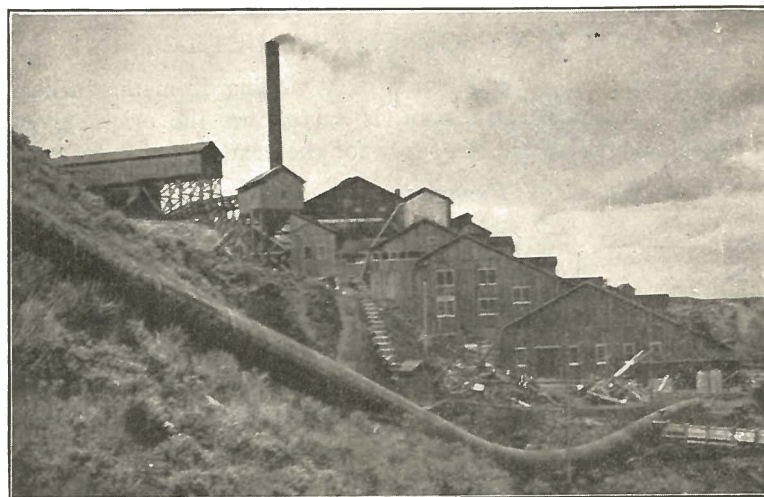


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MINING  
in the  
GRAND ENCAMPMENT  
COPPER DISTRICT

Carbon and Albany Counties, Wyoming



*Photo by J. E. Stimson, Cheyenne, Wyo.*

ENCAMPMENT REDUCTION WORKS.

HENRY C. BEELER,  
State Geologist of Wyoming,  
Cheyenne, Sept. 1, 1905

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The details of the geology of the western part of the district are admirably given in a work by Mr. Arthur C. Spencer of the United States Geological Survey, entitled, "The Copper Deposits of the Encampment District, Wyoming," Professional Paper No. 25, copies of which paper may be had by addressing The Director, U. S. G. S., Washington, D. C., and its careful study is recommended to the mining men of the district.

Acknowledgments are made to Mr. Spencer's work and to the management and owners of the various properties whose many and continued courtesies have greatly aided the work of this office.

HENRY C. BEELER, State Geologist.

CHEYENNE, WYO., August 30, 1905.

#### WYOMING COPPER PRODUCTION.

The total copper production of Wyoming from the earliest record to December 31st, 1904, is as follows, the prices given being the average price of copper for the year:

Year	Number of Pounds	Price per Pound	Value
1882.....	75,000.....	17.1 cents	\$ 12,757.50
1883.....	962,468.....	13.7 cents	131,858.11
1884.....	No record.....		
1885.....	No record.....		
1886.....	No record.....		
1887.....	No record.....		
1888.....	232,819.....	15.9 cents	36,017.32
1889.....	100,000.....	12.0 cents	12,000.00
1890.....	No record.....		
1891.....	No record.....		
1892.....	No record.....		
1893.....	No record.....		
1894.....	No record.....		
1895.....	6,872.....	10.11 cts.	694.07
1896.....	No record.....		
1897.....	127,471.....	11.10 cts.	14,149.28
1898.....	233,044.....	12.00 cts.	27,965.28
1899.....	3,104,827.....	17.10 cts.	530,925.39
1900.....	4,206,776.....	16.25 cts.	683,601.50
1901.....	914,412.....	16.11 cts.	140,909.82
1902.....	75,297.....	11.62 cts.	8,749.51
1903.....	947,106.....	13.42 cts.	127,101.62
1904.....	4,220,000.....	12.821 cts.	541,046.20
Totals.....	15,206,092		\$2,267,775.60

## THE GRAND ENCAMPMENT COPPER DISTRICT.

#### LOCATION.

The district popularly known as the "Grand Encampment" country lies in the southern part of Carbon County and the southwestern corner of Albany County, south of the main line of the Union Pacific Railroad.

#### HISTORY.

Mining has been carried on in this region from the earliest known period of the state's settlement, and traces of old work done during the ante-railroad days of Wyoming are often found, authenticated by old records and relics. The first permanent work was done in the Kurtz-Chatterton property, on Copper Creek, west of where Encampment now stands.

Gold Hill, in the Medicine Bow Range, was the next scene of excitement, followed by work on the Doane-Rambler mine at Battle Lake, in 1879, but it was not until 1897-8 that the district became prominent by reason of some rich gold ores found in Purgatory Gulch, a small tributary of the South Fork of the Grand Encampment River, and the town of Grand Encampment was started. This attracted great numbers of people to the region, and prospecting for gold was general for some time.

The discovery of the Ferris-Haggarty copper mine, on the North Fork of Battle Creek, by Ed. Haggarty, followed in the winter of 1898, and attention was then turned to copper, with the result that the region is being thoroughly exploited and has become a permanent copper producer.

#### GENERAL DESCRIPTION.

The district is somewhat irregular in shape. (See map on last page.) The tract embraced in the known mineralized country extends along the Wyoming-Colorado state line, easterly and

westerly for a distance of about eighty miles, and northerly and southerly for a distance of from fifteen miles at Encampment to forty miles at Elk Mountain, near Saratoga, comprising about 2,000 square miles of mountain and valley.

The North Platte River, which rises in Colorado, in this locality flows northwesterly and divides the district into two distinct halves, with a valley some fifteen miles wide lying between and watered by numerous tributary streams on each side. This valley and the adjacent creeks form a wonderfully rich agricultural and stock-raising country, and afford a constant supply of food products in the immediate vicinity of the mines, which has steadily grown in importance and extent as the market for this product has developed.

Parallel with the river are mountain ranges on either side, that on the east being known as the Medicine Bow Range, and with this latter range are a series of approximately parallel or connected smaller ranges known as Elk, Coad and Wood Mountains.

On the west is the Sierra Madre Range, composed of a number of similar ranges, known by various local names, and these form part of the great Continental Divide, from which the western waters flow towards the Pacific and the eastern waters towards the Gulf of Mexico and Atlantic Ocean.

Both these ranges enclose numerous parks and valleys, and in the main Platte Valley, in the Encampment vicinity, are a number of smaller hills or ranges, forming local divides between the smaller streams.

#### ALTITUDES.

The altitudes in this region vary. The Platte Valley is 7,000 feet above sea level at Saratoga and rises about fourteen feet to the mile towards the south, being about 7,400 feet elevation at the state line. The mountain ranges vary from 8,500 to 11,000 feet above set level, an altitude of 11,007 feet being noted at Bridger Peak, in the Sierra Madre, and 12,000 feet at the Snowy Range peaks, in the Medicine Bow.

#### STAGE ROUTES AND ROADS.

To reach the Encampment country, the best route is from Walcott station on the Union Pacific Railroad, where all trains, except the Overland Limited trains, stop regularly.

From this point the Scribner Stage Company runs stages to Encampment via Saratoga, leaving Walcott at 7 o'clock in the morning daily. These stages are six-horse Concord coaches, in charge of experienced drivers, and run through on schedule time. The distance is twenty-four miles to Saratoga and forty-four miles to Encampment from Walcott. Fare, \$5.00; round trip, \$9.00. Livery teams may also be obtained here for all points at reasonable rates.

