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Eighteenth Annual Report

OF THE

Mining Industry of Idaho

FOR THE YEAR

1916



ROBERT N. BELL
STATE MINE INSPECTOR

BOISE, IDAHO, JANUARY 1, 1917.

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, 1916.

ROBERT N. BELL,

State Inspector of Mines.

INTRODUCTION.

During 1916 the mining industry of Idaho has again enjoyed the most prosperous and profitable year of its history, while the output of mineral, for various reasons, did not much exceed in quantity that of 1915, by virtue of the exceptional demand maintained throughout the year for lead and zinc mineral and the high values for the metals prevailing, the gross mine value won from our mine operations in 1916 totaled about \$49,102,693, which is the largest and highest year's output in the history of the State. The metal contents of the mineral and bullion shipped, from statistics available is as follows:

Lead	366,594,000 lbs.
Zinc	98,700,740 lbs.
Copper	8,052,725 lbs.
Silver	12,205,132 ozs.
Gold	58,079 ozs.
Tungsten ore	120 000 lbs.

These figures are based on the gross metal contents of the ore as shipped without discounting for loss in smelting, which is a variable amount and hard to determine and to some extent made up with by-product recoveries that are not paid for by the smelters. These figures maintain Idaho in second place in lead production and a close second in silver production among the States of the Union and are a splendid endorsement of the progress and permanency of the mining industry of this State.

The estimated dividend distribution of the year aggregated about \$11,500,000, which is more than the total output of the State as recent as fifteen years ago, and was credited to fourteen mines, nine of which are lead-silver and zinc producers in the Coeur d'Alenes, and five in south central Idaho, situated in Boise, Blaine, Custer and Lemhi counties and included one gold, one copper and three silver-lead producers. That the dividend distribution was not larger was due to the fact of enormously increased operating costs, including labor and material. The chief operators of the north voluntarily increased the pay of their large army of employes on a sliding scale based on the average price of lead in New York for each increase of

half a cent a pound above five cents, and during the closing months of the year this bonus amounted to \$1.00 per day, which was applied to the wages of all classes of labor, including office hands engaged or connected with the mines and mills.

This increased pay as a profit sharing bonus, by virtue of the high metal prices enjoyed by the operators for their product, aggregated over \$1,500,000 in the Coeur d'Alene district, and with the increase in wages it stimulated in small and non-productive operations, in that and other districts of the State, would easily account for a total added distribution of \$2,000,000 during the year paid to labor account, in addition to the normal wages in the operation of Idaho mines.

As a result of the general industrial activity of the country at large, other mining costs, especially in the line of ammunition, machinery and material, was enormously advanced. This condition worked a hardship on the small operator and development enterprises but the general prosperity prevailing greatly stimulated interest in the search for metals and had a widespread effect that was felt by new activity in almost every mining district of the State. A number of new and important ore discoveries and developments were made. This was especially true in the south central mining districts of Idaho, including some of the oldest districts that, in connection with the advancement of metallurgical processes, are giving most definite evidences of coming back, and, in some instances, promise to renew and probably exceed the flourishing conditions of their early day activities.

MEN EMPLOYED AND ACCIDENT RESULTS.

During the year there were employed in the mining and milling operations of Idaho, according to the statistical reports received by this department, with a conservative estimate of the more remote parts of the State, 7,500 men, of which 5,300 are credited to Shoshone County.

In most of the larger mines of Shoshone County operations are carried on steadily throughout the year. The same is true of the larger operations of the State outside of that district. The development enterprises and the privately owned properties are less constant in their em-

ployment of labor, which would reduce the full time of employment very materially, and it is probable that 6,500 men would be a safer estimate for the State against which to charge the accident results that have occurred during the year.

By reason of the stimulated activity and capacity operations, mine labor was in good demand and the high wages paid attracted a great many new men to the work and doubtless included many green hands, temporarily at least, who were unfamiliar with the hazards of their surroundings and whose work had to be closely supervised by the men in charge, to whose care the low rate of accident results during the year is a handsome tribute under the circumstances.

The number of fatal accidents resulting from the operation of the mines during the year showed a very marked reduction over that of the previous year, a result that I largely attribute to the splendid efforts that are now being made by the principal big mine operators in safety first ideas, in substantial construction and a persistent effort to educate their men to be careful and constantly on their guard against the inevitable hazardous conditions which the industry involves.

Added to this very advisable move on the part of the operator, I am of the opinion that prohibition was a very important factor in the material reduction of accident results, and, if it is religiously enforced, will continue to be a decidedly important factor in mine accident immunity.

During the year 1916 there was reported to this office a total of thirteen fatal accidents as against twenty-three during 1915, a reduction of forty-five per cent for the year, and, based on a working force of 6,500 men, represented a loss of two men per thousand employed during the year, which is a low record of accidents in the history of the industry, since an effort has been made to keep track of these statistics, by this department in 1903, and is a result that compares favorably with branches of industry considered less hazardous than mining.

Fatalities at Metal Mines in the State of Idaho, classified by cause and occupation, for year ended December 31, 1916.

	Foreman	Miners	Muckers	Timberman	Other Mine Labor	Total Fatalities
Underground.						
1. Fall of rock or ore from roof or wall		3	2			5
2. Rock or ore while loading at working face or chute.....	..		1	..	..	1
3. Timber or hand tools.....	..		..	..	..	..
4. Explosives	1		..	..	..	1
5. Haulage system .....	..		..	1	1	2
6. Falling down chute, winze, raise or stope						
7. Run of ore from chute or pocket						
8. Drilling accidents						
9. Electricity						
10. Machinery (other than locomotives or drills).....			..			..
11. Mine fires .....			..			..
12. Suffocation from gases.....			1			1
13. Inrush of water.....			..			..
14. Nails, splinters, etc.....			..			..
15. Other causes .....			..			..
Shafts.						
16. Falling down shafts.....	..				..	..
17. Objects falling down shafts.....	..				..	..
18. Breaking of cables.....	..				..	..
19. Overwinding .....	..				..	..
20. Skip, cages or bucket.....	1				1	2
21. Other causes .....	..				..	..
Surface.						
22. Mine cars or mine locomotives, gravity or aerial tram.....						
23. Railway cars or locomotives....						
24. Run or fall of ore in or from ore bins .....	..	..	..	..	..	..
25. Fall of persons.....	..	..	..	..	..	..
26. Nails, splinters, etc.....	..	..	..	..	..	..
27. Hand tools, axes, bars, etc.....	..	..	..	..	..	..
28. Electricity .....	..	..	..	..	..	..
29. Machinery, mill .....	..	..	..	..	1	1
30. Other causes .....	..	..	..	..	..	..
Total	2	3	4	1	3	13

The serious, non-fatal and minor accidents reported for the year that have come to this department with the assistance of the Federal Bureau of Mines, aggregates as follows:

Serious accidents, involving time lost to victim of more than 14 days.....	219
Minor injuries involving a loss of time to the victim of 1 to 14 days.....	672

The causes of these accidents are in general attributable to the fatal accident classification, especially to hand tools, but very few of the government reports received from the operators are fully classified. A brief detailed review of the causes of the fatal accidents in Idaho mine operations during 1916 as reported to this department and gathered personally, are as follows:

On March 6th, at the Morning Mine at Mullan, Mike Aho, a married man employed as a timberman, while engaged in assisting with the transfer of a heavy cap on a timber truck at the 1,800 west drift was caught between the sliding timber and the side of the drift when the timber truck jumped the track, receiving a fractured skull which caused his death on March 11th. This accident was due to the fact that the timber was being handled loose on the truck and should have been locked to its frame.

On March 28th, at the Morning Mine, at Mullan, James Walsh, single, whose occupation was that of a shoveler, while working on the 4th floor of the 1,600 E. stope was caught by an inverted wedge shape piece of ground falling from the back of the stope and instantly killed. This ground had been sounded and examined by a timberman who was working within five or six feet of the victim, and by the victim himself, an old miner, who evidently considered it safe.

On March 31st, at the Green Hill-Cleveland Mine, at Mace, Marko Cerjak, a miner and single, while standing up on a stringer baring down loose ground on the 15th floor of the 1,600 stope was caught by a slab of ground falling on the timber on which he was standing and instantly killed.

On May 18th at the Consolidated Interstate-Callahan Mine, at Sunset, Charles Witkouski, a married man, employed as a shift boss, became frightened at the speed of the descending sinking bucket in which he was traveling down a vertical shaft with other men, and jumped off the bucket in an effort to catch the wall plate. This man, himself a hoist operator, had charge of and had just completed the changing of the hoisting cable and himself had loosened the tension nut on the clutch of the hoist and before starting down had forgotten to tighten it. The hoist man immediately applied the brakes and caught the load. It was evidently the appreciation of his error that induced

this victim to feel that the whole load was going to the bottom, which caused him to make his fatal jump for the timbers, which resulted in falling and being instantly killed.

On June 8th, at the Lost Packer Mine, at Ivers, in Custer County, Tom Hemovich, a single man, employed as a miner in a stope at the 6th level, while standing in a platform within reach of the back of the stope where he had been drilling and on which two other men were standing, when a slab of schisty ground let go from the hanging wall of the stope, which crushed him down to the floor and caused his death.

On June 13th, at the Morning Mine, at Mullan, Lewis Goffi, single and a machine miner, while drilling between two bulkheads 6 feet apart on the 11th floor of the 1,400 stope, which was heavily timbered and cribbed to the back, when his machine shook down a piece of loose ore ground which let go and caught him, injuring his back to such an extent that he died within an hour.

On July 26th, at the Empire Copper Mine, at Mackay, Rupert Magcler, a single man, engaged as a mucker in a new prospect shaft at the Copper Bullion tunnel level that was fifty feet deep and in which a round of holes had been blasted, returned to the collar of the shaft, in company with a mine foreman. The foreman found the smoke conditions too thick for immediate work and told the man to wait until it cleared and went on about his other duties. An hour later Magcler was found dead at the bottom of the shaft. He had evidently disobeyed the shift boss' orders in going down into the smoke too soon, had been overcome by the after gases of the blast and in attempting to climb the ladder had fallen back to the bottom and was dead when found.

On July 26th, at the Morning Mill, at Mullan, Charles M. Gilder, a married man, employed as a carpenter, was killed while in the act of nailing a platform hanger about 11 feet above the main floor of the mill over a three-inch moving line shaft, when his loose clothing was caught, which pulled him around the shaft. It was found that a suspender of his overalls was the first article to wrap around the shaft and had probably come loose in the course of his work.

On August 12th, at the Consolidated Interstate-Callahan Mine at Sunset, Mike Stellin, a single man, employed as

shoveler, while mucking in a new shaft station being cut that was heavily timbered except one set for which space was being made, was caught by a boulder of ground which fell from the back and pinned him to the floor causing his instant death.

On October 23rd, at the Morning Mine, at Mullan, John Cabin, a single man, employed as a shaft cager, while ascending the shaft with another man from the 16th to the 14th level with a small load of dull steel and a light stopper machine, was caught between the shaft timbers and the cage and instantly killed. This accident was probably due to the victim's holding the machine upright in his hand when the jar of the cage threw him off his balance, and might have been avoided by placing the machine upright in the tool box which was on the cage at the time and provided for that purpose.

