrates marketed are derived from the stamp mill tailings. When the value in tailings is in form of pyrite, chalcopyrite and galena, with gold and silver associated, the ore passes direct from the plates to different patterns of oscillating or bumping tables and the separation made. Where the base minerals occur in comparatively large crystals, the stamp battery is often preceded by crusher, rolls, sizing screens and hartz jigs, the jigs yielding a coarse concentrate and the tailings from jigs recrushed in battery, over the plates and tables. When the silver values occur in the form of fine disseminated crystals of the arsenical silver ores and not combined with the heavy sulphides, the methods pursued are more complicated. More attention is paid to crushing and "sliming" or mashing to an impalpable paste, more liable to occur with the more friable, and softer ores are avoided as much as possible by crushing coarse, removing the "fine," recrushing the coarse and continuing this process until the required fineness of the whole is obtained. The methods pursued with ores of this character are variable, some appearing to counteract the saving made by wear and tear of large and expensive plants, others go to the other extreme and attempt to recover too much in the slimers.

What is designed as a complicated plant is ore from crusher to rolls to sizing screens to jigs; coarse tailings from jigs to set of finishing rolls to second screen line joining fines from first jigs. From second screen line to second set of jigs; tailings to third set of finish rolls to battery of oscillating or bumping tables. Tailings from second set of tables to centrifugal buddles, stationary canvas tables or slimers of various designs. The utility of such a combination is questionable, but until better informed it must be assumed that the management know what they are doing.

The increased use of the canvas tables marks an advance for the past year. These tables are not new in Colorado but have been used to a very limited extent for ten or twelve years.

Another departure is the separation of the zinc from lead and iron sulphides and making a marketable zinc product as well as lead iron.

While it may be said that concentration has advanced during the past year, there is still room for improvement, and must be improved before some of the largest ore bodies can have commercial value.

It is regretted that the paper prepared at our request by Dr. Edmund B. Kirby, formerly a professor in the State School of Mines, at

Golden, and a recognized authority on concentration, could not be published on account of limited space. Dr. Kirby enters into the situation at length from a technical standpoint and explains fully the principles and history of concentration.

PYRITIC SMELTING OR FIRE CONCENTRATION.

Pyritic smelting, locally known as the "Austin Process," is practically fire concentration. This system is protected by letters patent of the United States in favor of Dr. W. L. Austin, of Denver, Colo. Its utility has been demonstrated by plants that have been successfully operated for several years, the largest being the Bi-Metallic smelter at Leadville, and can therefore be no longer considered an experiment.

Pyritic smelting or fire concentration occupies a rather unique position. It is neither a smelter nor a concentrator in the common application of the terms, yet it is both. The ores are fused in a furnace, the product, a copper-iron matte, containing the concentrated values, from which the silica is separated in a molten state.

The underlying principle of the Austin process is the utilization of the calorific power of ore. The ores, therefore, best adapted are pyrite, chalcopyrite, pyrrhotite and arsenopyrite, and these are so manipulated that they themselves form the fuel necessary to produce a molten liquid mass. The primitive and still common use of this power is shown in "heap roasting." The sulphide ores are piled, covered and fired with wood. Once ignited, the whole mass continues to burn until the sulphur is practically eliminated and the iron is converted into an oxide. The application of this principle to a smelting furnace so that the process may be rapid and automatic is what is now well known in Colorado as the Austin process.

A plant for this purpose is in plan of construction and mechanical appurtenances similar to the ordinary lead smelter, minus roasting and calcining furnaces. The water jacket furnace is larger, narrower and shallower, the blast more powerful and passed hot through the tuyers. The ore charge is calculated to produce a free-running slag and with the matte runs continuously into one or more settling vats. The matte with values settles to the bottom and is drawn off in pots and poured into moulds, the overflowing slag being usually granulated and run off in troughs with water.

The essential ore for successful operation and utilization for fuel purposes is pyrite, the usual proportion being four tons of pyrite to one of silica. This proportion is, however, varied to suit conditions, if lime and like ores are obtainable. When gold values exist in the ores, the charge should have at least 1, but better 3 per cent. of copper. The custom generally followed is to pass the matte obtained through the furnace the second time. The first matte product is a concentration of values of from 5 to 10 into 1. The expense of second smelting is more than

offset by affording an increased charge of high grade silicious ores and generally advantageous to the entire charge for reasons that will not be entered into. The result of second smelting effects a concentration of values about double that first obtained and may be still further concentrated if deemed advisable. Lead ores carrying an appreciable amount of lead are not suited, although 2 to 4 per cent. can be handled, the lead, however, being lost. Zinc ores are not desirable if the charge exceeds 10 to 12 per cent., but when other ores are available the percentage of zinc can be reduced.

The practical recovery or saving of values effected varies from 90 to 96 per cent. of the gross contents. The matte product or concentrate is in turn subject to transportation and treatment charges. The cost per ton for reducing to matte depends upon existing conditions at the plant, and therefore varies from $2 to $6 per ton.

Some of the advantages of this system may be stated as follows: Large bodies of sulphide ores, too low in values to market direct, too compact to admit of ordinary concentration, may be made profitable by this method of concentration. Such bodies are especially valuable if the sulphide has a fair percentage of copper by permitting the addition of silicious ores carrying gold to the charge. No roasting appliances being required, the cost of plant is reduced. The ore may be transported direct from the mine to the stack, requiring no crushing beyond what is usual for handling in a tram car. By the utilization of the sulphides themselves as a smelting fuel, this expense is greatly reduced. Its application and utility have passed the experimental stage and can be accurately determined before plant is constructed if proper advice is procured.

To those who have asked this department for the technical results obtained in Colorado from the practical application of the Austin process, no answer can be made beyond the statement that its use is being extended and it must be assumed that it is giving satisfactory returns. In common with all processes much time and money have been expended in working out the problems incident to commercial pyritic smelting, and those who have done so evince no desire to make their experience public property without remunerative return.

SMELTING.

The smelting industry of the state furnishes a striking example of western enterprise. From the establishment of the first successful plant in 1868 to the present time, the advance has been rapid, and to-day finds Colorado one of the recognized smelting centers of the world.

Prior to the advent of railroads, smelting plants were erected in various sections of the state, but these have gradually given way to more central points, possessing good transportation facilities to various mining districts that afford a large assortment of ores from which to choose an economic mixture. Pueblo, Denver, Leadville and Durango are now the

great smelting points. The Durango plant draws its main supply from the San Juan region; the others vie for ores from all districts. The result of close competition for ores has gradually reduced the prices for treatment, led to the introduction of various mechanical and labor-saving devices and the use of the most modern and advanced methods.

A description of the various smelters now operating would only prove interesting to those interested in like pursuit, and will, therefore, be omitted at this time for the more practical question of the ore market.

COLORADO ORE MARKET.

Inquiries relative to the methods pursued for the determination of values contained in ores, manner of settlement, prices paid, etc., etc., etc., are of frequent occurrence. These questions in the main emanate from non-residents, who have mining interests in the state and seem to feel that the value fixed upon ore is largely a matter of caprice with the smelters or ore buyers. To correct this erroneous impression, a brief description, general in character, will suffice.

What is known as "ore sampling" or "sampling" is the determination of values in ores placed on the market. This process consists of so mixing the ore that the final portion taken to the assayers is an average of the whole.