From Encampment daily stages leave for Battle, twelve miles; Rambler, fourteen miles; Dillon, nineteen miles, and Copperton, twenty miles, and connections are made for the camps south near the state line and Pearl, Colo., about thirty miles.

Livery teams and saddle horses may be had here for different parts of the district not reached by stage and to connect with the Holmes-Laramie stage line at the Great Rambler mine, thirty-two miles east of Encampment. This latter line runs daily, except Sunday, from Laramie, the county seat of Albany County, to Holmes, a distance of forty-five miles; fare, \$3.50, via Centennial, to which point the Laramie, Hahns Peak and Pacific Railroad is now building.

For Dillon and Rudefeha, where the great Ferris-Haggarty mine is located, connections by team may be made from Rawlins, the county seat of Carbon County, on the Union Pacific Railroad, a distance of fifty-two miles over a good road.

From Saratoga a mail and stage line runs to Dillon and Rudefeha daily, except Sunday, and the different points in the Elk Mountain vicinity may be reached by team. A number of the camps at Spring Creek and Jack Creek are also readily accessible from this place.

Freight is brought in mainly over the Walcott-Saratoga-Encampment road and distributed to the various camps throughout the district.

In a country separated from railroad transportation as these districts are, the construction of wagon roads is of primary importance to the welfare and advancement of the community and state, and the Encampment districts have been very active in this regard, with the result that over 500 miles of actual made roads have been built in this section, connecting the different camps with the towns and centers of travel.



## GEOLOGY.

The Sierra Madre Mountains consist of an irregular core of granite, with smaller islands and spurs of the same material showing both in and through the associated metamorphic formations. The granite is usually of a reddish feldspathic variety, in many instances much altered and showing little quartz or mica, but in others showing a predominance of quartz, inclining to the grey granites of Colorado, and frequently showing strong evidences of metamorphism, especially in the outcrops, and which is usually limited in extent.

In the vicinity of Encampment huge veins of white quartz, or "bull quartz," are seen, but nothing of importance has yet been found in this quartz.

The metamorphic formations consist principally of Algonkian schists, usually lying on the granites and having a varying dip and trend or direction in different parts of the district. These schists are of a number of varieties, some of which are local or limited in extent, the usual schist being a fine grained black mica-schist, and fine grained hornblende and tourmaline schist in bands varying from a few feet to several hundred feet in width.

Associated with these varieties have been noted muscovite or white mica schists and gneiss, Cerisite schist, garnet schist on Upper Cow Creek, Chlorite schist and amphibolite schist in various localities.

The dyke rocks noted here are locally called "diorite," but have been identified and classed by the United States Geological Survey as belonging to the Gabbro rocks. Several varieties have been noted, notably Norite at the Creede Tunnel and the head of Cow Creek, and Peridotite-Oligoclase-gabbro and Metagabbro or "diorite." These dykes vary in size from a few inches thick to a huge sheet several hundred feet in thickness, and generally lie conformably with the adjacent schist and quartzite, having the same trend or direction and the same dip, but instances are noted, as on Upper Cow Creek and near the Syndicate mine, on Savery Creek, where the dykes cut across the formation at a varying angle.

These dykes are also noted at many places in the granite near the New Rambler, on Douglas Creek, also near Encampment and Battle.

Associated with the schists and diorites are ledges or bands of quartzite and slates, which lie conformably with the including schists, as far as now known, as at the Ferris-Haggarty mine and at Bridger Peak, and are usually of considerable extent.

It is noted that in many instances the foregoing rocks (schists, dyke rocks, quartzites and slates) often show an extensive and sometimes a complete metamorphism and change from their original condition and composition, leaving only the structure as a means of identification, the composing minerals being replaced by silica and lime, as the schists near the Ferris-Haggarty are largely replaced by silica, and by lime near the Independence property, on Jack Creek, and the Mohawk, on the North Fork of the Grand Encampment River.

The dyke rocks usually show a weathered and softened condition in the vicinity of this schist alteration, but this is often local and does not affect the main body of the rock.

North of Battle, near Bridger Peak, and in the vicinity of Rudefeha, there is a huge deposit of conglomerate, which usually rests unconformably on the quartzite-slate series. The component pebbles are grey granite, hornblende schists and quartzite. It has a maximum thickness of about 700 feet.

The Snowy Range, in the Medicine Bow Mountains, is distinct in formation from the adjacent country and consists of trachite and quartzites, with an occasional dyke of porphyry.

On either side of the Medicine Bow Range the upper carboniferous limestones are noted, with the succeeding sedimentary formation dipping away from the main range until covered by the wash of the valley.

South and west of the Sierra Madre Mountains, and north of Saratoga, the sedimentary sandstones of the Cretaceous are noted, and here is found the coal used in the district.

## MINERALIZATION.

The mineralization may be said to be general throughout the formation just described, but varies in quantity and composition in each locality.

In the granites, schists, dyke rocks and quartzites are found bunches, streaks and veins of the different forms of iron and copper, both oxidized and base, varying from a tiny crystal or

speck to a huge mass a number of tons in weight enclosed in the adjacent rocks, and which may or may not be part of or related to the body of ore.

### ORE-DEPOSITS AND ORES.

In a district as little developed as the Grand Encampment country it is evident that the precise ore conditions may not be fully understood until greater depths have been reached and some of each class of ores and ore-deposits fully exploited.

At present these are understood to consist of two classes, viz., ores found in the hard, unchanged formation, the diorites and unaltered schists, associated with a vein quartz, as at the Blakeslee and Verde properties, south of Battle, as distinguished from the ores found as a contact deposit between two different formations, as at the Ferris-Haggarty and Doane-Rambler mines, and a fissure deposit, as at the New Rambler, on Douglas Creek, in the grey dioritic granite. The former may be termed original ores and the latter "secondary ores," or ores of replacement.

In the first case, sulphides of copper are found in the outcrops, with but little change beyond the shallow surface oxidization of the specimen, staining the adjacent rock with iron oxides and copper carbonates, often leaving the unchanged sulphides covered only with a thin film of oxides.

In the latter case, the sulphides are encountered at "water level," viz., the level of permanent underground water, varying in depth in different localities and covered by a capping of iron oxides, known as the "iron cap," the "gossan" of the Cornish miner.

This cap is usually a light, soft and porous brown oxide of iron, or limonite, sometimes silicious, and associated with the limonite are noted forms of hematite or red oxide of iron in varying quantity.

Throughout the district have been noted a number of huge ledges of oxidized iron, notably at the Gertrude and the Hidden Treasure, near Battle, and on Iron Creek and French Creek, in the Medicine Bow Range. The cappings of these ledges are usually a very hard, silicious, red hematite, which gives place with depth to the softer iron oxide forms, more or less stained with copper.

In many instances the iron cap contains thin scales of native copper and shows stains of the green carbonate of copper or Malachite and some blue carbonate of copper or Azurite. Small amounts of Chrysacolla or silicate of copper are often found, as well as some of the rarer forms of the oxidized copper minerals, noted later.

