

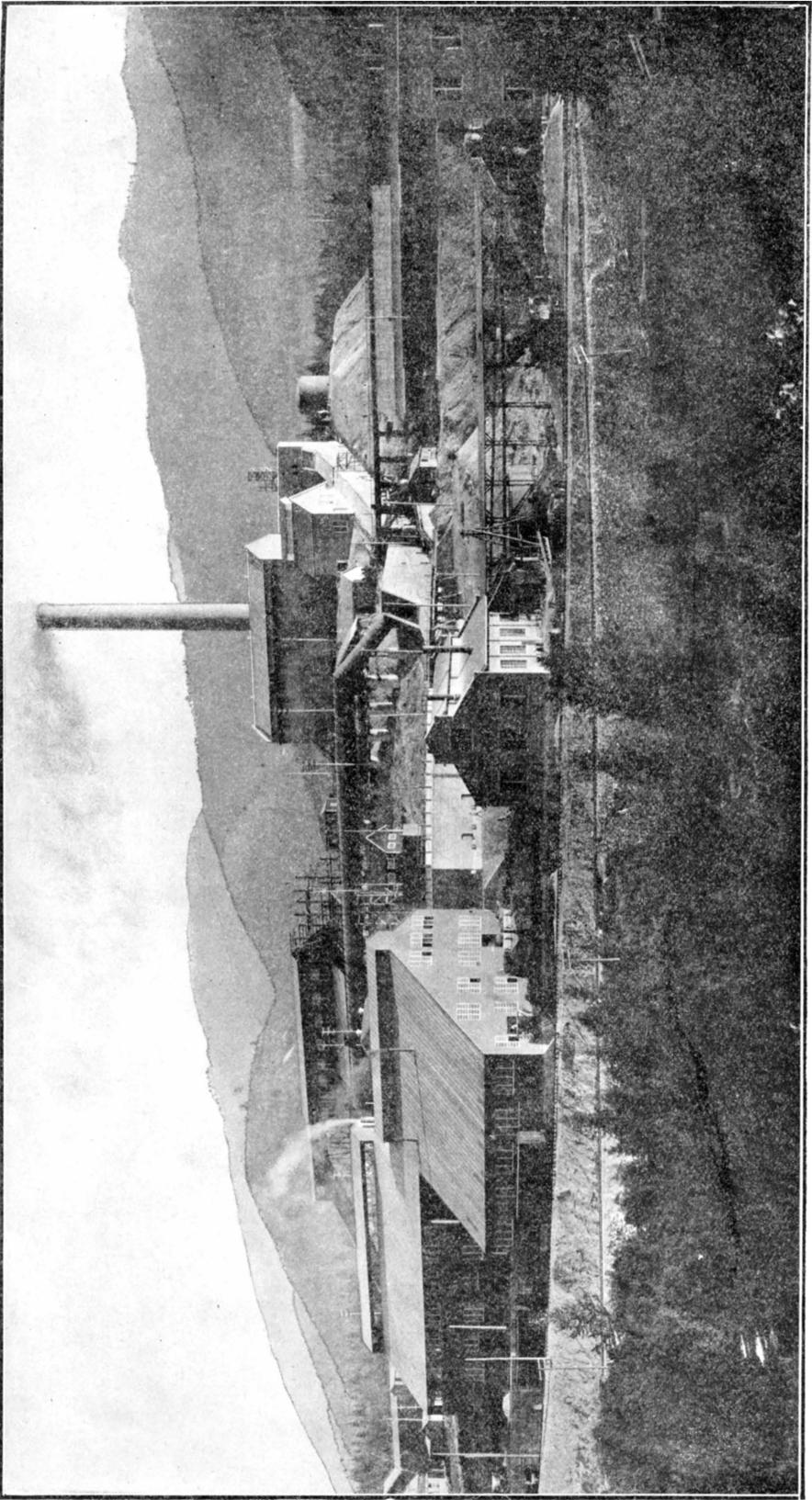
## **Notes about this document**

20181121 William Schuster, Idaho Geological Survey

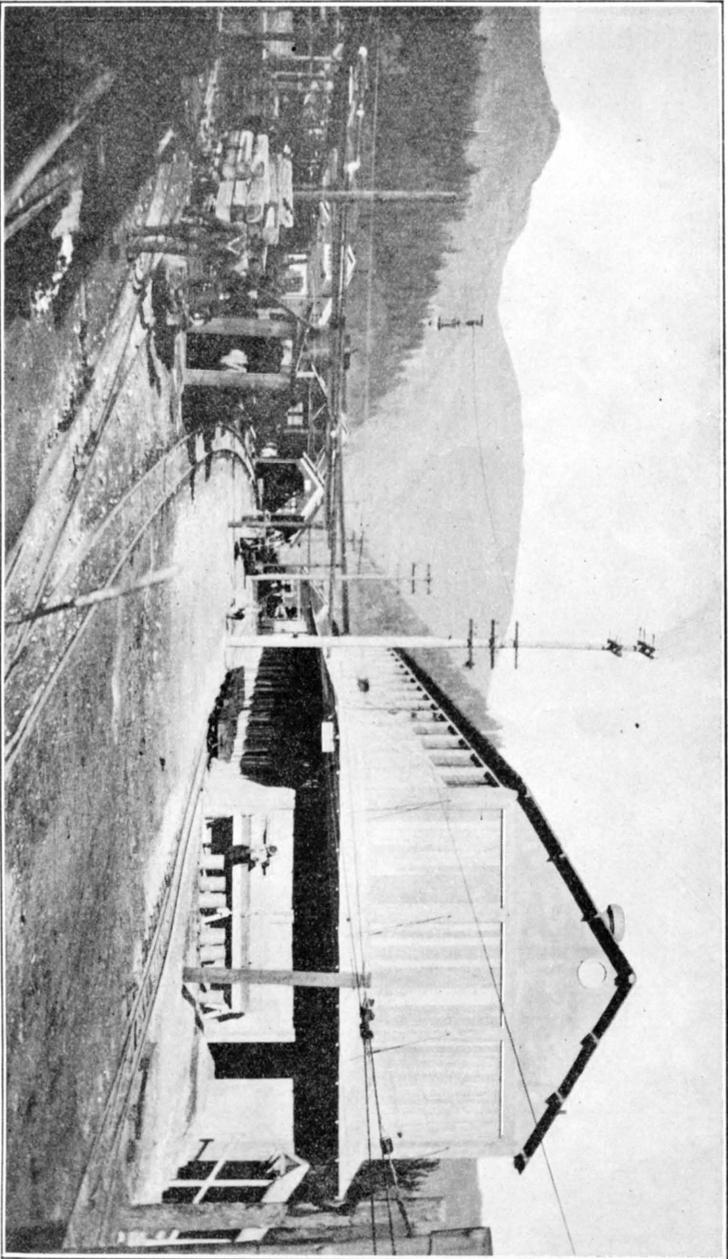
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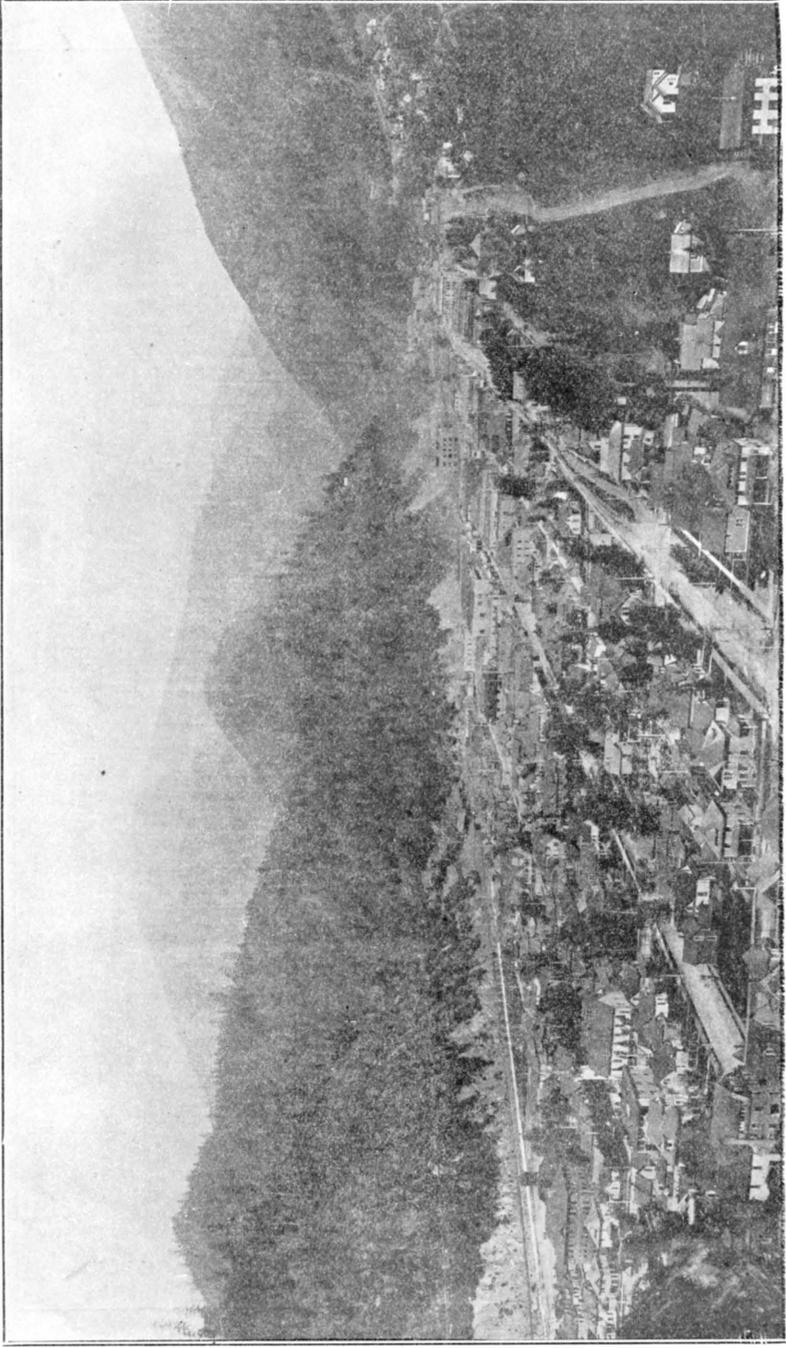