The methods pursued for obtaining this homogeneous mixture are largely dependent upon the character of the ore being treated. For illustration, what is known as a "spotted ore" will be traced through. A spotted ore is one having finely disseminated "spots" of high grade ore scattered through a comparatively barren gangue. Free gold in small "spots" throughout a barren quartz would be called "spotted ore." Ores of this character, after being received and carefully weighed, are passed through a rock breaker or crusher to rolls and so reduced that the whole will pass through a revolving screen, having four openings to a square inch. When thus reduced in size, the ore mass is reduced in bulk, usually one-tenth being separated and piled separately. This reduction or separation is effected in various ways, but generally by an automatic device that takes out one and permits nine-tenths to pass to storage bins. The most simple method and one used almost entirely by some plants upon "spotted ores" is to discharge the crushed ore upon a working floor, from where it is removed as fast as it is discharged, by men with shovels. If a tenth part is being separated, every alternate tenth shovelful is thrown to one side. The same method is applied if a fifth, twentieth, or any desired proportion is wanted. The tenth part, if still considered too large, may be further reduced by the same method. When the desired reduction is made, the ore is still further reduced in various ways, the most common being the use of a "split" shovel, or by "quartering." A split shovel is practically a long narrow shovel, usually calculated to hold an amount

equal to one-fifth or one-tenth of an ordinary shovelful. When a split shovel is used it is held by one man and the ore from the pile is pitched squarely upon it. The amount caught is placed alternately in two piles, one being designated as the original and the other the duplicate sample. If these samples are still too large they are further reduced, and the operation continued until each does not weigh to exceed 100 to 400 pounds, the amount being governed by the quantity of ore being sampled. If the quartering system is used, the segregated one-tenth is first shoveled into a cone, care being taken that each shovelful is poured upon the center and the ore allowed to distribute itself upon all sides of a cone thus raised. When coned the ore is scraped down, commencing at the bottom of the pile and raking same outward, thus forming a large circle of ore three to six inches deep. Then a marker is taken, usually a wooden straight-edge, and slid back and forth across the center of the pile, making a plain mark and dividing the ore into quarters or four equal parts. The two opposite quarters are then wheeled off to the storage bins and the remaining quarters are reconed again and raked down and the pile again reduced in same manner. As the bulk becomes smaller, the ore is often reconed several times before removing opposite quarters to insure a thorough mixture. When the pile has been reduced sufficient to transfer to sample room proper, it is coned and opposite quarters taken, one being designated as the original and the other the duplicate sample.

In the sample room proper, the ore is passed through finish rolls and crushed so it will all pass through an eight-mesh screen. It is then placed on an iron floor, coned and reconed and reduced further by removing opposite quarters until each sample has only from ten to forty pounds, this amount being largely in accordance with the wish of the owner of the ore. When reduced to this stage the sample is taken to another room and, after drying, passed through a grinding mill that reduces the sample to a fine pulp, or so that it will all pass through a screen, varying from 60 to 200-mesh, this being also governed by the desire of the owner. When passed through this screen the powdered ore is placed on a "blanket," usually a piece of oil cloth, and rolled back and forth until thoroughly mixed. Still further reduction in bulk is made by quartering, spreading and taking small amounts all over the spread out mass, or by an automatic device that cuts out several sections in the ore when passed over it. The final sample weighs from two to ten ounces. These are usually cut out in triplicate or more, any one of which the owner may choose, the buyer takes one of the others and the remaining samples are filed to await settlement. Both the buyer and seller have their samples assayed and the value per ton determined. If the assay results agree, a settlement for ore is made. If the two sets of assays differ but little, settlement is usually effected by a "split," that is, an average of the two. If the assays differ materially, both buyer and seller have their assays repeated, and should the differences remain the same, the filed sample is introduced and submitted to an

assayer mutually agreed upon, who is called an "umpire" and whose results are usually final.

In low grade sulphide and iron ores, the ore is often reduced in bulk before crushing, only the segregated part being passed through the crushing machinery. After reaching the sample room proper the operation is similar on all ores, regardless of grade.

Up to the time of accepting settlement all ore remains the property of the seller. He is at all times requested to be present and watch the weighing, sampling and taking of moisture sample, and if in any manner dissatisfied, which rarely happens, he may have all the ore again placed on the car and ship same to another plant.

All of the reduction works of the state have well equipped sampling departments, but those who do not desire to ship to a buyer direct can consign their ores to the public samplers. These plants are conducted on the commission basis and charge from 75 cents to $1.50 per ton for sampling and selling the ore. Their methods of sampling are the same as above described and their samplers are submitted to the various smelters for bids, the public samplers guaranteeing their samples and weights to be accurate.

The oft-repeated charge that reduction plants systematically rob the ore producers is without foundation. Reduction plants, as a rule, represent large investments and their financial success is largely and in most cases wholly dependent upon public patronage. As a strictly business proposition, therefore, they can not afford to be otherwise than upright in their dealings with customers. Nothing in the work relative to ascertaining the value in ore is hidden, and inspection of same is requested rather than avoided. Settlements are made in accordance with contract, and after settlement the recovery of amount paid for ore is a matter that only interests the ore buyer.

The value of ores is primarily dependent upon the market price of metals upon the day of settlement, New York quotations governing the ore market. Having ascertained by assaying, sampling and weighing, the amount of metals contained in ores, settlements are then adjusted in accordance with contract or character of ore. In cyanide, chlorination and like plants, the ores are limited in character and are paid for upon a "flat" basis, i. e., so much for gold, less a fixed price for treatment. These rates for treatment range from $5 to $10 per ton for ore delivered at works, the price being governed by value. Gold is generally calculated at $20 per ounce, and the above rate applies on a sliding scale from three-quarters to two ounces gold per ton in ores.

The ores marketed at smelters cover all known mineral combinations, and the charges for treatment are nearly as variable as the ores treated. For this reason no fixed price for treatment is possible, but each ore is rated in accordance with its gold, silver and lead value and associated minerals. Zinc, for example, is termed refractory, and its presence in considerable quantity adds to the price of treatment. Iron, on the other hand, if it exceeds the silica in percentage, is paid for or

reduces the treatment charge. Iron, however, may be in either an oxidized or sulphide form, the latter requiring roasting, the former can be used raw, and the two kinds of iron are, therefore, subject to different schedule prices. The various combinations, with differences as in iron, could be extended indefinitely, and iron is quoted for the purpose of showing that the smelter charge must be made to fit the ore and no fixed schedule can be stated.

In a general way ores are divided into classes known as lead, sulphide and silicious. Gold is paid for at rate varying from $19 to $20 per ounce; silver at rate of 95 per cent. of New York quotation, and lead in accordance with percentage calculated on market quotations. The charges on lead ores vary from $10 per ton to free treatment; sulphide ores from $12 to $1.50 per ton, and silicious ores from $5 to $12 per ton.

PETROLEUM.

Evidences of petroleum are found in several sections of the state, but the only developed field is at Florence, in Fremont county. The first well was bored in 1883. For a number of years prior to that time, "oil springs" had been worked in a small way for local consumption. More extended operations were instituted in 1887, and from that time until the present the production has gradually increased.

There are three companies in operation and two refineries, with a combined capacity of 2,000 barrels per day. The crude oil yields about 35 per cent. of illuminants and occurs in a shale bed of unknown thickness, apparently in reservoirs at depths ranging from 1,100 to 2,400 feet. The pressure in none of the wells is sufficient to bring the oil to the surface and pumping in all cases is necessary.

The residue of the refined product is partially made into lubricants, but the present demand for it for steam-making purposes is in excess of the supply.

About ten square miles of territory have been developed, and thirty-five wells are producing at the present time, employing an average of 100 men. The production for 1897 was 650,000 barrels (42 gallons), which will probably be increased by the new wells now sinking. There are a number of wells producing gas under good pressure and this is used locally for domestic purposes.

STONE AND MARBLE.