The principal ores are the yellow pyrites of copper or chalcopyrite and "peacock copper" or Bornite, as at the Ferris-Haggarty, and the Covellite ores of the New Rambler. Some phenomenally rich copper glance or chalcocite has been struck, mostly near the surface, as in the Keener-Price at Battle, the Doane-Rambler and New Rambler and many other places, but in each case the deposit has been limited.

The works so far have shown that the ores immediately succeeding the oxidized ores underlying the iron cap are very rich, often running from 35 per cent to 49 per cent copper in car load lots, as shipping returns have shown, but this is evidently a secondary enrichment, due to the leaching of the iron cap above and gradually gives place to the lower and more permanent grade of ore that is reached as depth is gained.

It is evident that the permanent ores of this district, when opened up by deep workings, will prove to be a low grade Chalcopyrite ore, suitable for treatment by a concentrating, roasting and smelting process.

Gold and silver values throughout the district have been uniformly low, although some phenomenally rich gold values have been noted in oxidized ores at Purgatory Gulch, the Charter Oak and some others.

### GRAND ENCAMPMENT.

This town is the practical center of the mining activity of this region, is pleasantly located on the Grand Encampment River at an altitude of 7,322 feet, substantially built and has about 1,000 population at the present time. Here are located the principal supply houses, bank and headquarters of the principal companies operating in this district, and is the eastern terminus of the aerial gravity tramway from the Ferris-Haggarty mine to the Encampment Reduction Works, the location of the Encampment Power and Light Company's works and the other enterprises now owned by the Penn-Wyoming Copper Company.

#### AERIAL TRAMWAY.

The tramway is sixteen miles in length, divided into three sections, one eight miles long and two of four miles each, with three auxiliary power stations, one at the mine terminal, one on Upper Cow Creek, at the foot of Bridger Peak, and one at Lower Cow Creek.

These stations are equipped with power plants, storage bins, etc., to facilitate the operation of the line.

Three hundred and four towers, with tension stations at intervals, are used to support the cables, which, moving at an average speed of four miles an hour, with buckets holding 700 pounds of ore each, are capable of delivering 984 tons of ore per day.

The present towers are placed at an average distance of 200 feet apart on regular ground, but owing to the rough and varied nature of some of the intervening ground it has been necessary to use some long spans, as at the Cow Creek crossings, where the spans are 2,000 and 2,200 feet long, and on the adjacent summits, it was necessary to place a number of towers close together for obvious reasons.

The terminal stations at the mine and smelter are equipped with automatic landing, filling and dumping arrangements, and sufficient storage capacity is provided to insure a supply of ore in case of a breakdown, either in the mine or on the line.

The tramway has been placed in daily commission and has given entire satisfaction. It was a remarkable work, being constructed in seven months over the highest peaks and deepest canons in the vicinity and through a new country, which made it necessary to build many miles of wagon roads before the cables and heavy machinery could be taken in.

#### THE ENCAMPMENT REDUCTION WORKS.

These works are located at the tramway terminal, on the west bank of the Grand Encampment River, and are favorably situated as regards convenience in operating, handling ores, tailings and slag dumps, etc.

The ore from the receiving bins is delivered to crushers and rolls, passes to rotary sizing screens, the coarser material passing *over* being elevated back to fine rolls, the finer passing

*through* the screens going on through the mill and being sized and classified by sizers and jigs.

The sized product passes over Wilfley concentrating tables for final treatment and the concentrates are sent to the briquetting plant, the tailings or waste being run out into a tailings dam and settled.

The smelter consists of two matte furnaces, smelting to a 50 per cent copper matte, which passes to a converter, is blown to blister copper and run into pigs for shipment. The blister copper is hauled from the smelter to Walcott station and shipped to eastern refineries, and the coke for the smelter hauled in from the same place by the returning wagons.

The entire plant is constructed on a 500-ton capacity basis, and all power used in the smelter, for cranes, etc., is electric, except the blowers and air compressor, which are driven direct from water power; twelve hundred-horse power can be developed in this plant.

This water power is furnished from a built wooden pipe, forty-eight inches in diameter, which extends from the smelter to a point four miles away on the South Fork of the Grand Encampment River, where a twenty-nine-foot dam has been built. The water drives five water wheels, some of which connect direct with the concentrating mill by shafting and a rope drive to the crushers, jigs, tables and other machinery.

Others are connected direct to the electric plant, which is very complete, and supplies power as stated above, and lights the works and towns of Grand Encampment and Riverside.

This reduction plant is the first in the locality and it affords an excellent opportunity to develop a satisfactory process for the concentration and treatment of the copper ores of this district, as well as a ready market for the ores produced on a small scale by other companies during development work, which enables them to realize promptly upon what might otherwise be of no present value, owing to distance from treatment centers, etc., and thus the Encampment works are in a direct sense a vast benefit to the whole region.



## THE NORTH FORK COUNTRY.

West of Encampment, in the country drained by the North Fork of the Grand Encampment River, a great deal of work has been done, mostly as development work.

The Kurtz-Chatterton mine, before mentioned, is the principal property and best developed. The ore is a low grade copper sulphide in granite, suitable for concentration on an extensive scale.

In this vicinity are also the Moon-Anchor and Sun-Anchor, and other properties on Green Mountain, the Sweet and Chicago-Venture properties near Green Mountain Falls.

## BATTLE.

Near the town of Battle, which is situated on the crest of the Continental Divide, at an altitude of 9,800 feet, are located the Gertrude and Hidden Treasure properties. On this ledge the red hematite is especially strong and shows stains of copper. A shaft is now being sunk on the Gertrude property and a tunnel 700 feet long has been run on the Hidden Treasure group, which cut a series of quartzites, quartz schist and altered diorite.

A similar ledge matter has been cut on the property of the Copper Rock Company, east of the Hidden Treasure, and at the present time a tunnel is being run to develop this showing.

North of Battle the Morris Mining Company is developing a new discovery, which promises well.

A shaft sunk by the Copper Age Company on the Copper Blossom claim is now down 300 feet and the present showings are very encouraging. The shaft was sunk following the dip of the formation, and the ore showings have steadily increased as depth was gained. The outcrop showed only a small quantity of copper, which continued for nearly 200 feet. At the second level, or at 200 feet, low grade copper sulphides were encountered and drifts run on the vein. At a depth of 300 feet a good shoot of concentrating ore was encountered and drifts run on the shoot.

Near the No. 3 tramway station the Continental Company has been running a cross-cut tunnel, but have not yet cut into their ore, which outcrops in a heavy quartz ledge, impregnated with sulphides, on the south side of Cow Creek.

The Lena Shields tunnel is not yet completed, but has been driven steadily and should cut into their ore within a short time.

The Cow Creek country presents a varied condition of ore occurrence and formation. There is a number of huge outcrops of conglomerates, but the schists predominate with many quartz veins, both large and small, showing throughout the district.