On November 21st, at the Consolidated Interstate-Calahan Mine, at Sunset, George Failey, a single man, employed as a shoveler, on which work he had been employed for a year at this mine, was working on a muck pile and undermined a large loose boulder lying on top of the pile which rolled down and caught him and crushed the life out of him. This accident should have been avoided by anticipating the fall of the boulder by pushing it off the top of the pile with a bar or blasting it.

On December 4th, at the Gold Hunter Mine, at Mullan, Joseph Carson, a married man, employed as mine superintendent and one of the most experienced men in that capacity in the Coeur d'Alene district, had his skull fractured by a fragment of rock from a small blast which resulted in his death four days later. Mr. Carson in going his rounds right after the morning shift went on was returning from the 42 floor of the East Brennen stope by the east raise and stepped onto the 32 floor where a small tight stope had been blasted on the previous shift, and where one man was at work mucking. This man had found a boulder on the top of the muck pile which needed bull dozing, had placed a single stick of powder on it, went to the east raise and hollowed fire—according to his testimony—then spit his fuse and went to the main raise a few feet further west to guard against approach. It appeared that Carson had not heard his warning and stepped on the 32 floor looking for this workman and was within a few feet of the blast when it went off.

On December 21st, at the Morning Mine, at Mullan, Arthur Fields, a single man and employed as a motorman's helper, was electrocuted on the 1,400 east drift while riding on the resistance box at the rear end of the motor. It was thought that he accidentally came in contact with the trolley wire, which, however, was well guarded by an inverted trough-shape box and the motorman, sitting in front of him with his back to the victim, did not see the immediate occurrence but discovered it within a few feet and stopped the train.

It will be seen from the foregoing that the personal element entered very largely into these unfortunate fatalities, together with the inevitable hazards of the business, as there was hardly an instance, especially in the accidents resulting from small falls of ground, where the timbering conditions were not as closely and substantially maintained as is competent with the economic operations of the ore bodies involved.

The honor list of immunity from fatal accidents during the year among the large mine operations of the Coeur d'Alene district, whose low record in serious and minor accidents was also decidedly creditable, including the Hercules, Hecla, Frisco, Tamarack & Custer, Bunker Hill & Sullivan and Last Chance Mine, with a total force of 2,200 employees.

The Morning Mine, at Mullan, was again unlucky and took an undue toll of accident victims in spite of the fact that it is one of the best protected and underground conditioned mines in the Coeur d'Alene district. Its chief danger is from small falls of ground, to guard against which its great vertical vein spaces are closely filled with waste in the stopes, in addition to being heavily timbered. I seriously doubt that there is a mine in the United States that uses thicker or stronger timber supports than does this property, and to demand any closer protection in this respect would practically put the property out of business under normal metal prices.

The principal trouble with the ground in this property is the fact that it is a closely sheared quartzite formation and ore gangue. Its stoping ground would be safer if it was more intensely crushed, or harder. It carries an intermediate condition of slabby walls and more or less cracked and blocky vein filling. The stopes are worked in nine foot floors with modified square set methods, using cap timbers

of choice red fir material up to thirty inches in diameter, as the side pressure of the walls affords the heaviest strain on the timber. The stopes are kept filled with waste to within one or two floors of the back all of the time, the filling seldom remaining lower than this excepting hard safe conditions and then only temporarily. The timbers are kept as close to the stope face as possible, and as soon as space is made by the muckers for a set, it is put in and the back closely supported with heavy cribs and posts from the top floor.

It is barely possible that the ground could be more safely mined with short shrinkage sub-levels, involving very much less timbering, but whether the extensive underground equipment and trackage involved in the operation of the property would stand such a method is questionable, and it is hard to conceive how the company can get away from or improve its present close methods of handling the operation with timber and waste fill and stay in business. Below the No. 6 level the ground is heavy throughout the mine. It is a ground condition that does not involve any prospect of large mass falls, but a slow creeping motion of the ground that results in steady pressure and more or less dribbling conditions before the spaces made can be protected by timbering.

EMPLOYEES LIABILITY LAW.

The coming session of the Idaho Legislature will doubtless be induced to consider and pass an Employers' Liability and Workmen's Compensation Act. This is a law that is urgently demanded by the mining and other hazardous industries of the State and I am heartily in accord with its purposes. It is a difficult piece of legislation to create and be equitable to all interests concerned, as there are so many angles and influences and conditions to consider.

A Compensation Law was passed at the last session of the Montana Legislature; has been in full force and effect for the past twenty months and, as far as I can learn from discussing the measure and its results with mine employees and different interests concerned in its operation, it has proven decidedly satisfactory to the mining feature of the hazardous occupations in Montana. These Montana conditions of hazardous employment are practically duplicated, but on a much more limited scale, in mining in Idaho, and I think that the elaborate detailed report of

the operation of this law for twenty months by the Montana Commission in charge of its administration could be very profitably studied by the Idaho Legislature in framing a bill to fit the conditions prevailing in this State.

In connection with the mining industry of Idaho in framing such a law, regard should be had to the fact that more than 98 per cent of the mining enterprises of the State are operated on a development and non-profit sharing basis. They pay good wages as a partial tribute to the hazards involved in the work, and any exacting demand made in this connection would prove a hardship on small operators.

If a compensation law is passed it will probably involve putting the mine inspection work under the control and operating cost of a commission, and if another proposed measure creating the office of State Geologist for the more scientific study and advertisement of the State's mineral resources—an institution that has my unbiased endorsement—is also created, there would be no further use for the existence of this department after the present term under its present form. The election ballot could be shortened to that extent and future Mine Inspectors appointed by the Compensation Board, with the Governor's consent.

If these suggested measures are not passed and this department has to be carried on under the present poorly financed and mixed statutory obligations, I shall recommend that the appropriation be increased to provide for a resident Deputy Inspector to be permanently located in the Coeur d'Alenes.

Such a deputy should be afforded a salary of six dollars a day and a limited traveling fund, the same as the Chief Inspector, as a competent man cannot be obtained for less, as the position calls for a man of broad underground experience of at least shift boss ability and considerable technical education, as required by the Pennsylvania law, who would be on hand, within phone call, to attend serious and fatal accidents, to study and closely classify their causes, and discuss, while the accident was fresh, with operators the best means of preventing similar occurrences and be on hand to see that improvement orders and suggestions were put into effect, with full police power to assist operators in the enforcement of safety rules, with lay-off penalties for infractions, the same as the system now employed at Butte and on the railways.

Most of the larger mines in the Coeur d'Alenes are not

suffering from the need of closer mine inspection from a general safety standpoint, as they are in splendid shape and their operators earnestly try to anticipate trouble and protect their men as far as is possible and consistent. But, a good local unbiased Mine Inspector and safety expert, working in co-operation with the operators in the strict enforcement of safety rules among the men, and in their behalf against undue risk, should result in making the Coeur d'Alenes one of the safest big metal mine working districts in the country. The interest being taken by several of the big companies in accident prevention and the care and health of their men is sincere and the instruction in first aid work and other precautionary measures is a commendable spirit of the times and is unquestionably giving results. It should be religiously persisted in with military rigidity.

In this connection, the necessity of the enforced use of injector sprays or other dust killing devices to be used, on light air hammer drills used for up holes in dry stopes or raise work, is manifest and a statutory requirement to this effect, as a prevention against miners' consumption induced by rock dust is worthy of serious consideration.

Several of the mines have provided these devices but it is difficult to get the men to use them as they balk at any added chore to their regular duties like carrying up a few gallons of water into a stope or raise and the extra care involved in handling their operation, which requires about as much mechanical ingenuity, on an injector's spray, as the operation of a carbide lamp, and any law passed for this purpose should, in addition to a penalty for not providing this or other means of health protection by the operators, include a penalty to the workman for refusal to protect themselves by the use and application of the device.

I would again repeat the admonition to miners that too much care cannot be taken in dry raise work and other dead end operations where ventilation is necessarily poor against the effect of spent powder gases, which should be religiously cleared out by a volume of compressed air, as the after gases of a dynamite blast, when present in a very small percentage in the mine air, is decidedly poisonous and should be carefully guarded against.

I would further urge the adoption of storage battery locomotives in all low drifts where electric haulage is used

in place of trolley operated machines, and am glad to find that their use has been extended, during the year, by application of this system in one of the shaft levels of the Hecla Mine, and at the Sinker Tunnel Mine in Owyhee County which, however, in these instances, replaced mule haulage.

The storage battery locomotives have given splendid satisfaction in all the shaft levels of the Bunker Hill Mine, which have been entirely free from electric shock accidents since their installation in that feature of the operation. Their use involves a considerable economic cost where the trolley system is in use to make the change. After their installation the operation is equally as cheap and decidedly safer and should be given serious study and consideration for its advantages over the trolley system from a safety standpoint where new electric haulage installations are contemplated.

GASOLINE UNDERGROUND.

The use of gasoline for small hoisting purposes underground is employed in several mines in the more arid mountain sections of south central Idaho, where timber is scarce and dear and steam power costs, from the use of either wood or coal, is almost prohibitive, especially with small development enterprises and limited producers who are working on a narrow margin of profit.

The use of this fuel in underground station is decidedly dangerous from a fire standpoint but has been permitted for several years at six properties in Custer, Lemhi and Blaine counties for the reasons outlined above, as there is no statutory prohibition against its use and efforts have been made to protect the engine tank supply as fully as consistent.

While such fuel in underground stations is decidedly dangerous from a fire standpoint, no complaints have ever been received from miners working under these conditions by this department. Efforts have been made to induce operators, under these conditions, to provide the necessary second outlets and ventilating air courses, and the tendency of these small operators, where better success in development has been encountered, is to get away from these conditions as fast as possible where sufficient ore has been demonstrated to warrant a surface installation and a more extensive shaft equipment through to the surface.

This is one of the extra hazards that miners seem perfectly willing to assume, and in a leasing or struggling development enterprise for development purposes in underground winze operations in such regions where other power isn't available or conditions do not warrant the capital risk involved in supplying electric power. Gasoline seems hard to get away from, and to deny small operators the economic advantage of its use in the dry regions would be to retard the progress of new development. Whenever a mine has assumed a condition of profitable operation from proven ore resources, the underground use of gasoline should be prohibitive by law.

MINERAL EXHIBIT.

At the San Francisco Fair the Idaho mineral resources were represented by one of the finest and most complete exhibition displays of commercial ores and minerals of any State in the Union. While not a show case exhibit of fancy specimens, it probably contained as large a list and as big a variety of commercial ores as was ever gotten together by any State. After the fair this exhibit was repacked and returned to Boise, and later, through the influence of the Idaho Mining Association, was taken out of storage and spread out in a well classified and arranged exhibit on the ground floor of the State House Annex west of the main capitol building, where it is now available to visitors as a splendid exhibit of Idaho's varied mineral resources. This handsome display of minerals is without the advantage of a paid caretaker. It cost considerable money to collect, and is more representative of the State mining districts as a whole than any exhibition that was ever previously collected and a very valuable advertisement of the developed and undeveloped ore resources of the State.