BUNKER HILL & SULLIVAN NEW SMELTER AND REFINERY NEAR KELLOGG



MODERN MINERS' DRY, KELLOGG TUNNEL, BUNKER HILL & SULLIVAN MINE



WALLACH, IDAHO, BUSINESS CENTHR CORUR D'ALENES

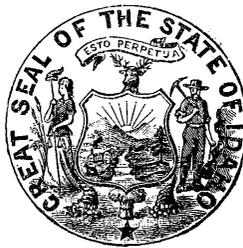
Twentieth Annual Report

OF THE

**Mining Industry**  
**of Idaho**

FOR THE YEAR

**1918**



ROBERT N. BELL, *State Mine Inspector*

BOISE, IDAHO, *January 1, 1919.*

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, 1918.

ROBERT N. BELL,  
*State Inspector of Mines.*

# INTRODUCTION.

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Various causes, due to both the war and natural conditions, seriously retarded mineral production from Idaho mines during 1918, starting in the early month of the year, when very severe floods in the Coeur d'Alene district seriously interrupted railway transportation for two or three weeks and partially destroyed several miles of track on two important branch railroads, one under construction up Pine Creek and the upper end of the North Fork branch, both feeders to the Oregon-Washington Railway and Navigation Company.

The slack market for zinc ore, and the extreme scarcity of labor, especially good miners, together with Flu troubles and the sudden collapse of the lead market in December, resulted in a decided decrease in total mineral yield for the year which aggregated, in gross metal contents, according to the Company estimates furnished to this Department, as follows:

Lead, lbs.....	290,848,425	
Silver, ozs.....	9,572,214	
Zinc, lbs.....	51,691,000	
Copper, lbs.....	5,240,400	
Gold, ozs.....	36,307	
Total gross value.....		\$37,320,000

These figures compare with the record output of 1917, as follows:

Lead, lbs.....	395,000,000	
Silver, ozs.....	12,496,000	
Zinc, lbs.....	96,000,000	
Copper, lbs.....	7,282,000	
Gold, ozs.....	53,000	
Total gross value.....		\$56,292,210

Results which were closely approximated in the two preceding years of 1915 and 1916.

Several of the big mines were operated with greatly reduced crews, due to the army drafts, enlistments and war

industries, which were directly responsible for a decided shortage of competent labor which extended through the whole range of employes, especially miners and timbermen, but also including mechanical and technical operatives, who responded nobly to the call of the government for army and war industrial workers.

As a result of this decided shortage of available labor, and excessive cost of mine supplies, dead work development progress suffered seriously in the big mines and new development enterprises were largely at a standstill. The labor shortage has been progressive since the European War started and the big mines of the Coeur d'Alene district, during that period, have been largely operated on proven ore resources which was made possible through a wise policy of advanced development inaugurated years ago.

It is gratifying to state that our big lead-silver mines have weathered through this severe and persistent war draft on their resources handsomely what dead work has incidently been accomplished during the period, particularly during 1918, has shown some marked results in continued ore expansion and evidence of deep-seated permanency and some instances of expanding capacity for ore production.

With returning soldiers and war industry workers, together with the sudden drop in lead values, immediately after the armistice was signed, which continued to recede to the end of the year, together with the still prevailing high operating costs, the labor situation has not only eased up but men are available in excess of requirement and the industry is decidedly upset, with a glutted market for lead metal, curtailment of output was necessary and the reconstruction period is likely to involve sacrifice of a rather serious nature of all interests involved in the industry, including employer, employe and contingent community business.

Lead has been the chief metal value produced in this State for a number of years, in which respect Idaho ranks second only to Missouri in its annual production and has maintained that position for twenty years. If the reconstruction period of the country at large to normal business conditions can be sanely accomplished, our Coeur d'Alene district, from its present known ore resources, can con-

tinue to be relied upon to maintain the high standing of the State as a producer of lead-silver mineral for years to come. The present curtailment of output, necessitated by the over-supply of metal, is a wise procedure, as to continue to push the metal on the market at the capacity of our big mines, would simply result in pushing the price to still lower levels. The future of lead metal, in my opinion, is sound. The world is short of lead for its normal progress as important sources of lead ore are of rarer occurrences in the world at large than those of any of the other common commercial metals. One of the principal outlets for lead in commerce is through the medium of pigments for paint and other uses, which in normal times absorbs, I am reliably advised, fully fifty per cent of the total output of the country, but for paint purposes lead oxide had to be mixed with a fairly rich proportion of linseed oil, and the price of linseed oil, at the present time, is almost prohibitive for this use, being approximately 500 per cent above normal, pre-war figures.

If this essential associated element of paint returns to a rational figure, the painting industry of the world at large, particularly of Europe and of this country, according to past records, could absorb the lead production of all our mines for a considerable period to catch up with its previously established consumption for this purpose.

This is a point where the agricultural industry shows a combined association and contingent influence on the mineral industry and presents a fit subject for our National agricultural authorities to consider in the stimulation of the cultivation and production of flax seed from which this desirable vegetable oil is made and for which there seems to be no substitute.

#### Men Employed.

According to the best figures obtainable at this date there were 4,500 men employed in the Idaho mining industry during the year 1918, which embraces both underground and surface workers, which are divided in an approximate ratio of two-thirds underground and one-third surface operatives, including mill and metallurgical plants. Wages ruled high through the year but there was such a demand for men and such a poor supply that efficiency

suffered seriously and the turn-over of labor was enormous. Many of the workers seemed to be indifferent to the opportunity offered by the high wages prevailing and were satisfied with a stake of \$50.00 to \$75.00 which they could earn in ten to fifteen days, and a great deal of shifting of employes prevailed through the year, as jobs were plentiful and it was no trouble to get employment.

Mining attracts vigorous, adventurous young men and most of our mining centers responded nobly to the patriotic calls of the Government to the army, navy, shipbuilding and the various drives for financing the war activities. Shoshone County was particularly responsive in manpower, which proved to be a heavy drain on the mines of their most effective operatives. The most effective operatives remaining were the married men and older employes not subject to the war draft, but decidedly subject to the sacrifice due to the war, in the prevailing high cost of living. The extensive turn-over of labor during the year, with an excess of wanderlust, short time workers, unfamiliar with their immediate surroundings, doubtless had some effect on the accident occurrences, and one incipient strike occurred at Mullen which was believed to have been agitated by outside influences, as the bulk of the men employed were contract workers and earning the biggest pay in the district at the time.

The total number of men employed in the mining industry of Idaho during 1918 aggregated 4,500 full time workers, including both surface and underground men, representing a total of 1,642,500 days worked.