The supply and variety of building stones in Colorado exceeds that of most any other state. Granite in many varieties, sandstones of all colors and texture, lavas, limestones and marbles of all colors and grades exist in large quantities, and afford the builder a choice of material

seldom equaled. The existence of stone does not always imply value for building or decorative purposes, and it may be said that while stone is everywhere abundant, stone quarries are few. The term stone quarry implies not only a place where stone is quarried, but a stone that possesses when in place resistance sufficient to sustain great weight, to withstand atmospheric action and to also possess and retain a color and texture pleasing to the eye. This may be exemplified by the statement that while the Colorado Front and other mountain ranges are almost entirely of granite, good granite quarries are less frequent than any other building stone in the state.

Along the base of these mountain ranges are found the exposed sedimentary beds indurated by heat to any desired degree. Not only this, but the upheaval of the mountain chains through these beds carried them up as far as they would reach, the upper ends being broken and afterwards eroded away, leaving along the bases a series of tilted beds. What now remains has a slight dip from the mountains and affords good floors for removing stone on a down-hill grade. These remaining ridges or hogbacks usually occur in a series, one back and above the other, with comparatively level glades or gulches intervening, thereby making them easy of access for roads to transport product. For economical extraction the conditions surrounding the stone deposits could not be bettered.

Reference to chapters upon various counties will disclose an oft-repeated statement of "large resources in building stones, but not developed beyond supplying local demand." The state abounds in quarries, but the stone industry, as a great resource, is as a whole little developed. The proper opening and equipping of a quarry requires both time and money, and its operation demands first a market and next cheap transportation facilities in order to meet competition. The home market is comparatively limited and large operators must look to more populous centers for purchasers of the product. This has been done to a limited extent, but the difference in freight rates, cost of labor and supplies, as compared with eastern quarries, has placed Colorado at a great disadvantage, and that stone has been marketed in the East is wholly due to its superiority over any other to be had. The same causes assigned in the short chapter on "Manufacturing" elsewhere in this report, as retarding the advancement of existing resources below a point justified by merit, are likewise true of the stone industry.

A visit to the various cities and towns throughout the state will best demonstrate the variable character and quality of existing stone deposits. A majority of the large public buildings are built of stone, and a visitor would be very non-observant not to notice the varied contrasts in color, texture and general finish.

The State Capitol building is a granite monument from the quarries in Gunnison county. While this granite was chosen by the State Capitol managers, the difference in favor of Gunnison over the granites of Fremont, Chaffee and Jefferson counties was very slight. In Larimer and

Boulder counties the stratified sandstones, used for curbing and sidewalks, are well known on account of ability of quarries to produce stone of almost any desired thickness or size, and their somewhat extended use in eastern cities. These same stones are found in other counties, but at present are less accessible to transportation and market.

Marble is another abundant resource of the state. The grade varies from a coarse grain impure marble to one of the finest produced anywhere. The best marble is found in Gunnison and Pitkin counties, and for purity and color compares favorably with the noted Carrara marble. Near this band are others of poorer quality and variable colors. Good marble exists in nearly all the counties forming the west half of the state, but the best developed, in addition to those mentioned, are in Chaffee, Fremont, Garfield, Boulder, Larimer, Huerfano and Pueblo counties. If marble be defined as any character of limestone, capable of being polished and used for architectural purposes, the state's resource in marble is very great.

The sandstone quarries reporting are divided as follows: Larimer county, Gray, Carlson and Frey, at Stout; Gray, Trowbridge, Low, Callahand and McWorter, at Arkins; American Red Sandstone Company, at Bellevue; Cliff, Finger, Kane, Metcalf and Welsh, tributary to Fort Collins. In Boulder county, Wenberg, Johnson, Plate, Olson, Heglof, Monks, Matson, Davidson, Lonkoven, Cheney, Ground, Hutchinson, Cheney & Co. and Anderson, at Lyons. In Las Animas county, Wienvroeer and Metcalf. In Fremont county, Harding Stone and Mining Company, near Cañon City. In El Paso county, Seldomridge & Durkee and Ord, near Colorado Springs. The American Red Stone Company, M. H. Rogers, Greenlee & Sons and Sites & Buell have main offices in Denver and operate sandstone quarries in various sections.

The limestone quarries reporting: In La Plata county, Bell, Ramsey, Stubbs and Jakway, near Durango; Lacount, near Rockwood; Alexander, Loftus and Hendrickson, near Animas. In Boulder county, Shaltenbrand, near Boulder. In Fremont county, Colorado state penitentiary, near Cañon City; Cavenaugh, at Wellsville. In Jefferson county, Quick and Company, near Golden; Johnson, Kirby, McLean, Ross, near Morrison. In Pitkin county, Miller Creek Company, near Meredith. In Larimer county, Peterson, near Stout. The Colorado Lime and Fluxing Company, W. R. Harp, Garfield & Company and The Leadville Lime and Fluxing Company have main office in Denver and operate quarries in various sections. A large proportion of the limestone quarried is used for flux by the smelters.

The granite quarries reporting: In Chaffee county, Western Granite Company, near Buena Vista; Bowen, Geddis & McCutcheon, near Salida. In Fremont county, Gilman, near Cotapaxi. In Douglas county, Castle Rock Stone Company, near Castle Rock, main office in Denver. In Gunnison county, McGilvray & Company, near Gunnison. The Geddis & Seerie Stone Company and J. D. McGilvray & Company have large yards in Denver and operate granite and other quarries in various sections.

In marble: The Denver Onyx and Marble Company have headquarters at Denver and operate quarries in Fremont, Pueblo and Gunnison counties. In Gunnison county the marble is sawed prior to shipment. The Fremont Marble Company, at Cañon City, Fremont county, has large quarries and produces a great variety of marbles. The Lyster quarry, near Aspen, in Pitkin county, is a comparatively new discovery, said to be of superior grade and is now being equipped with machinery.

The above list is by no means complete, but represents the more active and best developed quarries. Effort has been made to secure reliable data upon the production for 1897, but for various reasons the returns are so incomplete that even an estimate is impracticable. It is gratifying to be able to report, however, that during the past year the stone industry has shown more activity than at any time since the depression of 1893.

CLAYS.

The clay resource of Colorado is both great and varied. Its development has kept pace with the growth of the state and in some branches the superiority of the manufactured product has caused a growing demand from other sections. In common with building stone, good clay occurs in a majority of the counties throughout the state. It is utilized for the manufacture of common and pressed brick, vitrified paving and ornamental brick, drain tile, sewer pipe, ornamental terra cotta, floor tile, roofing tile, hollow building tile, pottery, fire brick and assayers' supplies, such as furnace linings, scorifiers and crucibles. Detail of this important resource can not be entered into, but a list of the number of firms engaged by towns will show its distribution: Boulder, 4; Brighton, 2; Buena Vista, 2; Cañon City, 2; Colfax, 1; Colorado City, 2; Colorado Springs, 2; Cripple Creek, 2; Denver, 27; Delta, 1; Durango, 2; Eaton, 1; Emma, 1; Florence, 3; Fort Collins, 2; Fort Lupton, 1; Fort Morgan, 1; Fraser, 1; Fruita, 2; Gillett, 1; Glenwood Springs, 2; Golden, 4; Grand Junction, 3; Greeley, 1; Idaho Springs, 1; La Junta, 1; Lamar, 1; Leadville, 1; Loveland, 6; McFerren, 1; Montrose, 1; Orson, 1; Ouray, 2; Piceance, 1; Platteville, 1; Pueblo, 5; Parkdale, 1; Rocky Ford, 1; Silver Cliff, 1; Trinidad, 4; Valverde, 1; Villa Park, 3.

