Notes about this document
20181121 William Schuster, Idaho Geological Survey

This page is inserted and not a part of the original scanned document that constitutes the following pages.

Idaho Geological Survey’s annual reports from the Idaho State Mine Inspector to the governor for years 1914-1918, originally in a single bound volume, are divided by year. A digital facsimile of the volume may be re-created by removing this page and combining PDF files for years 1914-1918.
INDEX

of

Report for 1915.

Introduction 5-9
Accidents and their causes 9-15
Employers' Liability 15-16
Mechanical Improvements 16-19
Marsh Hoist 19-23
Mill Improvements 23
Smelting 23-25
Electric Power Supply 25
Natural Resources 25-26
Agricultural Resources 26-28
Conservation fallacies 28-32
Mining Development Progress 33-35
Coeur d'Alene Geology 36-56
Idaho Batholith 56-68
Coeur d'Alene-Idaho Zinc 70-72
Lawrence Mine 72
Blaine County Mines 73-77
Lemhi County Mines 77-80
Custer County Mines 80-82
Fremont County 82-85
Boise County Mines 85-90
Horseshoe Bend & Pearl Dis. 90-92
Owyhee County 92-95
Adams County, Seven Devils 95-96
Red Ledge Mine 96-99
Elmore County 99-100
Warren district 100-103
Snake River Fine Gold 103-106
Phosphate fields 106-113
Potassium & Nitrate 113
Natural Gas & Calcium 113-114
Idaho Coal Resources 114-119
Tungsten Ore 119-122
Asbestos 122-123
Antimony 123-125
Conclusions 125-127
Grand Totals 128-134
Seventeenth Annual Report

of the

Mining Industry

of Idaho

for the year

1915

Robert N. Bell

State Inspector of Mines

To His Excellency, Moses Alexander,

Governor of Idaho.

Sir: I have the honor to submit herewith my report as State Inspector of Mines for the calendar year ending December 31, 1915.

Robert N. Bell,

State Inspector of Mines.
INTRODUCTION.

During 1915 the mining industry of Idaho again enjoyed the most prosperous year of its history, by reason of the excessive demand for base metals brought about by the European War and the shutting off of other sources of the world's supply. Our base metal products were in excellent demand and this condition, coupled with the extremely high market value prevailing for zinc and the rapid increase in lead and silver values during the closing months of the year, resulted in marked mining activity throughout the State and by far the greatest yield of net profits from mineral and metal shipments ever recorded in Idaho, exceeding the previous record yield in value by fully 50 per cent. The phenomenal profits made on zinc ore production particularly stimulated interest in the zinc resources of this State and a development activity that is likely to bring to light, in the near future, several additional producers of this useful metal and firmly establish a new important source of mining activity and profit in Idaho.

The total gross value of the metal contents of the ore and bullion shipped from Idaho during 1915 will aggregate approximately $39,000,000, of which probably over $9,000,000 was accumulated as net profit to the operators.

The Coeur d'Alene district in Shoshone County continues to be the greatest factor in the mineral output of the State. Its yield of zinc was fully 100 per cent higher than the large output of the previous year, and if the market demand continues through 1916, it can easily show an additional 100 per cent increase for the coming year from present proven resources. Some rapid advances have been made in the metallurgy of zinc, especially by the Anaconda Copper Company, of Montana, that promises to revolutionize the industry and give the Northwestern States a marked advantage in the production of this metal by virtue of the association of the valuable by-products of silver, lead and copper that are invariably found
in greater or less degree in Idaho and other northwestern zinc bearing ores.

The mine output of lead, which is Idaho's banner mineral product, aggregated 368,000,000 pounds and could easily have reached 400,000,000 had it not been for the interruption caused by smelter market troubles and conditions which put two of the largest lead producers out of commission for several months of the year.

Increased lead production was made in the Gilmore district and at the Wilbert Mine in the Dome Mining district in central Idaho.

The production of silver was about the same as in 1914. Shoshone County was responsible for fully 95 per cent of the output of lead, zinc and silver, and Custer County, principally from the successful operations of the Empire Copper Company, produced 85 per cent of the State's copper output, amounting to over 7,000,000 pounds.

More than 50 per cent of the gold production of the State came from Boise County. Development activity prevailed in nearly all the mining districts of the State and was especially emphasized in new enterprises and the revival of old operations. The demand for labor was good and well supplied with a good class of men.

With minor exceptions and some natural hazards that are difficult to eliminate, the big mines in the Coeur d'Alene district are kept up in splendid shape and the principal operators have taken a keen interest in accident prevention and in the general welfare of their men, especially stimulating interest in the study of accident causes and first aid work. This latter feature was materially encouraged by the Federal Bureau of Mines, who sent a corps of instructors to the Coeur d'Alene district during the summer and a competitive test was pulled off at Wallace in September between the first aid crews of the different big mines of the district, in which a great deal of interest was taken by the men.

Recently the Federal Company have employed a safety expert whose exclusive duties will be to instruct their men in precautionary measures and in a knowledge of first aid work. In spite of all these precautions and effort on the part of the operators, who are sincere in their desire to
prevent accidents, nearly the usual number of fatalities occurred, which seem to be hard to reduce, and, as usual, as will be seen from the cases described, are largely the result of a lack of care and judgment on the part of the victim or a co-worker and embraces the different grades of employee, from mucker to men in authority.

The air blast conditions at the Green Hill Cleveland Mine have been persistent in spite of every effort made in the way of end slicing of the Keystone stope blocks, closer timbering, and close filling to prevent them. The care of the company in this respect, however, has minimized this natural risk to a considerable extent.

In spite of the fact that the Morning Mine, under its present management, has been made about as fool proof as a big mine can be made, ill luck has followed this property and kept it prominently in the tributary accident list.

Some extensive changes and new mechanical installations were made by the Federal Company at both the Green Hill Cleveland and Morning Mine during the year with a view to reducing under ground temperatures, hoisting, and fire hazards at their main stations. The fire risks under ground are ordinarily remote in a metal mine but are likely to prove disastrous if they do occur and very difficult to fight, and I am gratified to find my suggestions along these lines very substantially complied with by the biggest operators. I find very little trouble in getting action on these matters with the profitable enterprises, but with the prospecting and development ventures, or under conditions where a mining enterprise, even of considerable capacity, is in an unproven or near exhaustion stage, economic conditions occasionally warrant considerable latitude on expensive improvements of a precautionary nature. In this connection the following extract from a personal letter of a rough diamond, but very practical operator of central Idaho, who is also manager of a big mine in another State, is very much to the point:

"This is to advise you that we have just received the oxygen breathing apparatus which you ordered and which incidentally sets us back about eight hundred bucks. I cannot say that I am deeply grateful
for your suggestion, still I recognize it is all in the day's work. I fear that our—friends in the legislature will some day pass a bill making it a misdemeanor for a mine owner to have sharp picks in the mine for fear the miners might hurt themselves—but seriously, these laws make life a burden to a poor unfortunate general manager and the only consolation I have is that things are a great deal worse in "C" than they are in Idaho."

**ACCIDENTS AND THEIR CAUSES.**

**Fatal Accidents Causes.**

The total number of men employed in the mining industry of Idaho during 1915 varied up to 7,500 men and would probably average 6,500, or an increase of 1,300 men over the previous year, and the number of fatal accidents per thousand men employed was 3.54, as compared to 5.19 in 1914. During the year there has been reported to this office a total of 23 fatal accidents, whose causes fall under the following classification:

<table>
<thead>
<tr>
<th>Mine Accidents Under Ground—Causes.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>By fall of rock or ore from roof or wall</td>
<td>9</td>
</tr>
<tr>
<td>By explosives, premature blasts, etc.</td>
<td>3</td>
</tr>
<tr>
<td>By haulage by mine car, mine locomotives</td>
<td>4</td>
</tr>
<tr>
<td>By falling down chute, winze raise or stope</td>
<td>1</td>
</tr>
<tr>
<td>By electricity</td>
<td>2</td>
</tr>
<tr>
<td>By suffocation from powder and other gases</td>
<td>3</td>
</tr>
<tr>
<td>By shaft accidents</td>
<td>0</td>
</tr>
<tr>
<td>By mill accidents</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>23</strong></td>
</tr>
</tbody>
</table>

The serious non-fatal and minor accidents statistics are not sufficiently complete for compilation at this date.

A brief detail review of the causes of this list of fatalities, as reported to this department and gathered personally, is as follows:

On January 5th, at the Stewart Mine, August Wendt, a widower and experienced shift boss and acting foreman at the time, was knocked down by an electric train car in
the main haulage tunnel of the property and received injuries from which he subsequently died.

On February 10th, in the Bunker Hill and Sullivan Mine, at Kellogg, Anton Danielson, age 42, Charles Jacobsen, age 34, and John Martinson, age 24, lost their lives as a result of a cave-in accident in the Cameron stope. This very serious run of ground was due to an unforeseeable condition of the hanging wall of the stope. A water crack had developed in the main ore body and let go a big block of ore which was gradually squeezing the sets when the shift went to work in the morning. The shift boss noticed the dangerous condition of the ground and ordered every body out from under it. Two of the victims were experienced timber men, employed by the company for several years. The ground involved could only fall the width of two sets between the breast of the stope and the back filling. The feather edge of the block, however, struck the floor of the last set next to the hanging wall, where it broke the timbers on which it was resting and pulled the support from the soft hanging wall, which resulted in a run of fine muck that came at an unexpected angle onto the stope floor on which two of the victims were standing evidently watching the block of ground work, not anticipating any trouble from the direction in which it came, and which resulted in catching and smothering them under just a few feet of loose earth. This wall condition had never before, nor has it since, given any serious trouble. It was timbered up tight at the time and supposed to be perfectly secure by the expert timbermen in charge of the work.

On April 25th, at the Green Hill Cleveland Mine at Mace, John McMillan, a married man and an experienced miner, employed as a shift boss, while standing on a stope floor and giving orders to a mucker, was struck by a slab of waste which fell from the hanging wall and resulted in injuries that caused his death a few days later.

On May 19th, at the Gold Hunter Mine, near Mullan, John F. Harper, a single man, while working in the Brennan raise was overcome by powder gas and fell into the chute and was killed.

On May 24th, at the Green Hill Cleveland Mine, John Samovich, a married man and an experienced machine miner, lost his life by an explosion of powder caused by
drilling into a missed hole in the face of the North cross cut on the 1400 foot level. The missed hole had been reported by the blaster and chalked up on the tally board at the end of the previous shift.

At the Success Mine, Tom Smith, single, a mucker, was drawn into an ore chute and smothered. Fifteen minutes before this accident happened the shift boss notified him to keep away from the top of the chute, which was full at the time, as they were going to draw it, but for some unknown reason the man was standing on or near the top of the filled chute when the muck was drawn on the level below and was pulled in with it.

On July 4th, at the Ontario Mine, Joe Dapra lost his life by electrocution. Dapra and three other miners were waiting at a switch in the Ontario tunnel for the return of a mule train with which they were cleaning up the track during a holiday, when the main mine was closed down. The men were standing under an incandescent light, visiting and waiting for the empty cars, when Dapra thoughtlessly put his hand on an insulated light wire carrying 250 volts while standing on the wet track rail. He had to reach up to do this, as the wire was carried close in to the upper north corner of the drift. Its insulation must have been faulty, as he received a shock from which he could not recover, although his partners worked over him for an hour in an effort to revive him by artificial breathing manipulation.

On July 12th, at the Morning Mine, near Mullan, James A. Cuddy, single, a motorman's helper, while loading cars on the 1,400 level, accidentally got his bar in touch with the protected trolley wire, while standing in a metal car, and was fatally injured.

On August 7th, at the Pittsburg-Idaho Mine, in the Gilmore district, Lemhi County, Thomas Martin, an old miner 60 years of age, was tending dump at the foot of a flat incline surface tramway, 2,400 feet long, when the coupling pin attaching the endless rope to the car broke and the loaded car run away and crashed into the dump bins, causing his death.

In the Spring Mountain district, a few miles south of Gilmore, Pat McAlinden and Mike Rooney, two experienced miners, the latter a champion hammerman well known in Butte, were working a lease on a lead-silver
prospect, and while temporarily absent from their cabin, which was built at the portal of a tunnel, the cabin caught fire and was still smoldering on their return. One of the partners for some purpose went into the tunnel and not returning, the other partner went in to see what was the matter with him. They were both overcome with the spent gas of the fire or burning powder gas and smothered, and were subsequently found dead in the tunnel by the owner of the claim.

On October 14th, at the Green Hill Cleveland Mine, at Mace, Isaac Johnson, a single man, while working on the 16th floor of the 12th level, was struck on the head by a piece of rock while pulling out lagging to let down the muck and fell to the next floor, receiving injuries that caused his death.

On October 17th, at the Morning Mine, William H. Joslin, a motorman at No. 6 haulage tunnel, ran a train into a standing clean up car on the main track and received injuries which caused his death. The trackman flashed the usual danger signal at a distance of 500 feet from the car, but the train was under too much headway to be checked in time to avoid the collision.

On September 16th, at the Success Mine, Amandus Larsen and Bert Oman were killed by a boulder of rock which dropped out of the hanging wall onto the floor of a well timbered stope in which they were working on fifth floor above the 1,100 foot level.

On October 3rd, at the Morning Mine, near Mullan, Joseph F. Thompson, 37 years old and married, an assistant master mechanic, had been working on a trouble call at the shaft station in the No. 6 two-mile tunnel. He started out after completing his job at three o’clock in the morning on a switch motor, after assuring himself over the phone that the track was clear, but through an error of a head house attendant, met the ore train coming in on a sharp curve, resulting in a head on collision under full speed and received injuries from which he died shortly after.

On November 6th, at the Morning Mine, Thomas Haurunnen, 36 years old and married, a machine miner, while barring down the back of the stope on the 21st floor of the 1,200 foot level, was struck by a slab of rock which pinned him to the floor and caused his death.
On November 15th, at the Morning Mill, H. E. Ramey, 27 years old and single, while attempting to untangle a small three-inch belt which drives a slow moving Macquisten flotation tube stand that had run off the pulley, without first shutting off the power, had his arm caught in a loop of the tangled belt and was whirled around the line shaft to his death.

On December 14th, at the Morning Mine, Jacob Bergh, 41 years old and single, a machine miner, while drilling in a narrow part of the vein on the 18th floor of the 1,200 foot stope and within hand reach of the back, drilled a slab of loose ground which proved to be two and a half feet thick by two and a half feet wide and four feet long, which fell on him and the machine and crushed the life out of him.

On December 19th, at the Stanley Mine, near Burke, two miners, George F. Davis and J. D. Morgan, both married, 40 and 38 years old respectively, earning $4.50 per day each, were spitting a round of 10 holes in a dry cross-cut from the lower Stanley tunnel and evidently stayed too long after lighting the fuses, as they were both killed by the resulting explosion.

The unusual number of tramway accidents that occurred during the year was deplorable, as they were all of a preventable nature.

The usual large percentage of fatalities attributed to falling ground are largely preventable and were, with one exception, all due to small falls of rock where a careful watch of the situation for loose ground and an appreciation of the danger by the victims might have materially reduced this list. In the Bunker Hill accident, which caught three men, the particular point in the hanging wall that was accidentally ruptured ran in like tapping a pocket of sand at a very unexpected angle, as the ground was closely timbered and filled, and two of the victims at least evidently thought themselves entirely out of danger where they stood.

The interest being taken by the big companies in accident prevention and the care and health of the men is unquestionably giving results and is a commendable spirit of the times and should be extended and persisted in with military rigidity; especially is this true in connection with the use of dust killers in dry stopes on one-man machines, which are now used extensively, as this class of work pro-
duces a very unhealthy atmosphere to work in. Dust killing devices should be insisted upon and the necessary latitude of footage requirements of the men should be considered under these conditions.

Too much care cannot be taken in dry raise work against spent powder gases, and the first move by the men in this class of work in going back after a round is blasted should be to turn on the air and get the air into the back of the raise after the muck is started, especially where the bulkhead hole has been chocked by the round, and before entering the chamber, as powder gas is very poisonous and a man is easily overcome and in a dangerous and unfavorable situation to take care of himself under the circumstances.

For working at an ore chute under a trolley wire, no matter how well it is guarded, steel poking bars should be provided with a heavy rubber cover at the dead end. Drift trolley haulage for underground gathering work should be replaced with storage battery locomotives where the operating costs are at all comparable, as the latter method eliminates the trolley wire dangers that are always a menace to men working under them, on account of their necessarily low hung position through long drifts in heavy filled ground.

EMPLOYERS' LIABILITY AND WORKMEN'S COMPENSATION ACT.

The last session of the legislature, as a result of the recommendation of a commission, passed a well considered and carefully prepared workmen's compensation act, based on the New Jersey law, but the bill was vetoed by the Governor for the expressed reason that its operating cost, involving an appropriation of $50,000 to start it off with, was contrary to his avowed policy of retrenchment and considered by him as an excessive demand on the general tax payers.

It is a fact that political considerations entered into the death of the bill on both sides of the fence. At the demise of the bill some Montana labor influence was brought to bear, and to show how little warrant it had, the State of Montana, at the same session, passed a bill that is almost an exact duplicate of the Idaho measure and is now in successful force and effect. A measure of this
kind is demanded and has been advocated by all political
parties in Idaho for the past 20 years for the equitable
protection of employer and employee in the hazardous oc-
cupations of Idaho, and it is to be hoped that the Mon-
tana experience with a measure so closely parallel to the
one vetoed in Idaho will be a sufficient guide to warrant
a further consideration of the passage of such a law by the
next Idaho legislative assembly.

MECHANICAL IMPROVEMENTS.

New Safety Equipment.

Among the more important safety improvements of the
year was the replacement of the boiler furnace air reheat-
ing apparatus of the big underground hoist in the Camp-
bell station of the Standard Mammoth Mine, for which
has been substituted electrical reheaters that have greatly
reduced temperatures and improved conditions at this
important man handling hoist from a safety standpoint.

The same company, at its Morning Mine, in its No. 6
tunnel station, two miles in from the tunnel portal, have
remodeled their big Corliss hoisting engine and adapted
the application of the Nordberg Segmental clutch, which
operates in six independent segments on each reel, a big
added factor of safety over the former single band type
of clutch. This big hoisting plant handles a thousand tons
of ore a day from a vertical shaft 1,000 feet deep. It is
actuated by compressed air formerly piped in from an
outside plant and reheated at the hoist by wood fires
under steam boilers, creating an undesirable heat con-
dition and fire risk. These have been displaced with elec-
trical reheaters for emergency on the outside air line,
which is also tied into a splendid new compressor instal-
lation in a room adjoining the hoist and consisting of a
direct driven, electrically operated, 2,500 cubic foot com-
pressor, as shown in an accompanying illustration, which
furnishes air direct to the hoist from an intake placed
some distance away in the main surface air course of the
mine, and is giving very satisfactory results and improved
safety conditions at this vital junction of this big mine’s
activities.

A new electric chippie hoist is also ordered for man
handling purposes in the third compartment of the shaft.
The latter, during the idleness of the property due to lack of ore market in 1914 and the early months of 1915, was retimered from top to bottom and is being gone over again with a second envelope of timbering to make accessible the maintenance of alignment of its main sets in a condition of uneasy ground. This improvement, together with a permanent new traveling way from below and additional outlet into the main tunnel several hundred feet distance east of the shaft station, the installation of a block signal system in the only curve of the long tunnel, its close timbering and filling and new head house for the portal of the tunnel, together with its three outlets to the surface, will put the Morning Mine, from the standpoint of precautionary conditions, on a par with the best example of mining progress in the country, I think, and there is not any good reason why its accident troubles should not be very materially reduced.

At the Bunker Hill Mine, an expensive adjustment of surface powder storage provision was made, and also the completion of a strictly up-to-date concrete and steel two-story dry or miners’ change house of the most modern design, with a capacity for taking care of 400 men, at the Kellogg tunnel portal.

At Burke, a second safety outlet was completed at the Hecla Mine, which, in common with the Standard Mammoth and Morning Mines, has also equipped the collar of its vertical shaft with convenient mechanical devices for a rapid exchange of skips and cages, greatly reducing the dead load on the cables formerly carried and providing a big reduction in former hoisting strains.

An extensive addition was made to the splendid modern head works of the Hercules No. 5, 8,000-foot tunnel, including an all under cover timber loading shed and blacksmith shop, accessible to the electric trains. The accompanying illustration gives a partial view of this interesting plant and the big modern concrete miners’ hotel built by the Hercules Company a year ago.

Marsh Hoist.

A very interesting mechanical installation at the Marsh Mine is worthy of a brief description and shows a warranted faith in the district by this company that could be copied to advantage by other new operators after the existence of a commercial ore channel is proved. This in-
Installation consists of a new Nordberg double drum geared hoist designed to operate normally in balance at a rope speed of 800 feet per minute, with an ultimate capacity of 2,500 feet in depth, with a combined muck, skip and rope load of 14,600 pounds, electrically driven, with maximum requirements of 300 horsepower. For present purposes, only one motor has been installed of 150 horsepower, which amply takes care of the present requirements of the mine. The rope is one and one-eighth inches, round, on a straight face drum six feet in diameter and governed by brakes of the truss bound post type, and clutches of the Nordberg axial friction type, both of which are operated by a dead weight and released with air engines.

This hoist is also equipped with a Welsh patent indicator and speed regulator, a function of which is to show the position of the cages in the shaft at all times and prevent under winding into the bottom and over winding into the sheave wheel, and also to prevent over speeding.

The cost of electrical power for operating this hoist at its present capacity for three months, has been $200, during which time the hoist was operated on a three-shift basis, handling 200 tons of ore daily in addition to all the other miscellaneous work. This plant is situated in a large underground station at the head of a vertical three-compartment shaft 900 feet deep. The station is 900 feet in from the portal of the main adit tunnel of the mine in very hard quartzite formation and is provided with a head frame 110 feet high above the collar of the shaft, with skip pockets cut out of the solid rock partitioned for ore and waste, and having a capacity of 700 tons. An under floor chamber, with automatic carriage, is provided for facilitating a rapid exchange of skips and cages, and the whole setting is a convenient and splendid design of underground architecture, a credit to the management and well worthy of copying where new installations of this kind are in prospect under similar conditions.

This company also recently installed an electrically driven horizontal Prescott Plunger station pump at its 900-foot level, weighing 20 tons, which was well warranted by the water flow encountered. The drift on this new level had just entered the main ore shoot at the time of my visit in November and was showing the same rich mineralization in high grade lead, zinc and silver values for which it has been noted, above.
Mill Improvements.

Other mechanical installations and progress of the year in the Coeur d'Alenes was a marked improvement and extended application of the flotation process at all the big milling plants, which has greatly increased the percentage of ore recovery in both lead and zinc at the fine end of the operations, where the slime losses have always been serious, and it is believed that the interest being taken in this new application of ore recovery in the concentration process of the district will result in shortly bringing its milling practice up to the highest possible standard of efficiency.

Smelting.

The great mineral yield of the Coeur d'Alene district, now aggregating over 400,000 tons of high grade shipping product a year, has always been shipped to other centers for final reduction by smelting, involving a high economic loss in railroad charges over long distances on an inevitable component of dead waste in the shipping product, for the 50 per cent lead concentrates produced by Coeur d'Alene mills still contains 50 per cent of dead weight in waste that has to be slugged off in the final smelting process, which means the mines pay $8.00 freight rate a year on 200,000 tons, at least, of practically valueless mineral, that it would seem could well be economically dropped very much closer to its source.

Owing to a controversy over the existing smelter rates, the Hercules Company, controlled by the Day Brothers, were forced into an independent smelting venture and during the summer purchased the well known Northport smelting plant in the northeastern corner of Washington. This splendid smelter plant was installed by a big Canadian company and only operated a short while when a consolidation of interests with another big company centralized its ore supply to another point and put it out of commission. This is said to be one of the best location sites in the Northwest for a smelter, with exceptional railway facilities and tributary sources of custom ore and fluxing materials. It is equipped with both copper and lead furnaces.