The total number of fatal accidents occurring during the year aggregated 19, as compared to 24 in 1917, which represents a proportionate loss of 4.22 men per thousand employed, or one man lost for 86,447 shifts worked, the highest ratio since records have been kept. A classification and a brief review of the causes of the fatal accidents are as follows:

**Fatalities at Metal Mines in the State classified by cause for the year ending December 31, 1918.**

CAUSE	Foremen and assistants	Miners and helpers.	Muckers and trammers	Timbermen.	Other mine labor.	Total fatalities.
1. Fall of rock or ore from roof or wall		3	1			4
2. Rock or ore while loading at working face or chute.						
3. Timber or hand tools				3		3
4. Explosives		2				2
5. Haulage system			1			1
6. Falling down chute, winze, raise or stope.						
7. Run of ore from chute or pocket						
8. Drilling accidents						
9. Electricity			1			1
10. Machinery (other than locomotives or drills)						
11. Mine fires						
12. Suffocation from natural gases						
13. Inrush of water						
14. Nails, splinters, etc.		1				1
15. Other causes					1	1
Total number killed underground						
16. Falling down shafts				1		1
17. Objects falling down shafts.						
18. Breaking of cables						
19. Overwinding		1	1			2
20. Skip, cage, or bucket						
21. Other causes						
Total number killed by shaft accidents						
22. Mine cars or mine locomotives, gravity or aerial trams						
23. Railway cars and 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						
30. Other causes						
Total number killed on surface (shops and power plants)						
31. Falls or slides of rock or ore						
32. Explosives						
33. Haulage system					1	1
34. Steam shovels						
35. Falls of persons						
36. Falls of derricks, booms, etc.						
37. Run or fall of ore in or from ore bins						
38. Machinery (other than 33 and 34)						
39. Electricity						
40. Hand tools						
41. Other causes, smaller machinery	1					1
42. Mill machinery	1					1
Total number killed by open-pit accidents						
Grand total						19
Number employed in each occupation	Underground, 3,000. Surface, 1,500.					

The serious, non-fatal and minor accidents reported for the year that have come to this department aggregates as follows:

Serious accidents involving time lost to victim of more than 14 days.....	485
Minor injuries involving a loss of time to victim of 1 to 14 days.....	663

Details of the fatal accident causes were as follows:

On February 25th, Stanly A. Hill, age 29, and married, employed as foreman at the Black Cloud mill of the Hecla Company, came to his death by becoming entangled in moving machinery. It is presumed that his clothing caught in the end of a shaft and produced injuries which resulted in his death.

On March 12th, at the Hecla Mine, at Burke, John Tuominan, 47 years old, a single man, employed as a miner, came to his death through a fall of rock while drilling in closely timbered stope, causing injuries which resulted in his death a few hours later.

On March 18th, at the Morning Mine, at Mullan, O. K. Olson, age 34, a single man, was electrocuted by accidentally getting his shoot bar in contact with a 250 volt trolley wire current which was properly guarded with inverted boxes opposite the shoot at which he was working. This current had been reduced by new and separate plant from 550 to 250 volts a year previous in all the shaft levels of this mine and was considered reasonably safe against such an occurrence.

On March 30th, Richard Scott, age 59, employed as a miner on the Bonham lease at Wardner, was killed by a small fall of ground.

On April 8th, Edwin Hutchinson, a married man, while working in the Mayflower Mine, injured his index finger by a sliver of wood which resulted in blood poisoning and caused his death in less than a month. This is a conspicuous example of why minor accidents should be reported immediately by the victim as their neglect sometimes proves fatal.

On June 27th, M. I. Wagner, age 38, a married man, employed as a nipper and timberman's helper at the Morning

Mine at Mullan, a man of nine years' experience, while hoisting steel into the 1,600 stope at the 28th raise was standing below the open timber slide when some small object was knocked into the slide from one of the floors above and struck him on the head, fracturing his skull, which caused his death.

On July 1st, Jens Hatle, 43 years of age, and married, a timber worker in the employ of the Bunker Hill & Sullivan Mine at Mullan, while unloading stulls, noticed some empty cars starting to move, and with heroic concern, fearing they might run away on the adjacent steep grade and endanger the passenger train on the main line, which was about due, jumped on the moving cars, set two of the brakes and was setting the third one when the cars struck the derailing switch near the main line, wrecking the car on which the victim was standing, causing his sudden death.

On July 20th at the Hecla Mine at Burke, V. B. Miller, age 42, and single, employed as a shoveler, while being lowered in cage with a double deck load of men, a projecting obstruction punctured the bottom of the cage, tearing out the safety door and throwing the deceased into the timbers. This shaft is inspected daily from top to bottom by men employed for this purpose, and it is believed that the obstruction was caused by a rock spilled from the previous skip hoisting operation. The obstruction was a three-inch lagging board and ordinarily the weight of the cage and its load should have splintered it without doing any damage, but it happened to strike end on and projected through the cage bottom. Careful inspection of the shaft subsequent to this accident revealed no other point of similar weakness, but the management are going over the whole structure with repairs to avoid similar hazards.

On August 14th, at the Bunker Hill & Sullivan Smelter, Joseph Rust, 52 years of age, and single, while oiling machinery noticed a defective belt and called to his assistant to stop that unit, but in the meantime was struck by the loose belt and knocked to the floor below, receiving injuries which caused his death.

On August 25th, Frank W. Wilcox, 61 years of age, a married man, employed as a teamster at the Vienna-Consolidated Mine at Vienna, Blaine County, while driv-

ing the team near the old Vienna mill, a mile from the mine, jumped or fell from the runaway team and broke his neck and was found dead in the road shortly afterwards.

On August 27th, at the Ambergris Mine, near Burke, John A. Johnson, age 33, and single, employed as a mucker and motorman's helper, was crushed between a loaded car of ore and the wall of the drift in which he was working. He had signalled the motorman to back up a short train of cars to couple onto an extra. The movement of the train for this purpose was only about thirty feet and after giving the motorman the signal to back up he apparently jumped on the bumper of the car to ride this thirty feet and was caught between the car and the wall of the drift and badly crushed, causing his instant death.

On September 9th, at the Hercules Mine, near Burke, W. H. Brusie, age 37, and married, working as a miner, together with E. M. Wright, age 25, and married, also employed as a miner, were both instantly killed on the seventh floor stope face in the East 400 sub-level by a premature explosion of powder evidently when trying to remove an unexploded charge from an old boot-leg. The men were both working on a Leyner machine which was set up on the bar when the accident happened, but not lined up for the hole that exploded.

On September 9th, at the Empire Copper Mine, at Mackay, Gus Janisch, a single man, and employed as a timberman, fell down a 200 foot vertical shaft and was instantly killed. Janisch was engaged in some repair work at the collar of this underground shaft and was alone when the accident happened. He had sent his helper in another drift to get some tools; when the helper returned his carbide lamp was still burning and hanging on the guard rail of the shaft, which was in place. Janisch had acted queerly for several days prior to the accident; had taken the war seriously to heart and had previously given the superintendent his money and valuables to take care of. The coroner's jury found that Janisch had either accidentally or intentionally met death by falling down the shaft.

On September 12th, at the Morning Mine, at Mullan, John Madronich, a timberman's helper, 40 years of age, and single, while landing a seventeen inch cap ten feet long on the eighteenth floor of the 1,600 East stope, was struck

in the head by a three inch block fifteen inches long and seven inches wide, that was knocked into the slide from above, which caused the fracture of his skull from which he died on September 17th. This was probably due to carelessness by leaving the block too close to the timber slide which it was accidentally knocked into from one of the floors above.

On October 18th, at the Hecla Mine, at Burke, Fred L. Helm, a single man, 42 years of age, employed as a timberman's helper, while assisting his partner in baring down some loose ground preparatory to placing a set of timbers and while holding a light for his partner, a rock fell from the back on Helm, causing injuries which resulted in his death.