It is worthy of maintenance for the benefit of the mining prospector and prospective investor in Idaho mineral resources, and a small appropriation should be made for a caretaker to be put in permanent charge for the purpose of maintaining and adding to the exhibit and affording a source of information at the capital of the State for the benefit of intending investors, especially in connection with the numerous very promising mineral resources immediately tributary to the capital.

STATE MINERAL LAND.

The State of Idaho owns a million acres of mountain timber and pasture lands. A large proportion of this area is unfit for agricultural purposes and always will be, by reason of its steep topographic conditions, and a good deal of it is very desirable prospecting territory that may contain valuable and workable deposits of mineral in addition to its surface values in timber and grazing advantages. These principal mineral values, however, involve all the expensive risks of preliminary development to determine whether or not pay ore bodies exist. This extensive area, however, is a land title reserve against a prospector and a petition has recently been received from a very likely territory in Clearwater County asking if the Constitution permits that the State land be thrown open to the prospector for mineral investigation with the privilege of location as is now enjoyed on government land and protection of his efforts and labors by being given the advantage of a subsequent preference purchase from the State of such lands as he is desirous of developing, after a proper valuation by the agents of the State Land Board.

Such a law would, of course, enhance the present surface values of the land and especially in more remote districts and would facilitate its disposition and sale. Colorado, I believe, has such a statute as an aid to mining development, and I heartily endorse the consideration of this petition by the coming session of the Legislature as a specific aid to the general industrial advancement of the State and in line with the new constitutional amendment to facilitate the disposition of State land holdings.

STATE GEOLOGICAL SURVEY.

There are few States in the Union that are without the services of a State Geological Survey, and Idaho is one of the few. There is no State in the Union that affords a richer, more varied, or more warranted field for the activities of such a public institution. In common with the Nation at large, the dominant industry of Idaho, at this time, is admittedly agriculture in its varied phases.

Agriculture in this State does and justly should receive the largest consideration of public support and encouragement. The Idaho farmer, however, is at a very serious geographic disadvantage by reason of the excessive railway haulage charge involved to market his products,

which often takes all his possible profit in railway charges. This is not due to excessive railway charges, as an analysis of freight rates will show that the per ton miles haulage cost of farm produce is as reasonable in the west as any other part of the country. It is purely a matter of distance, as the high cost of transporting potatoes to Texas and apples to New York can be readily appreciated.

I have previously stated and would again reiterate the opinion that the mineral resources of Idaho, when fully developed, can afford a home market for the bulk of Idaho farm products, which would cut this shipping cost to a minimum and add enormously to the profits of farm production.

I make this statement advisedly, for, in addition to the extensive undeveloped ore resources of Idaho, including lead, silver, zinc, copper, together with all the rarer mineral elements, building materials, and ceramic resources, the southeastern counties of Idaho contain a mineral asset in the form of rock phosphate that has a potential value running into billions of dollars, a mineral resource that in two or three southeastern States at this time, notably Florida and Tennessee, forms the basis of a mining and manufacturing industry that represents an actual cash capital investment of three hundred million dollars. The southeastern Idaho resources of this mineral have been elaborately surveyed by the United States government department and the quality and quantity of this mineral, which has already been definitely outlined, exceeds that of any other known resource in the world.

Phosphorus is the master key, the crucial and limiting element of all soil fertility, according to the highest authority, in successful agriculture and within a few years will become in active demand to replace the rapidly waning resources of this mineral in the southeastern States.

The surveyed portion of the Idaho resource of this mineral is estimated at 2,600,000,000 tons by the United States Geological Survey bulletins, with two-thirds of the known phosphate bearing area which has been withdrawn by the government yet to be covered by detailed survey. The proper study of this splendid potential business asset of Idaho is a duty that Idaho owes to itself and should provide the necessary financial support to that end. Its pro-

gress can best be induced, as well as that of the other mineral advantages which the State possesses, by the scientific study and endorsement of a State Geological Survey, which should be attached to the scientific department of the University of Idaho, where, as in other states, it will receive the hearty cooperation of the Federal Government.

Idaho, at this time, has absolutely no provision for this line of essential scientific advertising of its resources except the limited statutory requirements given to that feature by this department through the medium of an annual report. It is manifest that the mixed purposes of this report cannot have a fraction of the value in this connection that a properly established and supported scientific department would have and I urgently appeal to the legislators of the coming session from agricultural districts, to appreciate the value to their own personal interests, especially in farming, that could be made or at least materially advanced by an institution of this kind, in the direction of providing short haul home markets for their products.

MINING PROGRESS REVIEW AND METALLURGICAL ADVANCEMENTS.

The year 1916 will, I think, mark the entrance of Idaho into the field of metallurgical progress in a manner that is likely to prove of vast industrial importance to the further progress of the State. During the greater part of the year the entire product of the Hercules Mine was treated and reduced to bullion in a new smelter at Northport, Washington, just over the Idaho line, that was purchased and operated by the Day Brothers and other Hercules owners in connection with a silver refinery, also under their control, at Carnegie, Pennsylvania, to which point the base bullion was shipped for final separation.

This plant will also care for the production of the Tamarack & Custer Consolidated Mines, controlled by the same interests, during the coming year.

At Kellogg, in the Coeur d'Alene district, the Bunker Hill & Sullivan Mining Company in June commenced the construction of a very complete and up-to-date lead-silver smelting and refining plant of 1,000 tons daily capacity. This big plant has given employment to 200 additional men since June. Its construction had assumed definite shape at the close of the year and its completion and operation is quite definitely forecasted for the early spring of 1917. This big installation embraces the most modern and complete equipment of its class ever installed in the west and should prove a very important factor in the further progress of the Coeur d'Alene district and an encouragement to the prospector by affording a home market for his mineral product and should greatly reduce former freight costs on crude smelting ore to its customers, as I understand it will handle custom ore as well as the output of the company's big mine, which is the main object of its installation.

Such a local market will furnish the means to the small operator to pursue his investigations and is likely to result in the rapid expansion of the productive area of that field, which is quite extensively mineralized beyond the present centers of output.

Idaho is fortunate to be favored with the site of this new industry by the Bunker Hill & Sullivan Company, against

several competitors, as prior to last year the history of lead-silver ore output of the State aggregated more than \$300,000,000 in total gross value, all of which, with some small coffee pot exceptions, has been shipped out of Idaho to smelting centers in other States for final reduction, involving an operating charge against the industry amounting to fully one-third of its total gross yield, a substantial part of which will, by this new installation, be retained in the business channels of Idaho, in addition to the other local advantages it will create in mining progress.

In the gold mining districts of the south central part of the State, as well as in the Coeur d'Alene district, Idaho metallurgists have been keen to appreciate and take advantage of the very modern flotation processes in ore separation, and, in fact, have developed some marked advancements in the application of these methods that have proven of decided economic importance. This method of mineral separation is also especially adapted to the recovery of fine gold and silver bearing sulphide ore values, such as have previously resisted close separation by table methods. This new process, together with the progress made in cyaniding application to the recovered sulphide values that has been put in practical use, on a large scale operation in the recovery of gold from the complex ores of the Atlanta district, an advantage has been gained in ore treatment that will make available an immense tonnage of well developed mineral that formerly resisted profitable separation by the means available.

FAULTING TROUBLES.

In the Coeur d'Alene district notable mining events of the year was the loss through complex faulting movements of the famous Stewart ore channel. This system of faulting is also the weak feature of the future of the Caledonia Mine and terminated the formerly rich ore channel of the Crown Point Mine. It is possible that the extensive search now being made for the continuation of these handsome ore bodies beyond the fault displacement will prove successful, but it is one of the expensive tributes and uncertain outcomes that the mining industry exacts from investors.

This complex system of formation movements at Kellogg

together with smelting and mill lease troubles which put the Hercules Mine out of commission for five weeks during the year and the Tamarack & Custer Mine for nearly five months, resulting in a loss of production of about thirty million pounds of lead, which was credited to these operations during 1915. This decidedly important yield, however, was largely made up by the increased output of the Hercules, Hecla, Morning and Bunker Hill & Sullivan Mines. The policy of operation at these properties, with extensive advanced development, made it possible to speed up production and take advantage of the runaway metal market. The remarkable results of the operation of these four mines during the year, however, was the fact that new development in their deeper levels showed a marked expansion of ore tonnage in each instance, and affords a splendid example of the deep seated permanency of our most extensively developed ore bodies, whose lower levels on the four properties mentioned all range below 3,000 feet and the Bunker Hill & Sullivan extends down 4,400 feet in dip depth below the crest of the vein.

The unattractive surface evidences of mineral on each one of the big mines mentioned, with the exception of the Bunker Hill & Sullivan, is what makes development enterprises on strong fissuring courses in the Coeur d'Alenes attractive, together with the fact that experience has proven that ore bodies of great commercial importance have been developed underground whose highest crests were found as much as 2,000 feet below the surface.

ZINC ORE RESOURCES.

An interesting increase was made during the year in zinc ore production with the famous Interstate-Callahan Mine maintaining a big lead and retained its position as the third largest producer of zinc ore in the United States throughout the year. It has an ore channel 1,300 feet long and now developed nearly 2,000 feet deep with its lowest ore stopes still maintaining the remarkable strength and persistency in clean ore values that have made the property famous as one of the most profitable mines in the State, during the past two years.

The Success Mine, just below the Interstate, was continued in successful operation throughout the year, and while handling lower grade material it was the second

largest producer of zinc ore in the district and was actively operated from the surface down to the bottom level, where it still shows good mineral that is well worthy of deeper investigation and presents an excellent prospect of new ore resources in that direction as well as by drifting west.

Other important zinc producers of the Coeur d'Alenes were the Frisco Mine, and also an important by-product yield from the Morning and Green Hill-Cleveland Mines of good zinc mineral, in the production of which flotation methods proved an important factor.

The mines of Pine Creek, a few miles southwest of Kellogg, enjoyed a year of active operation which resulted in some decidedly important developments of zinc ore resources, especially at the Highland Surprise Mine, which was operated during the closing months of the year with a milling plant of 100 tons daily capacity on an ore shoot 500 feet long of massive mineral that was yielding one ton of concentrates to three tons of mill feed.

The Constitution Mine, in the same vicinity, was developed at a depth of 600 feet on a splendid body of massive high grade zinc ore over 350 feet long that showed a marked improvement in lead and silver values at the bottom level. This mine was equipped with a new mill of 150 tons daily capacity.

The Douglas mine, in the same vicinity, was taken over during the year by the Anaconda Copper Company. This property has a very interesting shoot of solid complex zinc ore which, while rather narrow, is persistent in length for 800 feet.

The Denver Mine, adjoining the Sidney on the opposite side of Pine Creek, was a new development of the year, which, in December, disclosed an ore shoot 250 feet long and nearly five feet wide on the average, of high grade zinc-lead-silver mineral.

The same big vein on the Sidney Mine, adjoining the Denver, was also being developed at the close of the year and disclosed some remarkably fine lead-zinc ore in a new winze being sunk on the ore body.