Since its acquisition by the Day Brothers, who, with characteristic thoroughness, also purchased a refinery
plant in the East, to take care of their own product, the smelter has been overhauled and it is expected will be blown in by February, 1916, and start off with a capacity of 350 tons a day, which will be supplied in the form of high grade concentrates and crude ore from the famous Hercules Mine, and from the rapidly expanding and extensive new resource of clean lead mineral at the Consolidated Tamarack and Custer Mines, also under the control of the Day Brothers, whose further acquisition of now proven rich lead and zinc mineral territory in the technically discredited formations still west of the big Tamarack ore body, gives this substantial smelting enterprise a positive resource of rich ore for years to come and should result in this remarkable mining family becoming a prominent factor in the base metal and silver production of the country.

Another smelting venture of still more local importance to the Coeur d'Alene district was the recent statement by the Bunker Hill and Sullivan Mining Company of their intention to enter the smelting field with the construction of a plant of 1,000 tons daily capacity, to be located either at some point on the coast or at Kellogg, near their big mines, the final site to be determined, however, by transportation costs and other economic conditions, and smelter smoke easements. There still seemed favorable prospects late in December that Kellogg would be chosen for the site of this new plant, if its construction was finally decided upon.

The selection of Kellogg for a smelter of this capacity would prove a desirable industrial asset to that community and an added advantage to the State at large. The Bunker Hill and Sullivan Mining Company, in its official equipment, has always been blessed with the highest type of practical and technical mining and metallurgical skill in the country. Its President, Mr. Fred W. Bradley, knows the lead smelting game from A to Z, having formerly operated a big reduction plant at Tacoma, Washington, for the reduction of lead-silver and other ores, and if he decides to enter the smelting field, especially locally, the venture would prove of inestimable value to the Coeur d'Alene district, for while the Bunker Hill Mine can supply from its own developed resources a thousand tons of ore a day for years to come, such a plant would also doubt-
less afford a ready cash market for the ores of the smaller operator and greatly stimulate activity in new mining development on the manifest evidences of numerous new sources of ore in the immediate vicinity of Kellogg, and would doubtless get a big custom patronage and should be able to considerably reduce the present high cost of freight and treatment on its own production and greatly increase the local labor demand and business interests of the Coeur d’Alenes in general and Kellogg in particular.

New Electric Power Supply.

Another marked economic advantage during the year to Coeur d’Alene district as a whole, and brought about by the personal initiative of the Day Brothers, was the introduction of healthy and desirable competition in the electric power supply. Collectively this district is a very large user of electric power, by which nearly all its mechanical equipment are directly or indirectly operated, and until recently this big market for power was almost exclusively controlled by the Washington Water Power Company, of Spokane, whose arrogant inclinations to press their advantage was resented by the big operators at the eastern end of the district, with the result that, when its big Thompson Falls plant was finished a little over a year ago, the Montana Power Company was induced to build a transmission line to the Idaho border, a few miles east of Burke, where it was picked up and extended with distributing branches by the big Idaho operators at Mullan, Burke and Nine Mile, which has resulted in a marked modification of the exacting power contract conditions of the dominant company and a warranted reduction in power cost all around.

NATURAL RESOURCES AND STATE RIGHTS.

Natural Resources.

Idaho is probably the richest State in the Union of its size in the potential value of its mineral and contingent natural resources which are susceptible, when properly appreciated and utilized, of forming the basis of one of the most populous and prosperous States in the Union. A partial list of its physical assets and possibilities in addition to its very fertile but limited area of irrigable land and 30,000,000 acres of grazing land, is as follows,
based largely, of course, on opinion, which, however, in
the mineral features, has successfully prevailed with emi­
nettily profitable results against the adverse opinions of
high technical authorities.
Lead, silver and zinc ores, well developed, one hundred
million tons.
Gold and silver bearing copper ores, five hundred mil­
lion tons.
Gold and silver silicious milling ores, five hundred mil­
lion tons.
Portland cement rock, several thousand million tons.
Phosphate rock, high grade, 70 per cent and over, ten
billion tons.
Phosphate rock, second grade, 40 per cent and over, one
hundred billion tons.
Sulphur in the form of pyrite, one hundred million
tons.
High grade coal, our weakest resource, estimated by
U. S. Bulletin, six hundred million tons; actually in
prospect, ten million tons.
Idle water power, five million horse power.
Timber resources, one hundred thirty-five billion feet
board measure, including twenty billion feet of pulp
wood pine.
We also have an extensive area of rich potassium and
sodium bearing formations in silicate form and an exten­sive
area of lake bed and ash bed formations that are
showing attractive values in the soluble form of the high
grades of soda nitrate and potassium salts. Add to these
magnificent assets immense deposits of iron ore and as­
bestos and an infinite variety of rare minerals, including
tungsten ore, in a dozen different counties, our mineral
and other natural resources are of such magnitude as to
offer an extensive and legitimate field for industrial in­
vestment and are susceptible of ultimately affording a
much needed home market for all the present products of
our farms.

Agricultural Resources.
Our agricultural resources are limited by the rugged
topography of the State, which consists of a highly ele­
vated and deeply eroded broad plateau, its northern half
largely a dense forest and its southern half an almost treeless desert in its primary state. We have a total maximum area amounting to 5,000,000 acres of irrigable land and have at the present date not to exceed 2,000,000 acres under irrigation, and its production has to depend for a market to a very large extent, on the adversities of other sections of the United States in crop production, and is hampered by an intervening freight charge covering distances of from 500 to 2,000 miles in marketing its farm products. It is a physical impossibility to shorten these long hauls of Idaho farm products to present markets and it is decidedly improbable that the present moderate per ton mile haulage rate can ever be much lower. These facts put our agricultural industry at a serious disadvantage that can only be overcome by the establishment of a home market.

We rank among the highest taxed and bonded States in the Union per capita, due to the fact of our limited population has pressed its laudable American instinct to keep abreast of the times in the administration of State and domestic affairs. If all our irrigation projects now under development were completed according to original contract, our available water resources would be pretty well used up and fall considerably short of supplying the maximum area. The dry farm feature does not hold much prospect of taxable revenues, and the outlook for the present dominant surface industry of Idaho ever giving the State any material advancement under the present conditions is rather discouraging.

Our citizens recently formed a State tax association, which was represented by many of the leading citizens of the State, in an effort to study, equalize and modify, if possible, the excessive tax burdens under which they are groaning. In its deliberations this new tax association overlooked the main point in failing to protest against the injustice that is being worked on Idaho by the persistent and insidious efforts of a misguided and unwise Nationalism emanating from the conservation faddists of the East.
Conservation Fallacies.

In their present laudable but decidedly hampered ambitions for State pride and progress, the people of Idaho are confronted by a definite prospect of being permanently disfranchised out of about two-thirds of their natural State rights and revenue resources, and of being put back in a Federal territory as to the bulk of their State area. The most conspicuous and pressing effort on the part of the government agents at Washington in this connection is the promised early passage of the so-called Ferris bill, and other Federal leasing bills, which would deprive this State of a constitutional right that has been recognized ever since it was admitted. The administration of its water resources, which our courts have always administered and adjudicated, by not only transferring this inalienable State right to exclusive Federal authority, but at the suggestion of a wealthy Shylock citizen of Pennsylvania, this law would make the people of Idaho pay millions of dollars tribute to Pennsylvania—and other States—for the use of its own acknowledged resources and exact its development under an uncertain tenure of title administered by a National political appointee. This, together with the avowed intention of administering all our other priceless natural resources by a permanent ownership and leasing system, is a subject that should demand the most vigorous protest of our citizens and especially those who are still here that fought so long and hard for admission to the Union on an equality with the original thirteen States, a condition that our Enabling Act guaranteed us.

The conservation policy of the United States is based largely on egotism and avarice. The government seems to have divested itself of so many sources of revenue that it has to pick on the far western States in an effort to make up a serious deficiency. There isn’t any question but that this policy was induced by the license of vested interests in resources of this nature, but after providing an Interstate Commerce Commission and State Utilities Commissions, who operate under the eyes of a critical court of a vitally interested local public opinion, and which are so effectively regulating these
predatory inclinations and promises to continue faithfully at the job, the conservation features could be very well left to the administration of the States involved, under restrictions if necessary, without burdening their communities with a hoard of highly expensive National agents that can only result in duplicating administrative costs, hamper their industrial progress, and stir up a feeling of dissatisfaction and unrest among the people of the public land States in regard to the abuse of their sovereign constitutional rights. Idaho is hit harder and stands to lose more in proportion to its area than any other of the public land States by the proposed extension of the Federal policy of leasing and controlling everything.

We have the beautifully inconsistent example, according to recent press reports, of the Supreme Court being shortly called upon to adjudicate the revenue rights between two of the original States to a strip of mud flats between high and low water on the Connecticut River, while the same tribunal is expected to sanction the deliberate alienation of hundreds of millions of dollars worth of revenue rights from the people of Idaho to the National Government, for the satisfaction of a questionable theory.

The business of the government is to govern, but not to do the thinking for its independent citizens. If Idaho has anything that the Nation needs and cannot get along without, it is willing to relinquish its constitutional mortgage on liberal terms, but if it has an excess of resources over the immediate National requirements, its people are at least entitled to an Indian allotment. In their efforts to grab the revenue rights of the public land States, on a pretext of conservation, the Federal authorities and other eastern meddlers of the Pinchot stripe are overlooking some real problems of National import.

As an example, the cost of living in the United States is one of the most serious problems that confronts the Government and is likely to be the cause of more social and serious industrial unrest, especially after the European War, by reason of the small purchasing power of a day's pay, than any other subject that confronts the Nation at this time, and in place of worrying his head
over Idaho forests, our National Secretary of Agriculture, within a day's ride of the National Capitol, can find a million acres of agriculturally abandoned soil that was formerly part of the fallow, fertile foundation of our great National agricultural industry, and several million more such acres in the original thirteen States of exhausted soil.

He can look to his census records and find that the average acre production of food stuffs from the soil of the United States has remained almost stationary for thirty years while our population has increased at a rapid geometrical ratio, and this in spite of the fact that so many million acres of virgin soil have been put under the plow within that period. He can further find, from authentic records, that the average acre production of grain is from a half to two-thirds less in this country than it is in several European countries under more favorable climatic and primary soil conditions.

To renew and conserve the primary fertility of the Nation's soil, the most vital basis of its life, and double the production of the present cultivated area with a consequent reduction of the cost of living, and a tripled increase of rural land credit assets, would be a man's size conservation job worth while. Idaho can supply the means to this end from its exhaustless resources of phosphates with everything else easily and cheaply available in the farmers hand, according to the opinion of high authority. This would be a much more fit subject for the consideration of our National Secretaries of the Interior and Agriculture than worrying their heads about the purely local affairs of the far western States and chasing native born white men off the grass.

The shallow inconsistency of the conservation faddists and the one that defeats and exposes their sincerity, is their inclination to deprive the public land States, not only of the control of their natural sovereign constitutional rights to their own resources, but to turn the government's trustee ownership of our lands into a permanent ownership and a source of revenue to the older States, at the expense of the progress of the pioneer commonwealths of the far West. Many of these treasures of
nature were evidently provided to supply the temporary demands of a crude human understanding. In his splendid but somewhat biased review of the natural resources of the United States, Mr. Charles R. Van Hise, acknowledged in a closing chapter that "The most daring speculation that I might make as to human achievement, would be poor and futile as compared with future realizations." As a matter of fact the average mature human mind is yet in an infantile stage of development in regard to the possibilities of physical and chemical science.

I read a press dispatch the other day that recited as a fact that a citizen of New York maintained a plainly audible telephone conversation with another citizen at the opposite side of the North American continent in San Francisco with no other connecting sound medium but the eternal ether.

While visiting Chicago a year ago I enjoyed the courtesy of a luncheon at the Sherman House with a prominent, high salaried practical chemist who told me a story of watching the laboratory experiments of a fellow chemist, who, with a few grains of a certain mineral substance that cost two cents to produce, transformed a gallon of distilled water into a gallon of liquid fuel equal, if not superior, to the best gallon of gasoline ever produced from crude hydro-carbon oil.

You, of course, will believe the first of these little miracle stories, and cannot prove that the second does not contain the element of possibility as the atmosphere you breathe contains the potential element of the most explosive gas known.

It isn't over a dozen years since organized common sense taught the farmer that it wasn't necessary to import soda nitrate from Chile at 20 cents a pound with which to fertilize his soil, as he could produce the nitrogen in the soil from the air with a handful of clover seed and a little intelligent cultivation for a cent a pound, with the assistance of an invisible bacterial bug, and it is possible that with the necessary encouragement this little microbe might be induced, with culture medium of cheap cost, to put the nitrates in a sack and save all the worry over a water power source of supply.

The many advances in the production of light and heat that have been made in the last few decades from other
things than coal and crude oil, presents a big field for further scientific research and study, and will unquestionably overcome and supply from crude primary elements of air, water and earth, when necessity develops many of the things of nature that the conservationists are now so anxious to conserve to the detriment of western progress. In place of harping on the patriotic necessity of the National requirements, our Secretary of the Interior, with several idle water powers at his command already developed, could well have established a practical experimental station on a considerable scale in the fixation of atmospheric nitrogen and demonstrated its feasibility and operating costs as a guide to permanent private investments along this line.

The present effort to nationalize everything is an un-American move that will tend to curb individual effort and initiative, which has been the chief factor of America's progress. It will retard the development of the public land States and create a sectional feeling of distrust in the Union. The horrible examples of bureaucratic centralization and an effort of the ruling class to do the exclusive thinking for their people, is conspicuously in evidence in Europe at the present time, and unless our National patriots can work out a more equitable regard for State revenue rights and prospects, their wholesale scheme of National aggrandizement at the expense of the public land States is likely to breed disastrous consequences. An unbiased and close analysis of their physical conditions and resources will show an equal or superior potentiality for the development of industry and population in the far western public land States as any in the eastern border of the Nation. We are willing to be reasonably regulated but object to being disfranchised, confiscated and put on such wholesale reservations, and would be poor, selfish, degenerate units of a republican form of government if we did not stand up for our natural rights in this connection.
MINING DEVELOPMENT PROGRESS.

Mining Progress.

The past year's progress in the development of Idaho's ore resources has been decidedly marked and is rich with promise of expanding results throughout the State and particularly in the Coeur d'Alene district.

Idaho is one of the most fertile fields in the Union for the activities of a State Geologist. Our dominant revenue resources, however, have been so largely from agricultural communities in recent years, and the demands in administrative costs of the State government so large and varied, that our legislators have not felt warranted in incurring even a limited appropriation for a State geological survey. This desirable institution could be admirably incorporated with, and is an office that could be administered by, the State University at Moscow, where we have a splendid staff of earnest practical engineering and technical instructors who take a keen interest in the affairs connected with our mineral wealth and embrace every convenient opportunity to advise themselves by practical research in this connection.

In lieu of a much desired specialist in this connection, who could find splendid and profitable employment to the State immediately in classifying our soil fertilizing minerals and the mineral values of considerable merit and extent that are known to exist on the State's land holdings, the only available official to take interest in these important matters, which the State has so far been able to afford, is the State Inspector of Mines, whose duties logically should be confined to the inspection of mines for safety purposes, exclusively, but the present statute requires that he shall also cover the advertising features of the industry through an annual report, by publishing all available statistical data and "all other information calculated to exhibit the mineral resources of the State and to promote the development of the same."

It is rather a delicate contract for a man in this position to stay within the statutory bounds of this and other features of the law and put up a decent story by reason of a variety of contending interests involved, and es-
especially where litigation troubles are in progress, and this class of troubles are generally existent in all big mining districts, as the discovery of a rich ore body always creates the immediate envy of neighbors, and our imperfect National mining law, with its puzzling extra lateral features, invites trouble along this line.

Mining development enterprises often warrant encouragement and generally get it from this department when the merits of the venture seems to justify. This work is sometimes abused by unscrupulous promoters who will go to unusual ends to get a chance to quote an official opinion in the sale of stock. On the other side of the question, the investor howls for protection if things don’t come out as they promise, and it is seldom that they do, as mining promoters will often take advantage of the results of a more or less remote but successful neighbor’s development to exploit ventures that have no definite merit.

Metal mining development is essentially a speculative business, especially the primary development phase of it, and often involves a very large outlay of money to demonstrate the worth or worthlessness of a more or less promising ore prospect. This is especially true in the Coeur d’Alene district, as well as every other mining district of the State, and people going into speculations of this kind should only do so to the extent of money whose loss will not injure them or their business, as about 90 per cent of the mining development enterprises fail to make paying mines. The attractiveness of this line of investments, however, is that the lucky winners in the game often make enormous profits. Some very expensive and long drawn out enterprises have realized bonanza results in several instances in the Shoshone County mines from comparatively blank starts, and a number of other big mines yet remain to be discovered in that remarkable mineral field, which produced 90 per cent of the total metal yield of the State the past year and which naturally calls for a large proportion of the consideration of this department.

The dominant value of the Coeur d’Alene mines is lead, and they embrace some of the largest, deepest, richest and
most permanent deposits of this class of mineral that has
ever been discovered in the world. Their production dur­
ing 1915 aggregated a gross lead metal contents in the
mineral shipped of 350,000,000 pounds, with a total pro­
duction since discovery, thirty-two years ago, of lead,
silver, zinc, copper and gold, of fully $300,000,000 gross
value.
These Coeur d’Alene lead ores are invariably associated
with silver values ranging from a third of an ounce up
to more than an ounce of silver to each unit or twenty
pounds of lead contents in the ore. A description of these
deposits, which has been covered in more or less detail in
my previous reports, is hard to segregate from another
important associated metal, which, within the past two
years, has gained rapid recognition as a source of mining
values. This is zinc ore in the form of spalerite or zinc
sulphide and is present in all of the lead ores of the dis­
trict, although some of them are relatively clean and free
from zinc, while other veins now carry their dominant val­
ues in zinc.
Due to the recent excessive demand for this metal one
of these properties, the Interstate Callahan Mine on Nine
Mile Creek, a few miles north of Wallace, made the largest
total net profit for a year of any mine in the Coeur d’Alene
district’s history. It was followed in a substantial man­
ner as a profit sharer by the original zinc shipping deposits
of the district, or the one that first gave it recognition as
a source of commercial zinc ore. This is known as the
Success Mine, also situated on Nine Mile Creek, three
miles nearer Wallace and in the same formation.
COEUR D'ALENE GEOLOGY.

I have been accused of being an irresponsible booster and an untrustworthy optimist on the future of the Coeur d'Alene ore deposits, but I have been consistent in this for the past 11 years with gratifying results. One of my recent statements was that Idaho had a hundred million tons of well developed lead-silver and zinc ore, and in that statement I had in mind that fully 90 per cent of that amount was in the Coeur d'Alene district. This was not expressed as measurable ore, but ore that was so well developed that its future extraction could be safely forecasted in a statement of that kind.

To put the matter in a more moderate light and say that the ore deposits of the Coeur d'Alenes would last for 25 years would not seem like such an exaggerated forecast. Including the low grade ore that has to be blasted down and handled, the mines of Shoshone county during 1915, mined approximately 4,000,000 tons of ore and gangue. The mechanical concentration process on the product of these veins starts on the stope floors and is finished by the flotation machines in the mills. Nearly half of the tonnage blasted is sorted out and kept in or returned to the mines as back filling to support the walls, in addition to heavy timbering methods employed, but it nevertheless has to be mined to get the finished product, and at that rate of mined product per year, which is annually growing in volume from new discoveries, it will be seen that the present well developed resources of the Coeur d'Alenes will only need to last 25 years to produce a hundred million tons without considering the other extensive prospects of the State.

For the community interest of Shoshone County and the general glory of the mining industry of the State at large, I would like to give the Coeur d'Alene district an additional hundred years of life at its present active scale of production and shall make an effort in the following argument to do so. This district was surveyed in considerable detail in 1904 by officials of the United States Geo-
logical Survey, Mr. Frederick Leslie Ransome and Frank Cathcart Calkins, which resulted in the publication, four years later, of a detailed review entitled "The Geology and Ore Deposits of the Coeur d'Alene District, Idaho," or Professional Paper 62.

Since that time this professional paper has virtually been the Bible of authority for many of the Coeur d'Alene operators, investors and promoters. It proved to be a splendidly illustrated study of the situation and a remarkably close classification of its formation, that has had some very useful features and forecasted some economic points of great importance, and others of very doubtful value.

I made the apparently discourteous remark at a recent gathering of technical and practical engineers at a branch meeting of the American Institute, in Wallace, that Professional Paper No. 62 had set the Coeur d'Alene district back 10 years, which expression naturally wasn't very well received in such a gathering and was probably indelicate, but I still believe it was more or less warranted by the facts, as I consider that the conclusions of that report has had a retarding influence with heavy investors in the expansion of warranted development enterprises and particularly so in one very important division of the Coeur d'Alene formation. "A man must serve his time to every trade save censure, critics all are ready made." I do not want to be understood as depreciating the value of technical knowledge, but am simply unfortunate in not having had any early advantages on these lines and what little technical information I have picked up I have to credit largely to the study of the publications of the U. S. Geological Survey, which have resulted from the splendid efforts and hard work of its members, past and present.

However, as a tribute to the rather extended opportunities of practical observation I have enjoyed during the past 11 years, I feel warranted, in the interest of truth and the economic progress of the district, in taking a hand in the guessing game to which the Coeur d'Alene ore conditions and prospects has been subjected.

The trouble with many technical men, to my mind, is,
that they don't display sufficient faith in nature but carry conservatism in mining forecast to an extreme. They seldom get a thousand feet below the surface before their imagination droops its pinions and commences to look for a place to alight for fear of singeing the delicate down of its technical plumage by a further approach to the zone of flowage.

One of the most conspicuous evidences of the merits of practical miner judgment, in this district, without any pretext of special regard for or faith in technical speculation, is the fact that by far the largest individual interests in some of the most profitable producing mines of the Coeur d'Alene district today are owned and managed by original Idaho prospectors and miners, who are rapidly becoming the dominant factors in the ownership of its mineral resources.

In addition to Professional Paper No. 62, another splendid study of the geology and ore deposits of the present most productive lead-silver bearing area of the Coeur d'Alenes is entitled "The Genesis of the Lead-Silver Ores in the Wardner District, Idaho," involving a two years' study of the subject by Mr. Oscar H. Hearshey, resident geologist of the Bunker Hill and Sullivan Mine, and was generously given publication by the president of that company, Mr. Fred W. Bradley, for the community interest and value it might have.

This paper is a remarkable example of detail geological work and resulted in the mapping of a complicated system of block faulting and attendant periodical mineralization evidences that makes a Chinese puzzle look as simple as a cube of candy by comparison. The merit of this work, however, is the fact that an intelligent miner can recognize the dominant periods of mineralization described very readily as he travels through the extensive underground workings of the Bunker Hill Mine and the connected properties accessible from the Kellogg tunnel.

The Coeur d'Alene mining district in Shoshone County, Idaho, embraces almost ideal natural conditions for a big mining center. Its topographic features are a close set system of deep, narrow canyons and steep mountain slopes, exceptionally well watered and densely timbered with pine
The elevations are moderate, ranging from about 3000 to 6000 feet above sea level. The district has fine railway facilities, several progressive, well regulated business centers, the principal of which is Wallace, the county seat, with a population of over 4000 people, situated in the center of the present most productive area. Snowfall in the winter is heavy and involves some bad slides at a few exposed points, but on the whole the climate is healthy and its natural beauty and environments afford a desirable situation in which to live.

The dominant features of Coeur d'Alene geology is a series of altered, thin bedded pre-cambrian sediments consisting of silicious slates, shales and quartzites about 20,000 feet thick, with a conspicuous zone stock belt or dike of grey igneous eruptive rock more than a thousand feet wide and several miles in length cutting across the course of several of the most productive fissures in a northeast direction, that is diagnosed as a monzonite and locally called granite, which it very much resembles in field appearance. In addition to the granite, the altered sediments carry a much more broadly distributed system of black green basic dikes resembling diabase, that are usually disintegrated and inconspicuous at the surface, but persistent in length, often narrow, but in one instance a dike of this variety 1000 feet thick has been mapped that can be followed for 30 miles.

These greenish dikes parallel the main northwest and also the older northeast ore courses of the district, and I believe, include the oldest phases of igneous intrusive rock in the field. All the Coeur d'Alene formations have been subjected to an intricate system of irregular block faulting which has apparently determined to a large degree the localization of its rich lead-silver, zinc and copper ore channels.