The above places, with few exceptions, are all in different counties, and the list is by no means complete. For reasons best known to operators, requests for production are in a great measure ignored and thereby prevents compilation of the state's output.

MINERAL SPRINGS.

Comparatively few counties in the state are without mineral springs. Taken collectively, they present a large and varied class of both hot and cold waters, and it is often asserted that Colorado can duplicate any mineral spring of merit in the world. This assertion, while broad, can not, as yet, be either affirmed or denied. Of the comparatively few that have been analyzed, the waters compare favorably with those of the most noted watering places, but taken as a whole, this resource of the state is little developed. The following analyses show the character and location of the best known springs:

PORTER'S SPRING.

DENVER, ARAPAHOE COUNTY.

Temperature, 60°; Porter's resort.

Constituents:

Sodium carbonate	9.97
Calcium carbonate	17.63
Magnesium carbonate	1.71
Iron carbonate	2.57
Sodium sulphate	47.23
Potassium sulphate	0.52
Sodium silicate	1.54
Sodium sulphide	3.27
Sodium chloride	9.14
Magnesium	1.96
Ammonia	Trace
Total parts in 100,000	95.54

E. J. MALLETT, JR., Analyst.

PAGOSA SPRINGS.

ARCHULETA COUNTY.

Number of springs, 4; temperature, 148° F.; resort.

Constituents:

	No. 1.	No. 2.	No. 3.	No. 4.
Sodium carbonate	4.70	3.33	....	....
Calcium carbonate	59.00	59.50	54.51	58.73
Magnesium carbonate	4.85	3.92	3.68	3.59
Lithium carbonate	0.71	Trace	Trace	Trace
Sodium sulphate	221.66	220.20	223.92	224.59
Potassium sulphate	7.13	6.98	6.63	7.10
Sodium chloride	29.25	29.36	31.21	29.81
Silica	5.70	5.21	5.53	3.82
Organic matter	Trace	Trace	Trace	Trace
Total parts in 100,000	333.00	328.50	325.48	327.64

OSCAR LOEW, Analyst.

BOULDER IRON AND EFFERVESCENT SPRING.

CRISMAN STATION, BOULDER COUNTY.

Constituents:

Silica	6.240
Sulphate of lime	149.223
Sulphate of potassa	9.997
Sulphate of soda	123.703
Chloride of magnesium	25.193
Chloride of sodium	98.609
Bicarbonate of iron	4.932
Bicarbonate of soda	213.160
Parts in 100,000	631.057

REGIS CHAUVENET, Analyst.

SELTZER MINERAL SPRINGS.

SPRINGDALE, BOULDER COUNTY.

Number of springs, 3; resort and used commercially.

Constituents:

Sodium carbonate	9.37
Calcium carbonate	74.29
Magnesium carbonate	1.14
Iron carbonate	6.86
Sodium sulphate	184.46
Sodium silicate	6.86
Sodium chloride	8.51
Sodium iodide and sodium bromide	2.23
Total parts in 100,000	293.72

C. T. JACKSON, Analyst.

IDAHO SPRINGS.

IDAHO SPRINGS, CLEAR CREEK COUNTY.

Constituents:

	High Rock.	Bathing Springs.
Silica	6.550	6.100
Sulphate of lime	47.590	46.410
Sulphate of potassa	13.450	12.300
Chloride of magnesium	7.890	6.623
Chloride of potassium	0.425	2.060
Bicarbonate of iron	0.921	0.614
Bicarbonate of magnesia	11.278	12.342
Bicarbonate of soda	177.948	174.667
Parts in 100,000	266.052	261.116

REGIS CHAUVENET, Analyst.

IDAHO HOT SODA SPRINGS.

IDAHO SPRINGS, CLEAR CREEK COUNTY.

Temperature, 85° to 120° F,; resort.

Constituents:	
Sodium carbonate	52.81
Calcium carbonate	16.32
Magnesium carbonate	4.94
Iron carbonate	7.07
Sodium sulphate	50.34
Magnesium sulphate	32.09
Sodium silicate	6.99
Sodium chloride	7.13
Total parts in 100,000	177.69

I. G. POHLE, Analyst.

CHALK CREEK HOT SPRINGS.

NEAR HAYWOOD, CHAFFEE COUNTY.

Chalk Creek springs; temperature, 150° F.

Constitutents:	
Potassium carbonate	0.23
Calcium carbonate	3.35
Magnesium carbonate	1.08
Sodium sulphate	10.58
Sodium silicate	4.45
Potassium chloride	1.09
Silica	3.49
Lithia	Trace
Organic matter	Trace
Total parts in 100,000	24.27

GEORGE E. PATRICK, Analyst.

PONCHA SPRINGS.

PONCHA, NEAR SALIDA, CHAFFEE COUNTY.

Number of springs. 100+; temperature, 90° to 168° F.; resort.

Constituents:	Poncha. No. 1.	Keg. No. 2.	Arbor. No. 3.	Tank. No. 4.
Silica	5.38	6.59	7.52	7.66
Sulphate of lime	10.71	10.71	10.71	10.71
Sulphate of soda	4.03	4.03	4.03	4.03
Chloride of potassium	.86	.86	.86	.86
Chloride of sodium	3.99	3.99	3.99	3.99
Iron carbonate	0.52	0.52	0.52	0.52
Sodium carbonate	39.34	39.34	39.34	39.34
Total parts in 100,000	64.83	66.04	66.97	67.11

REGIS CHAUVENET, Analyst.

HOT SPRINGS.

SOUTH FORK OF NAVAJO RIVER SOUTHWEST OF BANDED PEAK, CONEJOS COUNTY.

Navajo springs, temperature, 80° F.

Constituents:

Calcium carbonate	10.20
Magnesium carbonate	17.10
Calcium sulphate	61.50
Total parts in 100,000	88.80

OSCAR LOEW, Analyst.

MINERAL SPRINGS.

NEAR DEANSBURY, DOUGLAS COUNTY.

Constituents:

Silica	3.230
Sulphate of lime	107.633
Sulphate of strontia	3.338
Chloride of magnesium	1.761
Chloride of potassium	3.037
Chloride of sodium	228.963
Chloride of calcium	289.654
Parts in 100,000	637.616

REGIS CHAUVENET, Analyst.

MANITOU SPRINGS.

MANITOU, EL PASO COUNTY.

Number of springs, 9; temperature, 43° to 60° F.; resort.

Constituents.	Ute Iron.	Little Chief.	Manitou.	Navajo.	Ute Soda.	Shoshone.
Sodium carbonate	59.34	15.16	52.26	124.69	23.82	88.80
Calcium carbonate	59.04	75.20	111.00	129.40	40.00	108.50
Magnesium carbonate	14.56	13.01	20.51	31.66	6.10	
Lithium carbonate	Trace	Trace	0.21	0.24	Trace	Trace
Iron carbonate	5.78	1.80	Trace	.....	1.40	.....
Sodium sulphate	30.86	51.88	19.71	18.42	12.24	37.08
Potassium sulphate	7.01	6.24	13.35	16.21	Trace	5.12
Sodium chloride	31.59	47.97	40.95	39.78	13.93	42.12
Silica	2.59	2.22	2.01	1.47	Trace	Trace
Total parts in 100.000	210.87	213.48	260.00	361.87	97.47	286.62

OSCAR LOEW, Analyst.

CANON CITY SPRINGS.

CANON CITY, FREMONT COUNTY.

Number of springs, 5; temperature, 57° to 104°; resort.