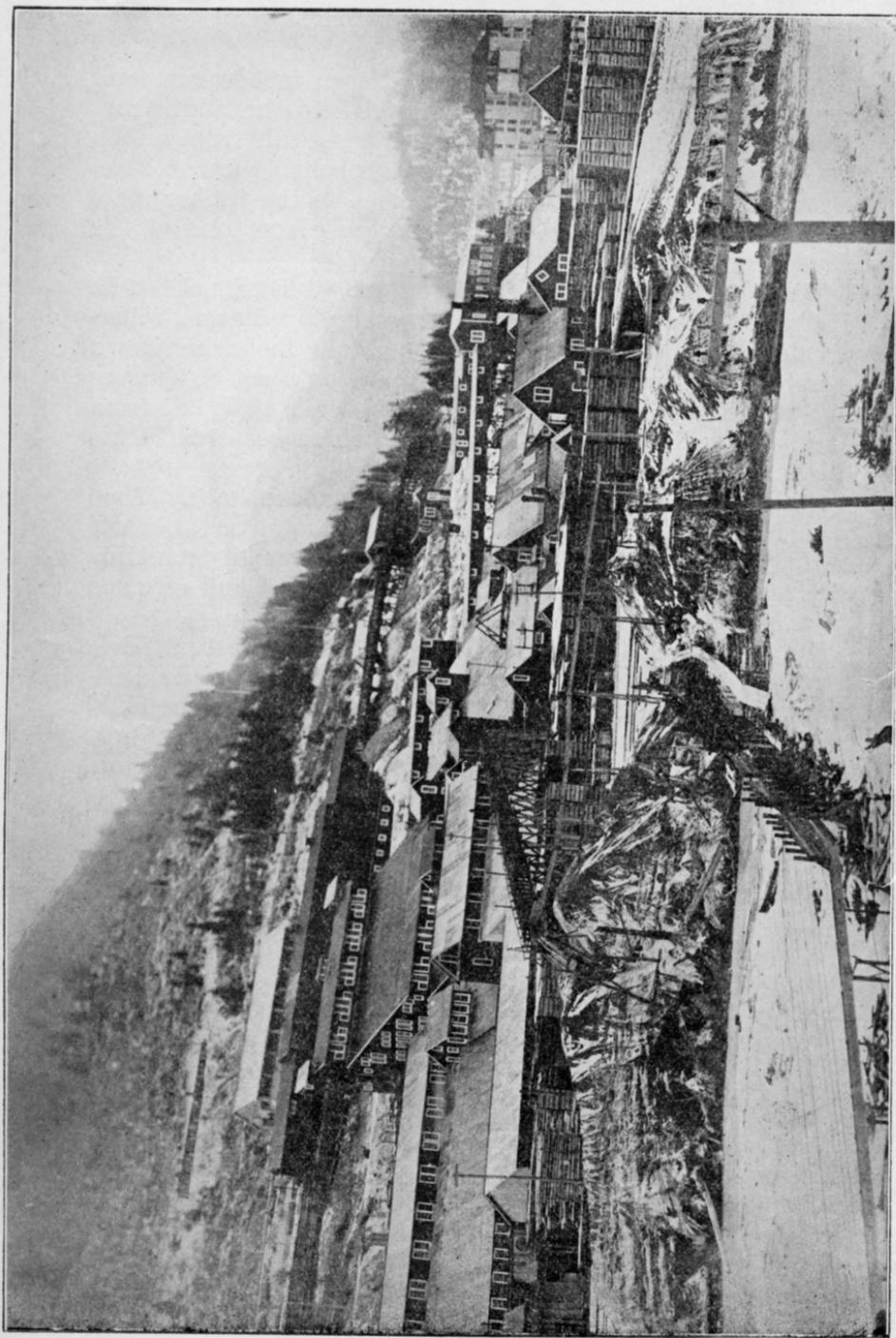
On November 17th, at the Coeur d'Alene Antimony Mine, near Kellogg, Arthur F. Hauter, age 48, and married, while riding to the surface on a skip in the Company's incline shaft, was pinched between the skip and shaft and received injuries which resulted in his death.

On December 4th, at the Success Mine, at Sunset, Eric Carlson, 51 years of age, an experienced miner, while drilling with a stoping machine from the third floor of the 1,400 stope, which was timbered within five feet of the back, loosened a block of ground weighing about half a ton, which fell and injured him internally, resulting in his death at the Wallace hospital shortly afterwards.

On December 28th, at the Bunker Hill & Sullivan Mine, at Kellogg, Frank Prusuak, a mucker, was injured by a small fall of ground in one of the stopes, which resulted in his death. This accident breaks a remarkable record of immunity from underground fatalities, in the main operations of this mine, extending back nearly four years with a crew varying from 300 to 400 men employed all the time.

#### STRIKE AT MULLAN.

For the first time since 1898 incipient labor troubles developed in the Coeur d'Alenes. During the summer, on July 31st, the men employed at the Morning and Gold Hunter Mines, embracing 138 of the crew at the Morning property and 90 men at the Gold Hunter, went out on a strike without previous notice to the foremen in charge, with a demand for a change in working conditions, prin-



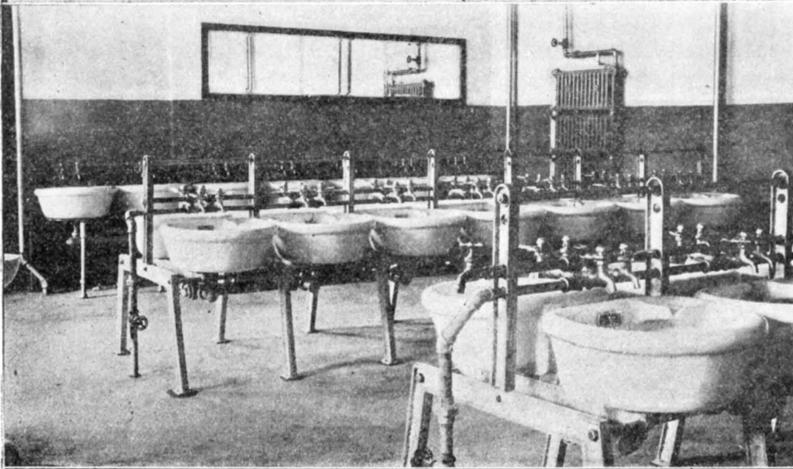
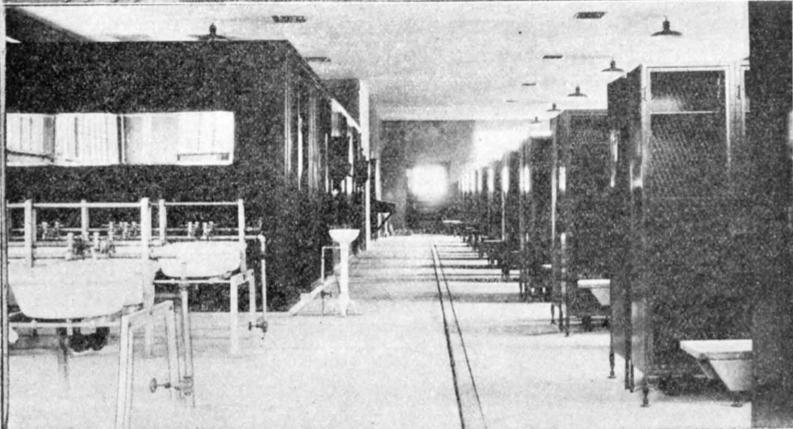
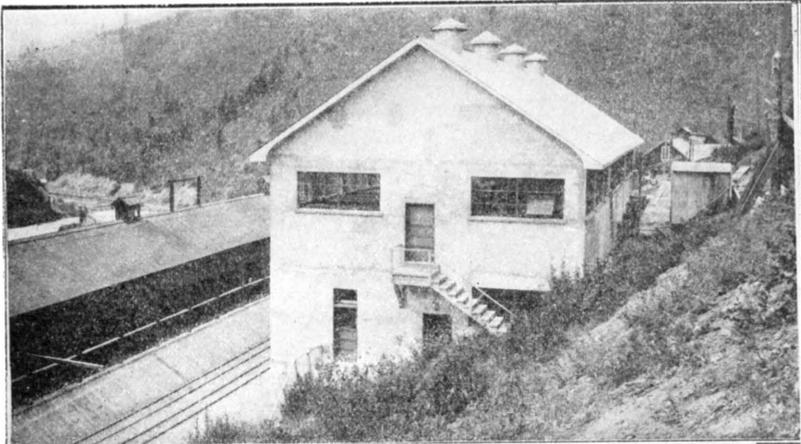
MORNING MILLS AT MULLIN AT NO. 6 TUNNEL, APPROACH

cipally aimed at obtaining the concession from the Company of going to work and returning from the tunnel portal within the period of an eight hour day, together with a demand for two pay days per month and the elimination of the short change day and better working conditions which the committee did not further definitely define at the time.

This strike occurred at a time when the Company was extremely short handed and making a strenuous effort, along with the other mines of the district, to supply a large portion of their production to the government for munition purposes, and by virtue of this fact, two well known and competent army officers were sent in from the spruce division of the Government work on the coast to help arbitrate the matter and to try and arrive at a settlement in the Government's interest.

These officers discussed the situation thoroughly, both with the Company officials and with the striking miners, advised the concession of the two pay days per month, the elimination of the short change day, which was cheerfully granted, and the men were advised that in Government work the Government expected for an eight hour day, eight hours actually on the job and induced the men to return to work pending a further investigation. The matter was subsequently taken up in the interest of the men by the U. S. Department of Labor, and three inspectors were sent at different times, one of whom was from the Federal Bureau of Conciliation, one from the Department of Justice, and one from the Department of Immigration, all of whom duly criticized the neglect of the State Inspector of Mines and the condition of the Morning Mine, but failed to have anything to say about the condition of the Gold Hunter Mine, to discuss with or to have much to say about the adverse natural and contingent conditions involved on the operation on the side of the owners.