In his conclusions, Mr. Ransome, in Professional Paper No. 62, attributes the genesis of all the ores in the Coeur d'Alene field to the monzonite magma that shows more or less bold outcrops of light colored granitic looking rocks with a definite strike northeasterly for 20 miles from Gem in Canyon Creek across Nine Mile and over into the north fork drainage near Murray and recognized on north into Montana. This intrusive igneous formation
is, in a general way, supposed to be the dorsal fin of a whale of a batholith of similar rock whose back forms a relatively shallow floor on which the great Coeur d'Alene sediments, carrying the steep dipping ore veins rest, and at the approach of which their commercial values will taper out.

Mr. Hearshey rather discounted this theory of the ore genesis and attributes the source of the rich concentration of the ore channels to a thin dissemination of the metals in the shallow upper horizon of the Prichard slate formations, one of the thickest members of the sedimentary series. I think they are both at least a mile too high in their conclusions.

The big thing of the year in mining production and profit has been the magnificent results of the operations of the Consolidated Interstate Callahan Mine, and of the Success Mine, together with the wonderful expansion of clean lead ore resources in the Tamarack and Custer Consolidated Mine nearby, and on the Tiger Poorman fissure to the west. Each one of these properties have their crest or ore apex in wall rocks of the Prichard period that were depreciated by Mr. Hershey and by Professional Paper No. 62 as an unfavorable medium for the precipitation and replacement of ascending ore solutions and the occurrence of commercial ore bodies.

Shortly after the first government report was published I took exception to this assumption in my annual report of 1907, on the theory that the described carboniferous elements in the silicious black slate should offer as favorable precipitant and substitution medium to ascending ore solutions as the more brittle quartzites if the fissuring was equally strong and favorable.

The interesting feature about the Interstate ore body is the fact that it stands well out in the Prichard slate area and in one of the blackest, muddiest and most typical phases of that formation, unaltered by unusual metamorphic action; that it is almost an exact replica in structural conditions, size and length with two of the famous tabular ore channels in the quartzite formations of the adjacent Canyon Creek district; that it is developed 1,800 feet in vertical depth from a blank start at the surface;
that the biggest end of its ore body is in its present lower levels; that in its quite extensive stope area throughout its length of over a thousand feet it has produced a larger proportion of commercial mineral concentrates per ton of ore mined than any other ore channel of the same length in the history of the Coeur d'Alene district; that it carries the same wall rock replacement evidences and the same short wedge like spurs of secondary quartz that characterizes the Standard-Mammoth and Hecla veins and in all respects show every evidence of equal deep seated permanency to the great tabular ore bodies of the district in quartzite walls. While it is an acknowledged fact that temporary economic conditions have been responsible for its remarkable dividends record of the past year, it is a significant fact that its wonderful ore channel carries the cleanest zinc sulphide mineral found anywhere in the northwest.

A little further north, on a nearly parallel vein, the Interstate Callahan Company has developed two other ore channels much richer in lead than its famous ore body above described, and one of these, the Callahan, has the distinction, I think, of shipping the cleanest hand picked crude lead ore of any mine in Shoshone County, with a record output by its original owner, James Callahan, of 50 car loads carrying an average value in lead of 70 per cent with a little better than half an ounce of silver to each unit of lead, and among these shipments were three car loads that came within a small fraction of averaging 80 per cent lead. Similar high grade clean lead ore shipments have been made from mines and prospects as far north in the Prichard formation, across the North Fork drainage, as the Jack Waite Mine, 20 miles distant.

In the same Prichard formation, seven miles west of Kellogg, at the Hypotheek Mine, a car load of hand sorted ore was produced from the 900-foot level, and shipped during the past year, that yielded 68 per cent lead and no zinc, while several car loads of ore were shipped from the Highland Surprise Mine, three miles south of Kellogg, during the year, containing 66 per cent lead, from the same Prichard formation. In fact, the prospects for continued and deep production of these high grade lead ores, as well
as zinc, at these and other points in the Prichard formation are decidedly flattering and should dispel the theory that the origin of all the Coeur d'Alene great lead resources, originating in the upper horizon of the Prichard formation, as advocated by Hershey.

Mr. Ransome assumed that the big granite intrusions of Canyon, Nine Mile and Beaver Creek were older than the big ore deposits of the district. In my report of 1907 I suggested that this big monzantite granite intrusive was younger than the ore in the Success vein. I have been inspecting mines and prospects in this district for 11 years, with a cursory opportunity to observe geological conditions underground and have failed to find at any point a single instance where commercial lead or zinc values occurred in the monzantite unless it was manifestly a torn fragment from an already existing ore body with which the disturbing intrusive came in contact, and such fragments invariably exhibited remnants of the sedimentary gangue which they originally replaced. The only true mineralization in the granite that Mr. Ransome could find was pyrite near Sunset Peak. This great granite zone, as I have said, has a definite strike northeast, while the prevailing strike of the main ore course of the district is east, west, varying up to 45 degrees north of west and south of east.

My crude conception of a big eruptive intrusive igneous mass into a deep overlying sedimentary formation has always been that the resulting sympathetic fissures in the elevated or ruptured rock would be roughly parallel to the longest axis of the eruption or elevation, and I never could comprehend how this great northeast zone of granite could have formed the dominant system of faults and fissures at almost right angles to its axis, and I am quite convinced that this intrusive is later than the district's great ore deposits and had absolutely nothing to do with their genesis.

Mr. Ransome's conclusions as to the contact metamorphic origin of the ore in the vein, at the Success Mine, as bounds the narrow strip of Prichard formation in which resulting from the monzantite intrusions that closely
that ore body actually occurs, never seemed justified to me. Beyond the addition to the disturbed Success zone, with its already existing lead and zinc ore bodies, of the contact metamorphic minerals and resulting tight silification of the entire zone of Prichard sediments in which they occur by accompanying silicious waters which transformed the original slate and thin quartzite beds into a tight amorphous mass of hornfels, and probably added the bulk of the pyrite and pyrrhotite. I believe a similar condition exists at the big Sunset lode and that the further these ore bodies can be followed away from the granite contact influences the freer they will become of the objectionable pyrite and pyrrhotite association.

A significant comparative condition of silica metamorphosis after ore mineralization is exhibited in one of the Idaho County districts, at Bear Creek, near Marshall Lake, where a prevailing black slate and schist formation is conspicuously ribbed with narrow, nearly vertical quartz filled fissures noted for their rich specimen gold values and mixed sulphides accompanied by basic dikes, near the big granite area. Paralleling these veins are zones of alteration that have been very largely or completely changed to pure silica or semi-transparent watery quartz, in widths of 100 to 200 feet and showing distinct outlines of the crumped cleavage of the original schist it replaced in agate-like bands. One of the veins of opaque quartz is near the middle of a big silica zone of this kind, and in it the original sulphides seem to have been reduced by partial fusion to a soft, amorphous mineral consisting of lead, zinc, copper and iron, very rich in gold and silver and associated with specimens of crystalized and wiry native gold.

In his further conclusions Mr. Ransome placed the dark basic dike, on the walls of which the rich galena ore bodies of the Hecla Mine are built, as being later than the ore. It always appeared to me that it would be impossible for a molten dike like that at the Hecla to be injected into such a rich vein of soft, high grade and very clean lead ore without producing some contact metamorphic effect, and I expressed the opinion in my report of 1906 that the Hecla dike was older than the ore; that the
fissure broke on the dike line, and in consequence it should form one of the deepest seated ore bodies in the district. I believe my conclusions in this matter, expressed long ago, have been fully borne out by the facts of later development.

The Hecla vein was developed to the 600-foot level below Canyon Creek at the time of Mr. Ransome's visit, and the adjoining Tiger Poorman vein was developed 2,200 feet deep, had passed through a band of slate, was getting poor and its ore shoot shorter, and was subsequently abandoned and its failure attributed to the approach in depth to the unfavorable Prichard slate formation on the granite batholith base, which naturally cast a reflection on the future prospects of the Hecla vein at similar depth.

In contrast with this prospect, the Hecla vein, only 1,000 feet distant and parallel, is now opened to the 1,600 foot level below the creek bed, while its noted accompanying basic dike has increased in size, carries rich ore on both walls, and in a fracture of its center and replacing its substance, and now within 600 feet of its fated finish, its primary shoot is showing probably a third more ore as clean and free from zinc or iron as it ever was and a bigger prospect for continued expansion at further depth than at any level in its history, and in addition to this, there has been developed a sister shoot to the main ore body further east that alone promises as big a future as the original ore body did at the time Mr. Ransome's stope maps were made.

The Hecla dike presents an interesting factor to my mind of the general mineralogy and ore genesis of the Coeur d'Alene district as a whole in the fact that it is one of a hundred other basic dikes that traverse the Coeur d'Alene formation, including all its sedimentary divisions and especially the Prichard formation, that have a general strike practically conformable to the vein system in a west-northwest direction, with a more limited cross system with a northeast strike.

These dikes are designated as diabase, minette and lamphophyre. They are of different successive periods, but many of them are, to my mind, the oldest intrusives of the district. They are generally blackish green or green-
ish grey, readily distintegrate and are inconspicuous at
the surface but well exposed in mining tunnels, railroad
and wagon road cuttings throughout the district. They
generally vary from a foot to 50 feet in thickness, with
steep dips, and one of them is referred to by Mr. Ransome,
crossing Placer Creek, as being a thousand feet thick.

They are characterized by a conspicuous development
of heavy basic minerals and the association of carbonates,
including plentiful crystals of apatite, a rich ore of phos-
phorus and a probable source of the secondary lead phos-
phate crystals in the form of pyromorphite, with which
most of the big ore bodies were associated in their oxidized
phases, and in connection with a few small light colored
dikes resembling diorite and monzanite, like those cut by
the ore bodies of the Hercules upper workings and the In-
terstate vein, I believe, in most instances, are the oldest
phases of igneous intrusions in the district, and that their
magma is the primary source and genesis of most of its
ores of both lead and zinc.

It is a significant fact that in the mineralogy of other
lead-zinc and copper bearing ore bodies in Idaho, rich
in gold and silver throughout the length and breadth of
the State, that basic dikes of dark igneous rock of similar
composition have been a conspicuous association of
their mineralization activities.

Like the Hecla vein, the Trade Dollar Consolidated vein
at Silver City, in Owyhee County, Idaho, was built on a
narrow intrusive dike of black basic rock that started in
the granite core of Florida Mountain and penetrated a
thick overlying cap of basalt and rhyolite. This vein did
not average over two feet wide, but was the most profitable
mining enterprise in the State prior to 1900, and pro-
duced a gross value of $20,000,000, with a net profit of
$10,000,000. Its gangue was ribbon quartz on both walls of
the dike, with a rich dissemination of chalcopyrite and arg-
gentite, with high values in gold.

At the Minnie Moore Mine, on Wood River, several nar-
row dikes of basic blue-black igneous rocks closely paral-
lel the ore course in the ancient sediments in which it oc-
curs, and Professor Jenny expressed the opinion that the
Minnie Moore vein, with its conspicuous iron carbonate
and calcite gangue and eight million dollars of high grade lead-silver and zinc ore production, was a replacement of one of these basic dikes.

A few miles north of the Minnie Moore, the Croesus vein was developed to a depth of 800 feet vertically on a contact fissure in quartz-diorite and carrying a narrow intrusive dike of diabase, which contains massive phylortite and chalcopyrite ore rich in gold from near the surface.

At 700 feet deep another vein was cut having a similar strike but dips in an opposite direction and is cut by the first vein. It is also accompanied by a small diabase dike carrying galena with iron carbonate gangue, disclosing a shoot from five to fifteen feet thick of considerable length of 10 per cent lead ore with an ounce of silver per unit of lead and $4.00 gold per ton of concentrate product. Both veins are later than the enclosing plutonic walls, which are assumed to be a phase of the Idaho granite batholith, with which the formation is connected.

The Democrat vein, three miles west of the Croesus, which produced several hundred thousand dollars worth of shipping ore, principally galena with two ounces of silver to each unit of lead, is within the eastern edge of the Idaho granite batholith, and the War Dance vein and Nay Aug vein, a little further north, both good producers of rich lead-silver and zinc ores, are in granite walls.

In one of the deepest erosion phases well into the heart of the Idaho granite (?) batholith, the Franklin Mine, at Pine Grove district, in Elmore County, produced $400,000 in gold from a quartz vein richly sprinkled with pyrite, galena and zinc blend. This vein was built on a basic dike, which, in places in the main ore shoot, entirely filled the fissure, except a narrow quartz seam, and in other places along the ore shoot, the dike was reduced to a clay gouge and the space filled with rich ore gangue.

The important lead-silver veins of the Gilmore district in Idaho are closely accompanied with the semi-basic intrusive dikes of diorite in cambrian quartzite and later lime bed. At Shoup, in Lemhi County, the Kentuck vein was developed 700 feet deep and produced a million dollars worth of gold ore from a quartz filled fissure in granite richly sprinkled with pyrite, zinc and galena. The
richest ore mined from this vein was on the levels where it was in contact with a dark green stone dike.

Parallel to a 300-foot zone of quartz in the big low grade gold ore district at Profile Creek, in Idaho County, in the heart of the Idaho batholith, a tunnel 100 feet long driven on a diabase dike 10 to 15 feet wide, shows what appears to be primary magmatic segregations of bright bunches of cleanly crystalized galena, zinc and pyrite.

At the Idaho Continental Mine, in Boundary County, some pronounced dikes of diabase are in close association with the main ore shoot. This deposit is in thin bedded pure quartzite resembling the Burke formation. It is developed 600 feet deep and has an aggregate of a thousand feet of ore shoots carrying an average of about 10 per cent lead and about six ounces of silver and quite free from zinc or pyrite. At Pearl, the Granite States Mine has developed a series of gold-bearing quartz filled fissures well sprinkled with pyrite, lead and zinc minerals in contact with black dikes. Also at the Diana Mines, in Boise Basin, a rich galena ore body is in contact with a black dike closely resembling the Hecla intrusive, and Lindgren specifically places this class of contact deposits in this region as later than the accompanying dikes. This widely distributed association of lead, zinc and copper minerals with igneous intrusives of the same prevailing type of the older basic dikes of the Coeur d'Alenes, and others I shall mention, which to my mind is significant of a kindred genesis and particularly in connection with the veins in whose gangue material quartz is subordinate, absent, or manifestly secondary, like numerous old lead, silver and copper producers in Blaine and Custer Counties, as well as in Shoshone and Bonner Counties.

Referring again to the local theories of exhaustion by the approach in depth to the Prichard formations in the Coeur d'Alenes or an underlying granite batholith, I would further emphasize some additional conflicting evidence. I think the results of the past two or three years in the wonderfully rich lead ore development of the Tamarack and Custer Mine in Prichard formation, of the Success Mine, of the Consolidated Interstate Callahan bonanza ore channels, the new and rich lead-zinc ore de-
veloped in the Prichard formations at Pine Creek and at the Hypotheek Mine near Kingston, together with some relatively deep showings around Murray and at the Jack Waite Mine, should be sufficient evidence that the approach of the Prichard formation, or the true granite batholith, should not necessarily mean exhaustion, other conditions being favorable.

As a matter of fact, the richest lead-silver deposit in the Coeur d'Alene district, the Hercules, is practically at the lower margin of the Burke formation, and so near the Prichard, that its gangue has always been too black for typical Burke below the oxidized horizon, and it was considered, when originally struck, as being too far out of the favorable territory to ever amount to anything, but its famous ore shoot has persisted to materially expand, and is now, at a depth of over 2,000 feet, practically three times as long as it was when its rich ore resources were first cut in No. 2 tunnel.

In 1904 I said in my annual report that the Hercules vein in some ways resembled the Bunker Hill in respect to its wide zonal fissuring and mineralization. The analogy of the two has worked out only in an economic way by the discovery of deeply buried new ore shoots. In the plane of the vein whose virgin crests are buried from 1,000 to 1,500 feet deep, two of these now being stope at the Canyon Creek or No. 5 tunnel level, show such a freshness of clean primary galena mineral filling as to warrant the anticipation of definite permanency to a further great depth, while the famous original ore shoot still maintains its remarkable segregations of clean, soft lead sulphide, rich in silver and carrying less sphalerite than in the No. 4 horizon.

The Frisco ore body, which was supposed to be reduced to an indefinite root, has been shown, by development during the past year, to have simply been passed through the cross-cut from the shaft where it was so narrow as not to be recognized. The present management has discovered this error of the former operators and have opened a splendid stope on the proper vein, which, while more zincy than formerly, probably contains as much commercial sulphide mineral per cubic fathom, at the 2,200 foot
level in a stope already nearly 300 feet long, as the old ore body formerly did.

The Tiger may be at an exhaustion point in its 2,200 foot level, but the Prichard formation evidently did not cause its demise, and it is not improbable that if the vein was followed to still greater depth it might enter a more favorable condition of wall rocks and an expansion of mineral values, as there are numerous instances in the world, and not excepting the Coeur d’Alene district, where deep mining has shown successive horizons of lean and fat ores in the vertical range of the ore channel. It is also probable that repeated periods of mineralization may have produced deeper and shallower ore results in the same vein or zone, for there are certainly no evidences of exhaustion in the nearby Hecla mine, but the present evidence in the deeper levels, only 600 feet above the bottom of the Tiger, shows definite indications of expansion in ore volume and values.

There are some sharp contrasts in mineralogy throughout the district, and unquestionable evidence, as Hershey has pointed out, of several periods of mineralization and sharp variations in the ore and gangue characteristic from closely related sources.

The clean copper ores of the Snow Storm, National and other mines near Mullan, practically in the same fissure zone lines as the Hecla or Tiger Poorman, and not two miles distant on their strike to the east, is of interest in this connection. Between the Tiger Poorman vein and the Hercules vein, the Stanley Mine carries a north-south quartz filled fissure containing high grade clean antimony sulphide ore, rich in gold, five feet wide and practically free from lead and silver, while the notable Caledonia bonanza, in the foot wall formation of the Bunker Hill lode, together with its rich silver-lead output, shipped nearly a million pounds of copper during 1915, and the Horst Powell Mine, a few miles north, in clean quartzite walls, is a quartz filled fissure with 50,000 tons of developed ore carrying a high percentage of lime in the form of chalcopyrite crystals with siderite and a clean uniform dissemination of chalcopyrite ore associated with a little gold and silver. and only a short distance above this vein, in similar formation, other interesting prospects are rich in copper, and
still others a little further north carry high grade lead-silver ore free from copper.

The Bunker Hill and Sullivan Mine is developed 4,000 feet deep on its dip, shows as strong a geological prospect in the bottom as at any horizon, while its deeper phases of mineralization in the old ore course are decidedly freer from zinc and pyrite than were the upper levels. This big mine, in one of its numerous ore courses in its deep shaft levels, show a remarkably interesting contrast in the action and order of ore deposition from ascending solutions. In this deep level manifestation a recent beautiful cross-section of one of its northeast veins in the foot wall country shows a band of clean galena nearly a foot thick on each wall, each faced with a thin crust of quartz and healed with a central suture of clean zinc blend several inches wide, completing the vein filling and giving manifest evidence that the zinc was last to form in the quartzite formations at this particular point.

At the Success Mine the granite vein, in its relatively shallow surface levels in the Prichard formations, rich zinc blend ore several feet wide lined each wall and the central core carried the galena body, which was evidently last to form and succeeded the zinc mineralization, and offers a strong argument for deep seated lead resources in this formation.

The Morning Mine, at 3,200 feet deep vertically, shows the biggest phase of total ore resources in its two bottom levels that it has at any proportionate horizon, with the conflicting contrast of high zinc values in the most popular Revett lead-bearing wall rocks from the No. 6 tunnel level down, and with a large zinc production for several years past.

The Standard Mammoth, Green Hill Cleveland ore shoot, with a strong pitch to the west, has admittedly shortened up at Mr. Ransome's estimated depth of 2,000 feet below the valley bottom, but its deeper levels, 3,600 feet vertically below the surface, still show a very healthy root, a more kindly condition of wall rock, and as rich silver associations as the ore carried at any horizon except the shallow secondary enrichment near the surface.

I am under the impression that if I am right in regard
to the main granite intrusions being later than the principle lead-zinc and copper mineralization of the district, that the age of Coeur d’Alene ores probably remotely antedate the granite and bears a more comparative analogy to the genesis of the Lake Superior copper ore deposits, which occur in a similar enormous thickness of ancient sediments of related age and a very similar association of basic igneous intrusive rocks. These basic intrusives are known to be relatively rich in heavy metals. They are much more prevalent, persistent and widely distributed through the district than is generally supposed, and could easily have afforded the primary magma on which and from which the deep seated fissures and faults of the Coeur d’Alene series have been subsequently formed and mineralized, which should mean that the ores may go a great deal deeper under these conditions in the Coeur d’Alene district than the shallow granite batholith magma or upper Prichard origin would admit of.

Some wonderful fault displacements of the Coeur d’Alene formations have been described by the specialists, amounting in places to two miles. Mr. Ransome, to his credit, hovered closer around the truth in his diagnosis of the historically famous Wardner lode or Bunker Hill foot wall fissure than any of the many eminent authorities that preceded him. This remarkable fault fissure, which formed the foot wall limit of all the ore bodies on the Wardner lode for more than a mile in length and half a mile in depth, and was the governing factor on which so many hundred thousands of dollars were spent in litigation costs as a result of past apex litigation, has lost its venerable standing as a foot wall to anything and proves to be nothing more important than a post mineral fault, as the great ore channels below the Kellogg level are now as far below and to the north of this famous foot wall as they ever were above and to the south of it, above the Kellogg tunnel horizon, from which it will appear that it is easy for the ablest authorities to be mistaken about the genetic relations of vein walls.

The great normal east-west, south dipping Osborne fault, by reason of compensating movements to the north
of it, does not necessarily mean any great vertical displacement of existing ore bodies, as shown by the fact that the Hunter Mine, near Mullan, north of the Osborne fault, in its foot wall country, has one of the best ore bodies of its history exposed in one of its shaft levels 800 feet below the valley bottom that is still enclosed in a highly calcareous phase of the Wallace shale formation, or what is probably the highest stratigraphic horizon of any commercial ore body in the district that should have the full range in thickness of the more popular Revett and Burke quartzites under it.

The Osborne fault is unquestionably one of the latest big fault movements of the district and is probably still alive. It cuts the ore courses of the Alice Mine, which occur in crushed Burke formation in its foot wall, and the Senator Stewart vein in the same formation in its hanging wall, and both these occurrences are at about the same elevation.

The Stewart ore course belongs to the rich silver bearing north-east system of fissures in the Wardner-Kellogg section. It is contained in a converging wedge of other pronounced north-west faults and an intervening system of north-south step faults at almost 50 foot intervals that have reduced the ore and formation almost to a pulp and the intricate shifts of the ore body has given the local mine manager of the Stewart, Mr. Beaudry, a puzzling problem to handle. His success in this connection, however, has been repeatedly demonstrated during this mine's meteoric career of rich ore output by producing more ore in a year than the total remaining resources of the mine that could be found by expert engineers sent to measure it up.

The Stewart's big output of approximately 500 tons a days was maintained up to the end of 1915. The present yield of the mine is lower grade than formerly, and it is well known that its famous ore body, at its richest end to the north, is cut off by the Osborne fault and by litigation limits in its dip direction to the east, facts that have had a depressing effect on its securities, but the company has recently acquired a big controlling interest in an adjoining large group of claims, including the Crown Point vein, formerly a big producer of the same rich silver-lead
ore west of the Stewart and south of the fault and on the same northeast fissure system, which, with the intimate knowledge of these fault movements acquired by several years of close personal study of Mr. Beaudry and the newly proven geological relation of these ore courses, which were formerly considered spurs of the Wardner lode, are likely to respond to his further development efforts with some surprising results in additional rich ore resources.

The extension to the south of the main Stewart ore course has been extensively and profitably mined on the Ontario and Sierra Nevada Company’s ground for hundreds of feet along its course and under identical conditions of complicated crushing and faulting.

At the Caledonia bonanza, a short distance east of the Stewart, a crew of 30 men underground during the past two years have produced almost as much silver in ore and mining profit as its great neighbor, the Bunker Hill. This remarkable ore channel is also situated in close association with the Osborne and other big faults. It has been successfully mined to a depth of 1,000 feet and still has large reserves of rich ore, also, a complicated convergence of fault conditions in its bottom level that may involve considerable extra development cost, but the existence of still other rich ore stopes on the same system of northeast fissures, still further west at the Bunker Hill Mine, and more than a thousand feet deeper than the bottom level of the Caledonia, are significant indications of its further permanency below the present disturbed horizon.