These Pine Creek zinc-lead ore mines are all contained in the same identical Prichard formation as the famous Interstate-Callahan bonanza. They carry the disadvantage of a higher proportion of iron mixture with the min-

eral, which makes it more complex and difficult to treat but well adapted for the new electro-chemical method of separation.

The virtue of these Pine Creek deposits is the fact that, like Nine Mile zinc ore deposits, they show little evidence of value at the surface outcrop but at comparatively shallow development disclose uniform conditions of massive mineral mixture. They are persistent in length, are evidently replacement deposits like those of Nine Mile, and, I believe, their present development is practically all confined to virgin ore crests, undisturbed by erosion, that should expand in thickness and probably in length as work progresses to greater depth.

Considerable production was made by the properties mentioned which had to be hauled twelve miles by wagon. There is a strong effort being made to have a railway spur extended up Pine Creek to serve these properties. The route is an easy one to cover and the present mineral showing in the mines mentioned, together with the dozens of handsome prospects in the adjacent mountain slopes, seem to well warrant this move in transportation facility.

Pine Creek is extensively mineralized from its mouth to its head. Two miles above its junction with the Coeur d'Alene river and the O. W. R. & N. Ry., the Northern Light Mine has been undergoing intelligent development during the past year, which has been very energetically pushed and has disclosed some very interesting results in the shape of a persistent vein that has been followed for two hundred feet at a vertical depth of 400 feet below the creek level in continuous ore carrying good milling values in both lead and zinc. This mine was still carrying a good face of ore in the west drift at the time of my visit in December and had the earmarks of a prospective producer. Two miles west of the Northern Light, the Hypoteek mine, eleven hundred feet deep, completed a new mill during the summer and has since been a steady shipper of clean, high grade lead-silver concentrates and crude ore.

RAY JEFFERSON MINE.

On the north side of the Coeur d'Alene district active development was carried on throughout the year at Sunset Peak, at the W. A. Clark Mine. At the Ray-Jefferson, adjoining the west end of the Interstate-Callahan, forty men

were employed in zinc-lead ore production and development on several pronounced veins. A new mill of 400 tons daily capacity was completed and put in operation on this mine in December that is of the most substantial construction and modern design.

This section also has a number of other attractive zinc-lead ore mines and prospects that are being actively developed at this time and has been recently made more accessible by the extension of a railway spur from the north fork branch of the O. W. R. & N. Railway Company to the mouth of Carbon Creek, near the Ray-Jefferson mill, which will greatly facilitate future ore shipments and production from this part of the district.

NORTH STAR MINE.

At Wood River the notable occurrence of the year was the introduction of the Federal Mining and Smelting Company of Wallace, Idaho, who purchased the well known North Star Mine, twelve miles above Hailey, on the east fork of Wood River. This company has been the dominant mining enterprise in the State for years in the Coeur d'Alenes, and its introduction to the Wood River district is one of decided advantage and has given an interesting illustration of vigorous activity to that old district by the further extensive development of an immense ore body of the North Star Mine and the erection and successful operation of a concentrating mill of 150 tons daily capacity between May and December from a flat start.

The North Star has been known for many years as the biggest mineral tonnage resource in the Wood River district. It has a past history of production in silver-lead values amounting to \$600,000. It has been idle for over twenty-five years with its bottom levels full of water. Its big exhibition of mineral on its drainage tunnel level consisted of a long shoot of massive sulphide ore ten to twenty feet thick, embracing a very complex mixture of lead, silver, zinc and iron minerals. After the bottom levels were successfully drained by a deeper tunnel a second vein of very rich ore less complex and more extensively developed was disclosed which involved little additional work to put it in shape to supply the daily milling requirements of 150 tons.

The property has been equipped with air compressors and other mechanical devices for deeper development and

the present ore disclosure and their extensions on the adjoining Triumph group, also embraced in the enterprise, are conservatively estimated at a million tons of developed and probable ore that is believed to carry fifteen to twenty per cent zinc with about eight per cent lead and eight ounces silver. The excess of iron in this ore complicates its treatment by concentration methods and its ultimate complete handling may involve the application of the new electro-chemical process, to which method of separation the ore is well adapted.

SOUTH MOUNTAIN ZINC.

The South Mountain Mine, situated twenty miles southwest of Silver City, in Owyhee County, and ten miles west of the Boulder Creek district, is one of the attractive big zinc tonnage prospects of the State. This mine is the oldest smelting ore producer in Idaho. It was equipped with a small lead furnace in 1875, with which several hundred thousand dollars worth of rich silver-lead bullion was produced from rich lead carbonate ores mined near the surface, which, however, soon changed to mixed sulphides of lead, zinc, iron and copper that resisted treatment by the crude smelting plant available.

This deposit is one of the contact metamorphic type between marbelized limestone and schist. It carries a splendid outcrop of gosseney mineral as much as fifty feet thick and continuous in surface outcrop for over 2,000 feet sprinkled with rich carbonates of lead, zinc and copper.

At the lowest point of access a tunnel 1,000 feet long has been driven that has attained a face depth of 350 feet and recently disclosed some handsome bands of clean zinc sulphide ore at a point almost directly under the west end of the biggest gossen outcrop, and its further extension should soon undercut a big body of massive sulphide mineral if surface evidences are any criterion to go by. At the extreme east end of this long outcrop, and 800 feet above the tunnel developmnt, a fifty foot prospect shaft discloses three feet of chalcopyrite ore assaying 8 per cent copper and thirty ounces silver with which is a parallel band of fairly clean zinc sulphide mineral two feet wide.

The virtue of this property is the fact that whenever the sulphide ores of lead or copper have been disclosed they have been invariably rich in silver, generally ranging from

two or three ounces to each unit of base metal and some gold. Its promised big bodies of massive mineral will doubtless prove complex, but should be amenable to some of the chemical methods of treatment now in vogue.

OTHER IDAHO LEAD-SILVER RESOURCES.

IDAHO CONTINENTAL AND OTHER MINES.

North of the Coeur d'Alene district a number of interesting ore prospects are operated adjacent to the shores of Lake Pend O'Reille and Clarksfork in both lead, zinc, silver, gold and copper bearing ores. The Keystone Mines Corporation, at Blacktail, shipped a number of cars of high grade silver-bearing gray copper ore and are pushing an intelligent campaign of deeper development.

At the north end of Boundary County, adjoining the international line, the Idaho-Continental Mine, in spite of serious set backs owing to power and transportation troubles, got its new mill of 150 tons daily capacity in operation during the summer and made a shipment of 46 cars of high grade concentrates and crude ore. This property has one of the longest and most persistent galena ore channels in the State. It is developed 500 feet deep with adit tunnels and shows a two years' ore reserve of clean high grade concentrating galena ore in quartzie gangue and walls which, with additional power and improved transportation advantages, should prove one of the future dividend paying lead-silver enterprises of the State.

THE GILMORE DISTRICT.

Important advancements were made in lead-silver ore development in south central Idaho during the year; especially was this true at the Gilmore district, in Lemhi County, where the principal producer, the Pittsburg-Idaho Mine, made the best output of its history, and, according to press reports, paid a handsome margin of profit in dividends to its stockholders.

The Latest Out Mine, adjoining, was also actively operated in richer ore than formerly from its bottom level and is believed to have done fully fifty per cent of the business of its neighbor, while the Gilmore Mining Company, adjoining the Latest Out, was a brand new producer of lead-silver ore. It entered the shipping list during the middle of the summer in a very substantial manner and had made an output of sixty-two cars of crude shipping ore by the

end of the year, from leasing operations from an ore body developed at its 450 foot level, which was discovered and operated under a lease by the Latest Out Mining Company. Above that level this ore shoot had been proven for 200 feet in length with a width varying from a foot to thirty feet of shipping ore carrying about the normal average values of the district.

The Gilmore Company's property is also being developed by a 6,000 foot tunnel, which is now closely approaching the vein at the 1,000 foot level. This tunnel has already passed a narrow companion fissure carrying rich ore at this depth and the mine gives eminent promise, at this time, of shortly becoming as large a producer as its neighbor, the Pittsburg-Idaho, and a valuable added asset to this district's growing importance in the production of very desirable oxidized lead-silver smelting ore.

In addition to these three mines in the Gilmore district, the favorable metal market brought to light te other producers which were able to market shipments ranging from one to four cars of profitable crude lead-silver ore.

Interest was revived during the year at the Skull Canyon district, on Birch Creek, where several cars of rich copper ore were shipped from the Weimer Mine, and new lead ore disclosures made on the Kaufman Mine.

At the Dome mining district, on Little Lost River, the Wilbert Mine was successfully operated throughout the year, and although its progress was seriously retarded by faulting troubles, it made a yield of several million pounds of lead and paid \$40,000 in dividends to its stockholders, a splendid record for a small lead mine with low silver values and located forty miles from railway transportation, involving a very expensive wagon haul.

MACKAY DISTRICT LEAD DISCOVERIES.

New lead ore discoveries of exceptional promise were made in the Mackay district, in Custer County, adjacent to the Empire Copper Company's operations on White Knob Mountain. From this point the Kennan lease on the Kennedy group of claims in Rio Grande Gulch developed a fine body of lead carbonate ore from which over 60 car loads of profitable mineral were shipped during the summer from a daylight operation in a big surface glory hole and a shallow grass root tunnel. This property was later optioned to the U. S. Mining and Smelting Company, who

are now actively developing it at a deeper level and have intersected two additional ore bodies of excellent promise, which, combined with the especially favorable geological conditions, promise a lead-silver ore resource of very considerable magnitude with further development.

Adjoining this property to the west the Horseshoe Mining Company, through leasing operations, also discovered a splendid shoot of desirable lead carbonate and galena ore from which two car loads were shipped that paid a good margin of profit. This discovery occurs under almost identical conditions with the discovery at the Kennedy group and also seems to have a very promising future.

ANTELOPE DISTRICT.

On Antelope Creek, twenty-five miles south of Mackay, a new development on the Weiler Lead Mine disclosed additional resources of better grade ore than had previously been encountered and made the best car load shipment of its history.

Considerable activity in prospect work on the numerous promising lead-silver prospects in this vicinity was manifested during the year that gave encouraging evidences of expanding resources. One car load of manganese gossan ore was shipped from a big vein in this district that yielded 120 ounces of silver per ton.

ERUPTIVE GRANITE LEAD ORE DEPOSITS.

Some remarkably attractive lead-silver ore discoveries have been made in the eruptive granite formations of central Idaho that embrace splendid mixtures of lead-silver values with gray copper and zinc mineral in veins and disseminated deposits which, at several points, present widths up to 100 feet of scattered sulphide ore in lead and zinc often carrying values of an ounce or more of silver to each unit of lead in shallow surface development.

Lead-silver ore in similar eruptive granite formations have been successfully and profitably mined to a depth of 700 feet in the Wood River district and there is no reason why this class of deposits should not prove permanent in depth with extensive development. If they do, the country tributary to Boise to the north and east extending as far as the Big Creek district in Idaho county is likely to ultimately become a very important factor in maintain-

ing the reputation of Idaho as a source of desirable lead-silver and zinc minerals.