One of these Federal Representatives complained to Governor Alexander about the bad condition of the Morning Mine and the lack of faith of the employes in the State Mine Inspector, requesting a special investigation by a private inspector from the Governor, who duly submitted this complaint to my department and asked me to investigate the situation, which I did on September 1st, and I



MODERN NEW DRY HOUSE—INSIDE VIEW—MORNING MINE NO. 6 TUNNEL.

found the Gold Hunter Mine in good condition, well timbered and well ventilated with the exception of one dead end that was supplied by a special fan and one stope in which a new air connection was being driven for and within a few feet of being made at the time. Ninety per cent of the active working faces of both this and the Morning Mine were inspected on this trip.

At the Morning Mine the quality of labor available up to June 1st, in spite of the high wages paid, was of such a low efficiency and indifference as to make it impossible for the Company to keep its immense milling plant operating at more than half its capacity, and the Company instituted a contract system of mining the ore by the ton, furnishing all supplies and timbers and turning the stopes over to the men with their usual shift bosses in charge, who also participated in the contract rate with a bonus over the other employes for their supervisory ability. The result of this method raised the production, with the same number of men approximately sixty per cent, and when the men went on a strike they were earning from \$6.00 to \$11.00 per day per man, varying with the advantages at the different stope backs in vein width and had two months' experience on the contract basis.

This fact was demonstrated by the daily production sheets hanging in the Company's office and demonstrated the men could work sixty per cent harder for themselves than they were willing to for the Company.

One of the chief complaints to the Federal Inspectors who investigated the mine conditions on behalf of the men was, that the air was so bad they could not stand a full eight hour shift. The increase in tonnage capacity from the same force of men belied the unwarranted nature of this contention and, as a matter of fact, my investigations proved that the mine, for a mine of its depth and character, was well ventilated at the time.

In February, 1918, this Company had taken the lead in the district in ventilation effort and had installed a modern Sirocco fan of 30,000 cubic feet capacity, taking fresh air from the No. 6 tunnel and the You Like shaft and delivering it at the extreme east end of the long ore body through a straight line raise at the No. 6 tunnel, down to the No. 18 level with a series of air doors at each cross cut

from the working shaft which distributed this volume of air well down to the bottom working levels and back up the main shaft as an up-cast.

Near the Collar of the working shaft another big fan of 13,000 cubic feet capacity was operating and acting as an exhaust, discharging the returning air through the 800 old shaft and out through the No. 5 and other openings in the mine, the main intake fan being separated from the shaft station by a tight air lock with two good doors with space sufficient to take in the whole electric train and prevent short circuit in the current. Both these fans had been working steadily since February up to the time of the trouble and have continued to do so since; and incidentally another Sirocco fan of 60,000 feet capacity has been ordered for this mine with a view to moving the present big fan to the 1,800 level as a pusher in anticipation of a larger crew.

It must be appreciated that these operations extend to a maximum vertical depth on the vein under the mountain of 3,400 feet and that the eighteenth level referred to is 1,000 feet below the No. 6 tunnel, which is the drainage level of the property and two miles long, and that it is no simple problem to ventilate a mine so situated; but the facts recited will indicate to any reasonable man familiar with deep mine workings that the ventilation could not have been very poor at the time, and the present improvements of mechanical installations and new air courses now being run will, I think, make the Morning Mine one of the best ventilated sub-level mines in the Coeur d'Alene district shortly, as it is the pioneer in the district in this line of modern mechanical ventilation, a subject to be covered in more detail further on.

Other complaints made by these Federal Inspectors were regarding the numerous broken timbers in the mine and the dirty, untidy condition of the manways in which "loose rocks were strewn around, which might fall and hurt the men." Both these complaints were, in a measure, justified in fact and were largely due, in the matter of untidyness, to the neglect of the contract workers themselves, and to the absolute impossibility on the part of the Company to employ the necessary labor capable of maintaining the drift timbering in better condition. These Federal Inspectors all claimed to be practical mining men and I have no doubt

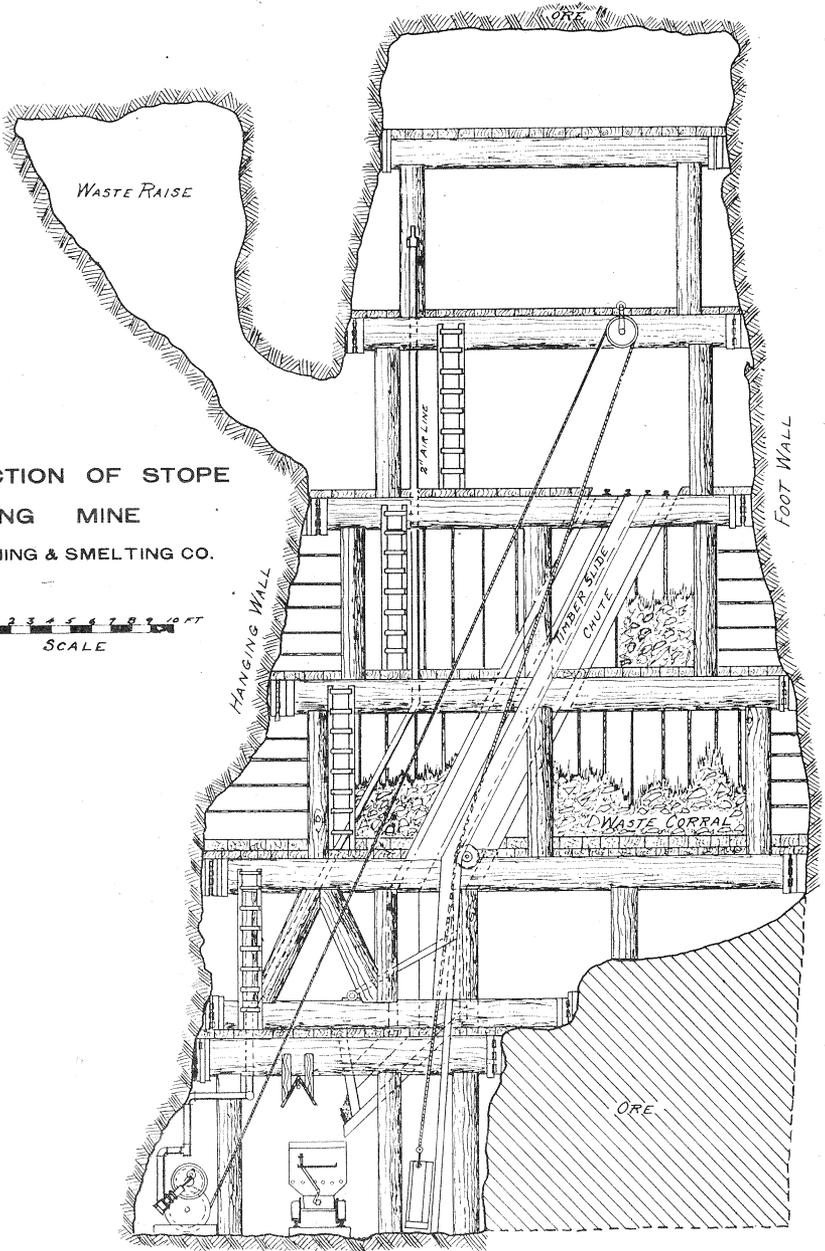
they were. A man may have a lot of practical experience in metal mining without getting much variety and a few broken timbers may look much more serious to him than they really are, if his experience in such matters isn't broad, especially with taking out bottoms in big ore bodies.