The Coeur d’Alene ore deposits are unquestionably later than the bulk of the faulting movements, and I think that the present erosion surface of the district barely reached their primary crests in any of the sedimentary horizons, as there are very few instances in the district where the ore shoots have shown anything like their maximum length until considerable depth was attained below the outcrop of the fissures, with no important remanent of gossen ore skeleton overlying them to account for their lineal expansion at depth. This is true of the big ore bodies developed in Prichard formations as well as those in the quartzite, and as the Prichard is 8,000 feet thick, and, as Mr. Hershey says, is underlaid by still older sedimentary horizons,
which he classifies as Cataldo quartzite, and which is readily distinguished in the field as a separate phase of clean sericitic quartzite, and the manifest evidences of the siliceous slate walls affording replacement facility to the ascending ore solutions under favorable fissuring conditions, there isn't any reason, to my mind, why the ores should not go as deep in this rock as in any other, and that their only limit in depth, as in the quartzites, will be the original bottom horizon of ascending precipitation, governed by original heat conditions, which is probably pretty deep and has been proven to be, in several other districts in the world in similar ancient sedimentary formations, fully 6,000 feet vertically, and the chances are that the dominant fissures in all the formations of the Coeur d'Alene district will carry their ore values to great but probably unequal depth, where they are not interrupted by unusual fault displacements and the destructive action of later igneous intrusions. I do not believe the granite zone, extending from Canyon Creek to Murray, is much more extensive a mile under ground than it is at the surface, or forms any floor for the veins to taper out on, except locally, and its only action on the ore courses that it has been intruded into and across will be to highly metamorphose them, cut them off or destroy them in the replacement space it occupies.

If the granite were older than the ore courses it would be practically impossible for it to be so free from mineralization and fissuring itself by ores of later date in a mineral district so rich in ore manifestations on both sides of its axis, as illustrated by the widespread occurrence of lead and zinc minerals in the deeply eroded body of the main Idaho granite batholith, which has continued to middle tertiary times and of which this is assumed to be a surface phase, and if it is, it must have been cooled off long before the finish of the Coeur d'Alenes repeated mineralization periods, and if Ransome is right about its post mineral activities, it should show at least a moderate amount of fissuring and mineralization itself, but as far as extensive prospecting and development work has been pushed for minerals in this rock and along its walls, it has failed to disclose pay ore, and it is probably the young-
est solid formation in the Coeur d'Alene quadrangle, with the possible exception of limited dike intrusions of later date.

Idaho Batholith.

The Idaho granite batholith, so called, is one of the largest granite areas in the United States. It is of irregular outline but has major surface dimensions fully 200 miles north and south by 100 miles east and west, in central Idaho. Its age has been guessed by United States geologists all the way from Archaen to early Tertiary, the later observers inclining strongly to the Cretaceous Tertiary junction of time.

Since Professor Lawson's bold criticism of the (Butte) "Boulder Batholith," and the probability of it being a Laccolith with a sedimentary floor, his arguments, I think, from certain marginal and included evidences, will apply equally strong to the Idaho granite area, in spite of its size.

The interesting thing about this great Idaho granite body, of which the barren Coeur d'Alene granite zone is supposed to be an attenuated crest, and to which nearly all Idaho ore genesis is tied by the United States Geological experts, is the fact that its deepest erosion surfaces, which include all the important placer basins of the State, are richly mineralized with veins carrying gold, silver, lead, zinc and copper ores, which, in a majority of the districts, are accompanied with intrusive dike rocks of the dark basic variety that antedate the veins. In this connection even the old pioneer placer miners I remember used to consider a good mixture of the so-called black porphyry boulders and pebbles in their gravel beds a favorable indication of richer pay dirt.

Lindgren suggests that the granite crests of the Sawtooth range, along the headwaters of the Salmon river, 10,000 feet high, may have been reduced by erosive forces several thousand feet from their original elevations, and a recent gas well in the Snake river valley 4,300 feet deep, whose bottom is still in unaltered granite sediments, substantiates this suggestion.
In the deeper granite canyons on the north slope of the Sawtooth range, near Vienna, are ore veins with ore shoots 500 to 800 feet long that have a production record from rich milling ores of more than $2,000,000 in silver and gold.

These mines have shipped several car loads of $50 lead-silver ore lately and the bottom level of the old Solace Mine at this point, now being further developed by a Chicago company, is making such a favorable showing of clean silver bearing galena ore that the company are seriously considering the erection of a smelter on the ground for its local treatment the coming season, and, I repeat, that these deep seated evidences of granite mineralization in other parts of Idaho is additional proof that the barren Coeur d'Alene granite intrusions is of later date than the bulk of the district's extensive mineralization; that the latter is in some instances of very much earlier date, and in connection with the recent development of rich commercial ore courses, whose deeply buried crests did not reach the Kellogg tunnel level of the Bunker Hill Mine and including a fracture which above that level was only recognized as a practically barren cross fault. The chances and prospects for more lasting and deeper seated mineralization of these veins and faults than Ransome suggests, are emphasized.

The favorable territory for the further disclosures of important ore deposits in the Coeur d'Alenes which, however, in many cases will involve expensive ventures in development, is scattered throughout the entire district and expands far beyond the present productive centers. The remarkable increase and record production of both silver and lead values from the Kellogg district during 1915 was derived in fully 70 per cent of the total amount from a system of northeast fissures with a pronounced southeast dip that traversed the foot wall as well as the hanging wall formations of the Wardner lode, and include the Stewart, Ontario, Sierra Nevada, Caledonia, Francis and other veins. This system of veins was only recognized as a separate system by the litigation experts who studied the Wardner lode geology in the interest of apex litigation in 1909.
These veins are probably much older than the Wardner lode. All of them are conspicuously different, from the fact that they carry very much higher silver values than the Wardner lode, and are of a decidedly different period of mineralization, and no small amount of the large increase in lead and silver production of the year was derived from the operations of part of this system of veins in the deep levels of the Bunker Hill Mine below the Kellogg tunnel.

Ransome mentions a northeast strike to several of the basic dikes previously referred to, and it is not unlikely that they bear a genetic relation to these now very productive northeast ore courses and faults in the same manner as I presume the east-west basic dikes do to the veins. A study of the geological map and its remarkable faulting system accompanying Professional Paper No. 62, will show that these deep seated north-south or northeast-southwest fault fissures are by no means inconspicuous in the Canyon Creek section.

In fact, Ransome partly suggests the likelihood of mineralization in the pronounced northeast fissures that cut the Gem-Frisco, Black Bear ore courses and I think it is not improbable that development work in favorable localities on this line of fractures in the Canyon Creek section will be found mineralized with important commercial ore bodies as they have been proved to be in the Kellogg-Wardner district and should at least be given the consideration of a diamond drilling test.

To my mind, fine chances for important lead-silver ore development lie in the territory traversed by the persistent grey copper veins in the so-called dry belt lying between Wardner, Kellogg and Wallace, where a consolidation of interests in such veins as are pointing to the associated and underlying Revett and Burke quartzite would be likely to bring results in wider ore bodies, much richer in lead than the thin veins in the Wallace slates now contain in their upper horizons.

The recent development of deeply buried rich lead ore bodies in the immediate vicinity of Burke argues favorably for further results in the well fissured and extensive areas of quartzite of the Canyon Creek drainage above that point.
on both slopes. The rich association of iron carbonate gangue in the veins along the range south of Mullan, with its promising display of basic dikes with included lead-zinc mineral at one point and association of spots of rich copper ore, are also worthy of deeper work to test their commercial ore bearing possibilities, for many of the big fissures that traverse that territory are notably rich in the primary iron carbonate gangue so conspicuously in evidence in the older mines and which preceded and followed their lead, silver and copper minerals.

The Nine Mile slopes are also conspicuously popular at the present time, and justly so, for the discovery of further important ore channels. The very recent new strike at the Patuxent Mine, where four feet of high grade lead-zinc ore, cut late in December in a fissure zone 50 feet wide, immediately south of the Interstate-Callahan on a parallel course and at considerable depth, is a case in point.

The Carbon Creek and Beaver Creek slopes, with their conspicuous manifestations of fissuring and several already valuable proven ore bodies, also present some flattering speculative chances for further deep mining development.

The same is true of the vicinity of Murray and the adjacent mountain spurs. Several of the properties tributary to Murray have made important shipments of remarkably rich lead ore, and while the ore courses of this section show a conspicuous association of zinc, I believe the future market for this class of mineral is pretty well established for the Coeur d’Alene region, and its value will be stimulated by the perfection of local metallurgical processes for its economic extraction.

The Murray ores have all shown a ready response to ordinary concentrating processes and have yielded very clean products of both lead and zinc. The Monarch Mine, in this vicinity, has been developed 1,400 feet deep, at which horizon it showed the biggest body of mineral in the mine, and while the principal vein has been badly disturbed by step faulting, the enclosing formations are exceptionally will fissured and afford favorable prospecting territory.
Six miles west of the Kellogg, the Hypotheek vein has been the subject of an expensive campaign of development in the Prichard formations of that section. This property presents one of the most exceptional conditions of deep oxidization in the Coeur d'Alene field. After an outlay of $300,000 it has still persisted in refusing to respond to the indicated bonanza results anticipated by some of the best practical judges of the district, whose opinions were substantially backed up by investments in its securities.

The Hypotheek appears to carry two veins. The first vein, which was quite extensively developed to the 500 foot level, is a very pronounced quartz filled fissure carrying a thin mineralization of banded chalcopyrite. At the 500 foot level a short cross-cut south revealed the existence of a soft, spongy brown gossen vein 10 feet wide, carrying a thin sprinkling of lead carbonate crystals. At the 700 foot level this gossen vein was very much richer in lead values and showed a remarkable display of crystalline bands of high grade lead carbonate ore in pure mass crystal aggregates and bands.

At the 900 foot level the same highly oxidized and gossen condition with associated rich lead carbonate values prevailed in a pronounced vein 20 feet wide, but showing occasional residue boulders and pebbles of very pure, coarsely crystalline galena characteristic of the best galena phases of the district and doubtless indicating the primary live ore of the vein at a greater depth. A new shaft on this property is now down to the 1,100 foot level, where pockets of the same spongy honeycomb were found in a hard white quartz vein that was being drifted on. The property carries some definite faulting movements and it is likely that this deep level was not on the lead vein disclosed above. A cross-cut was in progress to determine this feature at the time of my visit late in November.

The existence of this gossen oxidization is remarkable from the fact that the 1,100 foot level is 400 feet below the surface of Lake Coeur d'Alene and is hard to explain as extending below the surface drainage level of the country unless one can conceive a condition of an inverted siphon action, due to the fact that the pronounced charac-
ter of the fissure and the possibility of a lower outlet at some point along its course, which has set up a circulation of oxidizing surface water and produced the result.

The property, as now developed to the 900 foot level, carries quite an interesting resource of valuable lead carbonate ore in its lead vein and it will discredit all the canons of practical experience, especially in the Coeur d'Alene district, if it fails to reveal an important and profitable resource of high grade galena mineral, if development is persisted in to further depth on the proper ore course, and it is not unlikely that important bodies of the rich primary ore anticipated will be found on the 1,100 foot level when it has been fully explored, as indicated by the residue boulders of clean galena that have already been found on the 900 foot level.

Another valuable strip of territory that embraces some of the most favorable conditions in fissure courses and surface evidences of underlying ore bodies that have not been half proven, lies between the Frisco and the Morning Mine along the high mountain divide that separates Canyon Creek from the South Fork.

On the east fork of Pine Creek, a few miles south of Kellogg, some energetic development on zinc-lead ore courses is now in progress, and to my mind is destined to result in the disclosure of several very valuable ore channels. This is particularly true of the new zinc discoveries at the Little Pittsburg Mine, which, at the time of my visit early in December, was showing the earmarks of something big in zinc ore; it had recently cut a body of zinc ore in a very pronounced fissure that had been drifted on for 40 feet at the time and disclosed a breast of massive zinc sulphide mineral seven feet wide, which, from its appearance, would easily average 30 per cent zinc. If this ore body should prove to have a length of several hundred feet, like some of its close neighbors, and maintain its manifest quality, as shown on that date, it will result in another bonanza of zinc mineral.

In an adjacent gulch some excellent evidences of valuable ore shoots in both zinc and lead minerals have been disclosed on the Nabob and Sidney Mines, and a little further up the creek the Constitution Mine was starting a vigorous campaign of development on a splendid ore shoot.
in zinc and lead ore several feet wide and 600 feet long, and recently shipped three carloads of rich ore.

At the Highland Surprise Mine, in the same vicinity, an ore course has been drifted on over 1,500 feet in length. This property is equipped with an incomplete milling plant of a hundred tons a day capacity. Its interesting ore channel has been afflicted with a succession of short vertical cross faults that have disjointed the ore body a few feet in repeated steps. The quite extensive development work on the mine has been done largely by contract and this faulting condition was not fully recognized by the operators, whose principal object was footage. In the hands of an experienced manager, however, the development is now being carried on along much more intelligent lines, and it seems more than likely, from present evidences, that the Highland Surprise will prove one of the long ore shoots of the Coeur d'Alene district, carrying excellent values in concentrating lead-zinc ore. This ore, while carrying some pyrite, seems to separate readily into clean shipping concentrates of both lead and zinc by the present crude milling equipment, and far superior results can safely be anticipated with more complete milling equipment. Several cars of rich zinc and rich lead concentrates were shipped from the mine during December.

The Douglas Mine, in the same vicinity, is one of the richest and most persistent lead-zinc ore courses in the Coeur d'Alene field. It has a continuous ore shoot upwards of a thousand feet long, containing high values in both zinc and lead, but also closely combined with iron sulphide and forming an extremely fine textured massive mineral that has resisted all previous efforts of mechanical separation. This deposit has recently been optioned to some prominent Montana people, who will probably figure on the electro-chemical separation of the zinc values and turn the deposit to very excellent commercial account and profit.

There are a number of other splendid prospects in both zinc and lead on the Pine Creek drainage, which is noted for a conspicuous display of the Prichard formations, which have been unpopular as a basis of mining speculation in the district for several years past, due to unfavorable technical opinion, but since the abnormal profits and demonstrated ore bearing capacity of these formations have been disclosed in the Nine Mile section, a new interest has
been awakened in the further and deeper development of the ore deposits in these discredited rocks that are destined, to my mind, to add an expanding and important volume to the already magnificent annual yield of the Coeur d'Alene district.

One of the most conveniently situated and interesting mineral deposits of an unproven nature is situated in the Prichard formation two miles north of the Kellogg-Wardner depot on Italian Gulch, and known as Lombardy Mine. This property is owned by a veteran Italian miner and business man, Peter Abinola, who has held it for 25 years. His lower tunnel, 950 feet long, driven in from the creek level, crosses a big black diabase dike several yards wide near its portal. The last 400 feet is carried as a drift in the vein without systematic cross-cutting. The interesting phases of this prospect is the fact that it is opened on a powerful replacement fault fissure vein that can be followed at the surface for thousands of feet (Pete says miles) by outcrop manifestations and is 10 to 30 feet wide of silicious breccia gossen and iron sulphide ore at shallow depth, the lower tunnel drift disclosing bands of clean, massive pyrite up to four feet thick. Lately the face of the drift has disclosed three feet of tight breccia well sprinkled with fine grained clean galena. The only other comparable display of pyrite ore to this in the Coeur d'Alene district that I know of is the heavy pyrite ore bodies in Milo Gulch, on the east end of the main Bunker Hill ore course, whose associated and deep underlying lead-silver ores form the basis of the present prosperous town of Kellogg, and I think that the business interests of that place would be well warranted, under favorable terms, in financing a cooperative mining development enterprise to test out, at considerable further depth, the commercial lead-silver bearing possibilities of this big Lombardy vein.

Another point of attractive promise for the development of new ore resources has been disclosed on the Little North Fork of the Coeur d'Alene river about 10 miles northwest of Kellogg, where Messrs. Page & Devlin and their associates on the Horse Powell Mine have disclosed a magnificent shoot of copper ore, with an already developed resource of 50,000 tons of mineral that car load sampling and numerous other tests have shown to carry an average value of about three per cent copper with a little gold and silver per ton.
This deposit consists of a quartz filled fissure in clean hard quartzite walls that is traceable on the surface for 2,000 feet. Its tunnel and shaft development disclose an ore shoot for a proven length of over 400 feet that is 10 to 20 feet thick. The interesting feature of the gangue of this vein is the fact that while it is predominantly quartz, it also carries a conspicuous development of chalcite crystals, iron carbonate and a very uniform dissemination of chalcopyrite ore. Elaborate concentration tests have proven the ore to show splendid saving results with up to 89 per cent recovery with flotation equipment, giving a resulting concentrates containing values of over 25 per cent copper and promises a very profitable shipping product. The property has recently been equipped with a 1,500 cubic foot compressor plant; is to be energetically developed during the winter and equipped with a good sized mill in the spring.

The Horst Powell Mine has the only material development in this new district. Its ore deposits show a definite evidence of strength and permanency with very substantial tonnage resource of desirable concentrating ore already proven. There seems hardly any likelihood of misreading its future and I feel safe in predicting for it a profitable career. The splendid development results it exhibits in ore resources should prove a strong incentive to other development activities in this locality.

The neighboring hills are said to carry a number of fine copper prospects in well marked veins and containing relatively rich values in gold and silver, and still further up the creek a system of lead bearing veins has also been discovered which is said to show some splendid prospects containing high grade ores of both carbonate and galena mineral carrying good values in silver.

My general conception of the genesis of Coeur d'Alene ores is that they originated as ascending solutions in fissures, fault lines and ragged displacement breaks that penetrate the full depth of the sedimentary series and conforms to the expressed opinions of the technical experts who have gone into this subject in considerable detail. I believe, however, that the conspicuous lack of persistent vein quartz in the main ore courses in this and other lead bearing districts of the State and the prevailing occurrence of quartz gangue in the veins of the granite districts of the State, discounts the probable origin of the Coeur
d'Alene ores in the local silicious granite magma, assumed by Ransome; that the granite outcrops are more in the nature of big eruptive dikes or masses, as at a number of observable points at considerable depth their walls are invariably very steep to vertical, and show no tendency to flat dips and shallow spreading surface of an underlying batholith.

Their complete lack of commercial minerals should be sufficient proof of their later age, and the only detrimental effect these granite intrusions may have had on the Coeur d'Alene ore deposits has been their local rupture or displacement or absorption of that part of the older ore courses which they crossed and a subsequent metamorphosing action by silicious waters with accompanying contact metamorphic mineral addition to the already existing ore courses near the granite.

If, as suggested years ago, the Hecla dike is older than the Hecla ore vein, it is a pretty strong argument that the majority of the other basic dikes of the district long antedate the granite intrusions. The conformable strike of these dikes to the main ore courses offers, to my mind, a better argument of the origin of the fissures and their basic gangue mineral contents, the prospect of other contact ore courses and more likely magma for the origin of the Coeur d'Alene ores in both lead and zinc, than does the more acidic magma of the granite eruptions. The convergence and consequent exhaustion of the main ore bodies at the range of 2,000 feet below the drainage level of the country may be correct, but it isn't fully proven by any means, and they will doubtless be found to penetrate much deeper in the younger phases of mineralization.

The lilac colored sericitic quartzite of the Cataldo formation, described by Hershey as a thousand feet thick and underlying 8,000 feet of Prichard formation, making a total of nearly 20,000 feet of ancient pre-cambrian sedimentary beds, forms a substantial reservoir for deep ore occurrence, and according to world experience this type of rocks embraces the most attractive prospect for deep seated ore occurrence, whose limits in depth will only be governed by the horizon of original temperatures at which the metals commenced to precipitate out on the walls of the fissures from their ascending solutions, which I believe, in favorable situation in the Coeur d'Alenes, will be as deep as mining practice can follow them.
The present quite deep ore development demonstrates, to my mind, that the Prichard formation is just as favorable under strong fissuring conditions for replacement with and precipitation of commercial ore values of both high grade lead as well as high grade zinc ore as is the present more popular and better developed quartzite rock, and that these formations will produce just as large and profitable mines in the future as the quartzites have in the past.

I would further emphasize my opinion that the deep erosion surface of the Coeur d’Alene Mountains did not penetrate deep enough to materially rob any of the Coeur d’Alene ore deposits; that most of them have virgin, undisturbed crests regardless of enclosing formations and will carry their ores as deep as the original deep temperatures permitted precipitation; that other deeply buried commercial ore crests, such as have recently been disclosed in the deep levels of the Bunker Hill, Hercules and Hecla Mines, will continue to be discovered as deep work progresses and will include fractures that are now known only as fault planes.

The fine dissemination of metals in the different sedimentary horizons was probably introduced with the metamorphic processes that changed the original sediments to their present altered conditions, and I doubt if it afforded any material source of the metals in the present rich channels of ore concentration, which are more probably the result of a direct precipitation from the deep primary magmatic sources.

The bottom horizon of the commercial ore values in the Coeur d’Alene district has by no means been fully demonstrated and its areal distribution of dividend paying mines promises a broad expansion beyond the present centers of production.
NEW MILL NO. 2—IDAHO CONTINENTAL MINE
· OTHER IDAHO LEAD-ZINC RESOURCES.

Boundary and Bonner Counties—Continental Mine.

The most definitely prospective important source of high grade lead-silver ore in Idaho, outside of the Coeur d'Alene district, is that of the Idaho Continental Mine, adjoining the Canadian boundary line in Boundary County. This deposit consists of a nearly vertical fissure vein in thin bedded quartzite resembling the Burke formation and associated with conspicuous basic dike intrusions. It has been developed with a series of three adit tunnels driven on the vein, the lowest one 600 feet deep, is 1,600 feet long, which, with the other work on the property, proves the existence of three distinct ore shoots that vary from three to fifteen feet in thickness and will aggregate a thousand feet in length, of clean concentrating galena ore, with an average value of about 10 per cent lead and 6 to 8 ounces of silver per ton.

The silver values have materially increased in the lower level over the shallow surface development. The ore is free from zinc and objectionable sulphides. Its only apparent association in the bottom level is an occasional spot of chalcopyrite. Fully three hundred thousand dollars in cash capital has been spent on the developing and improvement of this property within the past three years in the way of mine, mill and power plant equipment, including a wagon road construction for a distance of 24 miles from the railway shipping point at Port Hill, through a very rugged canyon topography. This large investment was distributed under the charge of some highly technical engineers who did not make a very flattering result of their efforts, especially in the mine development, and almost wrecked the enterprise.

In July the company's splendid new mill was destroyed by fire, and its future looked doubtful and discouraging, but through the persistent energy and effort of an industrious Teutonic promoter, Mr. A. Klockman, and the kindly assistance of Mr. John D. Ryan, the situation has been favorably changed. Mr. Klockman wisely acquired the services of a real miner by the name of James Wilson, to take charge of the underground work, which now displays distinct promises of successful results. Mr. Wilson
served a ten years' apprenticeship in the game at the Hecla Mine, near Burke, and acquired a special nose for ore in this class of deposits, and in six months, since he took charge of the Continental Mine, has transformed the doubtful resources of the property into a positive asset that makes the original estimates of the engineers who examined the deposit of 80,000 tons of ore above the No. 4 level seem very moderate indeed, as Mr. Wilson already has 20,000 tons of broken ore in the stopes of the main ore shoots, which are still only a few floors above the levels, and has a number of faces of mineral showing clean bands of galena from one to three feet thick and giving very definite prospects of a further lineal extent of the ore bodies.

Through the tireless efforts of Mr. Klockman, the destroyed mill of 200 tons daily capacity has been rebuilt and is now under roof. This mine shipped 2,000 tons of 50 per cent lead concentrates and crude ore during 1915, carrying car load average values in silver of 30 to 40 ounces per ton. The new mill on the property should be completed and in shape for active production by early spring. Its further requirements will be a light Shay railway, the grade for which is already provided by the wagon road built on a maximum grade of four per cent with that object in view, and with these improvements completed the enterprise promises a steady shipping resource of at least a thousand tons a month of high grade lead-silver mineral.