IDAHO COPPER RESOURCES.

The copper ore resources of Idaho, while very widely distributed, are in a decidedly primary stage of development and condition, due largely to the fact that they are often situated in rather remote mountain sections where transportation facilities necessary for handling heavy mineral products are not available.

EMPIRE COPPER COMPANY AT MACKAY.

The output of copper in the State for the year showed a small increase and was largely due to the active operations of the Empire Copper Company at Mackay, in Custer County. This enterprise gave steady employment to over 200 men and made a monthly yield of nearly 8,000 tons of crude shipping ore, that, under the high metal prices prevailing, afforded dividend distributions by this company, amounting to \$250,000, according to published statements.

One of the notable occurrences of the year in the progress of this enterprise was the successful interception of the ore zone in the new development tunnel of the company now 6,000 feet long and 900 feet vertically below the present active horizon of operation at the Albert tunnel level. This deep level ore is identical in character with the sulphide mineral shipped from the upper works and adds immensely to the probable life and productive capacity of this mine, whose resources above the old level, in spite of the most active year's production of the mine's history, are still showing strong from a tonnage standpoint and prospects of future results.

Towards the close of the year this company's operations were materially speeded up and new mechanical installations, including additional power and milling facilities for the treatment of the mine's large tonnage resource of low grade ore, are in prospect of immediate installation, which will greatly expand the company's activities and volume of business.

COPPER BASIN MINE.

At Copper Basin, twenty-three miles west of Mackay, the Reed & Davidson property was taken over during the year by associated interest of the Empire Copper Company

and was actively developed with quite a force of men, whose work resulted in the shipment of a number of cars of crude ore of excellent value. The Copper Basin deposits produce some of the finest oxide and copper carbonate minerals found in the northwest. These ores, of a decidedly rich secondary nature, should result in some handsome bodies of high grade sulphide mineral when the permanent water horizon is reached, as they are associated with big gossen outcrops.

BLACKBIRD COPPER DISTRICT.

Some new life was put into the Blackbird Copper district, in Lemhi County, by the acquisition of one of the rich cobalt sulphide ore deposits for which that district is noted, in addition to its extensive copper resources.

Cobalt is now said to be one of the desirable alloys for steel and to have a good demand in electrical storage battery work. The deposits of this mineral in the Blackbird district are believed to be extensive, in favorable formation, and of such a nature as should prove permanent and lasting as development progresses and may prove an important factor in attracting attention to the other features of the Blackbird district, which embrace some large zones of disseminated copper sulphide ore carrying associated values in both cobalt and nickel and giving evidences of a big tonnage capacity, in some instances.

Another feature of the Blackbird ore deposits is the excellent associated values in gold and silver which the minerals contain and which should afford a very profitable by-product of precious metals in the event of their extensive operation and treatment.

SHOSHONE COUNTY COPPER.

Some splendid new copper ore developments were made at the Richmond Mine, in Shoshone County, near the Montana line, and closely tributary to the Missoula branch of the Northern Pacific Railway and the Chicago, Milwaukee & St. Paul Railway. This property shipped a number of cars of relatively high grade crude copper ore said to have averaged ten to fifteen per cent copper with several dollars in gold and silver. It has recently been financed for an extensive campaign of development and should contribute a much larger output during the coming year, which is also true of the adjoining Lawrence Mine, another

fine copper showing which is also being financed for active development at this time.

A considerable production of copper sulphide concentrates was made by the Empire Mine, at the little north fork of the Coeur d'Alene river, where a new mill of 150 tons capacity was installed and put in operation during the year. This property has a large vein of copper sulphide mineral ten to twenty feet wide with a proven ore shoot over 400 feet long. Its development has encountered some faulting difficulties, but it is of such apparent strength and persistency as to indicate permanent and profitable results with further development at depth.

GILMORE COPPER.

The Gilmore district, in Lemhi County, in addition to its lead-silver ore resources, has some magnificent prospects of copper bearing mineral, embracing one shoot of ore on the Simms group that is 100 feet wide of disseminated copper sulphide associated with massive magnetite mineral. Tributary veins to this great ore body have made shipments of ten per cent copper ore carrying \$10.00 in gold of a soft brown oxide nature. These deposits are of a contact metamorphic type similar to the Mackay deposits and are decidedly worthy of consideration with modern treatment methods in view.

Lemhi also has a number of other very interesting copper ore districts. One of these, at Worthington Creek, near Salmon, another near Hot Springs, carrying strong veins of massive sulphide mineral are now being developed at depth.

SEVEN DEVILS COPPER.

The Seven Devils range, in Adams County, is one of the most extensively mineralized copper belts in the west, more than 100 miles long by ten miles wide and embracing every variety and character of copper ore occurrence. One of the most attractive developments in this district made recently is that of the Red Ledge mine, a bedded porphyry schist conglomerate deposit which discloses a body of mineral fifty feet thick carrying average values of nearly five per cent copper with \$5.00 gold and silver per ton. This property is only seventeen miles from railway transportation but involves some very heavy canyon construction to make it accessible. It has recently been taken over

by a prominent copper operator of California and will be thoroughly tested by diamond drilling during the coming season.

Unless all geological judgments fail the properties mentioned and numerous other new copper ore manifestations will ultimately result in giving Idaho a position in copper production that should rank among some of the more important States in that line of activity.

GOLD MINING DEVELOPMENT.

The notable gold mining developments of the year were at the Atlanta district, in Elmore County; Boise Basin, in Boise County; Marshall Lake district, in Idaho County, and the Boulder Creek district, in Owyhee County.

BOULDER CREEK.

At Boulder Creek the Demming group of claims, twelve miles south of Silver City, were taken over under bond and lease by the Rowlands Corporation of Nampa, which is planning extensive development work during the coming year.

The Demming property is, at the present time, the most notable figure in this new district. Its limited development consists of an adit tunnel 150 feet long driven on a pronounced fissure vein and affording a dump pile resource of ore aggregating several hundred tons that I am reliably informed averages \$25.00 per ton in gold and silver. This handsome average value, coming as it does from a pronounced fissure vein that stands nearly vertical, is from six to ten feet thick, is traceable for more than 1,000 feet at the surface, and by reason of its values, size and persistency has attracted the interest of some very substantial mining investors and resulted, during the fall, in quite a little excitement that gives promise of a boom prospecting camp during the coming year.

BOULDER CREEK COMPANY.

The Demming group embraces a dozen other parallel veins, several of which show high values in gold and silver in grass root tunnels, and several of its veins continue through the adjoining Stevens Group of claims to the southeast, owned by the Boulder Creek Mining Company, which exhibits strong vein courses of similar well defined mineral occurrence with one fissure two feet wide on this

property containing specimen gold values that promise bonanza ore results with further development.

MAMMOTH GROUP.

The Mammoth group is one of the older Boulder Creek properties that, with a small rawhide mill, operated a number of years ago and made a production of \$10,000 in high grade concentrates from \$10.00 mill feed values.

MINERALOGY.

The best ore gangue of this district is hard crystalline blue quartz, containing a uniform dissemination in the better phases of the ore of very fine arsenical and antimonial sulphides. It appears to be of a primary nature uninfluenced by surface action to any extent.

GEOLOGY.

These veins traverse a low plateau country at the southern base of the Owyhee range. The enclosing formations are eruptive granite or quartz-monzonite, and embrace what may be a deeply eroded phase of the Owyhee range unit, which is a granite batholith that is probably of equal extent with the famous Boulder batholith in Montana.

The depth to which these veins have been eroded will prove an important factor in the permanency of their ore values. There are some interesting contingent faulting conditions, however, that may prove a favorable offset for the possible erosion feature in the line of different periods of mineralization as was experienced in the deep development of the Butte mines. The belt in which these veins occur is fully two miles wide and probably twenty miles in length and embraces a number of immense outcrops of largely barren quartz with narrow bands of pay mineral. Hundreds of claims have been located and if development proves the values to be permanent, this belt should result in a mining activity that will put the former bonanza history of the Silver City mines away in the shade.

SILVER CITY MINES.

The famous Trade Dollar and Delamar bonanza mines made their richest ore production and \$30,000,000 output from younger tertiary volcanic wall rocks, resting on granite, including basalt and rhyolite, which occur in local areas over the surrounding granite formations. The showings already made at Boulder Creek certainly warrant full

investigation by intelligent development, and are likely to prove of vast importance as a source of precious metal, if their values are found to go down.

THE OLD ATLANTA DISTRICTS.

This old mining district, eighty miles east of Boise, came to the front during the year with one of the best strikes of rich gold ore of its history. After a long period of inactivity successful milling ore disclosures were made in 1915 on the property of the Bagdad-Chase Mining Company, which was reorganized through the activity of Mr. Leo J. Falk, of Boise, under the title of the Boise-Rochester Mining Company, embracing the Sy. Smith interests. The property was successfully operated on \$8.00 to \$10.00 ore values at a capacity of about 100 tons a day for a year until September, 1916, when a blind vein was opened on the extreme eastern end of the Atlanta lode that revealed a pay streak varying from a mere seam up to ten inches thick of the same high grade bonanza ore values for which this famous lode was noted during the most productive period of its operation over forty years ago.

This interesting pay streak has been followed for over 300 feet and carries values ranging from \$500 to \$1,000 per ton in gold. Since its discovery it has been quite extensively opened by an adit tunnel now 500 feet long, disclosing an ore course that will average from five to seven feet wide with average milling values ranging from ten to twenty dollars per ton in addition to the rich paystreak, from which over a thousand sacks of choice mineral has been selected, in the stoping progress. A shipment of bonanza values can safely be anticipated from this property when the roads are open next spring.

THE MONARCH-BUFFALO MINES.

These old mines, in the middle section of the Atlanta lode, were the principal source of its former rich ore production, from which old shipping records are available of values ranging from \$800 to \$1,000 per ton in car load lots. These old properties were taken over by T. N. Barnsdale, of Pittsburg, fifteen years ago, have been under the direction of Mr. Daniel Kirby of Boise, under whose management they have been extensively developed at depth and proven to contain an immense resource of primary ore values of \$8.00 to \$10.00 per ton in gold and silver.

Expensive milling equipment was installed and a large amount of money spent in an effort to treat these values, which, however, proved unsuccessful by reason of their complex nature. It remained for a local Idaho metallurgist, Mr. Marcus White, formerly of Silver City, to successfully solve the problem. This old property carries a dump ore resource embracing the leavings of former operations, mixed with a great deal of dead waste development material and averaging \$4.50 per ton in gold and silver. Mr. White made use of the available machinery in the mill and has successfully operated on these dumps for the past two summers on a scale of 120 tons a day with an extraction of 92 per cent of the gold and 70 per cent of the silver values in the ore, which is an increased yield of fully 30 per cent over any former results obtained in efforts to treat this big resource of valuable mineral.

Mr. White's success has been through the careful roasting of the concentrates from the ore and its subsequent treatment by cyanide methods. His success in this direction makes available the big tonnage resource of the property of much higher average value than the dumps and it seems likely that the enterprise will be revived with the addition of modern crushing machinery and flotation to the mill, and afford a big scale operation and a very valuable addition to the precious metal output of the State in the near future, and, combined with the Boise-Rochester enterprise and the numerous other splendid evidences of ore channels on adjacent properties, that in some instances, carry quite extensive development, combines to promise a very permanent and prosperous camp for the old Atlanta district that is likely to discount its former splendid record of production.