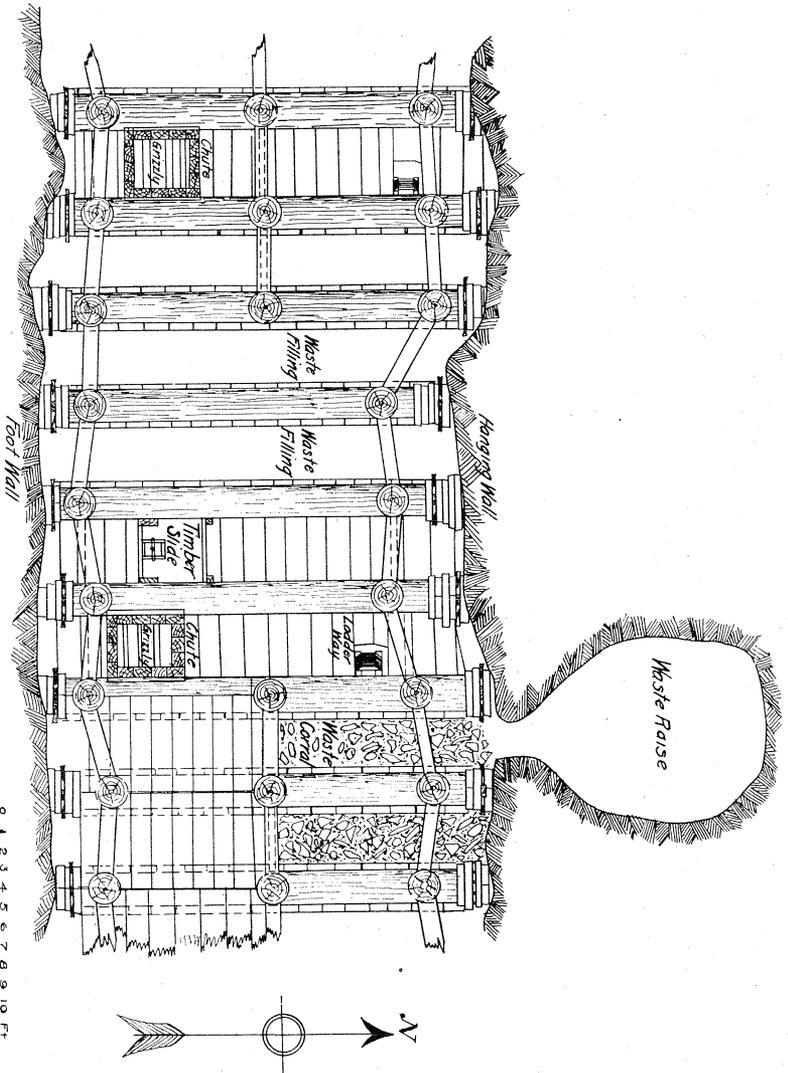
In this connection I want to say that the timber never grew that could resist the slow, steady side pressure of the walls of the Morning Mine. I would further say that it is one of the best timbered mines in the Coeur d'Alene district and that its operators spend more money per ton of ore extracted in timber actually installed than any other mine in the district. The broken timbers complained of were principally big cap timbers in the main levels and some squeezed shoot timbers. If these Federal critics had looked closely they would have found, in the majority of cases, that the cap timbers in the drifts were supported by helpers above them of equal size, including young saw logs up to thirty inches in diameter. The slow side wall pressure of this mine involves an excessive amount of repair work and timber replacement and it is admitted that this feature of the Company's operation was a little behind but in no place seriously menacing at the time of my visit.

The accompanying cuts illustrate the method employed in timbering this mine and the excessive proportion of timber used to the space cut in the stopes. These are old cuts that were used in one of my former reports and the only change that has been made in the method illustrated is, that as further depth on this vein is attained, like others in this district, the ground is gradually becoming more flexible and the ore bodies more checked and the top half floor illustrated in the stope sets which is left for the purpose of accessibility for drilling the back with stoping machines is now timbered closely with cribs, stulls and bridge sprags for the protection of the men when drilling the ground. The stope sets are put in as fast as room is made for them and when the stopes are active this excessive amount of heavy fir timber is completely buried within a few months with waste fill.

There isn't any false economy used by the operators of this property, or in fact possible, in the matter of timber supply, as the ground demands and must be closely timbered and filled with waste in addition. The big cap tim-

CROSS SECTION OF STOPE  
MORNING MINE  
FEDERAL MINING & SMELTING CO.





PLAN OF STOPE  
MORNING MINE

FEDERAL MINING & SMELTING CO.

bers in the drifts sometimes splinter into match wood before they have been in position three months, if not watched and eased, but the first floor above the sill is left open for the purpose of maintaining the protection of these haulage ways with duplicated new caps and angle braces.

The accompanying illustration of the Company's big mill also shows the near approach of the two mile tunnel and the modern, new, concrete dry house, together with the Company's big hotel in the distance and a portion of the timber yard, which at this date carries 3,000,000 feet, board measure, of material in the form of big round timbers, floor lagging and chute boards of three and six inch lumber.

Regarding the condition of the manways and the danger of falling rock I would say that the walls of this vein, in addition to carrying a heavy, slow, irresistible, creeping side pressure, due to the fact that the vein is a sheeted structure in thin parallel lines for ten or fifteen feet on each side of the ore, peels like an onion. It would take a crew of forty H. P. chamber men to keep the manways clean, especially in view of the fact that there are eighty shoots and manways in this long ore body, which are, of course, duplicated at each level, and I hardly think the complaint on this matter was fair, in view of the fact that at each nine foot floor of these manways a safety vent hole is cut into the ore shoot, which naturally spills a little fine material. Tight lagging of the walls is impracticable and would cause more trouble from splintered boards and heavy ground than protection. The manway ladders are in staggered nine foot lengths and each section generally completely floored over with three inch planks except a man hole, eliminating the chance of falling rock for more than one or two floors. The men are ordered to keep loose material safely clear of the timber slide manways and had themselves to blame under these contract operations for failing to do so.

At another inspection of this mine in December, after securing some modern air measuring instruments, I was able to confirm the Company's previous information that they were delivering 30,000 cubic feet of fresh air, or over 200 feet per man per minute, employed at the time, which was reasonably well distributed to the bottom level. I

further found, on repeated tests with a first class psychrometer, that the highest temperature development in the Morning Mine at the eighteenth level, 3,400 feet deep vertically under the mountain, was seventy-two degrees, and the highest temperature of the mine at the top of an exhausted old stope was 78 degrees. This is normal summer temperature of outside air.

The trouble with these moderate temperatures is the fact that the humidity is high. The ground is damp and the air passing through the works absorbs moisture, causing men to perspire readily. The relative humidity varied from seventy-two to ninety per cent, but that the men were not suffering from temperature was evident by the fact that most of them wore at least one shirt and some of them two in their work.

The formation of this vein is gradually growing more flexible as depth is attained, but has developed no condition so far but what a competent miner or timberman can take care of and protect himself in doing so. The principal complaint on this score is attributed to ten day men who come across a little extra hazardous condition and show the yellow streak and turn tail on the job, then go off and condemn the mine as dangerous. It is, of course, impractical to keep a big mine like this looking as neat as a lady's boudoir, and no reasonable miner expects it.

The surface conditions, under which the men live at this property, are exceptionally good, and to the alien employes equal if not superior to what the overlords of their own country enjoy. The men are hauled back and forth to their work by an electric motor in lazy-backed coaches which give them ample protection from danger in traveling through the two mile tunnel. The train starts and stops at a modern concrete, steam-heated, fire-proof dry house with accommodations for 300 men, in which the men can wash up and change their clothes and are given separate, cootie-proof, metallic lockers with modern porcelain lavatories and bathing conveniences that are strictly up to date. From the dry house it is only 150 yards to the Company's four story miners' hotel and boarding house, where good board is supplied and separate rooms with spring beds are available at a reasonable charge, with janitor work and clean linen supplied and a comfortable club room to lounge in; conditions common to other big mines of the district.

In travelling through both this mine and the Gold Hunter, they were conspicuously marked with I. W. W. signs burned onto the timbers and chute boards with carbide lamps. The crew that went on a strike were sixty per cent aliens, including many excellent miners, and I am of the opinion that the trouble was agitated at some I. W. W. center outside of the district. I happen to be a foreign born miner myself and I have some appreciation of the advantages these men enjoy compared to what they could possibly obtain in their own country, and I do not believe that it was the sentiment of the majority of them to start the trouble which was instigated, but that it was designed by outside propaganda to embarrass the Government's supply of metal and to involve the whole district, and this mine was selected as the likeliest spot to start trouble in the district by reason of its excess of alien employes.