Lawrence Mine.

In the vicinity of Clarksfork, in Bonner County, the Lawrence Mine carries an interesting system of fissures in thin beaded precambrain sediments. These veins range up to 20 feet thick and are conspicuous for the association of high grade galena ore in an iron carbonate gangue. The development of this enterprise has been retarded through lack of financial support. It has a small mill of 50 tons daily capacity and one of its smaller veins opened at a depth of 300 feet has given car load shipping results of 70 per cent lead concentrates and crude ore, and this group of veins should form the basis of a very attractive mining development enterprise that will warrant financial support.
Blaine County Mines.

In central Idaho the old Wood River district, during the closing months of the year, came through with three important new lead ore discoveries, which, in connection with activities in the zinc ore resources of this old district (the largest shipper operated in a granite formation), has given it new life and considerable promise of future production. One of the most interesting strikes in this locality was made in the Lipman tunnel, owned by the Red Elephant Consolidated Mines Company.

This property is situated about nine miles west of Hailey. It has been undergoing slow development for the past three years. The main feature consists of a crosscut tunnel 2,081 feet long, driven mostly by hand, which has penetrated what is believed to be the old Red Elephant vein where it shows 30 feet of gangue mineral. This vein was intersected at a depth of 850 feet and is one of the deepest vertical points attained in the Wood River district. A drift has been carried on the ore since it was cut for 80 feet, showing continuous high grade concentrating ore the full width of the drift, which was still maintained in both faces on January 1st, and carried good thick bands of clean coarsely crystalized galena rich in silver.

The importance of this strike consists of the fact that it is lower than the bottom level on the near by Bullion veins, which were so productive of rich silver bearing lead ore in the early history of the Wood River district, and practically proves that their failures were due more to faulting displacements than exhaustion of the ore course in depth, and this discovery is likely to result in a marked revival of interest in the several former important shippers of rich mineral from this part of the Wood River district.

Another interesting discovery was made at Kelly Gulch, a little further west, on a group of patented claims now being operated by the Idaho Exploration Company. These properties have been known to carry high values in lead-silver ore in their shallow surface development and the recent strike is said to show a big body of high grade concentrating ore with swells up to several feet thick of galena containing 70 per cent lead and 110 ounces of silver per ton.

The old Silver Fortune Mine, situated on the East Fork
of Wood River, and recently taken over by the Mascot Mining Company, of Salt Lake City, as a result of intelligent cross-cutting and new development in the old works, has disclosed a splendid deposit of high grade lead-silver ore that also promises an important tonnage capacity.

At the North Star and Triumph Mines, also on the East Fork of Wood River, an extensive resource of base zinc-lead-silver ore that it is believed will aggregate a hundred thousand tons of mineral above its bottom development levels and carrying about 15 per cent zinc with 8 per cent lead and 8 ounces of silver, is the subject of serious consideration at the present time by one of the ablest mining engineers of the country, Mr. Ralph Nichols, whose world-wide experience as a practical operator of large properties guarantees possible maximum results in working out the problem involved, which is admittedly a knotty one in this instance, as the ore is extremely base by a complication of massive arsenical pyrite association, but, it is believed that the recent advance in the electro-chemical treatments on zinc values will solve the problem of this deposit and transform its idle resources into a mining and milling enterprise of very considerable capacity and profit.

Near the head of Wood River 25 to 30 men were employed during the last half of the year in a resumption of operations at the long idle former bonanza silver ore deposits of the Vienna district, where recent reports indicate the uncovering of a considerable tonnage of good lead-silver ore that was left by the former operators, who handled the property with a pan process silver mill for its rich silver and gold values, which were conspicuous for their bonanza tenor in the early operations of these veins over 25 years ago. The management of this enterprise is finding indications and is hopeful of developing further reserves of the rich silver ore values for which the veins were formerly noted in addition to the lead smelting minerals that were left by the former operators and from which several car load shipments have been made.

The Croesus Mine, three miles from Hailey, changed hands during the year and it is expected to be the scene of active operations during the coming season. This mine is developed 850 feet deep and carries a gold-copper vein from the surface to the bottom containing good values and
from which half a million dollars' worth of ore has been extracted. In the two bottom levels a lead vein with a similar strike but different dip has been developed that shows a very attractive shoot up to 15 feet wide of good concentrating lead-silver ore with an associated basic dike, and indicating a similar deep-seated genesis of some of the Coeur d'Alene deposits.

At Bellevue, the old Queen of the Hills Mine was unwatered during the fall by Senator Rockwell. This old property has a shipping record of over a million and a half dollars in high grade silver-lead ore. It was noted for the association of clean zinc mineral and it is hoped to turn this discredited but now popular residue of the old mine to account and to search the bottom levels for evidence of the continuity of the former rich ore channel and the warrant of its further development at depth.

The Independence Mine, near Ketchum, made the best year's shipping record of its history and a considerable output under adverse milling conditions due to a very limited water supply. The car load shipments from this mine averaged 45 per cent lead, 95 ounces silver, and one-fifth of an ounce in gold per ton. It has a big vein and a promising future, but has unfortunately been afflicted for several years with apex litigation troubles.

At Deer Creek, a few miles northwest of Hailey, the Nay Aug Mine was actively operated in a well marked fissure vein in granite and was quite an important shipper of rich zinc and rich lead-silver ore during the year from a new level entirely below the point at which the former operators quit the property as an exhausted proposition. Several car loads of rich zinc ore were shipped from the War Dance, another granite vein, and some very rich zinc-lead ore discoveries were made on the north fork of Wood River that seemed to warrant the anticipation of a mining operation of considerable capacity.

In western Blaine County, on Bear Creek, the El Oro Mine made quite an important and profitable production of gold bullion and rich gold bearing concentrates and greatly improved its equipment and ore development with definite indications of increased profits in the future.

A new mill was installed and started on the old Cannon Ball Mine, near Soldier, which has a gold producing vein of considerable promise.

Active development was started on the Connor group of claims, near Muldoon, and the adjoining Eagle Bird
claims, which are known to carry some high grade lead-silver values and are admirably situated for rapid and deep development by adit tunnel work.

A number of cars of good lead-silver ore were shipped from Antelope Creek by Weiler & Son in the eastern corner of the county.

Some splendid specimens of high grade wolframite, a desirable ore of tungsten, was brought in from a new development on the Nelson Mine, near Martin, also in the eastern corner of Blaine County.

Some very rich tungsten shipments were also made from the Mountain View group of claims on Soldier Mountain, near Corral, 40 miles west of Hailey, from narrow bands of wolframite in a wide trachyte dike. A small crew of men are operating this property and additional shipments of this extremely popular high priced mineral are in promise for the near future.

The entire mountain area of Blaine County, which constitutes fully two-thirds of its total acreage, is richly mineralized with hundreds of good prospects embracing almost the full list of precious and base metals. Its formation ranges from carboniferous to pre-cambrian in its display of sedimentary rocks. It has an area of plutonic formations, embracing monzonite, granite aplite and quartz diorite, presenting a border phase of the so-called Idaho granite batholith, whose contact lines show little metamorphic change on the invaded and overflowed sediments at several mines and indicates a laccolithic character. They have, however, been extensively mineralized by later solfateric action. The rich silver-lead veins of the district, with their conspicuous gangue of carbonate minerals and prevalent association of small basic dikes, is a significant indication of similar ore genesis and probably deep seated permanency with the Coeur d'Alene deposits in Shoshone County.

The district carries some big zones of low grade lead-zinc minerals. In one place a width of 200 feet carries galena and blend scattered through its body in close set stringers and seams, and warrants development by diamond drilling on the prospect and possible warrant of a big scale operation.

The Homestake fissure, above Ketchum, is an example of the district's persistent fissuring in the sedimentary formations. It has shipped several hundred thousand dollars' worth of high grade silver-lead ore from a maximum depth
of about 200 feet and displays high values at 100 foot intervals for nearly 10,000 feet along its course, over a high mountain crest.

In the granite formation, 12 miles west of Hailey, the Camas lode, in granite walls, outcrops as conspicuously as a well paved highway for a mile and shows from 10 to 40 feet wide of well honeycombed red and white gold quartz. The central development on this vein at Camas No. 2, 500 feet deep, has produced $500,000 in gold, is said to have yielded an average of $10.00 per ton in free gold on the plates, and a resulting cyanide treatment of several thousand tons of tailings from its former milling operations are reliably reported to have given an extraction of $4.00 per ton, with $2.00 to $3.00 still remaining unrecovered.

This county contains dozens of splendid opportunities for legitimate mining development enterprises. If capital is willing to risk the necessary speculative mining chance of results it can find some excellent opportunities to do so in the extensive evidences of mineral distribution in the Blaine County mountains, where natural conditions for economic mining operations are especially favorable.

Lemhi County Mines.

The lead-silver district of Lemhi County, at Gilmore, enjoyed a prosperous year of profitable production, which was materially accentuated by the introduction of the leasing system on the upper levels of the two leading mines, the Pittsburg-Idaho and Latest Out, where the practical nose for ore of the local miners brought to light several million pounds of lead in territory that had been passed up as exhausted by company operations, and made for themselves considerable profit during the operation and also extended the general prospects of the properties for future development at further depth along the strike of their veins. Both these mines are showing the richest ore of their history in their deepest levels.

A very interesting condition was encountered at the Pittsburg-Idaho mine, whose total production has been obtained from crude shipping mineral of an oxidized character in dry ground. At the 600 foot level the first water flow of the mine was encountered and it was believed that it meant permanent water level and the prospect of a change in the character of the ore to sulphide with the
resulting necessity of milling operations to separate the zinc, lead and iron. A winze was sunk, however, during the year, 50 feet below the 600 foot level of this mine, which was carried all the way on a beautiful band of mineral three to five feet wide, which has continued to maintain a very high proportion of lead carbonate mineral and gives the richest average results in both lead and silver that has ever been found in the development of the property. Also indicating that the water encountered was naturally in process of deeper circulation and does not mean permanent water level with the attendant anticipation that the favorable carbonate minerals may extend to considerable further depth.

This property, in combination with the adjoining Allie and Gilmore Mining companies, have jointly run a development tunnel 4,500 feet long back into Gilmore Mountain, which crosses a dozen very interesting lead-silver bearing fissures and one important gold vein. The latter has a considerable production of fair grade gold ore consisting of an earthy brown iron gangue in which was found, extracted and shipped, two car loads of bonanza values in native gold that yielded about $300 per ton. The big fault fissure in which this long shoot of gold bearing iron ore occurs is a very attractive prospect for a reoccurrence of similar values at further depth.

During the year the Allie Company was confining its development from the deep tunnel to their lead bearing fissures in the strike of the Latest Out vein and found some encouraging evidences of a continuation of the latter property's mineralization along its strike into their territory. This development is being carried at a depth of about 800 feet under the crest of the vein and the intersection of a pay ore shoot at this horizon should mean the addition of a profitable resource of ore to this company's extensive holdings.

The geology of this district has been covered in considerable detail by Mr. J. B. Umpleby, of the United States Geological Survey, which shows a very favorable environment for the continuity of the ore channels to great depth and comparative conditions with some of the famous Utah camps.

The formation in which these pronounced fissure veins occur are ancient sediments, principally limestone formations, extending from the carboniferous period down. They
are 2,000 feet thick and underlaid by a pronounced mountain core of cambrian quartzite, the whole traversed with conspicuous intrusive dikes of diorite porphyry. The two principal mines have produced a total of a hundred thousand tons of crude shipping ore, without milling equipment or second class dumps, that has averaged around 30 per cent cent lead and 15 ounces silver per ton, and they are worthy of a substantial outlay of advanced development capital as the situation gives eminent promise of further successful and profitable results.

A rich body of silver-lead mineral was cut in the Lemhi Union Mine during the year, a few miles south of Gilmore along the same range, and several other prospects in the same vicinity were being operated during the year that gave evidence of future shipping results.

At Agency Creek, further north in Lemhi County, the old Copper Queen Mine was the scene of some intelligent concentration work on its big dump resource of vein gangue which resulted in the production and shipment of several cars of high grade copper-gold ore.

Dredging operations were carried on successfully at Kirtley Creek during part of the year. At Carmen Creek, 10 miles east of Salmon City, some core drill prospecting work was in progress on an enormous deposit of mineral bearing porphyry that was reported to be giving evidence of average results in concentrating values of about $3.00 per ton in gold and other metals and may form the basis of a big steam shovel mining and concentrating operation.

The enormous deposits of volcanic ash 15 miles east of Salmon City, which were described in my last annual report, were sampled during the year with conflicting results. Samples from one assay list gave from 50 cents to $3.50 per ton in gold and from other assayers on check samples, results carried from a trace to 50 cents per ton. These conflicting results indicated either a spotted condition of values or assay errors. This material is so favorable that it would mill itself to a hundred mesh pulp in a process of glory hole mining and could probably be handled at a profit if it would show an average value of $1.00 per ton in gold, as the deposit contains tens of millions of tons. Its importance as a source of big gold mining and milling operation, however, still remains rather problematical. I am advised that a similar ash bed deposit in Cen-
tral Oregon, on which similar conflicting fire assay results were encountered, is now being profitably milled.

The western half of Lemhi County carries dozens of splendid copper prospects, and in the Blackbird district some wide zones over 100 feet thick of disseminated copper sulphide ore carrying good values in copper and gold that, some day when transportation facilities are improved, will doubtless form the basis of big mining and milling operations.

This same district carries some very interesting deposits of cobalt sulphide ore, specimens of which were called to the personal attention of the famous inventor, Mr. Thomas A. Edison, by our mineral exhibitor at the San Francisco Fair, Mr. Edward Schwerd. Cobalt, I believe, is used in the Edison storage battery, and the interest of this famous national character in our cobalt resources was induced on that account, and may lead up to a thorough investigation of the merits of these deposits.

Custer County Mines.

At Mackay, in Custer County, the Empire Copper Company enjoyed the most prosperous year of ore production of its history, employing about 200 men, largely divided into small leasing units, which were almost uniformly successful and profitable to the leasors as well as the company. The leases were all renewed and in fact extended for another year in October, and a large force of men are now employed, and the property, from its Albert tunnel level to the surface, is being actively developed at a hundred different points and giving very definite promise of continued important production from above this horizon.

During the year this company continued its long, deep development tunnel, known as the Cassock tunnel, which has attained the length of 4,500 feet and recently entered the ore zone where the geological conditions described by Mr. Umpleby, of the United States Geological Survey, are found to be normal and give promise of important ore results when the necessary cross-cuts have been extended to explore the wide zone in which the ores occur above the Albert tunnel 900 feet vertically above this new opening. If the ore values are found to extend to this deep level, it will result in adding 20 years to the life of this property and should greatly expand the profit end of the enterprise and
the business activity of Mackay, which have been greatly benefited by the operation of this mine during the past year.

At Loon Creek, further west in Custer County, the Lost Packer Mine made a short run with its smelter and shipped two car loads of high grade gold and copper bearing matt. This company, during the year, also installed a 50 ton concentrating mill, with flotation attachment, with which to treat the large reserve of milling ore that has been blocked out in the past development of the mine but was too silicious for direct smelting. These resources of the Lost Packer Mine aggregate over 20,000 tons, which, together with the proof of recent development in the main ore shoot, carrying its rich sulphide values below the thousand foot level, gives this enterprise a very bright prospect for future profitable results. A small force is being carried on development work at the mine during the winter and it is anticipated by this company that milling operations will be started by early spring.

A short distance east of the Lost Packer, near the head of Jordan Creek, in the Yankee Fork district, some very rich ore discoveries were made in the old Montana Mine, now operated under lease and bond by the Custer Slide Mining and Development Company, and a small shipment of selected ore was reported to have given returns equal to the bonanza values for which this old property was noted in its early development. For the future treatment of the important ore resources that have recently been developed at this mine, an aerial tram, connecting this property with the Golden Sunbeam Mine on the opposite side of Jordan Creek canyon, has been constructed. The Golden Sunbeam Mine is equipped with a large milling plant and has, itself, been the producer of high grade gold ore. It also carries a zone of low grade gold ore more than 200 feet wide, consisting of a mineralized porphyry tuff that may be turned to account in the future on a big scale open pit method of mining.

Fremont County.

At the Dome Mining district, on Little Lost River, in Fremont County, the banner year's production of its history was made by the Wilbert Mining Company, which employed a force of 70 men in the mine and mill and was
shipping 600 tons a month of 50 per cent lead-silver concentrates and crude ore during a large part of the year.

This deposit is a fissure vein in cambrian quartzite. It is noted for an interesting surface quarry operation, where the top of the vein has been folded over into a nearly horizontal bed. The underground works have followed the main ore shoot to a depth of 400 feet, which has been noted for the remarkably clean character of its lead mineral, which, while low in silver values, is apparently free from zinc or iron, and occurs in a sandy crushed quartzite gangue. The deposit has been disturbed by block faulting that may involve some expensive cross-cut development work to keep track of its principal ore channels. Its physical problems are being intelligently handled by a capable manager, and the geological situation gives encouraging promise of a permanent and deep seated ore deposit.

The Wilbert paid its initial dividend to its stockholders during the year, and accumulated a good cash reserve. Its milling operations were still being continued in December and some interesting features of recent new development, it is hoped, may maintain the ore supply throughout the coming season.

Boise County Mines.

One of the most interesting new mining development results of 1915 and one that promises a new and important resource of smelting ore minerals associated with precious metal values, is being brought to light along the northern border of Boise Basin, near Grimes Pass, in Boise County. At this point the Diana Mines Company, a development enterprise backed by eastern capital, has acquired several groups of claims that have been undergoing development since the middle of the summer with a force of approximately a hundred men, whose work has disclosed high grade galena zinc and copper ore minerals associated in some instances with rich silver values and good gold values on half a dozen different veins.

Previously, the most important mining enterprise at Grimes Pass since the rich placer mining operations ceased, was that of the Golden Age Jr. Mining Company, whose property is equipped with a 15 stamp gold mill and carries an adit tunnel and shaft development aggregating 300 feet in depth on a pronounced fissure in altered granite that
varies from a few inches to several feet wide, of relatively high grade ore in a shoot 500 feet long that has produced free milling values of $5.00 to $20.00 per ton in gold and carries a good sprinkling of sulphide concentrates, embracing lead, iron and zinc mineral, that are rich in gold.

The mill on this property is idle at the present time pending the further development of the vein to put it in shape for the more economic extraction of its ore resources, which continue strong in the bottom and seem to warrant a considerable outlay in deeper development.

A number of shallow lode mining enterprises have been started in this vicinity that gave good results in gold ore values in the shallow oxidized horizons, but wherever a depth of 100 feet has been obtained a change in the character of the ore has invariably been encountered, which embraced both lead, zinc and copper minerals. This district carries some very pronounced and persistent fissures, whose continuity has been proven for several thousand feet in some instances. The occurrence of smelting ores, however, did not prove attractive to deeper development in past years by reason of the intervening transportation costs, involving a wagon haul over steep mountain grades a distance of 50 miles to the nearest railway shipping point. The completion during 1915 of the Inter-Mountain Railway, to the heart of the Boise Basin, near Centerville, has greatly stimulated interest in the further development of these smelting ore values. This splendid standard gauge, completely equipped railroad was built by an affiliated company of the Payette Lumber Company for the purpose of handling its extensive resource of yellow pine timber to its big milling plant five miles above Boise.

The present base ore developments at Grimes Pass are of such a nature as to indicate that this new railway may find a source of mineral traffic that will ultimately far exceed in value its primary logging purposes.

The geological conditions surrounding the Grimes Pass deposits are decidedly favorable for the existence of a smelting ore camp of big tonnage capacity, as the conspicuous quartz-pyrite veins which it carries are now proven to be richly mineralized at a moderate depth with high grade chalcopyrite ore and the other richer sulphides of copper, some of which resemble the product of the famous Butte district, in Montana, and to which this district bears some geological comparison in the fact that it
is situated well within the great Idaho granite batholith, which has locally been intruded through a belt several miles wide by 20 or 30 miles long, with enormous zones of semi-basic porphyry and great belts of silicious rhyolite, together with narrow black basic dikes in close contact with the ore courses, which show some splendid bands of
high grade coarse galena ore, rich in gold and silver on one side of the belt, and on the other side an association of gray copper mineral carrying specimen values in silver up to several hundred ounces per ton. The copper ore in the central part of the zone is associated, in some instances, with high values in zinc sulphide, which is a combination that again recalls conditions existing in parts of the Butte district. These favorable environments argue well for the establishment of a permanent smelting ore resource of big capacity, which, however, will involve the outlay of considerable mining development capital, but the conditions now in evidence well warrant a liberal risk of money for this purpose.

Ten miles northwest of Grimes Pass, in the vicinity of Placerville, on the main big porphyry zone, the Gold Hill and Iowa Mine was operated during the year with a force of about 30 men and made quite a substantial production of precious bullion with its 50 ton mill. This property embraces the Gold Hill vein, and the Pioneer porphyry zone, several hundred feet wide, the latter well mineralized on both its margins, and has produced about three million dollars in gold. The maximum depth obtained in its development is 550 feet below the valley bottom in which it occurs, and the bottom development still shows conspicuous samples of coarse native gold associated with iron sulphide and a little antimony sulphide, the latter always a definite indication of high gold values.

A few miles further southwest the National Mining and Development Company successfully operated the Mountain Chief Mine during the year and made an important production of gold with a five stamp mill. This mine carries a pronounced fissure on the margin of the same big porphyry zone, and in contact with a black dike, that contains an ore shoot 400 feet long, from a foot to three feet wide, that has been operated for several years and given average milling results of $20 to $30 per ton in gold. The resources of the two upper adit tunnels on this vein have been pretty well exhausted and a new tunnel 200 feet deeper has been extended in. In this new opening the old ore shoot was encountered nearly 200 feet earlier than was anticipated in the course of the vein, which would indicate a lengthening of the ore body to that extent or a sudden change in pitch. The same rich values have been found in this new tunnel, which characterized the ore
course above, and the enterprise gives decided promise of continued profitable operations.

The ore of this vein is heavy iron pyrite with a distinct association of very fine crystals of antimony sulphide that are associated with high values in both gold and silver, but difficult to save in the milling operations. Flotation attachments in the mill are being tried out and some concentrates are being made from this method that are giving returns of several hundred dollars per ton in gold and silver.

On the opposite margin of the big porphyry zone, which is several hundred feet wide on this property, a narrow vein, rich in silver, has been proven by some shallow development and will probably be tested during the coming year by a cross-cut from the new deep level.

In the strike of the Chief vein to the northwest the Ebenezer Mine, owned by the same company, noted for the production of high grade gold ore to the amount of over a hundred and fifty thousand dollars that was largely worked by sluicing by the early day placer miners, the soft outcrop of the ore shoot for several hundred feet along its course is now being developed by lesors, who are finding some decided encouragement in the form of rich gold ore at a point considerably short of the position of the main ore shoot in a deep tunnel they are driving, and it is very probable that the Ebenezer will shortly be put into profitable mining account.

At Placerville, the hydraulic diggings, with a bank of old channel gravel from 50 to 100 feet deep said to average 25 cents per cubic yard in coarse gold, known as the Leary-Brogan Diggings, was successfully operated during the spring for a very short run, due to the short water supply resulting from an unusually light snowfall of the previous winter. These deposits contain several million yards of pay gravel and present possibilities of profitable treatment by improved hydraulic methods or big scale mechanical equipment and are worthy of consideration by investors in that line of gold mining effort.

Near Idaho City, in the Boise Basin, the Lucky Boy Mining Company revived operations during the year with a considerable force of men. This property is equipped with a ten-stamp mill and made a considerable production a number of years ago, but through mismanagement
was shut down and remained idle for a number of years. It was purchased by local miners of the district, who were familiar with its merits and ore resources, and through their efforts the enterprise has been revived and is now said to be showing a considerable resource of ten-dollar gold ore and gives promise of another interesting source of gold production from the Basin country.

Boise Basin produced about 50 per cent of the total gold yield of Idaho during 1915 from its placer and deep mining operations, the principal source of production being from the continued operations of the big dredge of the Boston-Idaho Company, near Idaho City, which continued its successful career throughout the greater part of the year and remains at the top of the list in the matter of economy of operation and yardage handled among the big dredging enterprises of the United States.