GOLD HILL AND IOWA MINES.

At Boise Basin the very promising and attractive gold, silver bearing copper-lead zinc deposits of the Grimes Pass district were the scene of considerable development activity during the early part of the year, which, however, was poorly handled and did not make much permanent demonstrations of the merits of these deposits, which still afford some of the most attractive chances for mining development of that class of ores that the State affords, by reason of their size, persistency and favorable geological environment.

The famous old Gold Hill & Iowa mines, with a record output of gold estimated at over \$3,000,000, were actively operated throughout the year and the ore resources in the bottom levels so materially expanded in both size and value as to induce the company to double its milling capacity. This development was made on the old Pioneer vein, which is giving better promise of profitable results at this time than it has at any period of its past history.

The Mountain Chief mine, a short distance west of the Gold Hill & Iowa, was also actively developed throughout the year and made a fine output of bullion. A change in the character of the ore in the deeper development involved considerable milling adjustments that somewhat retarded the progress of the enterprise. These, however, are believed to have been successfully overcome.

BANNER MINE.

Other important results of mining activity in the Basin country was the transfer at the close of the year of the old Banner Silver Mine to some prominent northern operators, who made a large cash payment and resumed active development of the property.

The Banner group was operated over twenty-five years ago and was one of the notable silver producers of early Idaho mining history. It is credited with an output of between three and four million ounces of silver and its veins were noted for the occurrence of very high grade silver minerals, principally of the sulphide variety.

The Banner veins occur in a granite formation, are very persistent in length and have been undergoing further development during the past five or six years under the direction of Vivian Thorne, who was substantially supported in the venture by the Boston-Idaho Dredging Company, with the result that a resource of ore, estimated to contain three million ounces, has been undercut and will be further actively developed and treated with flotation milling methods, which it is believed will reduce the former milling costs by the pan process from thirty dollars a ton, to three dollars a ton.

The average values in the ore resources now disclosed in this property range from thirty to one hundred ounces silver per ton with some gold, in widths varying from a foot to three feet in one persistent ore shoot 500 feet long,

which has been developed at a depth of 600 feet below the surface in virgin ground, and with another parallel vein of proven values recently cut, the re-establishment of a very important silver producer at this point, in the near future, seems assured.

LUCKY BOY MINE.

Near Idaho City, in the Gambrinus district, the Lucky Boy Mine was reopened and an extensive new resource of free gold ore disclosed during the year with a definite prospect of a daily output of 100 tons in the near future. This enterprise has been retarded by the inability of the company to get machinery deliveries, due to the excessive market demands in that line. They are now receiving a Deisel engine power plant, air compressor, and additional milling equipment which should be placed and put in operation within the next ninety days.

BOSTON-IDAHO DREDGING COMPANY.

The Boston and Idaho Company's mammoth dredge on Moores Creek, just above Idaho City, rounded out a career of profitable gold production that has extended through the past five or six years of continuous operation and was closed down in the fall. It is reported that its worn bucket line will be renewed and the plant operated again next season on a small additional tract of gravel that is available. This enterprise has proven the largest individual source of gold production in Idaho for several years past. It has been one of the most substantially financed and cleverly operated mechanical mining enterprises in the State. Its equipment embraces one of the largest types of chain elevator bucket dredges in the country, which, while only involving a lift of about forty feet, has actually mined and concentrated as much metal bearing material in a year, as all the lode mines of the State combined.)

This company has also patronized the lode mining industry of the Basin country, especially at Quartzburg and Banner, and its financial support in that direction has brought to light ore results of a permanent and promising nature that would likely have lain dormant but for the interest and business support of this company, and it is sincerely to be hoped that its activities in the State will be continued.

MARSHALL LAKE DISTRICT—HOLT MINE.

The Marshall lake district, in Idaho county, which I have annually advertised as a likely source of gold mining profits for the past ten years, has demonstrated the virtue of this prediction during the past season as a result of the intelligent activities of Mr. L. D. Holt, an experienced Alaska operator. Mr. Holt took an option on one of the promising veins of that district about a year ago; demonstrated the permanency of the deposit with 500 feet of adit tunnel drifting work; built a wagon road connection to the property; built a sawmill to cut his own lumber and a quartz mill of twenty-five tons daily capacity, which, in a month's operation subsequent to starting the mill, produced enough gold bullion to pay for the mine and the entire cost of equipment and maintained an ore reserve in the mine estimated at a quarter of a million dollars in value.

This remarkable deposit of rich gold ore was formerly known as the Fox & Briggs Mine. I am reliably informed that its ores give an average value of \$50 per ton in free gold on plates with an additional recovery of twenty to thirty dollars per ton on the tables, affording a concentrate that will run several hundred dollars per ton in gold.

KIMBERLY AND OTHER MINES.

There are a number of other veins in this district of equal surface promise to the Holt property. Two of these carry considerable development and are known as the Kimberly, lying to the south, and the Jewel-Multnomah group, lying to the north of the Holt property. They are on parallel veins and carry similar high grade ore values.

The Kimberly Mine is particularly noted for magnificent native gold specimen ore. The veins of this district are narrow but persistent in length and carry a succession of short ore shoots. These values should be persistent in depth as the slope of the mountain on which they occur is very steep and shows a vertical range of rich ore crop-pings of fully 1,000 feet difference in elevation on different parallel vein outcrops.

A number of veins of this district are spotted and barren at the surface. A large tunnel now being driven by the Marshall Lake Company at the south end of the district is

said to be closely approaching the main vein for which it was started and will determine the staying qualities of the values at a depth of several hundred feet.

JANSON MINE.

At Crooked Creek, about twenty miles east of Edwardsburg, the Janson Mine developed a shoot of free gold ore in a fissure vein in granite, traceable at the surface in a succession of shallow openings for fully a mile. This shoot has been drifted on for 150 feet and was from two to four feet wide at the time of my visit during the summer. The face displayed nearly three feet of heavy sulphide bearing quartz that was said to average \$100 per ton in gold, and has produced and still displayed in the face, some magnificent native gold specimen ore, individual pieces of which had recently been taken out equal to anything ever found in Idaho. The property is equipped with a light one stamp mill, which was being further added to with a small arrastra for grinding the concentrates, and the property gives promise of a decidedly profitable gold vein with further development and larger milling equipment.

BIG CREEK LODES.

Quite a little interest was manifested during the year in the big low grade ore belt that crosses the upper drainage tributaries and rugged mountain spurs of Big Creek and extends over to Profile Creek. Some substantial development was carried on through a new deep tunnel on the Gold King group that demonstrated the continuation of values to a considerable further depth than formerly in this wide lode. What appears to be one of the most important discoveries yet made on this belt was reported, late in the fall, from Logan Creek, on the Shaunessy-Nethkin group, lying between the Moscow and Laufer-Davis properties, where values of ten to thirty ounces silver and five to ten dollars gold was disclosed in a lode that appears to be persistent for hundreds of feet up the steep canyon side and is described as three to ten feet wide of the values given.

The importance of this discovery is the fact that it is made near the lowest point of erosion on this big mineral belt, closer to the canyon bottom than any other important

development and affords a strong indication, to say the least, that the values in this big lode zone as now disclosed at the Moscow-Laufer-Davis, Gold King and Independence mines, may be depended on to go down 1,000 feet from the high positions on the mountain spurs where their principal present development exists on defined low grade gold ore zones one hundred to two hundred feet wide, carrying \$2 to \$4 per ton.

This discovery is likely to stimulate continued interest in this immense zone of mineralization and ultimately result in its more extensive operation with the encouraging prospects of very big silver-gold milling and mining operations.

TUNGSTEN.

There is probably no county in Idaho that carries a more complete list of precious, useful and rare minerals than does Lemhi County, and it is more than probable that the reason for the great variety of mineral values this interesting section of the State contains is the fact that Lemhi County embraces practically the entire geologic column of formations ranging from the archean to tertiary age. It is a rugged, mountain country and doubtless shared in all the periods of the earth's mineralizing activities since the first crust was formed.

At Patterson Creek, a tributary of Pahsimaroi River, the Ima Consolidated Company's property, operated by the Jeffs & Johnson Leasing Company of Salt Lake City, produced and marketed thirty tons of high grade hubnerite concentrates, containing an average value of 60 per cent tungstic oxide (WO_3) during 1916. This mineral was shipped in small lots as produced and totaled a small car load. It brought an average price of \$1,525 per ton and represented what is probably the highest value per ton for mineral product that has been shipped from Idaho since the bonanza days of Silver City and DeLamar.

The high grade of these tungsten mineral shipments is gratifying from the fact that it is separated from a complex ore carrying a variety of base sulphide minerals. The deposit from which it was derived is a strong quartz fissure vein rather lensey in its nature but varying from a foot up to as much as twenty feet wide and persistent for over 2,000 feet up this steep canyon slope of Patterson Creek in

a formation of silicious schist and slate of pre-cambrian age. The property was equipped several years ago with a concentrating mill of fifty tons daily capacity, which, however, was very poorly designed, but under the present management, the machinery available has been handled to the best advantage with several additions, including flotation cells, and considering the mixed character of the ore available the high grade tungsten mineral shipped is a commendable result.

The principal gangue of the vein is quartz and the tungsten mineral in the mixture of other minerals, which are mostly sulphides, will average low grade, under 2 per cent, but the size and persistency of the veins under the present careful handling of the deposit promises continued profitable results and the probable permanent establishment of a source of tungsten ore from this county, as the tungsten minerals are primary oxides and should go deep.

Other tungsten shipments from Idaho will probably total the amount derived from the Patterson Creek property and are credited to a small prospect on Soldier Mountain, in Blaine County, also to the Golden Winnie Mine, at Murray, in Shoshone County, Idaho, which shipped five tons of high grade sheelite ore, and to the Golden Chest Mine at the same place, which was the largest shipper of high grade sheelite ore from that point, where the mineral occurs sporadically in a pronounced gold bearing white quartz vein in pre-cambrian slate formations, but whose output figures are not available, as the owners of the property refuse to supply the information and act as finicky about it as an old prospector who has accidentally discovered a pocket of rich pay in an old placer district.

Some rich sheelite ore was found and small shipments made by mail from a deposit near Bonners Ferry, in Boundary County, that is said by responsible mining men to have considerable merit. Its development was retarded during the year by litigation troubles, which I am advised, however, have recently been settled and an interesting development of this rarer mineral is in prospect at this point.

In the same vicinity as the sheelite discoveries in Boundary County, an interesting deposit of molybdenite ore of large size was also discovered and is attracting considerable attention. Large size specimens up to several pounds

in weight of clean hubernite ore were discovered in the croppings of a narrow but prsistent quartz vein in granite at Deadwood Basin, in Boise County. The silicious formations of the State, which are considered the most favorable for tungsten, are of such wide spread occurrence as to warrant the anticipation of repeated discoveries and permanent results in the development of this and other rarer minerals.