The Gabbro rocks show a series of dykes and sheets of varying extent, and a number of the varieties of this rock previously noted may be found here.

West of Battle a tunnel has been run on the Portland group in a schist ledge or vein. The tunnel is now in about 370 feet and cross-cuts of about 120 feet have been run. This work is developing a showing which has been prospected for a surface vein of 3,000 feet and shows good ore.

South of Battle the Verde property is the most prominent, having put in a steam plant and sinking on the ore which outcrops as a heavy vein or shoot in which the sulphide ores of copper are found on the surface.

The Itmay group of claims near the Verde have been developed during the past year. The country rock is a grey diorite and the ore occurs along the walls of a much altered dyke. A shaft has been sunk to a depth of 100 feet in this showing and drifts run on the vein, which is given at twelve feet wide and the ore shoot twenty-seven inches wide.

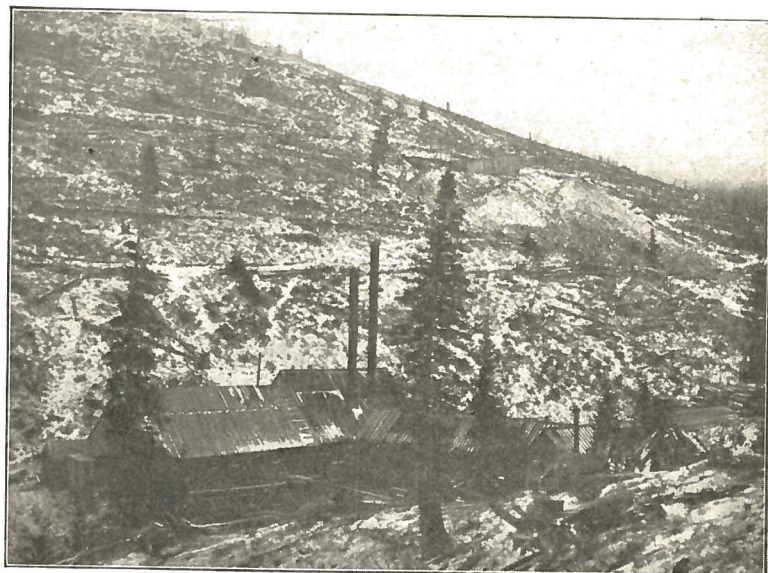
The Lone Fisherman group and Blakeslee group are the principal properties on the North Fork of the Snake River.

South of the Verde, near the state line, is located the Three Forks camp. Here the formation is generally granite, with dykes of quartz diorite and gabbro series scattered throughout the granite.

On the North Fork claim of the Boston Sierra Madre Company a shaft has been sunk to a depth of 160 feet on a vein of quartz carrying galena, zinc and copper and iron pyrites. It has varied in width in the shaft from six inches to twenty-six inches, and a tunnel is now being run to cross-cut the formation at a greater depth. A drift will be run from the tunnel to connect with the present shaft.

On the Three Forks claim a tunnel has been run on a similar showing to that of the North Fork claim. This tunnel is in

460 feet and a shaft sunk ninety feet on the vein. The ore on the Three Forks has shown some very high values in silver and is considered a very promising showing.



*Photo by H. G. Stegeman.*

VIEW OF DOANE-RAMBLER MINE.

#### DOANE-RAMBLER MINE.

The town of Rambler, named from this mine, is a mile and a half from Battle, at Battle Lake. It has an altitude of 9,230 feet and is at present quite active.

The Doane-Rambler is one of the oldest properties in the district and was originally located in 1874, and shipments were made at varying intervals by the different owners. Some of the richest ore of the district has been taken out of this mine. The conditions under which these ores are noted are similar to the Ferris-Haggarty ores, the outcrop being a similar light porous limonite and usually stained with copper carbonates, with diorite showing on either side of the quartzite and schist formations. The principal ores have been found in the fractures in the quartzite and the ore found impregnating the quartzite in shoots or lenses.

The principal ores of the Rambler are chalcopyrite and some bornite, but a number of other forms have been noted, especially some very high grade copper glance, which greatly resembles a copper matte in appearance. Some covelite has been found, as well as red and black oxides of copper in quantity, and the upper levels show the usual carbonate forms of copper.

The property is developed by a main working tunnel and a shaft 600 feet deep, from which levels have been run at intervals on the ore. The fifth and sixth levels have been completed recently and the work of determining the ore showings on these levels is now in progress, and enough has already been shown to demonstrate that the mine contains a vast quantity of commercial ore and that milling facilities on a suitable scale are fully warranted by these showings.

A complete operating plant has been installed at the mine and the work is proceeding rapidly at the present time.

East of the Rambler is situated the Investors' M. & D. property, where development on two large iron caps, lying on either side of a quartzite dyke, is now in progress and within a short time should demonstrate the existence of other shoots of copper ore in this locality. These outcrops are quite extensive and the showings made by the surface workings fully warrant the development of these ores.

West of the Rambler a similar condition is noted on the Doane-Verde and other claims and should, by all means, be developed.

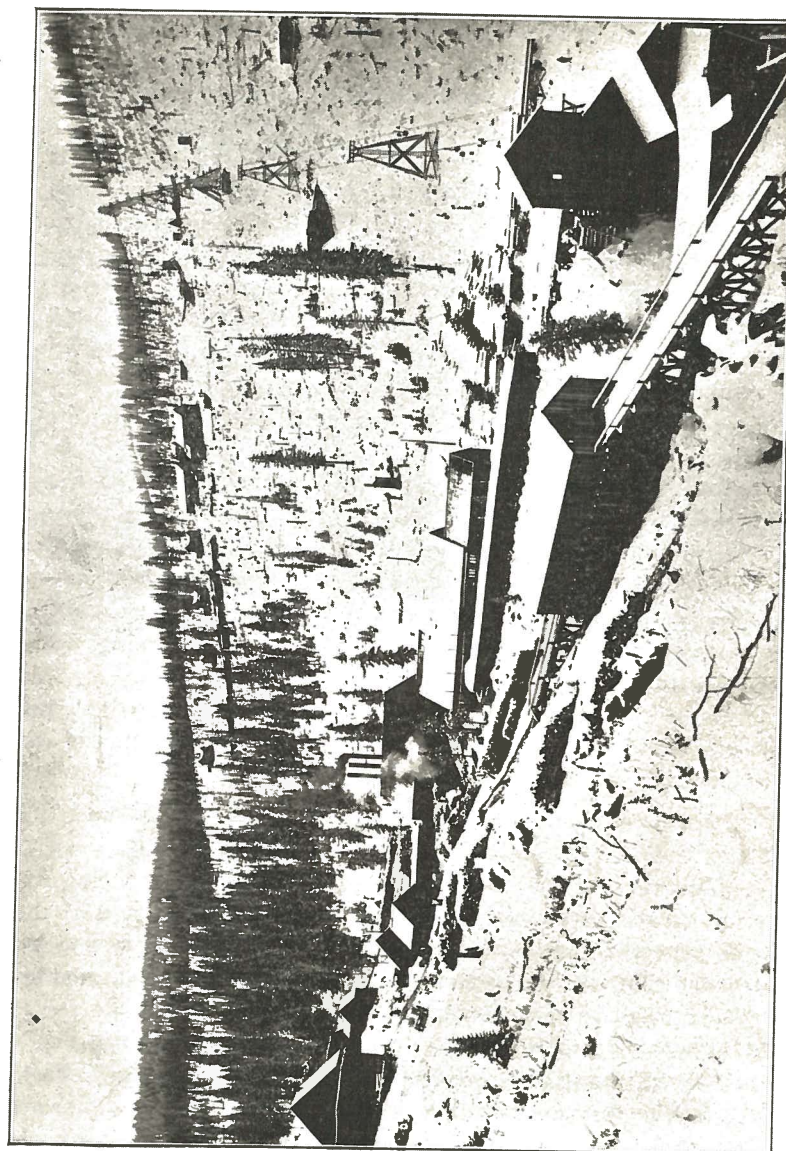
#### FERRIS-HAGGARTY MINE.