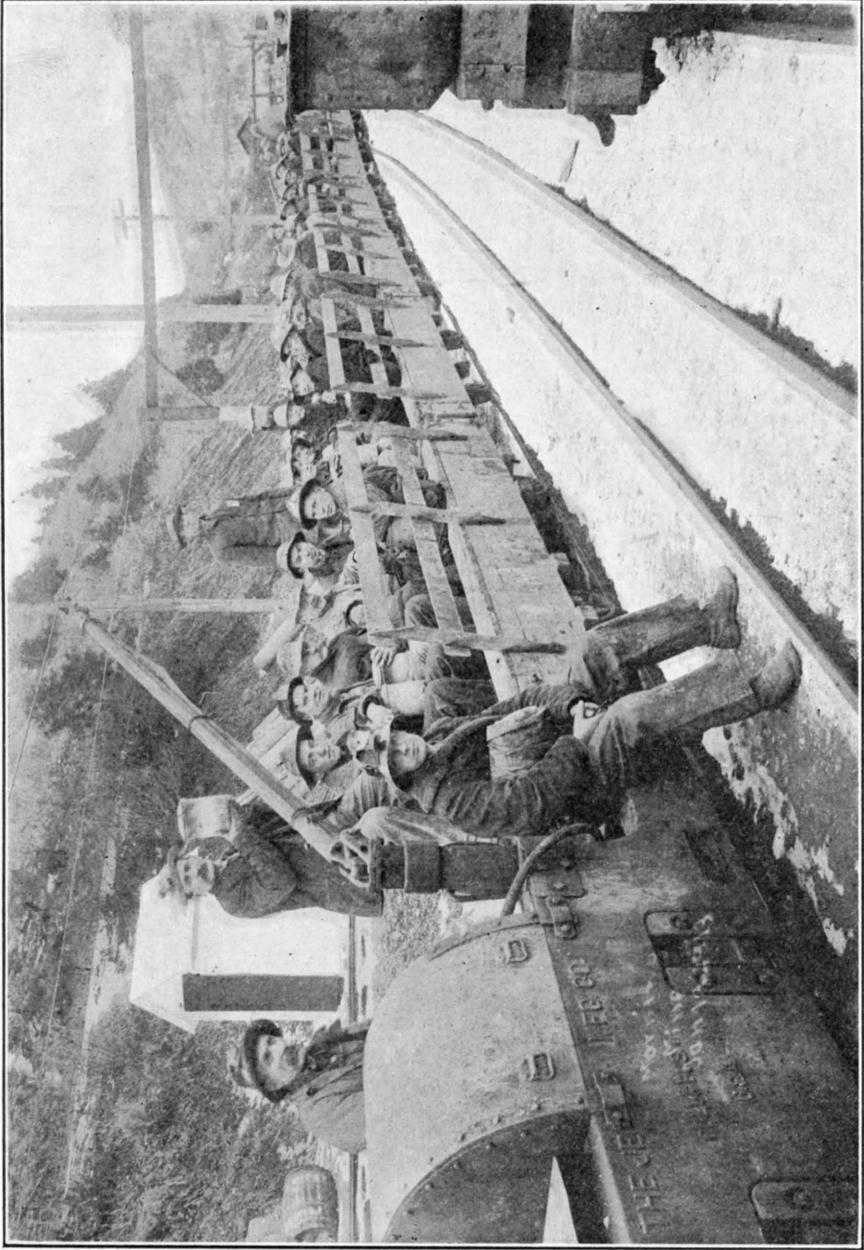
It seems unreasonable that a crew of this size would deliberately strike against themselves, as they were all contract workers earning big money when they went out, while many of the best miners of the district were fighting in France to maintain these splendid opportunities for employment for them at home, for a measly compensation of \$1.00 per day and no regard to an eight hour schedule. I repeat that I am of the opinion that it was a prapaganda proposition from start to finish in which the majority of the crew were not in full sympathy and were unduly influenced in the matter by a few unpatriotic agitators.

The stopeing contract system in this mine or other mines of this district, is undesirable from a safety and health standpoint, as it tends to make men, like leasers, take undue chances and grab unduly beyond the timbered spaces in the stopes for the sake of fattening up their tonnage record. It is an unwise policy to try and apply for the further reason of the variation in shape, thickness and condition of the ore bodies and the decided difficulty in establishing a uniform rate of pay on account of these erratic conditions of the ore occurrences in size and quality, and necessary waste sorting requirements.

The operating end of the Morning Mine has been a struggle, both from a mining and metallurgical standpoint, since the property was purchased by the present owners. The first five years under their management its great produc-

tion of lead and silver was paid almost exclusively to the labor employed in turning its ore resources into bullion with absolutely no profit to the Company, and in fact a sworn statement of actual loss in its operations was made. Since the commencement of the war and the substantial rise in the market value of lead, in common with the other mines of the district, the Company has paid a handsome profit sharing bonus to the men employed, which has been a substantial participation in its own current success. I seriously doubt, however, that the property has paid back its first costs to the owners, by reason of the low grade base nature of the ore and the complicated and expensive mechanical improvements its treatment has involved.

By reason of the extensive lineal distribution of its underground workings, which is true of several of the other big mines of the district, it is hardly reasonable to expect the Company to carry the men in and out within an eight hour shift, for all miners know that the eight hours is already punctured by unproductive trimmings, especially where blasting is done in going off shift; and to farther edge on an eight hour day with the demands that were advocated in this strike with the fair consideration in the matter of profit sharing bonuses that have been given the men, would be a serious drawback to the operating end in such low grade ore. In the general average and with the advanced improved ventilation conditions now in progress in the deep mines, I confidently anticipate that working conditions of this and other mines of this district will compare favorably with those of any other deep mines in the country and should be left alone in the interest of steady employment and sure pay their operation has afforded for so many years, as to attempt further trimming of the eight hour shift, especially with the low grade mines, would probably result in sickening the goose that lays the golden egg of good steady payrolls, and most of the men know they don't have to go much further to fare worse in underground work.



ELECTRIC TRAIN MORNING MINE NO. 6, TWO MILE TUNNEL, MULLAN

## MINE INSPECTION IN IDAHO.

## History.

The office of the State Inspector of Mines was created at the legislative session of 1893, as an elective office, and for the remainder of the term was filled by appointment, the successive appointees being Honorable E. H. Dewey, now of Nampa; I. T. Peterson of Silver City, William S. Haskins of Wallace. Ben F. Hastings of Silver City was first elected and served in 1897-1898; he was succeeded by A. J. Czizek of Warrens, Idaho County, in 1899-1900, who was succeeded by Martin Jacobs of Blaine County, who served until 1902, at which time the present incumbent was elected and served by re-election in 1904 and 1906 and until 1908, when he stepped aside for a Shoshone County man, Mr. F. Cushing Moore, a Republican, and a competent practical mining engineer with a number of years' experience in the big mines of the Coeur d'Alene district.

Mr. Moore was elected and served during 1909 and 1910, but tiring of the duties of the office in 1910, personally suggested that the writer get back into the game, which he did, and has since been re-elected on the Republican ticket five times, and to the end of December, 1918, has filled the position for fourteen years under six governors, two of whom were Democrats. My predecessors included Democrats or coalition candidates with Silver Republican and populist affiliations, except Mr. Moore, Republican. These elections have invariably given the writer a large majority of popular votes for this position, regardless of the variation of the political fortunes of the two dominant parties, a tribute of confidence on the part of the voters at large, very highly appreciated. I have never taken any conspicuous part in my own success during the election campaigns beyond the bare announcement of nomination and have usually left the political feature open for my opponents.

Originally the office carried a salary of \$100 per month with very limited appropriations for travelling and office expenses. It was later raised to \$150 per month and in 1909 to \$200 per month, at which figure the salary has remained; at the last raise a provision was also made for a permanent stenographer at \$75.00 per month. The law requires the incumbent to maintain an office at the Capitol in Boise as headquarters and in addition to the salary, car-

ries an appropriation for travelling expense, office expense and printing whose maximum provision has never exceeded \$1900 per year. No provision has ever been made for a deputy, except at the legislative session of 1917, when through my single handed effort an additional appropriation was asked for and allowed by the legislature for the employment of a resident deputy in the Coeur d'Alene district at the same salary as the Inspector, but for reasons of "political economy" this effort to obtain assistance in the work was vetoed by the Governor without protest from the employes.

The statutory duties of the office in this state are conflicting and impossible for single handed compliance, especially in regard to the investigation of accidents when they occur, by reason of the extreme and costly travelling distance to be covered between the different mines of the state and the Capitol at Boise.

In addition to the inspection of mines for safety purposes, the Inspector is required, by law, to virtually act as substitute state geologist, in the compilation of an annual report giving not only accidents and metal production statistics, but also a review of operating conditions and equipment that would involve useless repetition and an annual printing bill equal to that of the Idaho codes. Also the Inspector is required to cover all statistical and "other information" calculated to exhibit the mineral resources of the State and to "promote the development of the same." The financial provisions for these duties have always been totally inadequate and discretion has been used to make the best of this and other conflicting features of the law and still supply an annual report that would prove as timely as possible at the expense of accuracy after the close of each year, in which connection my efforts have been favorably recognized by leading mining journals and, in fact, occasionally convicted of some germs of originality.

The first report I published, that of 1903, was modelled after the work of Harry A. Lee, then Chief Metal Mine Inspector of the State of Colorado. In my report of 1905 I published a list of safety suggestions to miners on the handling of explosives, which, in 1906, was copied verbatim, without acknowledgment, by the Metal Mine Inspector of the State of Montana in his biennial report,

which was a decided gratification to the writer, regardless of the acknowledgment, as it showed him he was studying and thinking along the right lines on the subject, as he has always regarded Montana, and particularly the Butte district, as one of the leading practical mining schools in the world. Other safety first suggestions of the writer were subsequently embodied in the Idaho mine operating law and have proven of decided value in accident prevention.

Mine operatives are very insistent in their demands for a practical miner to fill this position. As previously stated, I have never actively participated in my own success at election times and as the recent election is passed, I can not be convicted of now playing for votes as my present intention is that I am serving my last term in this office, which is likely to be abolished in its present form. It might be timely to say to the men whose interests are involved in this connection that their confidence hasn't been entirely abused in this respect during the long years of my service and in answer to the arguments put up against my reelection in the interest of my opponent last fall, which, to express it mildly, were that I was a good deal like the nigger's definition of near beer, "all froth and no authority," I feel like inflicting on them a swan song in little story of a foreign born miner.