Constituents.	Iron Duke.	Little Duke.	Big Ute.	Aqua Vida.	Congress.	Hot.
Sodium carbonate	0.1267	0.1266	0.0594	0.1258	0.0332	0.0119
Calcium carbonate	0.0535	0.0374	0.0732	0.0678	0.0482	0.0553
Magnesium carbonate	0.0249	0.0234	0.0257	0.0302	0.0300	0.0211
Sodium sulphate	0.0201	0.0207	0.0280	0.0249	0.0310	0.0134
Sodium chloride	0.1372	0.1956	0.2258	0.2070	0.0652	0.0301
Total parts in 100.	0.3626	0.4040	0.4122	0.4559	0.2063	0.1320

OSCAR LOEW, Analyst.

YAMPAH SPRINGS.

GLENWOOD SPRINGS, GARFIELD COUNTY.

Resort.

Constituents:	Grains.
Chloride of sodium	1089.8307
Chloride of magnesium	13.0994
Bromide of sodium	0.5635
Iodide of sodium	Trace
Fluoride of calcium	Trace
Sulphate of potassa	24.0434
Sulphate of lime	82.3861
Bicarbonate of lithia	0.2209
Bicarbonate of magnesia	13.5532
Bicarbonate of lime	24.3727
Bicarbonate of iron	Trace
Phosphate of soda	Trace
Biborate of soda	Trace
Alumina	Trace
Silica	1.9712
Organic matter	Trace
Total solids in one U. S. gallon of 231 inches of water	1250.0411

CHARLES F. CHANDLER, Ph. D., New York, Analyst.

HOT SULPHUR SPRINGS.

MIDDLE PARK, GRAND COUNTY.

Number of springs, 22; temperature, 91° to 117° F.; resort.

Constitutents:	Spring No. 1.	Spring No. 2.	Spring No. 3.	Spring No. 4.	Spring No. 5.	Spring No. 6.
Sodium carbonate	58.57	50.45	20.37	29.42	39.37	22.42
Calcium carbonate	10.08	....	....	8.46	3.68	6.43
Magnesium carbonate	6.57	4.14	....	2.66	1.93	....
Sodium sulphate	8.48	8.97	17.53	14.25	9.85	25.11
Potassium sulphate	0.50	0.07	1.03	7.03	0.96	1.69
Magnesium sulphate	....	....	5.26	....	0.96	....
Sodium silicate	....	1.46	....	....	....	....

Sodium chloride	14.61	....	13.29	12.18	13.97	13.11
Silica	....	....	0.61	0.54	1.31	1.36
Magnesia	....	Trace	....	....	....	....
Lithia	Trace	Trace	Trace	....	....	....
Iron	Trace	Trace	Trace	Trace	Trace	Trace
Ammonia	....	....	Trace	Trace	Trace	Trace
Carbonic acid (free)	2.94	....	8.42	0.42	9.49	4.69
Total grains per gallon	101.75	65.09	66.51	74.96	80.56	74.81

E. J. MALLET, JR., Analyst.

TRIMBLE HOT SPRINGS.

TRIMBLE, LA PLATA COUNTY.

Temperature, 130° F.; one litre of mineral water contains the following:

Silicic acid	80 milligrames
Carbonate of iron	56 milligrames
Carbonate of calcium	980 milligrames
Carbonate of magnesia	18 milligrames
Carbonate of potash	Trace
Carbonate of sodium	21 milligrames
Carbonate of baryta	Trace
Sulphate of iron	15 milligrames
Sulphate of calcium	809 milligrames
Sulphate of magnesia	201 milligrames
Sulphate of copper	Trace
Sulphate of alumina	3 milligrames
Sulphuric acid	726 milligrames
Carbonic acid	436 milligrames
Chloride of sodium	181 milligrames
Chloride of calcium	105 milligrames
Chloride of magnesia	84 milligrames
Chloride	56 milligrames
Iodide	None
Bromide	None

ESTES PARK SPRINGS.

ESTES PARK, LARIMER COUNTY.

Number of springs, 2; temperature, 58° F.; resort.

Constitutents:	River Spring.	Ranch Spring.
Calcium carbonate	2.84	6.89
Magnesium carbonate	2.01	1.83
Iron carbonate	6.66	3.12
Potassium sulphate	0.99	1.09
Sodium chloride	1.31	1.32
Silica	0.78	0.99
Alumina	Trace	Trace
Organic matter	1.79	2.06
Total parts in 100,000	16.38	17.30

C. F. CHANDLER, Analyst.

LIBERTY HOT SPRINGS.

WAGON WHEEL GAP, MINERAL COUNTY.

Number of springs, 3; temperature, 140° to 150° F.

Constitutents:	No. 1.	No. 2.	No. 3.
Sodium carbonate	69.42	Trace	144.50
Calcium carbonate	13.08	31.00	22.42
Magnesium carbonate	10.91	5.10	
Lithium carbonate	Trace	Trace	Trace
Sodium sulphate	23.73	10.50	13.76
Potassium sulphate	Trace	Trace	Trace
Sodium chloride	29.25	11.72	33.34
Silica	5.73	1.07	4.75
Organic matter	Trace	Trace	Trace
Sulphuretted hydrogen	Trace	12.00	....
Total parts in 100,000	152.12	71.39	218.77

OSCAR LOEW, Analyst.

WAGON WHEEL GAP SPRINGS.

WAGON WHEEL GAP, MINERAL COUNTY.

Constitutents:	No. 1. 150° F.	No. 2. Cold.	No. 3. 140° F.
Sodium carbonate	69.42	Trace	144.50
Lithium carbonate	Trace	Trace	Trace
Calcium carbonate	14.08	31.00	22.42
Magnesium carbonate	10.91	5.10	22.42
Potassium sulphate	Trace	Trace	Trace
Sodium sulphate	23.73	10.50	13.76
Sodium chloride	29.25	11.72	33.34
Silicic acid	5.73	1.07	4.72
Organic matter	Trace	Trace	....
Sulphuretted hydrogen	Trace	12.00	....
Total parts in 1,000	152.12	71.39	218.77

LIEUT. G. M. WHEELER, U. S. A., Analyst.

HARTSEL HOT MINERAL SPRINGS.

HARTSEL, PARK COUNTY.

Number of springs, 5; temperature, 105° F.; resort.

Constitutents:	
Sodium carbonate	130.55
Calcium carbonate	19.89
Magnesium carbonate	11.09
Sodium sulphate	9.69
Sodium chloride	165.03
Potassium chloride	32.58
Silica	0.92
Alumina	0.65
Sulphur	Present
Total parts in 100,000	370.40

GEORGE E. PATRICK, Analyst.

PARNASSUS SPRINGS.

NEAR BUELAH, PUEBLO COUNTY.

Number of springs, 5; temperature, 59° to 71° F.

Constitutents:	No. 1.	No. 2.	No. 5.
Sodium carbonate	126.04	118.45	73.32
Calcium carbonate	71.00	54.54	46.91
Magnesium carbonate		22.43	17.03
Lithium carbonate	Trace	1.78	0.15
Iron carbonate	1.54	2.23	2.75
Sodium sulphate	8.78	3.98	3.28
Potassium sulphate	9.22	18.44	14.54
Sodium chloride	102.96	104.13	53.23
Silica	4.21	7.94	6.00
Organic matter	Trace	Trace	Trace
Sulphuretted hydrogen	....	....	Trace
Carbonic acid	In excess	In excess	In excess
Total parts in 100,000	333.75	333.92	217.21

OSCAR LOEW, Analyst.

CARLISLE SPRINGS.

NEAR BEAVER CREEK, PUEBLO COUNTY.

Temperature, 65° F.

Constitutents:	
Sodium carbonate	15.42
Calcium carbonate	38.40
Magnesium carbonate	19.52
Iron carbonate	0.51
Sodium sulphate	34.28
Potassium sulphate	1.20
Sodium chloride	19.30
Silica	Trace
Organic matter	Trace
Total parts in 100,000	128.63

OSCAR LOEW, Analyst.