This mine, owned by the Penn-Wyoming Copper Company, is the greatest producer in the Sierra Madre Range and at the same time the most systematically developed property, and on the conditions shown in this mine may be based what theories are advanced for this class of deposits in this locality.

The ore is found on the contact between a quartzite and a mica schist, the quartzite forming the lower or foot wall of the deposit, the formation having a dip of 40°-45° to the southeast and a general strike east and west.

On either side of the ore-carrying formation are diorite dykes, and the schists of the vicinity, especially the hanging walls, show considerable evidence of replacement by silica.





THE FERRIS-HAGGARTY MINE AND TRAMWAY.

Photo by Stimson, Cheyenne.

The ore was found outcropping as a soft, spongy, light and porous limonite, showing some green copper stains. This was followed to a depth of thirty-nine feet, where sulphide ores were encountered, and the successful career of the mine began.

The ore at this mine is bornite and chalcopyrite, and some remarkably rich ore has been shipped from the upper levels, where it was taken out, put on a table, sorted and shipped to smelters at Denver and Omaha. As a rule, these ores shipped varied from 30 per cent to 40 per cent copper and carried from \$2 to \$9 per ton in gold, with a little silver.

The property was first developed to a depth of 250 feet by a shaft and two levels run, most of the shipping ore being taken out of a large stope on the upper level.

A tunnel has been run from the creek level at a point 390 feet vertically below the old shaft and connections established with the old workings by upraises, cross-cuts and levels run on the ore for development purposes.

A winze has been sunk to a depth of 180 feet below the tunnel level, and drifts and cross-cuts run from this winze, but results have not been given to the public. Recently the mine has been thoroughly retimbered and all loose ground taken up in a substantial manner.

The width of the ore varies, but may be given at an average of twenty feet, as far as the present workings have extended. The grade of the ore throughout the mine may be given at from 6 to 8 per cent copper, with considerable much richer ore in sight, especially on the upper levels. On the lower or tunnel level the ore is about 8 per cent copper.

The ore is stoped out by machine drills, thrown into shoots, dropped to the tunnel level and hauled out by compressed air haulage, seven cars to a train, whence it is dumped directly into tramway ore bins and shipped over the tramway to the smelter.

Buildings for all purposes have been erected at the tunnel mouth and active development of the known and supposed ore bodies is under way, and in a short time the Ferris-Haggarty mine will be in shape to produce all ores required by the plants at Encampment.

At the present time, for this development only, 125 men are employed and 200 to 300 tons of ore per day run over the tramway, the latter being operated only a part of the time.

## DILLON.

The town of Dillon has an altitude of 9,000 feet, is three-quarters of a mile southwest of the Ferris-Haggarty mine and is the principal supply point of this section. Supply houses, hotel accommodations, livery barn, etc., are located here and a good trade carried on.

North of Dillon, the Batchelder property has been developed for some time and has made a fine showing of ore, but unfortunately lost their surface works by fire, which has delayed the work during the summer to a considerable extent.

The Congo group, north of Dillon, shows a number of huge mineralized quartz ledges in the schist, and at one point the work has shown a width of thirty feet of mineralized matter. A tunnel has been run to cut these showings at a greater depth and has now reached a depth of 250 feet. A smaller stringer of concentrating material, showing a width of four feet, has also been cut by this tunnel, but the main lead has not yet been encountered.

West of the Congo are located the Hildebrand and Syndicate properties, where a heavily mineralized oxidized iron cap has been shown by surface workings. A shaft has been sunk on the Syndicate to a depth of 180 feet and some fine ore encountered, but it has not yet reached sufficient depth to fully prove the property. This property is located on a contact between an altered schist and diorite, and is considered to fully justify the work necessary to open it up.

East of the Congo the Independence and Mammoth properties are developing promising showings.

A tunnel has been run on the Pluto property to cross-cut the contact between quartzite and diorite, and drifts are now being run here.

The Echo property is especially interesting and promising, as it lies on the northern edge of the same band of quartzite, on whose southern edge occurs the Ferris-Haggarty ore deposits. A shaft has been sunk on this ore, has reached a depth of 114 feet and at this point the gossan is three feet wide, with some copper stains showing. In this property the conditions of this gossan are exactly opposite that of the Ferris-Haggarty, which latter has a quartzite foot wall and a schist hanging wall, where

the Echo shows a schist foot wall and a quartzite hanging wall. Developments on this property are being watched with interest.

The district south of Dillon has made considerable progress in the last year or two, and there are a number of promising prospects now being opened up. The principal showing is the Anchoria group, five miles south of Dillon, where a shaft is being sunk on a forty-foot ledge of mineralized schist, which shows considerable copper glance and other copper minerals. The present shaft is down 103 feet and a complete machinery plant is now being installed to reach a permanent working depth, with every prospect of having a good showing in the near future.

The Jack-Pot and Azurite properties are also good prospects for permanent work and results will be known before long.

Many good showings are made from the "Sandstone" country, west of Dillon, and it should receive the attention of prospectors this season, as there is every probability of opening up some profitable works there.

## SPRING CREEK VICINITY.

In this section the conditions are similar to those noted on Cow Creek and no deep mining has been attempted, though several of the properties have been working steadily. The Copper Bar Company erected a steam plant and have been sinking a shaft and pushing development work.

The Creede and Island City properties are developing a mineralized showing occurring on a contact between a norite dyke and schist, and east of the Creede, near Spring Creek, located on the Dreamland King property, is being developed a highly mineralized showing in a quartz ledge in schist similar to the Continental ledge, previously noted.

On Jack Creek the Badger State M. & M. Company has been sinking on a strong vein of quartz carrying copper and lead sulphides in a much altered schist and with diorite dykes in the vicinity.

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## WORK SOUTH OF ENCAMPMENT.

### PURGATORY GULCH.

In this gulch, situated six miles south of Encampment, in 1897 some remarkably rich gold specimens were found and formed the basis of the mining excitement which has developed into the Grand Encampment copper district.