Besides being a leader in tungsten production Lemhi County bids fair to become the originator from Idaho of cobalt ore shipments through the activity of the Haines-Stellite Company of Kokomo, Indiana, a well known metal firm who have recently started the development of the Beliel Mine, in the Blackbird copper district, which carries a vein five to fifty feet wide of high grade concentrating cobalt.

Cobalt is coming rapidly to the front as a very valuable steel alloy and the demand for it is likely to increase rapidly. In addition to copper and cobalt the Blackbird district also carries in some of its wide disseminated copper sulphide deposits, an average value of ten pounds of nickel to the ton. Lemhi County also contains interesting deposits of stream tin on Panther and Silver creeks, not far from the Blackbird copper district. The constantly advancing values and demand for these rarer minerals has stimulated interest in their search and should prove of material value in the mining progress of this county.

SOIL FOOD IDAHO'S MOST VALUABLE MINERAL RESOURCE.

Little progress was made during the year in the further development of the extensive rock phosphate resources of southeastern Idaho. This lack of interest is attributed to the keen concern of base ore producers to take advantage of current metal markets, as it is known that two of the largest metallurgical institutions of the west are endeavoring to work out a cheap chemical process for the treatment of Idaho rock phosphate to a high grade shipping product, but whose efforts in that direction have been temporarily suspended for the above reason.

The potential value of the phosphate resources of southeastern Idaho, I think, can be demonstrated to be of greater importance to the future industrial progress of the State than all its other great mining values combined.

The population of the United States has increased at the rate of more than a million a year for several decades an increase that will gradually be compounded. The exports of meat and grain of various kinds from this country has fallen off 60 per cent in the past twenty years through the absolute necessity of our domestic demand, and it is only a matter of one or two more decades when the American people will not be able to feed themselves from their present magnificent agricultural area unless a more intelligent use is made of the soil's productive capacity on European lines.

Six southeastern Idaho counties have a government surveyed and geologically estimated resource of high grade rock phosphate exhibited in published bulletins amounting to over two billion six hundred million tons, with only a third of the known phosphate bearing area in Idaho, which has been withdrawn, as yet not surveyed in detail.

I have very good reasons to believe that this State contains fully ten billion tons of high grade rock phosphate and one hundred billion tons of second grade rock phosphate of commercial value. This mineral, where it is extensively mined in Florida and Tennessee, has a spot value of four to five dollars per ton. It forms the basis of an industry at this time, in that part of the United States, that has involved a cash capital investment of three hundred million dollars and makes an annual yield of finished product with a selling value of one hundred and twenty million dollars.

The western phosphate field, whose heart and center is in southeastern Idaho, is the most extensive known in the world, the purest and most free from objectionable mineral mixtures. Its deposits occur as regular, uniform and persistent as the coal veins of Pennsylvania, with scores of miles of outcrops. They are of sedimentary origin, apparently of uniform value—as exhibited by hundreds of government tests and samples—in the desirable mineral contents of phosphorus in the form of bone of phosphate of lime.

This mineral, according to the highest Federal and State authorities in this country, is a master key, the crucial and limiting factor, in the production and growth of all living things, animal and vegetable. Modern experience demon-

strates that after years of crop production, this essential element of soil fertility becomes so depleted through its absorption by plant growth that it must be physically put back in the soil to maintain anything like its virgin productive capacity.

It is further shown that big areas of American virgin soils are primarily deficient in this element. The present average yield of wheat in the United States, for example, is fourteen bushels per acre, and in spite of the fact that more than fifteen per cent of the improved farm area of the United States has been added in the past twenty years. The increase in wheat yield hasn't amounted to one per cent, which is accounted for by the retrograding production of the older sections of the country, including millions of acres of abandoned farm land, due to phosphate exhaustion, that was originally highly productive.

This American yield is a miserable average showing as compared to European standards, where mineral plant foods are extensively used, and does not amount to much over a third of the actual productive capacity of the soil, as proven by decade averages in European countries under much less favorable climatic conditions, and presents a vital question that is worthy of very serious consideration in this country in the matter of preparedness to feed its future expanding population.

It has been demonstrated by practical experiments, extending back as much as sixty years by the older state University experiment stations in this country and in Europe, that it is as necessary for the farmer to feed his soil a balanced ration of plant food as it is to feed his animals in order to obtain the most profitable and maximum results, and it has been further demonstrated by these conservative and unbiased institutions that practically everything is in the farmer's hands or very cheaply available to supply this ration of plant food except phosphorus, and for this reason I argue that this Idaho field must shortly be largely drawn upon to supply the chief item of preparedness for the future of the basic industry of this Nation, which is admittedly agriculture, and these facts should result in giving Idaho an industrial advantage unequaled by any other source of business, as the waning deficiencies in agricultural yield has already been felt west of

the Mississippi River through constant cropping without regard to soil food maintenance.

COAL.

Idaho is suffering more severely at this moment for coal than it ever has at any of the repeated coal famine periods of recent years. The Oregon Short Line Railway Company is doing its best to prevent actual suffering and has succeeded fairly well, but the situation has proven decidedly critical over a large part of the State this winter. The predominant rock formations of Idaho are very largely of a crystalline and non-coal bearing nature.

Some limited patches of low grade lignite coal that are barely of commercial value by reason of their excessive ash contents are scattered over the tertiary formations of the valley borders of the State, but none of these have proven of material value so far.

We have, however, a limited area of the most productive coal bearing formations of Wyoming extending a short distance across the State line in Teton County, and in these formations of cretaceous age, at Horseshoe Creek, 12 miles from the railway at Driggs, some interesting deposits of clean, high grade bituminous coal have been partially developed on several workable veins that vary from three to ten feet thick and that are as clean and free from bone and carry as high an average analysis according to government geological survey tests, as Castle Gate, Sunnyside, Kemmerer or Rock Springs coals.

These veins are in the hands of local Idaho people, who are unable to push their development to a point that would warrant the construction of a railway spur, which has already been surveyed to the mine dump by the Short Line Company. At present these prospects carry over 3,000 feet of underground development at a maximum depth of 200 feet and are producing from two to five hundred tons of coal a month this winter, which is sold to the farmers of the tributary region, who haul it away in their wagons and sleighs at a cost to them that has averaged, for the past ten years, about \$3.00 per ton.

These deposits have been carefully examined and reported on by one of the ablest engineers and geologists in the country, and they are believed by that authority to

contain a resource of between four and five million tons of coal within 500 feet of their surface outcrop on a patented area of 1,000 acres.

There are eighteen pitching veins in a close parallel series about one-half a mile with a proven length of two miles. They vary from a few inches up to a maximum thickness of ten feet. They are somewhat disturbed by faulting, which, however, does not injure the quality of the coal, and these deposits present fine opportunity for co-operative Idaho coal mining enterprise. They can be bought cheap and are worth the serious consideration of a competent and honest promoter of such a venture, as the present development is sufficient to practically guarantee profitable results for years to come on the necessary capital required to purchase the mine and put the deposits in shape for quite a large production, which their present development seems to warrant, and which would afford an immediate local market of very considerable capacity and would be available to materially relieve such coal famine conditions as are now prevailing in Idaho.

CONCLUSIONS.

The foregoing review of mining conditions in Idaho isn't intended to specifically endorse any mining investment. The information is gathered personally and from the most reliable sources available, and is intended as an encouragement to the development of the primary mineral resources of the State. This department has no money available to cover the cost of printing a more full report, which will account for the briefness of this issue and the fact that it leaves out a good many promising properties and districts in the State that are worthy of considerable detailed review in this connection.

The statistical figures used are reasonably accurate for most of the large producers, but small and scattered producers are difficult to communicate with in time for this purpose and estimates have to be made in that connection in rounding out the figures. The total values are based on the total gross contents of the mineral shipped from the mines and not on the net returns received by the operators for the mineral. This is a custom that is warranted from the fact that the bulk of the gross metal contents of

ore ultimately find their way into commerce and do somebody some good, and it is believed the losses in smelting charged against the producer are not nearly so serious as he is charged with and are, to a considerable extent, made up by the recovery of by-product values that are not paid for in smelting ore contracts. County production credits may be in error in some instances on account of the repeated changes in county lines. Last year the production of the Wilbert lead mine was credited to Fremont county. The best State map available this year puts it well within Blaine county, and next year it will probably be in Butte County.

METAL PRODUCTIONS FOR 1916 BY COUNTIES.

ADA COUNTY.

Gold, fine oz., 550.....	\$	11,000 00
Silver, fine oz., 278.....		180 00
		11,180 00
Total value	\$	11,180 00

ADAMS COUNTY.

Gold, fine oz., 350.....	\$	7,000 00
Silver, fine oz., 1,500.....		984 00
Copper, lbs., 150,000.....		40,000 00
		48,784 00
Total value	\$	48,784 00

BONNEVILLE COUNTY.

Gold, fine oz., 227.....	\$	4,540 00
Silver, fine oz., 44.....		29 00
Total value	\$	4,569 00

BLAINE COUNTY.

Gold, fine oz., 1,500.....	\$	30,000 00
Silver, fine oz., 125,000.....		82,075 00
Lead, lbs., 4,100,000.....		280,850 00
Zinc, lbs., 700,000.....		89,600 00
Copper, lbs., 40,000.....		10,880 00
		493,405 00
Total value	\$	493,405 00

BOISE COUNTY.

Gold, fine oz., 19,318.....	\$	386,360 00
Silver, fine oz., 15,422.....		10,126 00
Lead, lbs., 125,000.....		8,562 00
Zinc, lbs., 80,740.....		10,334 00
Copper, lbs., 14,725.....		4,005 00
		419,387 00
Total value	\$	419,387 00

BONNER AND BOUNDARY COUNTIES.

Gold, fine oz., 539.....	\$	10,780 00
Silver, fine oz., 89,000.....		58,437 00
Lead, lbs., 1,950,000.....		133,575 00
Copper, lbs., 35,000.....		9,520 00
		212,312 00
Total value	\$	212,312 00

CANYON COUNTY.

Gold, fine oz., 67.....	\$	1,340 00
Silver, fine oz., 9.....		5 00
		1,345 00
Total value	\$	1,345 00

CLEARWATER COUNTY.

Gold, fine oz., 1,700.....	\$	34,000 00
Silver, fine oz., 270.....		177 00
Total value	\$	34,177 00

CUSTER COUNTY.

Gold, fine oz., 2,938.....	\$	58,760 00
Silver, fine oz., 185,039.....		121,496 00
Lead, lbs., 1,200,000.....		82,200 00
Copper, lbs., 5,997,0000.....		1,631,184 00
Total value	\$	1,893,640 00

ELMORE COUNTY.

Gold, fine oz., 11,800.....	\$	236,000 00
Silver, fine oz., 6,244.....		4,099 00
Total value	\$	240,099 00

FREMONT COUNTY.

Gold, fine oz., 125.....	\$	2,500 00
Silver, fine oz., 1,400.....		919 00
Lead, lbs., 75,000.....		5,337 00
Copper, lbs., 50,000.....		13,600 00
Total value	\$	22,356 00

IDAHO COUNTY.