This company has showed a marked interest in mining development ventures in both lode and placer work in this and other districts. Its interest in the Gold Hill and Iowa enterprise has been the principal factor in the success of that mine for several years; it is also interested in the Banner Mine, northeast of Grimes Pass. The latter was a noted producer of high grade silver ore 25 years ago. The development work being done at this point is said to be showing some of the characteristic values for which its early day operations were noted. Specimens, occasionally brought into Idaho City from the deep tunnel work of this property, contains values of several hundred ounces of silver per ton.

**Horseshoe Bend and Pearl Districts.**

Fifteen miles southwest of Placerville, in the mining districts adjacent to the Payette River, the Nellie Bloom Mining Company, after a campaign of development extending over the past two years, has disclosed a shoot of oxidized gold ore 500 feet long and 3 to 5 feet wide at a maximum depth of 300 feet that is said to carry average milling values of $10.00 to $15.00 per ton. A new ten-stamp mill was built and completed ready for operation on this property late in December, to be driven by electric power furnished from the Horseshoe Bend Power Plant.
of the Electric Investment Company, which is situated within half a mile of the mine.

In the same vicinity the Granite States Mining Company have quite an extensive resource of gold ore values developed and are planning the erection of a fifty-ton milling plant for its treatment.

The Lincoln Mine, just below Pearl, which has been quite extensively developed in the past, but idle for several years, was noted for a gold ore shoot over a thousand feet long containing values of $8.00 to $10.00 gold per ton and opened by four levels to a depth of 430 feet. The possible economic merits at this mine were destroyed by lack of capital and bad management. It has recently gotten into private hands and some new development from the surface on the course of the vein has recently shown a splendid evidence of relatively high grade gold ore values said to average $20.00 per ton in an ore course 3 to 4 feet wide, with selected shipping ore values containing $100.00 per ton in gold. This deposit occurs between a firm granite foot wall and a rotten porphyry hanging wall of a swelling nature, which through lack of experience, its former operators were unable to handle, with the result that more than half of the developed resources of the mine in the shaft levels were lost but still remain a definite asset to the property if it is reopened and intelligently handled.

These districts carry a number of good prospects, are noted for the occurrence of pronounced dikes and wide zones of intrusive igneous rock in eruptive granite and the association of a little lead and zinc in the veins with dominant arsenical pyrite ore in a quartz gangue. The ores of this district below water level, have always been difficult to treat, but it is believed that by modern methods of gold mining and cyanide practice that profitable results can be obtained and that the district will again revive and afford several successful mining operations.

The geology is believed to be related to and in fact a continuation of the Grimes Pass-Placerville zone by Mr. Waldmar Lindgren of the United States Geological Survey, who covered this district in splendid detail in his professional paper entitled "The Mining Districts of
Idaho Basin and the Boise Ridge," which was contained in the 18th Annual Report of the United States Geological Survey, now out of print and hard to get.

At the east central edge of Boise County, on Deadwood Creek, some important development results were obtained during the year on the Hall Brothers Mine, which has recently been incorporated. This property carries a wide fissured zone more than 100 feet between walls showing very pronounced shearing and evidences of deep seated mineral and dynamic action. The interesting surface feature of this deposit was a 10 foot pay streak cropping of high grade concentrating lead ore carrying relatively high values in silver and gold. The recent development on the property is reported to have demonstrated a continuation of the rich lead bearing ore course in both length and depth.

The Deadwood country is also noted for the occurrence of some excellent gold bearing fissure veins, and at one point carries a narrow fissure richly mineralized with tungsten ore of the hubnerite variety, according to beautiful specimens displayed by a well known Boise County prospector and said to come from that locality.

Owyhee County.

In Owyhee County, the Silver City mining district, which has been undergoing a period of stagnation for several years past, showed signs of revival in mining interest during the year. Some profitable leases were operated on the upper levels of the Trade Dollar Consolidated Mine. A small crew was carried in development work on the Banner Mine, which was testing the strength of a small shoot of rich argentite ore in its long lower tunnel and extending the drift to the north on the vein in a search for other indicated ore shoots.

At the property of the Silver City Mining Company, the old Blaine Mill, operated during bonanza days, was purchased by the above company from the Trade Dollar Consolidated and affords a very favorable site for a reduction plant to this company by reason of its attendant natural advantages and location near the dump of their long lower tunnel and has been rebuilt on modern lines and completed to a capacity of 25 tons per day under the design of Mr. F. C. Brown, the well known cyanide process man, inven-
tor and practical expert. After its completion, this mill was tested out with several small runs of company ore and lease ore from the adjoining Trade Dollar property and found to have been constructed on intelligent modern lines, as the reported saving of 91 per cent of the total combined values in gold and silver from a rather complex ore, would indicate.

The Silver City Company's property lies immediately adjoining the Trade Dollar Consolidated to the east and and carries a system of parallel fissures. It has been developed through a deep cross-cut tunnel with a total length of 2,000 feet. At a distance of 1,500 feet in, one of the main fissures of the group, known as the Crown Point, is showing a well defined vein in granite walls, four feet wide, parallel with and about 1,000 feet distant from the Trade Dollar vein; it has been drifted on for several hundred feet and has encountered an ore shoot 200 feet long containing good milling values. A raise in the center of this ore shoot has been put up 100 feet and a blind level started, which had been extended 70 feet on the vein late in December.

This new drift carries a pay streak that will average a foot wide with about $40.00 per ton in gold and silver and affording sortable crude ore amounting to one ton in three of $150 value. This interesting showing is being stoped with a small crew of men and the higher grade material will probably be milled when a sufficient quantity has accumulated and a concentrate shipping product made pending the more extensive development of the shoot to put it in shape for economic extraction. A sample shipment of concentrates from this class of ore, which is almost identical with the rich ore of the adjacent Trade Dollar property in its mineral contents, has yielded $800 per ton in gold and silver values from a ton shipment that has already been made.

The banded quartz filling of this vein, together with its fine lines of high grade argentite and other rich silver minerals, a fine grained chalcopyrite and free gold, identifies the ore and the vein as bearing a close relation in its genesis and origin with the Trade Dollar Consolidated vein, which has produced twenty millions of dollars, but has been abandoned as exhausted from a company operating standpoint. The occurrence of such comparative conditions in such close association with this famous old
bonanza well warrants the speculative risk involved in
the further demonstration of the merits of the Silver City
companies' veins. It is believed by the management that
with further development the present ore showing can be
made to pay a handsome margin of profit. From the per-
sistent appearance of the vein in the face of the drift, the
management feels warranted in anticipating other ore
shoots by extending the drift along its course. Before this
ore can be stoped to any extent, however, it will be neces-
sary for the company to comply with the statutory re-
quirements in this connection and drive a raise through on
the vein to the upper tunnel or the surface for a second
outlet, which is very necessary for ventilation and safety.

This company controls an additional parallel vein be-
tween the Crown Point and the Trade Dollar, known as
the Lone Tree vein. The face of the main cross-cut tunnel
is now within 225 feet of the Lone Tree vein, which will
be penetrated at a vertical depth of about 1,000 feet and
should give additional ore results, as it was a producer
of rich ore values from some shallow development along
its outcrop in the early history of the camp and shows
some very attractive gangue and structural features and
wall rock conditions from a local standpoint.

Some rich ore was mined in small lots from the War
Eagle Mountain mines, and some interesting development
of excellent gold values is reported from the Boulder
Creek section of the Carson mining district, a few miles
south of Silver City.

An intelligent movement is on foot to reopen the Sink-
er Tunnel, one of the long bores of the district that was
driven in a mile and a quarter from the northern slope of
War Eagle Mountain for the purpose of tapping its system
of former rich fissure veins at depth of over 2,000 feet. It is
sincerely to be hoped that this latter project may be short-
ly financed and intelligently prosecuted. The purpose
for which it was driven, at an enormous outlay, was not
accomplished as it fell short of a thorough demonstration
of the ore zone, and the results of its revival would prob-
ably prove of great scientific or economic interest as it
would demonstrate whether or not the strong contact fis-
sures of War Eagle Mountain carried their values to this
great depth. Should it succeed in demonstrating the local miners' opinion of deep continuity of values, it would doubtless result in a revival of interest and the reopening to further depth of the several other bonanza ore courses of this district, or establish the value of previously expressed technical judgment on this subject.

Adams County—Seven Devils Copper.

Considerable activity was manifested during the year in the Seven Devils Copper Belt. This interesting mineral region, which practically extends from the junction of the Snake and Salmon Rivers, south for 150 miles, by a width of from 2 to 20 miles, in Idaho, in a region of former profound volcanic activity, embracing an area of old porphyries and green stone that have ruptured, absorbed and displaced a series of ancient sedimentary formations, including limestone, slate and shale. It is one of the most persistently mineralized belts of rugged mountain territory, embracing, as it does, the slopes of the profound Snake River and Salmon River canyons, that can be found anywhere in the west, and probably carries as wide distribution of surface evidences of high grade copper ore as any other district. Its deposits embrace a variety of phases, including everything from simple fissures, contact metamorphic deposits, bedded conglomerate and breccia mixtures to disseminated monzanite gangue manifestations.

Several car load shipments of high grade ore were made from leasing operations in the vicinity of Landore from the old contact metamorphic deposits which gave this belt its wide prominence, by the organization of the Seven Devils Mining district, over 25 years ago. The trouble with these deposits, from a commercial standpoint, has been principally one of isolation and transportation costs, but, more particularly from the fact that the contact deposits in the Landore vicinity are largely in the form of copper carbonate mineral that resists successful concentration by mechanical means but will doubtless be made available as a resource of mining profit in the not distant future by leaching methods or prepared flotation.

I have read quite an intelligent engineer's report on the
old Peacock Mine, which has a shipping record of 20,000 tons of ore that has ranged from 10 to 20 per cent copper, largely in the form of copper carbonate and hand picked kidneys of bornite ore from a mass of garnet gangue in walls of grano-diorite that is 100 feet wide and 300 feet long and whose shallow shaft tunnel and gophering open cut development is now said, by the engineer's report referred to, to contain a resource of 50,000 tons of 6 per cent copper ore very largely in the form of green carbonate. This deposit is in the line of an included zone of white marbelized limestone from one to three hundred feet wide, which extends south of this mine to Landore in a broad belt of grano-diorite a distance of seven miles and carries a continuous string of smaller but related contact metamorphic deposits, one of which, the Blue Jacket-Queen Group, has a shipping record of 50 or 60 cars of hand picked ore with an average value of 30 per cent copper, according to apparently authentic records.

Near Cuprum, three miles west of Landore, the Badger Group of claims carries a very interesting display of copper mineral in the form of a close network of stringers of clean chalcocite. The zone is 200 feet wide in a formation of andesite lava. This interesting deposit shows no other mineral association except fine lines of calcite and shallow carbonate alterations at the crossings of the stringers. The chalcocite is believed to be primary and would not change its character with depth, and the prospect, lying on a steep mountain slope, is worthy of the cost of a cross-cut tunnel at a few hundred feet of depth to determine whether its numerous rich stringers of mineral, which vary from a fraction of an inch to several inches wide, at the surface, coalesce in depth and form wider bands of the same rich ore, or a zone of sufficient grade to warrant its extraction and concentration on a large tonnage basis.

Red Ledge.

North of the Peacock Mine, six miles, the Red Ledge copper deposit was operated with a small development crew during the year and has attracted the attention and interest of a string of high class copper experts, including some well known authorities. This deposit has surface symptoms of becoming one of the big things in the copper world, but so far it remains an undetermined asset from a
future economic standpoint. It is unfortunately situated in a very rugged topography, two miles from Snake River canyon, on Deep Creek, and 17 miles from the railway terminal at Homestead, Oregon. The construction cost to connect it with the railway would be about $50,000 a mile, a fact which has mitigated and stood largely in the way of successful enlistment of capital in the further development of the deposit.

The Red Ledge deposit is a conspicuous outcrop of very red and yellow stained porphyry, with zones of faulting and shearing, that is from 1,000 to 2,000 feet wide and conspicuously exposed up the very steep canyon slopes of Deep Creek for two miles. It is bordered on one side by a pronounced zone of fine grained silicious igneous rock several hundred feet wide and on the other side by green stone porphyry. Its development now consists of a main cross-cut tunnel, driven in from the creek level 400 feet. This whole 400-foot zone is intensely sheared and resembles green stone schist. It carries a dissemination of copper iron sulphide mineral throughout its entire length and will probably give five pounds of copper as a minimum result in any 10-foot section of the cross-cut tunnel, outside of the main ore zone, with stringers of much better values.

The main ore zone was penetrated at 200 feet in from the portal of the tunnel. It was 80 feet wide and had two hanging walls dipping northwest and southeast, the inside wall at a dip of 40 degrees and the outside wall at 60 degrees. The cross-section of this 80 foot ore body shows 30 feet of leached sandy gangue carrying an average of $7.00 per ton in gold and silver and about half of 1 per cent copper.

The next 50 feet to the inside hanging wall is massive black looking sulphide mineral carrying an average value, by repeated practical sampling tests in five foot sections, of 4.6 per cent copper and $5.00 in gold and silver per ton. One of the big authorities who examined this showing concluded that the sulphide copper values were a shallow secondary enrichment of a wide fissured zone and probably would not have much permanency at depth. A thin section microscopic study of the mineral made by a California geologist, determined the sulphide mass to be primary. A drift has been run along the strike of this great ore body 200 feet. It has been carried almost its full
length in the leached mineral, which is found to contain uniform average values in gold and silver equal to the massive sulphide body contents, but only in short stretches does the sulphide crest come above the drift floor, where it carries similar copper values. A strong flow of acid water runs from the tunnel.

The deposit has been variously read by the big experts who have examined it, including two geologists of high standing, as a vertical sheared zone in altered green stone, and as a bedded porphyry schist conglomerate sharply folded and that the cross-cut has simply passed through an anticlinal crest of the conglomerate bed.

The latter opinion was expressed by the geologists, neither one of whom knew of the other’s visit to the property, which were spaced a year apart. This conclusion, if correct, still maintains a very favorable economic prospect for the showing, for, in spite of its isolation, its average values, as now exposed, are good from a copper, gold and silver smelting ore standpoint, and there is quite definite evidence that the bed, if it is a bed, is a hundred feet thick, and the problem could be definitely proven by short vertical diamond drill holes from the present tunnel and drift development, which, if successful in finding the thickness of the assumed bed I have indicated and anything like the average values now displayed, would easily demonstrate the existence of a million tons of ore within the present tunnel area.

This demonstration could be made at a cost of a few thousand dollars and presents a splendid mining development chance that is worthy the consideration of big capital. If the geological reading above outlined on this deposit is correct, it is not unlikely that the folded bed of conglomerate schist will be co-extensive with the enormous mineralized porphyry outcrop, and, as suggested by these experts, may be accompanied by higher or lower beds of the same nature that are believed to exist, with localized copper sulphide enrichments in conjunction with the upper side of a series of narrow vertical basic dikes that traverse the enormous exposure of red and yellow quartz porphyry, and it is a significant fact that this great porphyry area carries gold and silver values throughout its entire surface, ranging from a trace up to several dollars per ton, also traces of copper.
South of Landore 20 miles, at Cudahy Mountain, the I. X. L. group of claims carries a zone of quartz monzante 500 feet wide and several thousand feet long on a very steep mountain slope in which a hundred shallow surface pits show copper carbonate values and assay results ranging from a half to three per cent copper with chalcopyrite chalcocite alterations in some short tunnels, and $10,000 worth of intelligent cross-cut tunnel work at a depth of a couple hundred feet in this zone might demonstrate the position of a workable porphyry copper deposit of several million tons capacity.

Near Homestead, Oregon, 16 miles southwest of Landore, on the Idaho side of the canyon and on the slopes of Indian Creek, a very interesting system of fissure veins occur carrying high values in gold, in places showing average results of $20.00 to $30.00 per ton in ore courses 3 to 5 feet wide. One of these fine showings is now being developed with a cross-cut tunnel which will tap it at a depth of several hundred feet. In the same vicinity are zones of red porphyry carrying associated copper values. Some smaller veins have shown scabs of 50 per cent native copper ore as much as six inches thick, and other fissures carry conspicuous segregations of grey copper mineral and silver chlorride, containing values up to 1,000 ounces of silver per ton.

One vein in this locality, in a tunnel 300 feet deep on the vein, shows a face of ore carrying 30 per cent lead and 30 per cent zinc, with 20 to 30 ounces silver and several dollars gold per ton. This is a decidedly interesting locality, accessible to the terminus of the Oregon Short Line railway branch at Homestead and should yield some profitable mines with further development.

Elmore County.

Placer mining was successfully carried on with hydraulic and mechanical elevator methods under the able management of Captain Rupert Winters, at Featherville. The most important lode mining operations of the year in this county were in the Atlanta district, on the middle fork of the Boise River, where the ore disclosures made in the Boise Rochester Mine, formerly known as the Pettit and Bagdad Chase, have proven of a most gratifying nature and manifestation of future mining profits.
The pronounced contact fissure vein on this property has been opened by a new tunnel at considerable depth below the old works and now discloses an ore shoot of $10.00 to $15.00 values that carries a stowing width of 3 to 6 feet for a length of 500 feet. Ten stamps of the company's mill were successfully operated during part of the year, when power was available, that gave amalgamation recovery results of between 60 and 70 per cent of the total values, and quite a lot of rich concentrates were made that are now the subject of practical experiment for local treatment by cyaniding, and in spite of their rather complex mixture of rich silver minerals with the gold bearing iron pyrite, in the hands of a capable cyanide expert, are giving promise of a very satisfactory recovery.

In the same district the veteran operator, Mr. Daniel Kirby, persisted in his further efforts to solve the local metallurgical problems by the operation of the Monarch Mill on Monarch Dump ore, and is confident of successful and profitable results in the near future.

The Monarch vein has an extensive reserve of well developed ore and a shipping record of rich secondary surface ores amounting to $5,000,000 in gross value. The adjoining Minerva Mine, also a former big producer of rich gold ore and containing a long proven ore shoot, together with several other adjacent properties, I am reliably informed, have recently been consolidated into a big new mining development enterprise that is likely to be actively operated during the coming year.

The metallurgical difficulties the ores of this district have involved have now been pretty well cornered and solved, and the good gold values and extensively proven ore resources of this consolidation, under good management, and well financed, should result in the establishment of a large and profitable gold mining and milling enterprise, and with its other splendid resources give this old district a revival of mining activity and tributary business value to Boise that will discount its palmiest days of the past.

Warren District.

A revival of lode mining activity and interest was manifested at the old Warren placer district in southern Idaho County as a result of the successful development of import-
ant ore shoots in the old Rescue Mine at considerable depth through a lower tunnel.

This enterprise was promoted by Mr. Jay A. Czizek, and financed by Boise business men. It now shows shoots of rich free gold ore several hundred feet long and 1 to 5 feet thick, said to give free milling results of $20.00 per ton. A new Huntington mill of 25 tons daily capacity was installed early in the season that has since been yielding very profitable results on the operation and has stimulated an active interest in the numerous other veins of the district.

This district is known to contain a little tungsten, in the form of scheelite, associated with its ores, but the well known spotted occurrence of this mineral has not induced any systematic search for it; however, the recent runaway market for tungsten ore may result in a more thorough search in this field and bring results during the coming year.

The big low grade ore deposits of the Big Creek district, 30 miles east of Warren, continued to attract the interest of mining experts and investors, and negotiations now pending seem of such a definite nature as to promise a more thorough development of this interesting gold ore occurrence, which shows manifestations of pay values of from $2.00 to $4.00 per ton in zones of mineral from 60 to 200 feet wide.

A deal was also recently consumated and development started on one of the smaller gold veins at Ramey Ridge that seems likely to form the basis of a ten-stamp milling operation in the near future.

**SNAKE RIVER FINE GOLD.**

Three of the accompanying small illustrations will give a fairly definite idea of the construction of the Snake River burlap machine. This is a simple device, consisting of a screened bottom sluice-box and under-current which separates the fine material passing over the screen and conveys it to a series of incline burlap covered tables, to which the material is fed like the pulp from a stamp battery on amalgamation plates, with the effect of recovering all the black sand and concentrates and fine free gold in the gravel. The concentrates and black sand are collected together by alternate washings of the burlaps in a tub of
SNAKE RIVER BURLAP MACHINE FOR SAVING FINE GOLD.
water and the concentrates thus obtained are further treated by grinding for a few hours in a small arrastra pan, which removes the rust or scale from the gold particles and makes it amalgamate perfectly with quicksilver. The resulting black sand concentrates are practically valueless for anything but iron ore when intelligently handled.

This simple method will save 90 per cent of the fine scale gold contents of the Snake River bars, under intelligent manipulation, and is the most successful device that has ever been applied to the extraction of these fine gold values.

This department is frequently called upon to advise favorable locations for the recovery of fine gold values of the Snake River bars by enterprising gold recovery process inventors. As a matter of fact, it has been my experience after a fairly thorough investigation for hundreds of miles along Snake River, that the average gold values contained in the gravel bars and terraces that border the stream are too low grade to pay, except in limited spots that are seldom of sufficient area to warrant a large mechanical installation necessary to make the basis of a mining company venture, and as a matter of fact there is more than a million dollars' worth of scrap machinery scattered along the Snake River banks in Idaho that are mute testimony of the failure of financial ventures directed towards the recovery of the Snake River fine gold values.

These ventures have included some very intelligent efforts, but the facts of the matter are that, on any material scale of operation, the gold values in the gravel are too low grade to pay and are more adapted to local equipment of the type described, which is cheaply installed and will give as high results in gold recovery under these conditions as anything that has ever been tried.

PHOSPHATE FIELDS.

In southeastern Idaho little activity was manifested in the large government controlled and withdrawn phosphate fields beyond the continued efforts of the few privately owned groups to obtain title, and the shipment of a few thousand tons of rock by the Waterloo Mine, at Montpelier. This remarkably interesting mineral field has been the subject of repeated investigations and resulting bulle-
tin reviews by the United States Geological Survey, whose investigations of the Idaho part of the field, as far as surveyed, discloses a resource of 2,600,000,000 tons of high grade rock phosphate.

The numerous analytical tests made by the department in connection with this work have indicated an average value for the main 7-foot beds of about 70 per cent tricalcium phosphate. Since it was opened the Waterloo Mine, at Montpelier, Idaho, has shipped approximately a hundred thousand tons of phosphate rock to the San Francisco chemical works of the company that own it, which has given an average practical working result of 69.9 percent tricalcium phosphate and is a very substantial confirmation of the field work of the Government experts.

The phosphates of southeastern Idaho unquestionably embraces the most valuable mineral asset of the State. The enormous tonnage outlined in the part of the Idaho phosphate areas survey is based on an estimate of 2,000 feet of mineable mineral on the dip of the regular beds in which it occurs.