At this time the Golden Eagle prospect was being opened up by an English company, but was afterwards abandoned and is now being developed with good results by local capital, as the ElRey group. Near this prospect is the Ball and Morgan prospect, which shows some good values and is undoubtedly a valuable property, but not developed.

The Fremont Copper Company, on Dunkard Creek, has installed a plant of machinery for sinking an inclined shaft on a promising showing. The King Mining Company, on the South Fork of the Grand Encampment River, is running a cross-cut tunnel to cut a quartz lead in schist that carries promising values in gold, and is one of the few properties in this locality worked for gold alone.

Here the formation shows contacts between the granites and schist, with several well defined veins and a highly mineralized condition. Considerable good ore has been found and development work has been satisfactory.

### BEAVER CREEK.

This locality, situated some twelve miles south of Encampment, contains some promising prospects. The Ætna and Evening Star properties are working, and recent reports are very encouraging. The Bay Horse, Newsboy and Kearns-Consolidated are prominent properties which have steam plants erected and have done considerable development work.

Here the formation shows some granite, a mica-gneiss and mica-schists, the latter being mineralized and showing copper

stains. Some graphite schist is found at the Kearns-Consolidated, as well as several heavily mineralized ledges, with a heavy capping of iron oxides.

### BIG CREEK AND STATE LINE.

The Cox mine, on Big Creek, twenty-two miles from Encampment, has produced some remarkably high grade copper ore and several shipments have been made from it. The ore is found in a huge quartzose ledge lying conformably with a wide band of schist in the granite foothills that are shown in the Platte Valley, distinct from the general uplift of the mountains.

The usual iron capping was found and the rich copper glance ore, noted above, found with copper carbonates near the surface. With depth, these gave place to bornite ore, filling the spaces in the crushed and broken quartz, often filling places formerly occupied by quartz and feldspar crystals, evidenced by the shape of the copper sulphide masses.

At the properties south of this, near the state line, prospecting has been general and hoisting plants have been erected for work that may be heard from later.

At Pearl, Colo., just south of the Wyoming and Colorado line, a smelter is being erected on a line similar to that of the Encampment works, to handle the ores of the Cold Water and Mount Zirkel mines of that region.

### CHARTER OAK MINE.

This is one of the oldest properties in the district and is located seven miles north of Encampment, in the northern edge of the foothills.

The general formation here is granite and diorite, the ore occurring in a schistose ledge matter in connection with the above formations. Ores consist of sulphides in the lower and oxidized forms in the upper levels. A shaft 488 feet deep has been sunk and about 300 feet of drifts run, with a good showing of ore.

This property has recently been reopened and a shaft is now being sunk on a fine showing south of the old main shaft following the dip of the ore, and working in the upper portion of what appears to be a huge vein with rich streaks occurring on



the foot and hanging walls. A plant of machinery will be placed on this new showing as soon as the present workings have sufficiently demonstrated the proper place for work and the property placed in shipping order as rapidly as possible.

### SARATOGA.

This town is situated on the North Platte River, twenty-four miles from Walcott, and is principally the headquarters and trading point for the ranches in the Platte Valley in this vicinity. The mines are mostly situated at Elk and Coad Mountains, some fifteen miles east of the town.

### ELK MOUNTAIN.

This is the most northerly of the ranges comprising the Medicine Bow Range in Wyoming and is a later uplift than the Sierra Madre on the west side of the Platte. In common with the most of these ranges on this eastern side, the sedimentary limestones of the upper Carboniferous period lie on the schists and granites of the earlier formations, and at the Elk Mountain M. & M. Company's property, on the north side of Pass Creek, the ore is found at or near the contact of these formations.

This ore, in the upper workings, is copper glance, occurring in bunches common to this ore, but in the lower workings is giving place to chalcopryrite, which is becoming more common as depth is reached. At the outcrops the usual iron oxides were found staining the limestone, with some glance and a great deal of green copper carbonates as a stain.

This company is well equipped with electric hoist and other machinery to develop this property, which is believed to contain large bodies of copper ores on the contact of limestone and schist, and toward which the workings are now being steadily driven.

There are several other promising prospects at Elk Mountain, and the schists, dyke rocks, etc., as well as the granites, show a heavily mineralized condition that compares very favorably with the conditions in the rest of the district, where more development work has been done.

### COAD MOUNTAIN.

This mountain, lying directly south of Elk Mountain, shows a very similar condition, but with the fine grained schists predominating and showing several huge ledges of a copper bearing quartzose ore material.

The Cumberland group, on the south end of the mountain, shows a huge ledge of quartzose material, some twelve feet wide, lying conformably with the dip and trend of the schist and showing a good grade of ore. A tunnel has been run to cross-cut the ore, but has not yet reached it, but it is believed will show a large body of concentrating copper ore at the depth of the tunnel, about 1,000 feet on the dip of the vein. The Camperdown group, north of the Cumberland, has a remarkable showing of copper ore, similar to the Cumberland, both of which are considered as good development propositions.

### THE GREAT RAMBLER MINE.

This property is owned by the Rambler Mining and Smelting Company, and is located on the crest of the Medicine Bow Range, just east of the Carbon-Albany County line, in Albany County, near the head of Douglas Creek, and was first opened up as a gold prospect. In 1900 the first copper was struck at a depth of sixty-five feet and the mine immediately began to ship high grade copper ore.

The formation containing the copper is a grey dioritic granite with some micaceous schist in the vicinity, but the ore is found in a series of fissures in the granite, both extent and direction of these fissures varying in the different levels, but having a general trend a little west of north and a dip of 40° to the east, as shown by the present workings.

The different lenses are connected by stringers and streaks of ore in the granite and form together an immense ore body, the full extent of which has not been exploited.

In common with other prominent properties in Southern Wyoming, the surface and outcrops of this property show the usual oxidized forms of iron or "iron cap," with an occasional copper stain.

The capping here is usually a light, porous, spongy limonite, but in many of the upper workings hard red hematite is often

noted, with what is called "Jaspilite" in small, hard bunches. The "iron hat," as this capping is called, here extends to a varying depth and gives place to the varying forms of copper minerals met with in this mine.

The Rambler mine is a veritable museum of copper minerals and nearly all the known forms have been found here, either in quantity or as specimens. Native copper is noted in sheets often of a dendritic form, and as small nuggets. Copper carbonates, green and blue, are abundant, as well as the silicates of copper. The red oxide of copper, Cuprite, and the black oxides, Tenorite and Malaconite, are noted in quantity.

Covellite, or "Indigo Copper," is the ore that made the Rambler famous, as this variety has always been a rare form and seldom, if ever, found in the quantity in which it occurs in this mine, as only small specimens of this variety are usually found in the different museums of minerals.

Quantities of a very fine grained copper glance are found, carrying minute specks of unaltered chalcopryite, similar to that noted in the Doane-Rambler mine on Battle Creek, in the Sierra Madre Range. Many of the other forms of copper are noted in small quantities, scattered throughout the gangue, which, as a rule, is silicious and contains some lime.

A remarkable feature of these ores is their comparative freedom from the minerals, such as bismuth, antimony, etc., which are frequently associated with copper ores and are a serious hindrance to the economical smelting of such ores.