STEAMBOAT SPRINGS.

NEAR STEAMBOAT SPRINGS, ROUTT COUNTY.

Number of springs, 30; resort.

Constituents.	Pavilion.	Sweet.	Bubbling.	Bitter and Riverside.	Upper Steambt.
Silica	2.880	1.78	2.620	2.68	2.830
Bicarbonate of iron	0.506	0.34	0.396	1.79	0.756
Magnesium chloride	20.428	13.46	14.505	11.84	13.060
Potassium chloride	9.167	.....	.....	17.89	.....
Sodium chloride	38.010	125.37	193.130	201.77	216.830
Bicarbonate of soda	202.452	347.16	423.417	554.65	452.185
Bicarbonate of lime	73.840	.....	.....	.....	.....

Sulphate of lime.....	44.44	49.810	39.17	41.840
Sulphate of potassa..	20.47	27.306	5.16	27.150
Sulphate of soda.....	3.55	16.117	.....	27.370
Bicarb. manganese...	0.46	0.354	.....	0.354
Parts in 100,000....347.283	557.03	727.655	834.95	782.375

REGIS CHAUVENET, Analyst.

VALLEY VIEW HOT SPRINGS.

SAGUACHE COUNTY.

Constitutents:	
Silica	1.810
Sulphate of lime	10.103
Chloride of potassium	0.288
Bicarbonate of iron	0.245
Bicarbonate of magnesia	8.704
Bicarbonate of soda	0.808
Bicarbonate of lime	8.683
Total parts in 100,000	30.641

REGIS CHAUVENET, Analyst.

DILLON MANGANESE SPRINGS.

DILLON, SUMMIT COUNTY.

Constitutents:	
Silica	1.78
Bicarbonate of iron	0.31
Calcium sulphate	18.15
Potassium chloride	10.08
Bicarbonate of soda	104.35
Bicarbonate of manganese	0.38
Bicarbonate of magnesia	12.04
Bicarbonate of lime	56.13
Bicarbonate of potassa	13.87
Total parts in 100,000	217.09

REGIS CHAUVENET, Analyst.

In addition to the above there are numerous springs in various sections of the state, with few exceptions unimproved, but nevertheless utilized each year by many conversant with their curative properties. Among those best known are the following:

Mineral springs, three miles southeast of Pagosa Springs; mineral springs, one mile below Pagosa Springs; Archuleta county.

Alum spring, in Schell cañon, Purgatory river; chalybeate spring, Spring Bottom, Arkansas river; iron springs, northwest of Thatcher; mineral spring, mouth of cañon on Purgatory river; mineral spring, on Caddo creek, twenty miles above mouth; salt springs, between Fort Lyon and Kit Carson; Bent county.

Agua Caliente, near Capulin; mineral springs, near Conejos; Conejos county.

Cottonwood hot springs, Cottonwood; Chaffee county.

Alkali springs, near Monument park; El Paso county.

Sulphur springs, on Grand river, near Gypsum; Eagle county.

Soda springs, on Pine creek, south of Texas creek; Wellsville warm springs, Wellsville; Fremont county.

Twelve springs, on Rock creek, near Sopris peak, 30° to 104°; mineral springs, on Cement creek, near East river; mineral springs, in Bidwell basin, near Irwin; mineral springs, on White Earth river, 48° to 84°; sulphur springs, near head of Cement creek; sulphur springs, three miles from Crested Butte; Tomichi hot springs, near Elgin 75, 140° to 160°; Gunnison county.

Glenwood Springs (20+ springs), Glenwood resort; Garfield county.

Sulphur springs, nineteen miles east of Huerfano; Huerfano county.

Burdsall's Soda Lake springs; Morrison's spring, Morrison resort; Jefferson county.

Elbert iron springs, near Rockwood, 90°; Pinkerton's springs, twelve miles west of Durango, 95°; Tripp springs, Hermosa, 95°; La Plata county.

Soda springs, west of Leadville; Lake county.

Sulphur springs, east of Chicosa; sulphur springs, three miles west of Trinidad; Las Animas county.

Antelope springs, Antelope Park resort; Mineral county.

Cañon Creek (three springs), near Ouray, 130° to 158°; Ouray mineral springs (five springs), near Ouray, 120° to 140°; Uncompahgre springs, Uncompahgre park; Ouray county.

Artesian well, at steel works, Pueblo; Clark's magnetic mineral springs, near Union depot, 80° (bathing resort); Mineral Park well (artesian), on Arkansas river, one-half mile above Pueblo; Salt Creek springs, Salt Creek; stinking springs, two miles from Salt Creek; Pueblo county.

Mound soda springs, Currant Creek; salt springs, at Buffalo Springs, South park; South Park springs, south end of South park; Park county.

Sulphur springs, on Fryingpan creek; Pitkin county.

Shaws magnetic springs, five miles from Del Norte resort; Rio Grande county.

Ink springs, Steamboat Springs; Routt county.

Soda springs, east of Dillon; Summit county.

Hauman hot springs, east side of San Luis valley; Ojos de los Caballos, San Luis valley; Saguache county.

Iron Lake springs, near Silverton pass; San Juan county.

Iron springs, twelve miles from Telluride; San Miguel county.

Rock springs, three miles northwest of Akron; Sedgwick county.

OTHER RESOURCES.

Among the mineral resources of Colorado, developed or prospective, are large and valuable deposits of gypsum, known deposits of asphaltum, and the various hydro-carbons having an asphaltum base, gem stones, mica, grindstone, corundum, asbestos, mineral paint, aluminum, sulphur, nickel, cobalt, uranium and the tungsten minerals. These, with other matters of interest, must at the present time be passed for lack of space.

MANUFACTURING.

During the year 1897, the Colorado manufacturer of mechanical devices connected with mining has received greater recognition than ever before. This is not due to their ability to sell cheaper, but to the superiority of the articles offered for sale. Those engaged in the business are generally conversant with the demands and are able, by changing the designs, to suit the case in hand and provide against contingencies liable to arise in isolated places, where the greater portion of the machinery is placed. For this reason the average Colorado mine operator appreciates that although the first cost for a Colorado product may be more, it costs less eventually. The raw material that enters into the composition of a mechanical device is of small moment. Its market price is fixed and graded according to quality. The first cost of a manufactured article is due to the amount of material used in construction, the grade of material used and the cost of labor. Labor costs far more in Colorado than in the East, but the freight on various grades of raw material is practically the same, the difference of first cost being slight, the better grade of material is therefore used. Add to this the extra amount of material used and the superiority of the article is established.

Probably no industry has been so much discriminated against as manufacturing in Colorado. This is not due to the fact that the corporations having the power to discriminate act collectively with a view of retarding Colorado's progress, but is due to that inborn principle common to individuals, singly and collectively, to always do that which will most advance their own interests. The corporations possessing the powers of discrimination also possess large interests further east, and the upholding of these interests in the large commercial centers of the East is more to their advantage than encouraging competition in places like Colorado, which is yet young as a manufacturing center. The same motive that impels discrimination by the corporation governs the individual in his purchase of machinery. While a few act from a "patronize home industry" principle, it is safe to assume that the growing demand for Colorado machinery is due to the fact that the home manufacturer gives more for the money than can be obtained elsewhere. This is evidenced by a constantly increasing demand for the products of Colorado manufacture, and the demand will continue to increase as knowledge of this fact becomes better known.

LIBRARY.

Through the courtesy of the Hon. John F. Shafroth, the Bureau of Mines was added to the permant list of libraries entitled to the publications emanating from the United States Geological Survey. One hundred and eighty-eight volumes have been received, and the whole makes a complete set of these valuable works.