At Rock Springs, Wyoming, a coal mine in the much softer and more flexible cretaceous formations has been successfully mined to a dip depth of 6,000 feet. The phosphate deposits occur in a more compact and much more ancient middle carboniferous formation, and there isn't any question, from a practical mining standpoint, but that the moderate dipping beds can be followed in many places to an equal depth with the soft cretaceous coal bearing beds of the near by Wyoming country, which would mean, at a rough estimate, three times the tonnage outlined by the Government reports. Add to this the fact that this estimate is made on a single bed at the base of the phosphate series from five to seven feet thick, and the fact that there are several other superimposed beds equally rich but of narrower width in several cross-sections of the series, and the fact that the Idaho part of the phosphate field hasn't been more than half covered by the detail survey, my estimate of ten billions of tons of this high grade mineable rock phosphate in six southeastern Idaho counties is, I think, conservative. The phosphate deposits occur in middle carboniferous sedimentary formations, principally limestones and shales, carrying conspicuous shell fossil inclusions. The well defined series of beds that carry the phosphate rock are from 60 to 150 feet thick, and stand at all
angles in the folded mountainous uplifts and foot hill country that is drained by the water sheds of the Bear, Blackfoot, Snake and Teton Rivers. The following is a cross-section of the phosphate beds in one of the best development exposures available to the United States Geologists and is copied from Bulletin 577, entitled "The Geology of the Phosphate Deposits Northeast of Georgetown, Idaho," and will give an idea of the enormous resources of high and low grade rock phosphate which the south-eastern Idaho counties contain:
### Section of basal portion of Phosphoria formation in Georgetown Canyon (SE 1/4 NW 1/4 Sec. 30, T. 10 S., R. 45 E. of the Boise Meridian) Idaho

<table>
<thead>
<tr>
<th>Field No. of Stratum</th>
<th>Description</th>
<th>Pct Phos.</th>
<th>Eqv. mg P2O5</th>
<th>Pct Calc.</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>144A</td>
<td>Shale, calcareous, or muddy limestone, brown weathering into irregular chip fragments; effervesces vigorously</td>
<td>3.5</td>
<td>7.7</td>
<td>35.8</td>
<td>25</td>
</tr>
<tr>
<td>144B</td>
<td>Phosphate rock, oolitic, weathering brown or gray; effervesces slightly; lower 1/2 inches somewhat cherty</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>144C</td>
<td>Shale, hard, brown, calcareous at the top; effervesces vigorously</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>144D</td>
<td>Phosphate rock, coarsely oolitic, gray; effervesces vigorously</td>
<td>37.6</td>
<td>82.1</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>144E</td>
<td>Shale, brownish, earthy, containing 6 inches of phosphate; effervesces considerably</td>
<td></td>
<td></td>
<td>21.9</td>
<td></td>
</tr>
<tr>
<td>144F</td>
<td>Phosphate rock, including phosphate rock, oolitic, hard, gray, calcareous</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>144G</td>
<td>Phosphate rock, medium, gray, oolitic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>144H</td>
<td>Phosphate rock, including phosphate rock, coarsely oolitic, gray, brittle</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>144I</td>
<td>Phosphate rock, including Phosphate rock, coarsely oolitic, brownish-black streaks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>144K</td>
<td>Phosphate rock, medium to coarsely oolitic (sample effervesces considerably)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>144L</td>
<td>Shale, brownish to black, earthy composition, thin bedded with a few limestone lenses; effervesces slightly</td>
<td>24.2</td>
<td>53.0</td>
<td>34.7</td>
<td>10</td>
</tr>
<tr>
<td>144M</td>
<td>Shale, including shale, brownish black, earthy</td>
<td></td>
<td></td>
<td>29.3</td>
<td>10</td>
</tr>
<tr>
<td>144N</td>
<td>Shale, black, earthy; effervesces slightly</td>
<td></td>
<td></td>
<td>11.7</td>
<td>12</td>
</tr>
<tr>
<td>144O</td>
<td>Limestone, single stratum (not sampled)</td>
<td>4</td>
<td>21.2</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>144P</td>
<td>Shale, black and dark brown, calcareous, earthy, effervesces considerably</td>
<td></td>
<td></td>
<td>25.8</td>
<td>11</td>
</tr>
<tr>
<td>144Q</td>
<td>Limestone, single stratum (not sampled)</td>
<td></td>
<td></td>
<td>36.8</td>
<td>11</td>
</tr>
<tr>
<td>144R</td>
<td>Limestone, (cap Lime fine, dark gray fossiliferous)</td>
<td></td>
<td></td>
<td>3.7</td>
<td>4</td>
</tr>
<tr>
<td>144S</td>
<td>Shale, brown, earthy; effervesces slightly</td>
<td></td>
<td></td>
<td>3.7</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>1.9</td>
<td></td>
</tr>
</tbody>
</table>
While the great thickness of included phosphate rock above described will probably not be maintained throughout the field, there is a remarkable uniformity of the series in Idaho and I personally know of an exposure of these beds, 100 miles north of Georgetown, Idaho, that I believe is fully as rich or richer in phosphatic contents, with almost continuous exposure of the phosphate series over a territory 140 miles north and south by 40 miles east and west, and I believe that my general estimate of a hundred billion tons of this mineral of 40 per cent grade would be easily borne out by a detailed survey of the field.

It is further probable that the extension of these series of phosphate bearing formations with conspicuous exposures of the rich mineral beds for several hundred miles north along the western border of Wyoming and northwest as far as Garrison, Montana, and south into northern Utah, would easily duplicate this enormous tonnage resource of this valuable mineral in Idaho and embraces by far the largest and richest known phosphate field in the world, with an available tonnage that is practically exhaustless for all our probable national demands for all time.

These phosphate beds are closely accessible at a dozen different points to the main and branch line tracks of the Oregon Short Line railway. They resemble coal beds in their mode of occurrence, and their origin is attributed to shallow marine plateau conditions during middle carboniferous times. The principal rich bed lies at the base of the series and varies from four to eight feet thick. In appearance it resembles a brown shale at the outcrop with thin slips and shrinkage line coatings of blue gray mineral. These brown shaly outcrops were taken for coal indications and prospect shafts were sunk on them at a dozen different points in this field for years before the recognition of the mineral as phosphate rock, in the early nineties, in the belief that it was coalcroppings.

A short distance below the croppings the mineral changes to a black color, and, in the steeply pitched beds, shows a schisty slip cleavage. Its normal texture is oolitic like the roe of a fish. It is heavier than the enclosing formations and is easily mined by the same methods and using the same tools and at about the same cost per ton as ordinary bituminous coal veins. The beds dip at various angles, from flat to nearly vertical, often outcrop high up
on the mountain slopes, and with conformable dip presents splendid opportunities for cheap cross-cut tunnel and drainage entry work. The enormous tonnage estimated by the Government bulletins would probably be largely available to this method of mining without the necessity of hoisting, pumping or artificial ventilation.

The phosphate beds of this field are remarkable for their freedom from the objectionable associate minerals found in other fields, consisting of iron and alumina, which rarely exceed, in hundreds of analyses, more than 1 per cent. Spot value for this mineral in the southeastern States is from $4.00 to $5.00 per ton, from which it will be appreciated what an enormously potential value these Idaho deposits have.

The present largest world's supply of rock phosphate is derived from the States of Tennessee and Florida, whose resources are estimated at 40 years supply. They are largely under control of foreign capital and form the basis of a fertilizer industry with an aggregate invested capital estimated at $300,000,000, principally in the States named.

This industry is based on the ownership of the phosphate deposits of the southeastern States mentioned, but whose product is complete fertilizer for replenishing worn out soil, the phosphatic contents of the product being by far the largest and most important element contained, together with a small percentage of nitrogen and potassium, the bulk being common soil. The nitrogen and potassium minerals also occur in Idaho and some very interesting prospects of both have been found in the southwestern corner of the State that seems to promise commercial results in some instances and may give this State a complete combination of the elements of the fertilizer industry.

It is further suggested by competent scientific men that the conditions are favorable adjacent to the Idaho deposits in the line of water power and waste furnace gases for the production of ammonium phosphate, which embraces a high concentration of the phosphorus contents in the rock and promises a product of high value that will stand transportation cost to any market, and it is not unlikely that results will be obtained along this line in the utilization of these Idaho resources.

Another most attractive outlet for our rock phosphate industry is outlined by the work of Cyril G. Hopkins, of the Agricultural Experiment Station of the University of
Illinois, whose splendid research has demonstrated that raw rock phosphate, ground to the consistency of Portland cement, or 100 mesh, is susceptible of renewing its primary fertility to soil where it has been depleted by single cropping; that the elements other than phosphorus are very largely and very cheaply available to the farmer, and that the intelligent use of finely ground raw rock phosphate will pay several hundred per cent profit over the cost of its application in all kinds of grain and grass production.

In view of the fact that the American farmer, as a whole, is a soil robber and has for decades been using up his principal by taking more from his soil than he returns to it in the elements of plant food, together with the fact that the average yield of wheat, as a basis, and all other grains in proportion, is from one to two hundred per cent lower in this country than they are in several European countries, under less favorable climatic conditions, it is manifest that there is a big field in the United States for a rapid expansion of industrial results and railroad traffic, based on improved agricultural methods, as it is known that there are millions of acres of agriculturally abandoned lands in the original thirteen States and that the recession in acre yield of grain production, especially wheat and corn, is rapidly advancing westward and has crossed the Mississippi River a long distance in some directions. This condition is very largely due to the depletion of the phosphate element in the soil, on which seed bearing plants so largely feed. The population of the United States has progressed at a very rapid and a consistent ratio, while the acre yield of grain of all kinds, in spite of the enormous area of new land put under the plow, has remained stationary for several decades at about 14 bushels of wheat per acre.

These vast western phosphate fields are almost entirely tied up and withdrawn from entry by the National Government on a misconceived theory of conservation. Prior to the discovery of this western field, the known resources of the Nation in this most valuable mineral were estimated at being within 30 or 40 years of exhaustion and its conservation was doubtless justified; but since this great resource has been given to the Nation by the prospectors of the western States, and its great magnitude is now appreciated, its use should be encouraged on a most liberal scale, as it holds the key to the solution of some of the most serious social problems that now confront the Nation,
which must either lower the standard of living of its people, provide a cheaper food supply, or suffer the disastrous results of strikes and riots that must ensue with the diminishing purchasing power of labor’s daily wage.

POTASSIUM AND NITRATE DEPOSITS.

The Owyhee range, consisting largely of rhyolite, basalt and monzante granite formations, rich in the silicates of potassium and sodium, is bordered around its northern and western base with lava terraces that include numerous beds of volcanic ash and breccia, and below these horizontal lake bed sediments of the early tertiary period, in these formations between the igneous rocks and the lake bed sediments, some very interesting deposits of the soluble salts of potassium and sodium have been discovered, giving average analyses ranging up to 70 per cent in both sodium and potassium salts, but, as far as I have been able to learn, the higher results have been obtained from crusts and seepage pockets in the ash beds and sedimentary deposits and at the base of their exposed bluffs.

I have been advised, however, on apparently reliable authority, of the occurrence of 10 foot average samples showing 10 per cent values in potassium sulphate. The results obtained were from a bed of amorphous silica that is believed, by Boise chemists, to have been produced by extensive solfataric or hot spring action, of which there are numerous manifestations of former extensive activity in the territory described, while hundreds of claims have been taken under the placer law, and are the subject of more or less prospecting work at the present time, which may result in finding commercial deposits of these valuable salts.

A very interesting occurrence in a tunnel in one of these lake beds is the rapid development, on the floor of the tunnel, of a bed of pure epsom salts that had accumulated to a depth of several inches within four months after the tunnel was run, and in other parts of this field pure soda nitrate salts are found in what is believed to be commercially average values and to have originated through the action of volcanic gases.

NATURAL GAS AND CALCIUM.

One of the interesting developments of the year in the minor mineral substances of the State was the discovery
of a promising flow of natural gas near the center of the
city limits of Weiser, in Washington County.

This strike was made in sinking a well for water, which,
at a depth of less than 200 feet, encountered a strong flow
of natural gas that gives a flame several feet high above
the collar of the two-inch casing of the well when ignited.

This discovery has created a good deal of local interest
by reason of the fact that the gas flame is dense and pro-
duces a heavy deposit of soot on any object held over it,
and in this respect is in sharp contrast with the lighter
non-sooty natural gas flows of the valley region to the
southeast and is believed to indicate a resource of heavy
hydro-carbon oil with an asphalt base at further depth, and
certainly warrants further investigation, as the lake bed
sediments in which the strike was made present favorable
geological conditions for the existence of gas or oil.

Another interesting venture in mineral production has
been established at Eaton, Idaho, a few miles west of
Weiser, where an extensive bed of marl rich in calcium car-
bonate has recently been acquired and equipped for quite
a big shipping capacity by the Farmers' Lime company,
a local organization, who believe they can develop a big
business in marketing their product.

The product of this mineral deposit will be cheap and
is especially adapted for the correction of acid or clay soil
conditions, and is said to also contain an appreciable
amount of soluble phosphates and to have a powerful stim-
ulating effect on increased crop production, especially on
soils deficient in calcium. It could probably be used to
excellent advantage in the clay patch soil conditions of the
Boise valley as a leavening element. There is said to be
a big market for it on the coast and the enterprise may
develop a local industry of considerable importance.

IDAHO COAL RESOURCES.

A government bulletin by E. W. Parker gives an esti-
mate of six hundred million tons of coal for Idaho. This
is probably a pure guess at long range and based on the
assumed coal contents of the total area of cretaceous for-
mations, which embrace a few townships along the extreme
eastern border of the State that extend over the line from
Wyoming.

There are probably few States in the union poorer in
coal than Idaho, as a very large percentage of its formations are volcanic or of the crystalline metamorphic variety, unfavorable to the occurrence of commercial coal deposits. This applies also to quite a large and extensive area of tertiary lake bed sediments, which contain numerous small manifestations of lignite, but it has invariably proven to be too ashy and low grade for domestic use.

The only coal deposits in Idaho that have ever presented any probabilities of commercial value are exhibited on Horse Shoe Creek, a tributary of the Teton River, in Teton County, 30 miles east of St. Anthony and 10 miles west of the nearest railway point at Driggs, Idaho, at which point the Horse Shoe and Brown Bear claims embrace a total of less than a thousand acres of patented land, carrying a series of 18 veins. The two principal veins contain high grade bituminous coal, one of which is five feet thick and the other 10 feet thick. These veins have a steep pitch and are contained in a belt of cretaceous shales and sandstones that have been exposed by the erosion of a former deep rhyolite capping.

The five foot vein has been developed by cross-cut tunnel and entry work for a length along its course of 2,000 feet and at a maximum depth of 200 feet and has produced about 15,000 tons of coal, which has been sold to local settlers who hauled it away in their wagons and sleights during favorable parts of the season at an average cost to them of about $3.00 per ton. The 10 foot vein has been drifted on for about 500 feet with an adit tunnel to a face depth of about 100 feet and has produced 2,000 tons of coal. The quality of this coal will be appreciated from the following analysis, which is an average analysis of a number of samples and about the results given by a government bulletin which has covered this limited Idaho coal field:

**Horse Shoe Creek Coal Analysis.**

<table>
<thead>
<tr>
<th></th>
<th>P. C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed carbon</td>
<td>55.65</td>
</tr>
<tr>
<td>Volatile carbon</td>
<td>36.62</td>
</tr>
<tr>
<td>Moisture</td>
<td>3.13</td>
</tr>
<tr>
<td>Ash</td>
<td>4.10</td>
</tr>
<tr>
<td>Sulphur</td>
<td>.50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.00</strong></td>
</tr>
</tbody>
</table>

The actual fuel contents are **92.27** per cent.
The production above outlined covers the total commercial coal yield of Idaho to date, which means that this State pays a cash tribute of several million dollars a year to the adjoining States of Wyoming and Utah, from which its essential coal requirements are mostly imported.

The government report on this Horse Shoe Creek deposit does not give a very enthusiastic anticipation of their ultimate importance, but admits that they may be able to supply a considerable local domestic demand. Reports on this field from other able coal authorities have indicated a resource on the limited acreage patented of from five to ten million tons within a depth of 500 feet from the surface on the dip of the workable veins that the area is known to carry, and there isn't any question but that these deposits warrant the necessary capital cost to put them in shape for economic production and that the venture would afford a profitable coal mining enterprise of considerable capacity that is worthy of local financial support, as there is a ready market afforded by the most extensively connected agricultural area in Idaho, which lies immediately adjoining it to the west.

The veins are clean and free from bone, with the exception of very narrow bands that are readily sorted out in the mining process. When properly opened by drainage entry and air courses, these deposits, to a considerable depth, can doubtless be very economically mined, as their pitch will permit of gravity handling, natural ventilation and drainage.

An interesting natural condition exists in connection with these coal deposits, consisting of a pronounced reversed fault of enormous displacement, laying a short distance west of the upper coal veins. This steep fault has brought the phosphate bearing carboniferous limestones above the coal formations, and has exposed a high vertical bluff of pure carboniferous limestone, which, in connection with the beds of pure shale occurring associated with the coal veins, would afford a site for and the basis of a Portland cement industry that would be hard to beat from the standpoint of assembling costs of raw material, and with its location would be afforded a splendid market for its product, as Idaho uses more than a million dollars worth of Portland cement a year, which is now entirely imported from other States.
REPORT OF INSPECTOR OF MINES.

TUNGSTEN ORE.

The demand for tungsten ore, created as a result of the war in Europe and the use of this mineral in the manufacture of tool steel, together with the enormous price prevailing for the mineral, has induced a persistent search in this State. The Idaho formations are especially favorable for the occurrence of tungsten ore, and its existence has been brought to light in half a dozen different counties in the State.

The principal shipments made during the year, and especially during the last four months of the year, were from Lemhi, Blaine and Shoshone Counties. A total of probably 30 tons of concentrates were made, equal to 50 per cent average tungstic acid contents. The shipments from Shoshone County were mostly from the gold quartz vein of the Golden Chest Mine. This vein of white gold bearing quartz is in black Prichard slate formation, is from one to ten feet thick and has been known for years to carry scheelite. The property has laid idle for years by reason of the exhaustion of its richer gold values. Its total production is estimated at more than a million dollars in gold, and largely as free gold to ordinary plate amalgamation methods, and the old operators cite the fact of the heavy spar, as they then called it, frequently clogging the plates and interfering with the amalgamation process.

In mining the quartz this supposed spar was picked out and wasted when possible, as its true character was not recognized or appreciated at that time. Through mismanagement the property failed to pay and has lain idle for a number of years. The knowledge of its contents in scheelite, however, has brought it into prominence recently and an interesting search is now being made for the bunches and kidneys of clean calcium tungstate, for which the vein has been noted in the past, with some very interesting results, and I am reliably informed that $30,000 or $40,000 worth of this valuable mineral has been shipped from this property recently. Scheelite is also known to occur associated with several lead bearing veins in the Murray vicinity.

The largest operation in Idaho worked exclusively for
tungsten was at the Ima Mines, operated by the Idaho Tungsten Company, and situated on Patterson Creek, in Lemhi County. At this point the tungsten deposits occur in pronounced white quartz fissure veins in a formation of precambrian sediments resembling silicious schist. The veins are from a foot to ten feet thick and outcrop plainly up a very steep canyon slope for hundreds of feet. The tungsten ore in this instance embraces both wolframite and hubnerite, the latter mineral predominating. The quartz gangue also carries sulphide of zinc, lead and iron. The average tungsten contents of the veins have been estimated at two per cent, but this is probably too liberal an estimate; however, no systematic sampling has been done.

The property is equipped with a concentrating mill of fifty tons daily capacity, which, however, was very poorly designed but has lately gotten into the hands of more intelligent operators who have added flotation cells and are making an interesting production of high grade tungsten concentrates and shipped about 12 tons during the closing months of the year of an average value of 60 per cent tungstic acid.

The development on these veins by short adit tunnels is very limited, but they present a very attractive prospect for a considerable tonnage resource of profitable tungsten ore, especially under present exaggerated prices for the mineral.

Nine miles north of Corral, in Blaine County, on Soldier Mountain, a new source of tungsten ore is being worked. About five tons of high grade ore were shipped to Salt Lake City for further concentration during the last two months of 1915. This deposit is interesting from the fact that it occurs in a fissured zone near the center of a dike of porphyry that has been classified as a variety of trachyte. The dike is several hundred feet wide and traverses the monzanite granite of the region. In the center of this great dike is a fissured zone from five to ten feet wide carrying thin bands of tungsten ore, which is almost exclusively wolframite. These stringers are a mixture of the tungsten mineral and a honey colored quartz frozen to the porphyry gangue. They vary from a quarter of an inch up to two inches in thickness and there are several
of them in the fissured zone. A cross course in the shallow development of the prospect, which consists of an incline shaft sunk on the ore course at a pitch of 30 degrees, forms swells of ore producing specimens up to 6 inches thick of 40 per cent tungsten mineral. This development is only 30 feet deep from the surface, but its environments and structural relations of fissuring gives an interesting promise of permanency. Four men are employed and efforts will be continued to further develop the deposit and continue its production during the winter, with a view of taking advantage of the present high market for the mineral.

Near the eastern end of the Sawtooth range, also in Blaine County, the Nelson tungsten prospect is a contact vein of porphyry breccia cemented with narrow bands of dog tooth quartz in a contact between yellow porphyry and ancient limestone quartzite sediments. The vein is from a foot to four feet wide and carries quite a conspicuous display of soft brown manganese oxide in its outcrop, mixed with the dog tooth quartz, and occasional beautiful specimens up to a pound in weight of clean sparkling crystals of wolframite have been obtained, but it is doubtful that any commercial average values could be obtained from thecroppings of this deposit. The permanent appearance of the vein, however, and the richness of the specimens found, warrants its further development, for which there is a splendid natural advantage by adit tunnel work, as the vein traverses a very steep, bluff mountain slope.

Specimen tungsten ore is reported from the tertiary lava deposits of Fremont County, near Union, Idaho.

High grade tungsten minerals have also been reported from the Elk City country, in Idaho County, and from Bonner County, also Deadwood Creek, in Boise County. The ores of tungsten are known to occur in widely scattered districts over the entire State of Idaho, and the energetic search now being made for the mineral as a result of the high prices prevailing, which have ranged in the past month up to $50.00 per unit of tungstic acid contents, have stimulated a vigorous search for deposits of this mineral that is likely to result in giving the State
quite an important yield of this desirable ore during the coming year.

ASBESTOS.

Considerable interest was stimulated during the year by the discovery of additional large deposits of amphibole asbestos in Idaho County. Interest in this mineral was created by the statement a year ago of some Lewiston people, who had secured a lease from the State on some large deposits of short fiber asbestos on State land situated about 12 miles northeast of Kamiah on the Clearwater plateaus. These people installed a small fiberizing plant with which to separate the lighter fibre from the less perfect and heavier components. These people proposed to manufacture fire-proof shingles by mixing cement with the fiberized material and compressing the pulp under hydraulic pressure into the finished product. The result, however, is found to carry the disadvantage of high gravity and heavy freight costs and the lease has been modified by the State, permitting the operators to ship the crude material to other centers, which can be done under a lower freight rate, and there combine to advantage with other material for heat insulation and fire-proof lumber purposes.

Another discovery of this mineral is situated about 16 miles east of Grangeville, also in Idaho County, and is described by Mr. W. E. Perry, a responsible mining man, as being several hundred feet thick and containing a number of bands of long slip fibre material in strands six or eight inches long, that promises a separation of a good percentage of lighter fibre. This deposit has been taken over by a local corporation of Lewiston and is to be developed and may result in the establishment of an industry in the way of fireproof mineral lumber production. As far as I am aware, the asbestos deposits of this State described, are confined to the amphibole variety, whose crude commercial value is about $10.00 per ton and whose principal use is for heat insulation purposes. Its high gravity and high transportation costs to available markets is the present bar to its extensive use, but it will doubtless in time become the basis of industrial development, as there are evidences of unlimited quantity of the material in this region, as discoveries have been made at several points
along a belt of country consisting of granite and porphyry formations, which, while extensively covered by the Columbia lava flows, the mineral has been exposed by erosion intervals in a belt 50 miles long from the north fork of the Clearwater River south to the head of White Bird Creek, a tributary of Salmon River.

ANTIMONY.

In common with the other high metal prices due to the war, antimony ore was in great demand and vigorously sought for in Idaho during the year, which resulted in a marked stimulation of interest in an effort to take advantage of the high prices prevailing. Antimony ore is widely distributed in Idaho and occurs in nearly all its prominent mining districts. Unfortunately, many of the deposits are remote from railway transportation and difficult of access. A number of Idaho antimony showings are associated with the objectionable sulphides of iron, arsenic and other minerals, and are not marketable, as the purchasing interests demand an ore with less than two per cent of impurities. This State contains several very interesting deposits, however, of pure antimony ore.

In common with its other remarkable mineral deposits, Shoshone County also cuts the biggest figure in antimony production, and was practically the only source of supply during the past year. The amount shipped, however, did not total over four car loads, or about 150 tons.

This remarkable mineral field shows a sharp contrast of mineral conditions by the existence of a north and south vein at the Stanley Mine, near Burke, between two of its historically famous east-west lead ore courses and having the conspicuous difference in mineral character of being a pronounced quartz vein, carrying practically nothing but stibnite in clean bladed crystals with associated values in gold up to eight or ten dollars per ton. The vein is five feet wide, has an ore shoot of considerable length, and on one of its best levels shows average values of 10 to 30 per cent antimony sulphide mineral that is susceptible of concentration to a high grade product. The ore is practically devoid of silver and lead, which is the dominant production of the adjoining mines, and offers an interesting condition of sharply contrasting ore genesis. This deposit is in the quartzite walls of the Burke formation.
At the mouth of Pine Creek, a few miles west of Kellogg, in the black Prichard slate formation, a very interesting antimony vein is being developed by the Coeur d'Alene Company. This mine was first operated in 1893 and was worked for about three years, producing 1,500 tons of antimony oxide. The low price of antimony at that time brought about seven or eight cents a pound, and the high cost of freight caused the owners to shut down the enterprise as unprofitable. The present company commenced to operate last August. The mine was full of water and considerably caved and the machinery that had been installed had mostly been hauled away.