Platinum has been found in the Rambler ores, occurring in the Covellite and showing 1.4 oz. of platinum per ton of ore. Paladium has also been noted in the Covellite ores with the platinum.

The mine has been developed by shafts and drifts, and has some 2,800 feet of development workings. A winze has been sunk on the ore for a depth of eighty-five feet below the lower level, opening an additional amount of ore. Developments have indicated the presence of a number of cross fissures in the formation, and further work on this theory will be awaited with interest.

The grade of ore at this property has been high and a number of cars of very high grade ore have been shipped, especially



*Photo by Prof. B. C. Buffum.*

VIEW OF NEW RAMBLER MINE.

that containing the glance and Covellite. Smelter receipts of these shipments show 1,928 dry tons of ore shipped, averaging 19 per cent copper and representing a gross value of \$77,622.

The general grade of the oxidized ores is low, about 10 per cent copper, and to treat these ores a matte smelter of forty tons per day capacity has been installed at the mine and successfully operated, as the ores treated are easily smelted and contain within themselves the necessary constituents for successful smelting and are known among smelting men as "self-fluxing" ores. The grade of matte shipped varied from 30 per cent to 60 per cent copper, the former being made during experimental runs and the latter during general practice.

The matte made and shipped is given as follows:

613,881 lbs. matte.  
249,196 lbs. copper.  
\$36,135.41 value.

A first-class mechanical plant and buildings have been erected at the mine and work carried on in a thorough workmanlike man-

ner. The mine has been idle for the past two years, the attention of the owners being directed to their other properties, but arrangements are now being perfected to open and work the mine to its full capacity.

Prospecting in this locality is difficult, as a heavy wash covers the ground to a depth of from two to twenty feet and outcrops are rare.

A great deal of surface drifting and trenching is, therefore, necessary to uncover the leads and determine the location of even preliminary workings.

#### FRENCH CREEK.

The territory lying north and west of the Rambler, on the west slope of the range, between French Creek and Mullen Creek, has been the scene of a great deal of prospecting and work during the past year.

On Iron Creek a huge ledge of iron oxides is noted, outcropping in general as a hard, silicious hematite, but often associated with deposits of brown limonite and frequently carrying small copper values.

A shaft sunk by the Ak-Sar-Ben Company on this material to a depth of eighty feet is the deepest working and shows a soft condition beneath the capping. This shaft also shows considerable of the black oxides of iron and manganese, with some graphite schist in the ledge matter. Cross-cuts have been run across the lead for seventy-two feet. This material varies in composition from the hard hematite, as above, to a light, soft, spongy limonite, identical to all appearance with that overlying the commercial deposits of this district.

On the Raven group, adjoining the Ak-Sar-Ben group, an especially good exposure of a soft limonite is noted, and in another shaft on the Ak-Sar-Ben group the soft brown and yellow limonite underlies the hard hematite cap.

A number of other properties have been located on this ledge, but none of the workings have yet penetrated through this oxidized material. It is believed that this material is underlaid by iron sulphides carrying copper and this in turn by copper sulphide ores, and with similar deposits in Wyoming should be thoroughly exploited.

#### HOLMES.

This town is at the Rambler mine, altitude 9,860 feet, and is the postoffice of the mine and adjacent country.

Adjoining the Rambler group is the Blanche property, where a steam plant has been erected and a shaft sunk to a depth of 160 feet. At 120 feet carbonates of copper and some glance were found. The shaft was sunk to cut the Rambler ore bodies, the exact trend and extent of which has never been exactly determined, and the work on the Skylark claim of the New Lincoln Copper Company, north of the Rambler, is being done with the same end in view. A similar plant was set up on the Duchess property, west of the Blanche, and sinking is going on.

East of Holmes is the Albany group of the American Copper Company, where a shaft has been sunk 360 feet on a low grade copper ore and drifts run on the vein.

The Medicine Bow Mines Company is running a cross-cut development tunnel to prove their principal holdings and also cut the ore already proven in the Cuprite shaft at a greater depth. The tunnel has reached a present length of 954 feet, has cut a number of bodies of ore, and values in cobalt, copper and gold are reported in these ores. The tunnel will cut the Cuprite ore at a depth of 200 feet, and the development has shown a good proposition.

On the Papose claim, near the Cuprite, a heavy vein of quartz, carrying gold values and showing the usual oxidized iron surface ores, has been opened up and a shaft has been started for deeper work.

At Keystone, altitude 8,890 feet, four miles south of Holmes, is the old Keystone mine, worked for gold during the first excitement in this region, and which, with proper management, would again make a production record. The shaft is 365 feet deep, and about a mile of drifts has been run on ore which supplied the twenty-stamp mill on the property. Near the Keystone is the Independence, whose surface showings indicate commercial bodies of ore and warrant their full development. A quartz outcrop eight to ten feet wide, heavily stained with iron oxides and copper carbonates, extends through the group, and a shaft eighty feet deep, sunk through the vein with drifts to the ore, has shown up a body of milling ore.



The Gold Crater group is under bond to the American Copper Company, and a tunnel, run to cross-cut the formation, cut a vein showing phenomenal gold values as free gold in the quartz. It is being pushed to cut a lead known as the Mammoth lead and which has shown pay values where it has already been opened up.

On Lake Creek, about nine miles southeast of Holmes, the Ottumwa and Maudem properties are situated, a cross-cut tunnel being run on the former to cut a heavy showing of concentrating copper ore, which has been developed by shallow workings on the outcrop. This tunnel is in 280 feet and has about 250 feet to run before reaching the ore. The Maudem has a tunnel run on the trend of the vein and has shown up a shoot of concentrating ore.

#### PLACERS.

The first workings in the Medicine Bow Ranges were placers and followed the discovery of gold in Moore's Gulch in the fall of 1868, and for years placer mining was the main work in these ranges, the usual method being primitive rockers and sluices, and in a number of instances the claims were worked by panning alone. The total amount of gold produced by these placers is not known, as it was taken out by many different parties, often in small amounts and no exact record kept.

Douglas Creek is the principal creek and producer in this locality, and the tributary creeks of Lake Creek, Beaver Creek, Lincoln Gulch, Muddy Creek and Spring Creek, with a dozen others less well known, offer a fine field for development of the ground as yet untouched, as in many cases the placer ground is held by people financially unable to put in the proper plants to handle the gravel economically or profitably.

It is believed that dredging will prove the most satisfactory method of handling the gravels here, as in many cases the gravel is small and free from large boulders and the gulches wide enough to permit extensive workings. The fall is from twenty to thirty feet per mile in the flats and from forty to sixty feet in the canons. This varies locally, as in all mountain streams.

The water supply in these creeks is constant during the working seasons and reservoir sites are available throughout the district.

About 25 per cent of the gold taken up is coarse and jagged in appearance. Nuggets up to 68 dwts. have been found and many have had considerable quartz attached. Gravel varies from three feet to fifteen feet in thickness. Most of the gold is found on bed rock, and there is no pipe clay or hard cement on bed rock, as in many localities, to interfere with the free handling of the gravel.