Gold, fine oz., 4,841.....	\$	96,820 00
Silver, fine oz., 2,200.....		1,444 00
Total value		98,264 00

LEMHI COUNTY.

Gold, fine oz., 5,887.....	\$	117,740 00
Silver, fine oz., 303,000.....		198,949 00
Lead, lbs., 12,999,000.....		890,431 00
Copper, lbs., 120,000.....		32,640 00
Tungsten, lbs., 60,000.....		45,750 00
Total value	\$	1,285,480 00

OWYHEE COUNTY.

Gold, fine oz., 550.....	\$	11,000 00
Silver, fine oz., 21,000.....		13,788 00
Total value	\$	24,788 00

SHOSHONE COUNTY.

Gold, fine oz., 2,600.....	\$	52,000 00
Silver, fine oz., 11,454,680.....		7,521,142 00
Lead, lbs., 346,145,000.....		23,710,932 00
Zinc, lbs., 97,920,000.....		12,533,760 00
Copper, lbs., 1,646,000.....		447,720 00
Tungsten, lbs., 60,000.....		45,750 00
Total value	\$	44,311,304 00

TWIN FALLS COUNTY.

Gold, fine oz., 87.....	\$	1,740	00
Silver, fine oz., 46.....		29	00
Total value		\$	1,769 00

TOTALS FOR STATE.

Gold, fine oz., 53,079.....	\$	1,061,580	00
Silver, fine oz., 12,205,132.....		8,013,889	00
Lead, lbs., 366,594,000.....		25,111,689	00
Zinc, lbs., 98,700,740.....		12,633,694	00
Copper, lbs., 8,052,725.....		2,190,341	00
Tungsten, lbs., 120,000.....		91,500	00
Gross total for 1916.....		\$	49,102,693 00
Gross total for 1915.....			39,315,312 00
Increase		\$	9,787,381 00

ANNUAL METAL OUTPUT FOR IDAHO SINCE 1898.

TOTAL FOR THE STATE FOR THE YEAR 1898.

Gold, fine oz., 91,698.....	\$ 1,895,566 00
Silver, fine oz., 5,256,700.....	3,654,020 00
Lead, lbs., 122,479,275.....	4,899,171 00
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Total	\$ 10,448,757 00

TOTAL FOR THE STATE FOR THE YEAR 1899.

Gold, fine oz., 75,054.....	\$ 1,550,958 00
Silver, fine oz., 4,480,174.....	2,688,105 00
Lead, lbs., 86,449,506.....	3,760,553 00
Copper	60,000 00
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Total	\$ 6,059,616 00

TOTAL FOR THE STATE FOR THE YEAR 1900.

By direct shipment:

Gold, fine oz., 102,782.....	\$ 2,124,603 94
Silver, fine oz., 4,324,133.....	2,534,480 00
Lead, lbs., 96,425,500.....	3,857,020 00
Copper	35,000 00
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Total	\$ 8,551,103 94
Through the U. S. assay office.....	1,699,760 22
Estimated from other sources.....	1,000,000 00
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Total	\$ 11,250,864 16

TOTAL FOR THE STATE FOR THE YEAR 1901.

Gold, fine oz., 110,228.....	\$ 2,280,422 76
Silver, fine oz., 3,305,154.....	1,983,092 00
Lead, lbs., 65,967,000.....	2,638,680 00
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Total	\$ 6,902,194 76

TOTAL FOR THE STATE FOR THE YEAR 1902.

Gold, fine oz., 119,363.....	\$ 2,467,233 21
Silver, fine oz., 5,259,778.....	3,655,866 80
Lead, lbs., 119,223,000.....	4,172,805 00
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Total	\$ 10,295,905 01

TOTAL FOR THE STATE FOR THE YEAR 1903.

Gold, fine oz., 92,938.42.....	\$ 2,085,993 76
Silver, fine oz., 7,224,021.58.....	4,338,412 60
Lead, lbs., 220,857,956.....	9,386,213 13
Copper, lbs., 2,524,000.....	336,954 00
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Total	\$ 16,143,573 49

TOTAL FOR THE STATE FOR THE YEAR 1904.

Gold, fine oz., 84,461.89.....	\$ 1,845,282 08
Silver, fine oz., 8,284,639.12.....	4,970,783 40
Lead, lbs., 226,261,728.....	9,729,425 86
Copper, lbs., 5,422,007.05.....	704,860 91
Total	\$ 17,250,898 25

TOTAL FOR THE STATE FOR THE YEAR 1905.

Gold, fine oz., 60,515.91.....	\$ 1,250,863 85
Silver, fine oz., 7,626,795.55.....	5,196,270 51
Lead, lbs., 260,791,456.00.....	12,257,198 43
Copper, lbs., 6,661,400.00.....	1,025,189 46
Zinc, lbs., 2,174,960.00.....	127,887 89
Total	\$ 19,876,409 89

TOTAL FOR THE STATE FOR THE YEAR 1906.

Gold, fine oz., 58,762.32.....	\$ 1,214,617 15
Silver, fine oz., 9,136,860.73.....	6,071,443 96
Lead, lbs., 255,966,083.00.....	14,487,680 30
Copper, lbs., 11,640,565.00.....	2,252,449 32
Zinc, lbs., 1,477,000.00.....	91,426 30
Antimony, lbs., 90,000.....	20,700 00
Total	\$ 24,138,317 03

TOTAL FOR THE STATE FOR THE YEAR 1907.

Gold, fine oz., 66,426.29.....	\$ 1,373,031 40
Silver, fine oz., 8,491,356.13.....	5,546,553 82
Lead, lbs., 234,404,920.....	12,4703,41 74
Copper, lbs., 10,847,905.....	2,241,177 17
Zinc, lbs., 9,192,551.....	534,087 21
Total	\$ 22,165,191 34

TOTAL FOR THE STATE FOR THE YEAR 1908.

Gold, fine oz., 68,145.16.....	\$ 1,409,992 97
Silver, fine oz., 7,660,507.38.....	4,407,811 63
Lead, lbs., 207,998,499.....	8,764,485 35
Copper, lbs., 10,110,506.....	1,336,608 89
Zinc, lbs., 64,000.....	3,020 80
Total	\$ 15,561,131 64

TOTAL FOR THE STATE FOR THE YEAR 1909.

Gold, fine oz., 70,898,938.....	\$ 1,465,481 05
Silver, fine oz., 7,039,451.20.....	3,625,317 40
Lead, lbs., 217,594,679.....	9,356,571 20
Copper, lbs., 7,759,886.00.....	1,034,651 50
Zinc, lbs., 1,906,200.00.....	104,841 00
Total	\$ 15,606,862 00

TOTAL FOR THE STATE FOR THE YEAR 1910.

Gold, fine oz., 49,289.22.....	\$ 1,018,808 26
Silver, fine oz., 7,890,388.....	4,268,813 00
Lead, lbs., 239,144,570.00.....	10,761,057 70
Copper, lbs., 5,837,639.00.....	753,055 40
Zinc, lbs., 5,995,600.00.....	33,513 60
Total	\$ 17,135,695 90

TOTAL FOR THE STATE FOR THE YEAR 1911.

Gold, fine oz., 66,927.11.....	\$ 1,375,068 22
Silver, fine oz., 8,592,400.00.....	4,579,621 15
Lead, lbs., 274,492,873.....	12,225,912 56
Copper, lbs., 3,962,060.....	502,488 67
Zinc, lbs., 10,087,600.....	386,593 94
Total	\$ 19,270,212 00

TOTAL FOR THE STATE FOR THE YEAR 1912.

Gold, fine oz., 69,300.10.....	\$ 1,432,434 00
Silver, fine oz., 8,238,971.....	5,011,766 00
Lead, lbs., 296,054,813.....	13,233,650 00
Copper, lbs., 7,392,280.....	1,224,161 00
Zinc, lbs., 16,243,840.....	1,127,316 00
Total	\$ 22,029,327 00

TOTAL FOR THE STATE FOR THE YEAR 1913.

Gold, fine oz., 67,792.....	\$ 1,450,531 50
Silver, fine oz., 10,163,205.....	6,044,925 11
Lead, lbs., 318,377,280.....	13,907,447 04
Copper, lbs., 8,627,242.....	1,316,509 20
Zinc, lbs., 30,271,323.....	1,707,352 62
Total	\$ 24,572,396 47

TOTAL FOR THE STATE FOR THE YEAR 1914.

Gold, fine oz., 62,238.....	\$ 1,286,459 46
Silver, fine oz., 13,621,123.....	7,412,378 77
Lead, lbs., 345,334,106.....	13,426,086 23
Zinc, lbs., 49,239,000.....	2,166,351 90
Copper, lbs., 5,178,000.....	685,430 00
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	\$ 39,315,312 00

TOTALS FOR THE STATE FOR THE YEAR 1916.

Gold, fine oz., 53,079.....	\$ 1,061,580 00
Silver, fine oz., 12,205,132.....	8,013,889 00
Lead, lbs., 366,594,000.....	25,111,689 00
Zinc, lbs., 98,700,740.....	12,633,694 00
Copper, lbs., 8,052,725.....	2,190,341 00
Tungsten, lbs., 120,000.....	91,500 00
	<hr/>
Gross total for 1916.....	\$ 49,102,693 00
Gross total for 1915.....	39,315,312 00
	<hr/>
Increase	\$ 9,787,381 00
Total output of all metals for the past 19 years since state records were kept.....	\$372,102,062 00
Total output for preceding 38 years (estimated).....	381,315,312 00
	<hr/>
Grand total for 56 years.....	\$753,417,374 00

INDEX.

	Page
Introduction	3
Men employed and accident results.....	4
Fatalities in Idaho metal mines during 1916.....	6-11
Employees liability law.....	11
Gasoline underground	14
Mineral exhibit	15
State Geological Survey.....	16
Mining progress review.....	19
Faulting troubles	20
Zinc ore resources.....	21
Ray Jefferson mine.....	23
North Star mine.....	24
South Mountain zinc.....	25
Idaho-Continental and other mines.....	26
Gilmore district	26
Mackay district lead discoveries.....	27
Antelope district	28
Eruptive granite lead ore deposits.....	28
Idaho copper resources.....	29
Empire Copper Company.....	29
Copper Basin mines.....	29
Blackbird copper district.....	30
Shoshone County copper.....	30
Gilmore district	31
Seven Devils copper.....	31
Gold mining development.....	32
Boulder Creek	32
Boulder Creek Company.....	32

Mammoth group	33
Mineralogy and Geology, Boulder Creek district.....	33
Silver City mines.....	33
Old Atlanta district.....	34
Monarch-Buffalo mines.....	34
Gold Hill & Iowa mines.....	35
Banner mine	36
Lucky Boy mine.....	37
Boston-Idaho Dredging Co.....	37
Marshall Lake district, Holt mine.....	38
Kimberly and other mines.....	38
Janson mine	39
Tungsten & Cobalt.....	40-42
Phosphate, soil food resources.....	42
Coal	42
Conclusions	46
Metal production by counties.....	47-49
Total annual output figures since 1898.....	50-53