MINERAL COLLECTION.

During the year 3,276 specimens have been added to the mineral collection. Several counties have donated wall cases and panoramic pictures of the leading towns. A large and valuable portion of the collection added during the past year is in the vaults awaiting proper cases for display.

The present arrangement of the mineral collection seems to give perfect satisfaction to the many visitors to the department, besides furnishing an easy and systematic method of studying mineralogy, with the aid of crystalline specimens properly classified. This is testified to by the numerous classes brought in weekly for object lessons in this special line.

MEN EMPLOYED IN MINING DURING 1897.

A careful compilation of the average number of men employed is as follows:

Arapahoe county	1,583
Archuleta county	76
Boulder county	1,653
Chaffee county	707
Clear Creek county	1,712
Conejos county	46
Custer county	318
Costilla county	28
Dolores county	354
Douglas county	77
Eagle county	182
El Paso county	5,386
Fremont county	384
Garfield county	27
Gilpin county	2,473
Grand county	48
Gunnison county	787
Hinsdale county	493
Huerfano county	26
Jefferson county	45
Lake county	3,519
La Plata county	544
Larimer county	147

Las Animas county	26
Mineral county	495
Montezuma county	52
Ouray county	1,185
Park county	467
Pitkin county	1,242
Pueblo county	1,685
Rio Blanco county	32
Rio Grande county	194
Routt county	247
Saguache county	264
San Juan county	996
San Miguel county	1,289
Summit county	426
Total	29,215

The above represents the average number of men engaged in mining in the various counties during the year 1897. It does not include the employés in the general offices, or corporations, mining and consulting engineers, United States deputy surveyors, mining brokers and promoters, or those owning and operating properties, but giving their time to other vocations.

NUMBER OF ACCIDENTS.

The following is a brief statement of the accidents and their causes, investigated by the Bureau of Mines, for twelve months, ending November 30, 1897:

Cause of Accidents.	Fatal.	Non-fatal.	Total.
Fall of earth and rock	23	43	66
Accidental discharge of blasting compounds	40	56	96
Material falling down shaft	9	9	18
Other shaft accidents	19	11	30
Persons falling down unprotected shafts, winzes and passes	9	5	14
Ladder accidents	1	8	9
Machinery accidents	1	11	12
Falls from staging	..	6	6
Accidents from other causes	8	20	28
Total	110	169	279

RECOMMENDATIONS.

The following is a summary of orders issued by the inspectors for the safety of employés:

Exits	93
Sanitary condition	13
Connections for air	62
Fire protection	259
Handling explosives	359
Bucket ways	6

Trap doors to shafts and man-ways	23
Regarding timbering	403
Divide shaft and construct ladders	107
Repair plats and ladders	198
Up-raise to surface	4
Repair machinery	20
New cable	4
Stop hoisting men on bucket	15
Overloading with men	97
Discontinue use of shaft	1
Place guard rails	44
Steam jet down shaft	1
Bulk heads	11
Stop use of iron tamp bar	6

RATE OF WAGES PAID.

Shift boss	$3 50 to $5 00 per day
Miners	2 50 to 3 00 per day
Trammers	2 50 to 3 00 per day
Cagers	2 50 to 3 50 per day
Nippers	1 00 to 3 00 per day
Timbermen	3 00 to 4 00 per day
Topmen	2 00 to 3 00 per day
Laborers	2 00 to 3 00 per day
Engineers	3 00 to 5 00 per day
Pumpmen	3 00 to 5 00 per day
Ore sorters	2 00 to 3 00 per day
Blacksmiths	3 00 to 5 00 per day

Superintendents, foremen, assayers and electricians are generally retained by the month, the salaries being in proportion to the magnitude of mine operations.

In the Cripple Creek and a few other districts, eight hours is a day's work. In the majority of districts, ten hours on day and nine hours on night shift is a day's work. Pumpmen, firemen and engineers are in a number of cases employed on twelve-hour shifts.

COLORADO'S PRODUCTION OF PRECIOUS METALS.

TOTAL PRODUCTION FOR 1897.

Gold	947,249 Ozs.	$19,579,636.83
Silver	21,278,202 Ozs.	12,692,447.47
Copper	9,151,592 Lbs.	960,917.13
Lead	80,799,778 Lbs.	2,731,032.49
Total		$35,964,033.92

PRODUCTION OF GOLD AND SILVER FOR 1897.

COUNTY	GOLD		SILVER	
	FINE OUNCES	VALUE	FINE OUNCES	VALUE
Arapahoe	102	$ 2,108 34	14	$ 8 35
Archuleta	34	702 78	348	207 58
Boulder	24,802	512,657 34	138,715	82,743 50
Chaffee	10,979	226,935 93	53,859	32,126 89
Clear Creek	37,864	782,648 88	1,442,583	860,500 76
Conejos	51	1,054 17	98	58 46
Costilla	262	5,415 54	482	287 51
Custer	103	2,129 01	26,842	16,011 25
Delta	14	289 38	-------	-------
Dolores	2,103	43,469 01	179,901	107,310 95
Douglas	23	475 41	10	5 96
Eagle	1,682	34,766 94	46,046	27,466 44
El Paso	490,172	10,131,855 24	59,879	35,717 82
Fremont	623	12,877 41	1,525	909 66
Garfield	15	310 05	42	25 05
Gilpin	100,942	2,086,471 14	374,417	223,339 74
Grand	94	1,942 98	85	50 70
Gunnison	1,972	40,761 24	103,941	62,000 81
Hinsdale	8,136	168,171 12	243,439	145,210 17
Huerfano	35	723 45	167	99 62
Jefferson	399	8,247 33	1,614	962 75
Lake	99,848	2,063,858 16	5,451,317	3,251,710 59
La Plata	1,426	29,475 42	1,409	840 47
Larimer	144	2,976 48	97	57 86
Las Animas	31	640 77	9	5 37
Mineral	2,967	61,327 89	3,070,576	1,831,598 58
Montrose	317	6,552 39	851	507 62
Montezuma	371	7,668 57	105	62 63
Ouray	26,746	552,839 82	2,776,394	1,656,119 02
Park	7,432	153,619 44	199,945	119,267 19
Pitkin	7,955	164,429 85	4,599,946	2,743,867 79
Rio Grande	1,093	22,592 31	8,168	4,872 21
Routt	473	9,776 91	7,805	4,655 68
Saguache	665	13,745 55	2,482	1,480 51
San Juan	33,591	694,325 97	1,101,907	657,287 53
San Miguel	70,544	1,458,144 48	869,079	518,405 62
Summit	13,239	273,650 13	514,107	306,664 83
	947,249	$19,579,636 83	21,278,202	$12,692,447 47

NOTE—Gold is figured at its coinage value, $20 67 an ounce; silver at 59.65 cents an ounce.

PRODUCTION OF COPPER AND LEAD FOR 1897.