The Douglas Consolidated M. & M. Company holds 1,920 acres of placer ground on Douglas Creek and Muddy Creek, eight miles lying on Douglas Creek and five miles on Muddy Creek and varying from 600 feet to 2,700 feet in width, the latter width occurring at the junction of the two creeks. Nearly all of this ground is adapted for dredging work.



*Photo by Prof. B. C. Buffum.*

SCENE ON HOME PLACER, DOUGLAS CREEK.

The Home Placers on Douglas Creek, owned by Otto Gramm of Laramie, produced the largest nugget yet found, 68 dwts., and extend two miles up Douglas Creek and one mile up Beaver Creek. The Pioneer Placer Mining Company has a steam shovel

at work on the lower end of a promising flat on this property and working seven men. This is in the nature of preliminary work on this gravel, and the season's results are being watched with interest.

The Spring Creek Placers, held by William Sturgis and others of Cheyenne; Albany Placers, on Upper Douglas Creek; the Ritchie Placers, on Lake Creek, and the Hurley workings, on Lincoln Gulch, are all good examples of their class of gravel, and there are others in the district which also merit the attention of placer miners who understand their business.

### SNOWY RANGE.

On this range, near the head of French Creek and Gold Hill, considerable prospecting has been going on for a number of years, and specimens of copper ores, both oxides and sulphides, indicate a continuance of the same conditions that are observed in the district and only await development to become profitable properties.

### CENTENNIAL AND JELM MOUNTAIN.

These camps are located on the east slope of the Medicine Bow Range, the former having been prospected for gold almost exclusively.

Centennial, the present western terminus of the Laramie, Hahns Peak and Pacific Railroad, now building, has shown some remarkably rich gold ores, and the half dozen properties now working in this vicinity are making good showings and will be heard from later.

The Bradley is the principal property here and is to be systematically developed, after a thorough prospecting and working out of the surface conditions, by a tunnel on the vein to the main ore shoots, which have been cut in the upper workings.

Jelm Mountain is located south and east of Centennial, near the Colorado-Wyoming state line, on the Big Laramie River, and mining has been going on there for some years, development work having been done on a number of properties and mills erected.

The Wyoming Queen Company has been pushing development work, has erected a stamp mill and is working steadily

with good showings. The ores reported from Jelm show a similar condition to the other parts of this district, the formation being gneiss and schist, and the ores copper sulphides and galena, with gold and silver values associated therewith.

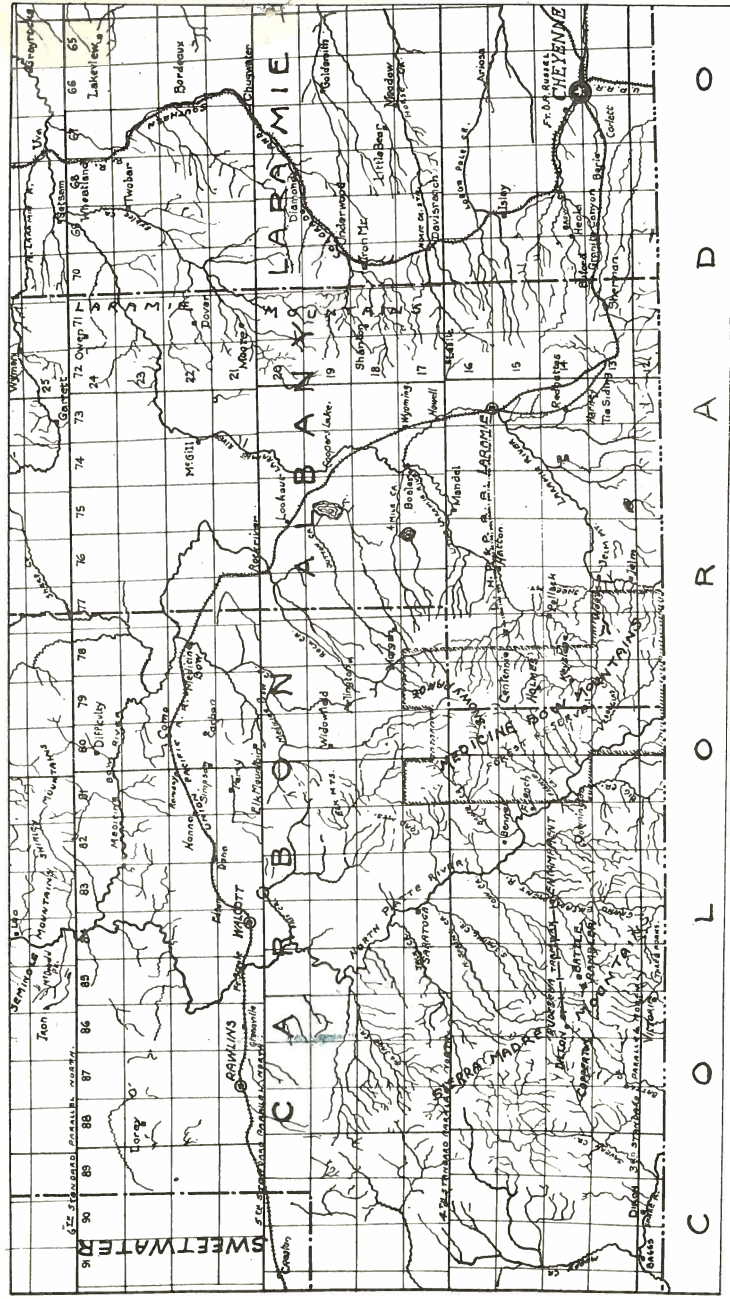
The developments of the past two years have conclusively demonstrated that the ores of the district are not confined to a few shoots in the prominent producers of the present time and that the present prospects do not cover the possibilities of the district, or that a prospect is worthless because pay ore was not opened up within a few feet of the surface, but it is a fact beyond dispute that few new districts have shown as few failures, *where the work has been done on the ore*, as the Grand Encampment District.

It is unjust to the district to charge the non-success of incompetent or ignorant operators to a lack of commercial ore, or to condemn the locality as barren because a few have failed to open pay ores on insufficient capital or worked without regard to the ore conditions.

Systematic development *on the ore* is the only method that has yet succeeded in this district, and the only course open to the prospector is to *follow the ore or ore indications* without regard to the possibilities of long range tunnel sites or working shafts *until the ore has been proven*. STICK TO THE ORE.

The work on the Doane-Rambler, Ferris-Haggarty and Copper Age mines has shown that the ores in the Grand Encampment District are not surface shoots, and that the permanent ores are concentrating ores of low grade, and in all equipments installed in the future this fact should be carefully considered.

There is no longer any doubt as to the proper method of treatment of these ores, as the Encampment smelter has solved this problem and buys all ores of suitable grade in ten ton lots, producing a local market for the district, and there is now no reason why the production of the Grand Encampment Copper District should not be rapidly increased and steadily maintained at a high figure.



MAP OF THE COUNTY REFERRED TO IN THIS BULLETIN.