The new venture has put in an eighty horsepower boiler and a No. 7 Cameron sinking pump, also a hoist, and have re-equipped the mill with crusher, rolls, jigs, and tables. This company shipped 19 tons of 34 per cent ore and 22 tons of 37 per cent ore last fall that was hand sorted from the dump residues of the mine.

The mine has been pumped out and the lower levels, several hundred feet long, reopened. It is carried on a quartz filled fissure several feet wide, well sprinkled with clean antimony sulphide mineral. A pay streak along this vein a foot thick will average 40 to 50 per cent antimony contents and the balance of the vein about eight or 10 per cent, will be concentrated in the new mill. The present management expects to produce about five tons of crude ore per day and a car or two of rich concentrates per month. The concentrated product is quite free from objectionable associated minerals.

Further up Pine Creek, on the East Fork, on a tributary called Stewart Creek, near some well developed lead-silver zinc mines of this locality, the Star Antimony Mine is being operated with a crew of eight men on a vein five feet wide of mixed antimony sulphide and quartz that, at the close of the year, was producing about a ton and a half of 60 per cent ore per day by hand sorting. This product is said to carry not over one per cent iron and a trace of arsenic.

On the west fork of Pine Creek, the Pearson Antimony vein is considerably developed, and last fall shipped 14 tons of crude ore running 35 per cent and six tons of 58 per cent antimony sulphide. This is also a promising prospect that is under development and likely to be heard from
the coming year if the present market value of the metal continues.

One of the richest antimony deposits of the State is at Yellow Pine Basin, in Idaho County. It has a very limited development, a short tunnel has been run cutting two closely parallel veins of clean stibnite in a granite formation that have an aggregate width of about five feet. In addition to this showing the surface slopes below the course of the vein carry numerous great boulders of clean stibnite mineral, some of which will exceed a ton in weight, and indicate a strong shoot of the same high grade ore. A company was formed to operate this property during the year, but I was unable to learn of any shipments being made. The great drawback to this discovery is the fact of its isolation, being about 60 miles from the nearest railway transportation on the Payette Lake branch of the Oregon Short Line in Long Valley, over a rough mountain road and several miles of trail.

Some interesting prospects of clean antimony ore, in narrow granite veins, are in evidence in Owyhee County, near Silver City, and should afford a marketable product if the price stays up for any length of time.

The Wood River district, in Blaine County, has half a dozen interesting antimony prospects, but several of them examined by the writer during the summer proved to be badly mixed with other objectionable sulphides.

CONCLUSION

The foregoing review of Idaho Mining Progress, written and printed within 30 days after the close of the year, is based on personal investigations and the best information obtainable. It must be appreciated that this department has to be handled on very limited financial support, with no field assistant, and to comply with mining progress features of its statutory requirements, dependence has to be largely placed on second hand information, as it is manifestly impossible to give the results of personal knowledge of such matters up to the close of the year from such an enormous field.

An effort is made, however, only to use such information as seems reasonably reliable. This department in no way guarantees investment results in Idaho mining development enterprises. I am firmly convinced that this
State affords some of the finest chances of any State in the west for speculative investments along this line, but investors are cautioned to fully appreciate the speculative nature of the game. Reasonably good deductions can sometimes be made of future results in mining development ventures, but the best expert in the work cannot see an inch further into solid rock than he can push his finger.

There isn't such a thing as measurable ore, in actual fact, for a big ore vein may be cut into square blocks with hundred foot edges and sampled on four sides, and such work will give a reasonably close estimate of the metallic contents, but even such a complete measuring of an ore resource cannot assure that the actual mining results will be free from hidden factors of barren gangue.

It is often a very expensive and long drawn out process to make a profitable mine out of a most flattering prospect. The experience of other mines, where similar geological and mineral conditions prevail, is often a valuable guide, but not always dependable.

The cost of making a mine, especially in our great Coeur d'Alene district, after the vein and its embracing claim areas is acquired, has generally been very high and involved big capital risk. Several of the most profitable properties, however, have been financed in some instances with nothing more costly than the hard labor of their owners to wonderful dividend results, in others by the cheap 10 cent treasury stock and assessment route. The enormous dividend results in some of these instances is what makes this remarkable mineral field so attractive to speculators.

It must be appreciated, however, that advantage is often taken by promoters of the successful enterprises in neighboring territory that is more or less remote. As a general proposition, the operators of the Coeur d'Alene district give the investor an honest and legitimate run for his money in actual work accomplished. There are doubtless some exceptions to this rule, and apparent unfairness brought about sometimes by contingent conditions, especially in connection with the reorganization of idle properties where stockholders tire of or refuse to pay further assessments and sometimes have to be side tracked in the interest of finding new capital to further test out the merits of an enterprise, that changing conditions and neighboring development seems to warrant.
These conditions and the exaggeration or unwarranted optimism of some promoters of Idaho mining ventures in general occasion a vast amount of correspondence to this department from disappointed stockholders who fail to realize the sometimes unwarranted promises that induce them to invest their money in mining stocks, and I would caution investors in this line of securities that the non-assessable features of stock certificates can practically be annulled at the discretion of company directors; that development stocks are an eminently speculative risk under the best of management and carry an element of chance that cannot be eliminated. However, as the big mining dividend results of this State show, they occasionally produce splendid grand prize results.

The values given in the following statistics are largely based on close estimates, as it is impossible to get actual results for several months after the close of the year. The total values are figured on the gross metal contents of the mineral shipped, which is subject, of course, to smelter losses, which are variable, but the only serious loss in this connection is on zinc ore, which should be discounted from the gross metal contents for actual loss in treatment, about 15 per cent.
# Metal Production for 1915
## By Counties

### Ada County
- Gold, fine oz., 700: \$14,469.00
- Silver, fine oz., 525: \$2,608.70
- **Total value:** \$14,729.87

### Adams County
- Gold, fine oz., 750: \$15,502.50
- Silver, fine oz., 1,600: \$755.04
- Copper, lbs., 120,000: \$20,964.00
- **Total value:** \$37,261.54

### Bingham and Bonneville Counties
- Gold, fine oz., 340: \$7,027.80
- Silver, fine oz., 270: \$1,341.60
- **Total value:** \$8,369.40

### Blaine County
- Gold, fine oz., 1,405: \$29,041.35
- Silver, fine oz., 1,200: \$59,628.00
- Lead, lbs., 1,200,000: \$56,040.00
- Zinc, lbs., 1,100,000: \$153,010.00
- Tungsten ore, tons, 6,000: \$9,000.00
- **Total value:** \$306,719.35

### Boise County
- Gold, fine oz., 29,810: \$618,172.70
- Silver, fine oz., 22,000: \$10,931.80
- **Total value:** \$629,104.50

### Bonner and Boundary Counties
- Gold, fine oz., 350: \$7,234.50
- Silver, fine oz., 88,000: \$42,733.40
- Lead, lbs., 2,314,000: \$108,063.80
- **Total value:** \$158,031.70

### Canyon County
- Gold, fine oz., 29: \$599.43
- Silver, fine oz., 11: \$54.70
- **Total value:** \$654.10

### Clearwater County
- Gold, fine oz., 2,318: \$47,913.06
- Silver, fine oz., 700: \$3,478.33
- **Total value:** \$48,291.39
<table>
<thead>
<tr>
<th>County</th>
<th>Gold, fine oz.,</th>
<th>Silver, fine oz.,</th>
<th>Copper, lbs.,</th>
<th>Lead, lbs.,</th>
<th>Total value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUSTER COUNTY</td>
<td>4,100</td>
<td>190,000</td>
<td>6,195,000</td>
<td>150,000</td>
<td>1,268,429</td>
</tr>
<tr>
<td>Elmore County</td>
<td>3,050</td>
<td>1,580</td>
<td></td>
<td></td>
<td>63,828</td>
</tr>
<tr>
<td>Fremont County</td>
<td>57</td>
<td>38,000</td>
<td>5,300,000</td>
<td>247,510</td>
<td>2,675,708</td>
</tr>
<tr>
<td>Idaho County</td>
<td>2,700</td>
<td>900</td>
<td></td>
<td></td>
<td>56,256</td>
</tr>
<tr>
<td>Lemhi County</td>
<td>7,500</td>
<td>253,000</td>
<td>9,223,000</td>
<td>38,000</td>
<td>756,189</td>
</tr>
<tr>
<td>Nez Perce County</td>
<td>75</td>
<td>21</td>
<td></td>
<td></td>
<td>1,560</td>
</tr>
<tr>
<td>Owyhee County</td>
<td>3,017</td>
<td>20,000</td>
<td></td>
<td></td>
<td>72,299</td>
</tr>
<tr>
<td>Power County</td>
<td>9</td>
<td>3</td>
<td></td>
<td></td>
<td>187</td>
</tr>
</tbody>
</table>
## SHOSHONE COUNTY.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, fine oz.</td>
<td>4,500</td>
<td>$33,015 00</td>
</tr>
<tr>
<td>Silver, fine oz.</td>
<td>12,199,000</td>
<td>$6,061,683 10</td>
</tr>
<tr>
<td>Lead, lbs.</td>
<td>351,055,000</td>
<td>$16,394,268 50</td>
</tr>
<tr>
<td>Copper, lbs.</td>
<td>1,000,000</td>
<td>$174,700 00</td>
</tr>
<tr>
<td>Zinc, lbs.</td>
<td>92,310,000</td>
<td>$12,840,321 00</td>
</tr>
<tr>
<td>Antimony ore</td>
<td>70,950</td>
<td>$23,380 00</td>
</tr>
<tr>
<td>Tungsten ore</td>
<td>24,000</td>
<td>$36,000 00</td>
</tr>
<tr>
<td><strong>Total value</strong></td>
<td></td>
<td><strong>$35,628,367 60</strong></td>
</tr>
</tbody>
</table>

## TWIN FALLS COUNTY.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, fine oz.</td>
<td>17</td>
<td>$351 39</td>
</tr>
<tr>
<td>Silver, fine oz.</td>
<td>4</td>
<td>$2 48</td>
</tr>
<tr>
<td><strong>Total value</strong></td>
<td></td>
<td><strong>$353 87</strong></td>
</tr>
</tbody>
</table>

## WASHINGTON COUNTY.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, fine oz.</td>
<td>19</td>
<td>$392 73</td>
</tr>
<tr>
<td>Silver, fine oz.</td>
<td>5</td>
<td>$2 48</td>
</tr>
<tr>
<td><strong>Total value</strong></td>
<td></td>
<td><strong>$395 21</strong></td>
</tr>
</tbody>
</table>

## TOTALS FOR THE STATE.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, fine oz.</td>
<td>69,746</td>
<td>$1,255,619 00</td>
</tr>
<tr>
<td>Silver, fine oz.</td>
<td>12,933,619</td>
<td>$6,426,715 00</td>
</tr>
<tr>
<td>Lead, lbs.</td>
<td>369,242,000</td>
<td>$17,243,601 00</td>
</tr>
<tr>
<td>Zinc, lbs.</td>
<td>93,410,000</td>
<td>$12,993,331 00</td>
</tr>
<tr>
<td>Copper, lbs.</td>
<td>7,365,000</td>
<td>$1,286,665 00</td>
</tr>
<tr>
<td>Antimony, lbs.</td>
<td>70,950</td>
<td>$28,380 00</td>
</tr>
<tr>
<td>Tungsten ore, lbs.</td>
<td>54,000</td>
<td>$81,000 00</td>
</tr>
<tr>
<td><strong>Total gross value, 1915</strong></td>
<td></td>
<td><strong>$39,315,312 00</strong></td>
</tr>
<tr>
<td><strong>Total gross value, 1914</strong></td>
<td></td>
<td><strong>$24,976,706 00</strong></td>
</tr>
<tr>
<td><strong>Increase</strong></td>
<td></td>
<td><strong>$14,338,606 00</strong></td>
</tr>
</tbody>
</table>
ANNUAL METAL OUTPUT FOR IDAHO SINCE 1898.

TOTAL FOR THE STATE FOR THE YEAR 1898.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>91,698 fine oz</td>
<td>$1,895,566</td>
</tr>
<tr>
<td>Silver</td>
<td>5,256,700</td>
<td>$3,654,020</td>
</tr>
<tr>
<td>Lead</td>
<td>122,479,275 lbs</td>
<td>$4,899,171</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>$10,448,757</td>
</tr>
</tbody>
</table>

TOTAL FOR THE STATE FOR THE YEAR 1899.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>75,054 fine oz</td>
<td>$1,550,958</td>
</tr>
<tr>
<td>Silver</td>
<td>4,480,174</td>
<td>$2,688,105</td>
</tr>
<tr>
<td>Lead</td>
<td>86,449,506 lbs</td>
<td>$3,760,553</td>
</tr>
<tr>
<td>Copper</td>
<td></td>
<td>$60,000</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>$6,059,616</td>
</tr>
</tbody>
</table>

TOTAL FOR THE STATE FOR THE YEAR 1900.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>102,782 fine oz</td>
<td>$2,124,603</td>
</tr>
<tr>
<td>Silver</td>
<td>4,324,133</td>
<td>$2,534,480</td>
</tr>
<tr>
<td>Lead</td>
<td>96,425,500 lbs</td>
<td>$3,857,020</td>
</tr>
<tr>
<td>Copper</td>
<td></td>
<td>$35,000</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>$8,551,103</td>
</tr>
</tbody>
</table>

TOTAL FOR THE STATE FOR THE YEAR 1901.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>110,228 fine oz</td>
<td>$2,280,422</td>
</tr>
<tr>
<td>Silver</td>
<td>3,305,154</td>
<td>$1,983,092</td>
</tr>
<tr>
<td>Lead</td>
<td>65,967,000 lbs</td>
<td>$2,638,680</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>$6,902,194</td>
</tr>
</tbody>
</table>

TOTAL FOR THE STATE FOR THE YEAR 1902.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>119,363 fine oz</td>
<td>$2,467,233</td>
</tr>
<tr>
<td>Silver</td>
<td>5,259,778</td>
<td>$3,655,866</td>
</tr>
<tr>
<td>Lead</td>
<td>119,223,000 lbs</td>
<td>$4,172,805</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>$10,295,905</td>
</tr>
</tbody>
</table>

TOTAL FOR THE STATE FOR THE YEAR 1903.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold</td>
<td>92,938.42 fine oz</td>
<td>$2,085,993</td>
</tr>
<tr>
<td>Silver</td>
<td>7,224,021.58</td>
<td>$4,338,412</td>
</tr>
<tr>
<td>Lead</td>
<td>220,857,956 lbs</td>
<td>$2,386,213</td>
</tr>
<tr>
<td>Copper</td>
<td>2,524,000</td>
<td>$338,954</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>$16,143,573</td>
</tr>
</tbody>
</table>
### TOTAL FOR THE STATE FOR THE YEAR 1904.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, fine oz.</td>
<td>84,461.89</td>
<td>$1,845,282.08</td>
</tr>
<tr>
<td>Silver, fine oz.</td>
<td>8,284,639.12</td>
<td>4,970,783.40</td>
</tr>
<tr>
<td>Lead, lbs.</td>
<td>226,261.728</td>
<td>9,729,425.86</td>
</tr>
<tr>
<td>Copper, lbs.</td>
<td>5,422,007.05</td>
<td>704,860.91</td>
</tr>
</tbody>
</table>

**Total**$17,250,898.25

### TOTAL FOR THE STATE FOR THE YEAR 1905.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, fine oz.</td>
<td>60,515.91</td>
<td>$1,250,863.85</td>
</tr>
<tr>
<td>Silver, fine oz.</td>
<td>8,626,794.55</td>
<td>5,196,270.51</td>
</tr>
<tr>
<td>Lead, lbs.</td>
<td>260,791.456</td>
<td>12,257,198.43</td>
</tr>
<tr>
<td>Copper, lbs.</td>
<td>6,861,400.00</td>
<td>1,025,189.46</td>
</tr>
<tr>
<td>Zinc, lbs.</td>
<td>2,174,960.00</td>
<td>127,887.89</td>
</tr>
</tbody>
</table>

**Total**$19,876,409.89

### TOTAL FOR THE STATE FOR THE YEAR 1906.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, fine oz.</td>
<td>58,762.32</td>
<td>$1,214,617.15</td>
</tr>
<tr>
<td>Silver, fine oz.</td>
<td>9,136,860.73</td>
<td>6,071,443.96</td>
</tr>
<tr>
<td>Lead, lbs.</td>
<td>255,966,083</td>
<td>14,487,680.30</td>
</tr>
<tr>
<td>Copper, lbs.</td>
<td>11,640,565</td>
<td>2,252,449.32</td>
</tr>
<tr>
<td>Zinc, lbs.</td>
<td>1,477,000</td>
<td>91,426.30</td>
</tr>
<tr>
<td>Antimony, lbs.</td>
<td>90,000</td>
<td>20,700.00</td>
</tr>
</tbody>
</table>

**Total**$24,138,317.03

### TOTAL FOR THE STATE FOR THE YEAR 1907.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, fine oz.</td>
<td>66,426.29</td>
<td>$1,373,031.40</td>
</tr>
<tr>
<td>Silver, fine oz.</td>
<td>8,491,356.13</td>
<td>5,546,553.82</td>
</tr>
<tr>
<td>Lead, lbs.</td>
<td>234,404,920</td>
<td>12,470,341.74</td>
</tr>
<tr>
<td>Copper, lbs.</td>
<td>10,847,905</td>
<td>2,241,177.17</td>
</tr>
<tr>
<td>Zinc, lbs.</td>
<td>9,192,551</td>
<td>534,087.21</td>
</tr>
</tbody>
</table>

**Total**$22,165,191.34

### TOTAL FOR THE STATE FOR THE YEAR 1908.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, fine oz.</td>
<td>68,145.16</td>
<td>$1,409,992.97</td>
</tr>
<tr>
<td>Silver, fine oz.</td>
<td>7,660,507.38</td>
<td>4,407,811.63</td>
</tr>
<tr>
<td>Lead, lbs.</td>
<td>207,998,499</td>
<td>8,764,485.35</td>
</tr>
<tr>
<td>Copper, lbs.</td>
<td>10,110,506</td>
<td>1,336,608.89</td>
</tr>
<tr>
<td>Zinc, lbs.</td>
<td>64,000</td>
<td>3,020.80</td>
</tr>
</tbody>
</table>

**Total**$15,561,131.64

### TOTAL FOR THE STATE FOR THE YEAR 1909.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, fine oz.</td>
<td>70,898.938</td>
<td>$1,465,481.05</td>
</tr>
<tr>
<td>Silver, fine oz.</td>
<td>7,039,451.20</td>
<td>3,625,317.40</td>
</tr>
<tr>
<td>Lead, lbs.</td>
<td>217,594,679</td>
<td>9,356,571.20</td>
</tr>
<tr>
<td>Copper, lbs.</td>
<td>7,759,886.00</td>
<td>1,034,651.50</td>
</tr>
<tr>
<td>Zinc, lbs.</td>
<td>1,906,200.00</td>
<td>104,841.00</td>
</tr>
</tbody>
</table>

**Total**$15,606,862.00
### TOTAL FOR THE STATE FOR THE YEAR 1910.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, fine oz.</td>
<td>49,289.22</td>
<td>$1,018,808.20</td>
</tr>
<tr>
<td>Silver, fine oz.</td>
<td>7,890,388</td>
<td>$4,268,813.00</td>
</tr>
<tr>
<td>Lead, lbs.</td>
<td>239,144,570.00</td>
<td>$10,761,057.70</td>
</tr>
<tr>
<td>Copper, lbs.</td>
<td>5,837,839.00</td>
<td>$753,055.40</td>
</tr>
<tr>
<td>Zinc, lbs.</td>
<td>5,985,600.00</td>
<td>$33,513.60</td>
</tr>
</tbody>
</table>

Total ........................................ $17,135,695.90

### TOTAL FOR THE STATE FOR THE YEAR 1911.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, fine oz.</td>
<td>66,927.11</td>
<td>$1,375,068.22</td>
</tr>
<tr>
<td>Silver, fine oz.</td>
<td>8,592,400.00</td>
<td>$4,579,621.15</td>
</tr>
<tr>
<td>Lead, lbs.</td>
<td>274,492,873</td>
<td>$12,225,912.56</td>
</tr>
<tr>
<td>Copper, lbs.</td>
<td>3,962,060.00</td>
<td>$502,488.67</td>
</tr>
<tr>
<td>Zinc, lbs.</td>
<td>10,087,500</td>
<td>$386,593.94</td>
</tr>
</tbody>
</table>

Total ........................................ $19,270,212.00

### TOTAL FOR THE STATE FOR THE YEAR 1912.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, fine oz.</td>
<td>69,300.10</td>
<td>$1,432,434.00</td>
</tr>
<tr>
<td>Silver, fine oz.</td>
<td>8,238,971</td>
<td>$5,011,768.00</td>
</tr>
<tr>
<td>Lead, lbs.</td>
<td>296,054,813</td>
<td>$13,233,650.00</td>
</tr>
<tr>
<td>Copper, lbs.</td>
<td>7,392,280.00</td>
<td>$1,224,161.00</td>
</tr>
<tr>
<td>Zinc, lbs.</td>
<td>16,243,840</td>
<td>$1,127,316.00</td>
</tr>
</tbody>
</table>

Total ........................................ $22,029,327.00

### TOTAL FOR THE STATE FOR THE YEAR 1913.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, fine oz.</td>
<td>67,792.00</td>
<td>$1,450,531.50</td>
</tr>
<tr>
<td>Silver, fine oz.</td>
<td>10,163,205</td>
<td>$6,044,925.11</td>
</tr>
<tr>
<td>Lead, lbs.</td>
<td>318,377,280</td>
<td>$13,907,447.04</td>
</tr>
<tr>
<td>Copper, lbs.</td>
<td>8,627,242.00</td>
<td>$1,316,509.20</td>
</tr>
<tr>
<td>Zinc, lbs.</td>
<td>30,271,323</td>
<td>$1,707,352.62</td>
</tr>
</tbody>
</table>

Total ........................................ $24,572,396.47

### TOTAL FOR THE STATE FOR THE YEAR 1914.

<table>
<thead>
<tr>
<th>Metal</th>
<th>Quantity</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold, fine oz.</td>
<td>62,238.00</td>
<td>$1,286,459.46</td>
</tr>
<tr>
<td>Silver, fine oz.</td>
<td>13,621,123</td>
<td>$7,412,378.77</td>
</tr>
<tr>
<td>Lead, lbs.</td>
<td>345,334,106</td>
<td>$13,426,056.23</td>
</tr>
<tr>
<td>Copper, lbs.</td>
<td>49,239,000</td>
<td>$2,166,351.90</td>
</tr>
<tr>
<td>Zinc, lbs.</td>
<td>5,178,000</td>
<td>$685,430.00</td>
</tr>
</tbody>
</table>

Total ........................................ $24,976,706.36
TOTAL FOR THE STATE FOR THE YEAR 1915.

Gold, fine oz., 60,746 ............................... $ 1,255,619 00
Silver, fine oz., 12,933,619 ........................ 6,426,715 00
Lead, lbs., 369,242,000 .......................... 17,243,601 00
Zinc, lbs., 93,410,000 ............................. 12,993,331 00
Copper lbs., 7,365,000 ............................. 1,286,665 00
Antimony, lbs., 70,950 ............................ 28,380 00
Tungsten ore, lbs., 54,000 .......................... 81,000 00

Total gross value, 1915 ........................ $ 39,315,312 00
Total gross value, 1914 ........................ 24,976,706 00

Increase ........................................... $ 14,338,606 00

Total output all metals for the past 18 years, since state records were kept........................................ $322,999,369 00
Total Idaho output for preceding 38 years (estimated) 381,315,312 00

Grand total for 55 years ............................ $704,314,681 00