COUNTY	COPPER		LEAD	
	FINE COPPER, POUNDS	VALUE	METALLIC LEAD, POUNDS	VALUE
Boulder	58,474	$ 6,139 77	309,115	$ 10,448 09
Chaffee	172,891	18,153 55	1,686,391	57,000 02
Clear Creek	516,034	54,183 57	5,263,116	177,893 32
Costilla	502	52 71	50,048	1,691 62
Custer	874	91 77	2,101,041	71.015 19
Dolores	39,654	4,163 67	1,093,840	36,971 79
Eagle	2,200	231 00	1,144.013	38,667 64
El Paso	1,625	170 58	5.492	185 63
Gilpin	1,018,595	106,952 48	2,007,698	67,860 19
Gunnison	2,770	290 85	1,013,114	34,243 25
Hinsdale	8,085	848 93	5,550,058	187,591 96
Huerfano	92	9 66	1,067	36 06
Jefferson	1,602	168 21	10.093	341 14
Lake	3,146,802	330,414 21	23,700,908	801,090 69
La Plata	420	44 10	857	28 97
Mineral	1,500	157 50	6,080,673	205,526 75
Ouray	2,185,084	229,433 82	7,784,212	263,106 37
Park	58,002	6,090 21	4.517,614	152,695 35
Pitkin	8,360	877 80	4,456,478	150,628 96
Rio Grande	627	65 84	12,006	405 80
Routt	958	100 59	88,736	2,999 28
Saguache	2,975	312 38	9,266	313 19
San Juan	1,435,203	150,696 32	8,021,414	271,123 79
San Miguel	354,781	37,252 00	4,143,767	140,059 32
Summit	133,482	14,015 61	1,748,761	59,108 12
	9,151,592	$960,917 13	80,799,778	$2,731,032 49

NOTE—Copper is estimated at $0.105 per pound, and lead at $3.38 per 100 pounds.

TOTAL PRODUCTION OF GOLD IN COLORADO.

YEAR	FINE OUNCES	PRICE PER OUNCE	VALUE
Previous to 1870	1,316,550	$20 67	$ 27,213,081 00
1870	145,864	20 67	3,015,000 00
1871	175.808	20 67	3,633,951 00
1872	128,034	20 67	2,646.463 00
1873	88,788	20 67	1,835,248 00
1874	99,932	20 67	2,065,595 00
1875	112,291	20 67	2,321,055 00
1876	131,897	20 67	2,726.311 00
1877	145.138	20 67	3,000,000 00
1878	162,864	20 67	3,366,404 00
1879	156,023	20 67	3,225.000 00
1880	154,814	20 67	3,200,000 00
1881	159,652	20 67	3,300,000 00
1882	162.554	20 67	3,360,000 00
1883	198,355	20 67	4,100.000 00
1884	205,612	20 67	4,250,000 00
1885	203,193	20 67	4,200.000 00
1886	215,288	20 67	4,450,000 00
1887	193,517	20 67	4,000.000 00
1888	181,809	20 67	3.758,000 00
1889	187,898	20 67	3.883,859 00
1890	200,774	20 67	4,150,000 00
1891	222,545	20 67	4,600.000 00
1892	256,410	20 67	5,300,000 00
1893	364,151	20 67	7,527,000 00
1894	462,009	20 67	9,549,731 00
1895	656,021	20 67	13.559,954 00
1896	738.618	20 67	15,267.234 00
1897	947.249	20 67	19,579,637 00
	8,373,658		$173,083,523 00

TOTAL PRODUCTION OF SILVER IN COLORADO.

YEAR	FINE OUNCES	PRICE PER OUNCE	VALUE
Previous to 1870	250,000	$1 32	$ 330,000 00
1870	500,000	1 32	660,000 00
1871	779,590	1 32	1,029,058 00
1872	1,524,207	1 322	2,015,001 00
1873	1,683,370	1 298	2,185,014 00
1874	2,415,435	1 278	3,086,926 00
1875	2,306,253	1 246	2,873,591 00
1876	2,552,125	1 156	2,950,256 00
1877	3,480,548	1 201	4,180,138 00
1878	4,172,744	1 152	4,807,001 00
1879	9,049,424	1 123	10,162,503 00
1880	13,148,735	1 145	15,055 302 00
1881	13,272,488	1 138	15,104,092 00
1882	12,707,866	1 136	14,436,136 00
1883	13,434,915	1 11	14,912,756 00
1884	12,375,280	1 13	13,984,066 00
1885	12,220,589	1 065	13,014,927 00
1886	12 375,280	995	12,313,404 00
1887	11,600,826	978	11,345,608 00
1888	14,695,645	94	13,813,906 00
1889	18,375,519	936	17,199,486 00
1890	18,800,425	1 046	19,665,245 00
1891	21,160,480	988	20,906,554 00
1892	26,350,000	876	23,082,600 00
1893	25,838,600	782	20,205,785 00
1894	23,236,025	63	14,638,696 00
1895	17,891,626	653	11,683,232 00
1896	21,547,743	671	14,458,536 co
1897	21,278,202	5965	12,692,448 00
	339,023,940		$312,792,267 00

TOTAL PRODUCTION OF COPPER IN COLORADO.

YEAR	POUNDS	PRICE PERPOUND	VALUE
Previous to 1870	200,000	$0.20	$ 40,000 00
1870	97,088	.206	20,000 00
1871	90,909	.33	30,000 00
1872	155,172	.29	45,000 00
1873	28,172	.232	65,000 00
1874	400,876	.225	90,197 00
1875	428,571	.21	90,000 00
1876	376,244	.186	70,000 00
1877	504,283	.186	93,796 64
1878	539,393	.165	89,000 00
1879	766,082	.171	131,000 00
1880	915,422	.201	184,000 00
1881	889,503	.181	161,000 00
1882	1,494,000	.185	276,390 00
1883	1,153,000	.1585	182,750 50
1884	2,013,000	.1385	278,800 50
1885	1,146,000	.1112	127,435 20
1886	409,000	.11	44,990 00
1887	2,012,000	.1125	226,350 00
1888	1,621,000	.1666	270,058 60
1889	3,100,000	.1375	426,250 00
1890	6,000,000	.1575	945,000 00
1891	7,000,000	.1262	883,400 00
1892	7,250,000	.1155	837,375 00
1893	7,121,157	.1075	765 535 13
1894	6,528,214	.0956	624.097 26
1895	6,125,000	.1076	659,050 00
1896	7,539,245	.1088	820,269 86
1897	9,151,592	.105	960,917 13
	75,306,923		$9.437,662 82

TOTAL PRODUCTION OF LEAD IN COLORADO.

YEAR	POUNDS	PRICE PER POUND	VALUE
1872	80,000	$0.0625	$ 5,000 00
1873	112,000	.0632	7,078 40
1874	624,000	.0601	37,502 40
1875	1,636,000	.0585	95,766 00
1876	1,334,000	.0613	81,774 20
1877	1,794,000	.0549	98,490 60
1878	13,338,000	.0361	481,501 80
1879	47,348,000	.0414	1,960,207 20
1880	71,348,000	.0504	3,595,939 20
1881	81,094,000	.0481	3,900,621 40
1882	110,000,000	.0491	5,401,000 00
1883	141,114,000	.0432	6,096,124 80
1884	126,330,000	.0374	4,724,742 00
1885	111,000,000	.0395	4,345,000 00
1886	118,000,000	.0463	5,463,400 00
1887	126,000,000	.0450	5,670,000 00
1888	131,000,000	.0442	5,790,200 00
1889	138,000,000	.0393	5,423,400 00
1890	109,000,000	.0448	4,883,200 00
1891	128,000,000	.0435	5,568,000 00
1892	123,000,000	.0409	5,030,700 00
1893	84,396,000	.0373	3,147,970 80
1894	97,264,000	.0329	3,200,000 00
1895	91,477,214	.0323	2,954,714 00
1896	82,018,000	.0283	2,321,109 40
1897	80,799,778	.0338	2,731,032 49
	2,016,106,992		$83,014,414 69

TOTAL PRODUCTION IN COLORADO.

Gold	8,373,658	Ozs	**$173,083,523.00**
Silver	339,023,940	Ozs	**312,792,267.00**
Copper	75,306,923	Lbs	**9,437,662.82**
Lead	2,016,106,992	Lbs	**83,014,414.69**
Total			**$578,327,867.51**

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