"This miner, when a boy sixteen years of age, came to this country from one of the more Democratic nations of Northern Europe in the steerage of a Cunard liner, looking for a job, in 1880. He landed in Milwaukee, Wisconsin, with a capital of ten cents, quickly secured a job on a Southern Wisconsin farm, which he successfully filled for a year and a half and was fortunate in falling into the hands of an old forty-niner, whose stories of gold mining experience imbued this young emigrant with a desire to become a metal miner."

"Following out this desire in the summer of 1882, by the free fare labor employment route, he landed in Montana and engaged in railroad grade work, a few months of which work satisfied him on the surface digging feature and his book study of precious and base metal occurrences emphasized the fact, in his mind, that such substances had to be sought for at depth under the surface and involved prac-

tical experience along those lines so he took the first underground opportunity that presented itself, which was at the West end of the Bozeman tunnel on the Northern Pacific Railway then under construction, where he served a severe apprenticeship for nearly two years, graduating from the chief engineer of a Missouri mule pulling dump car, to mucker, then chuck tender and timberman's helper."

"This was a man's sized tunnel timbered with choice red fir posts 16x24 inches and 18 feet long on parallel mud sills. The caps were of the same dimensions forming a hip roof in five segments, nicely framed and fitted, involving special care in there blocking, bracing and construction. The ground varied from hard to rotten. The roof leaked like a sieve and the face was always gassey. Overbreaks were common and the dangerous placing of hundreds of cords of red fir wood to crib the back was one of the retarding and hazardous features of the work. One section of the tunnel was so rotten the whole face had to be breast boarded and driven up in segments. The ground was drilled with old fashioned Ingersoll-Sullivan sluggers that weighed about a quarter of a ton each and were operated from tripods and staging except where the ground was hard enough to run a heading, where bars were used."

"Accidents were of common occurrence, both serious and fatal, as the work was being rushed and the crew crowded all the time. Mr. William Delaney was the efficient chief foreman of the job at the West end and the Muir Brothers the contractors. Delaney afterwards lived in the Coeur d'Alenes for a while. At that time 'Jim' Honorable James M. Callahan and Andrew Devlin, two well known Coeur d'Aleners, were ordinary railroad rock men, and Mr. Al Dunn of the Wallace Miner was a surface rustler and can confirm these statements of this piece of difficult underground practical mining and engineering work, compared to the hazards of which there is nothing to exceed in any of the big mines of Idaho."

"This young emigrant subsequently worked for fifteen years as a practical miner, covering experience at Marysville, Wicks and Comet, Montana and Anaconda Hill at Butte, and afterwards, for a number of years, in the gold and silver-lead district of Central Idaho, where, as miner and prospector, he discovered mines, developed them, built

small mills, took out bullion and filled every capacity in smaller operations from miner to general manager and incidentally worked on the winning side of a hammersman contest to settle a dispute as to the advantages of single and double jack work in a hard gold quartz vein against a couple of selected Butte huskies, and was subsequently elected State Mine Inspector for Idaho from Custer County. He embraced full citizenship at the earliest chance to do so and has never ceased to appreciate its obligations and splendid opportunities. The name of this emigrant appears on the title page of this report and of thirteen other reports that have preceded it, and it will be seen his early training left little opportunity for technical frills or finish, much to his personal regret."

### Conflicting Duties.

Idaho is a State of relatively small population and exceptionally broad and varied natural resources, especially in the mineral world. It can be successfully demonstrated that these mineral resources in Idaho have as big a potential value for the industrial advancement of the State, as those of any State in the Union. The dominant interests of the State at present are of an agricultural nature and that line of industry dominates the State political activities and personnel, and while the most valuable feature of our State mineral resources are in the form of fertilizer mineral, which has a direct and important bearing on the agricultural success of the State and of the agricultural success of the nation in general, it has been very difficult to get much recognition for the mining industry and mineral resources of Idaho from the dominant political authorities or to seriously imbue them with the industrial advantages that these natural mineral resources of Idaho present.

Economy is the chief argument of each new administration in State affairs, which generally overlook the fact of the rapidly expanding business activities of the commonwealth and the constantly increasing cost their administration involves. Political rearrangements and consolidations are doubtless justified and duplications have occurred that have seemed unwarranted in such a limited population as ours. I was an advocate for years of the Workmen's Compensation Law before it was consummated in Idaho and am delighted that this protection to working men was insti-

tuted, which I hope will be administered equitably and from the limited experience of its administration so far seems to be working to excellent advantage. Any new legislation on this subject should seriously consider both sides of the question in the mining industry branch of hazardous occupation, and the fact that a very large majority of mining enterprises are of a development nature and only in rare instances result in providing permanent payrolls and profitable operations, and that without the incentive of a few good dividend payers the industry would prove unattractive to investors soon languish and die out.

This new department of the State's political activity in a measure duplicates the work of the State Mine Inspector, and I have already advocated that at the close of the current term of office, this department could be eliminated as an elective office and put under the control and direction of the Workman's Compensation Commission. In case such a move is considered, it must be appreciated that it cannot be properly accomplished with any financial economy and will probably cost more than the present method of administering the law, as it should involve at least two Mine Inspectors, one permanently located in the Coeur d'Alenes and one at large to cover the balance of the State. This change is objected to by some who feel that the business has been satisfactorily taken care of and that its present and prospective volume warrants elective administration.

#### State Geologist.

If this change is considered and the office is abolished in its present form, which seems to be a growing sentiment, it should involve the further expense to the State of the creation of a State Geologist, for which there is as rich a field for intelligent activity in Idaho as any other State in the Union and there are very few of the mineral bearing States of America but which now enjoy the beneficial advantages of such a department.

Quite an important part of my mail is addressed to State Geologist for information on that line, and correspondents can not understand why a State of such an important position in metal production can not afford a department of this nature. Such a department should be

attached to the State University, where it could be handled to excellent advantage by professional men in that line, and where the moderate appropriation required will be duplicated for co-operative work by the Federal Government.

Under the present law the combined duties of Mine Inspector and Official Mineral Advertiser for the State are conflicting. The Mine Inspector, who is required to specifically encourage mine development, is likely to find economic conditions in his inspection work that demand considerable judgment and latitude to operating conditions, on that account, and the duties of the Mine Inspector could be more efficiently and unbiasedly executed with the entire elimination of this advertising duty.

### Mine Inspection Results.

During my fourteen years of service the office has afforded absolutely no perquisites beyond the small salary provided, but has involved a lot of hard work and worry. It has been my endeavor to cover the field as fully as the limited means provided would permit, and to administer the law more in its spirit than its letter with a decided leniency towards small operators, leasors and prospectors, without whose persistent endeavor and encouragement the payrolls would soon diminish and the few profitable mining enterprises would become exhausted.

Mining is essentially a hazardous business on both its labor and investment sides and no amount of mine inspection can eliminate its natural hazards. The only safe mine is a bonanza prospect that has just been discovered and the first ground broken with a prospect pick. After the first collar set is put in on underground work the hazards of the business are established and naturally expands with the progress of development. Prior to the creation of the Compensation Commission, accident and employment statistics were difficult to get and the new Commission with its retinue of clerks is finding that feature of its work a problem of no mean importance.

It has always been my endeavor to record all the fatalities, and while some omissions may have been made in this connection, they have been rare. During my period of service, including close contact with the work in 1909

and 1910, the big center of mine activity has continued to be in the Coeur d'Alene district, which embraces some of the deepest and most extensive mine operations in America, and I am gratified to state that during my long term of service to that district, and the balance of the State, there has never occurred what might be termed a mine disaster. While any fatality is disastrous enough, no great group fatality has happened, involving more than three men, eliminating snow slides and forest fires, at mining camps, surface acts of nature for which mine operations were not directly responsible, and the ratio of victims to the number of men employed in the business around three per thousand I think will average about as low as that of most other metal mining States in the Union for a like period.

In all my service in the office I have never received a single regular complaint from the workers, who probably average as high in character and ability as the metal mine workers of any State. In considering the relative immunity from fatal accidents in the Coeur d'Alene district, which has involved labor employment ranging around a million and a half shifts worked a year during this long period, there has never been a disastrous shaft accident, or any shaft accident in which more than one man met death at the time. There has never been a magazine explosion, either surface or underground. Four mine fires have been recorded in the period, in each case confined to underground stations and of limited extent, involving only two single fatalities, and considering the enormous amount of powder annually used in breaking from two to four millions tons of hard ground a year, the accidents due to premature explosions of powder have been relatively few. Accidents due to fall of ground have been the most common, but these have seldom involved any large caves and were largely caused by slabs and small falls of ground in barring down or drilling in cracked backs without sufficient precautionary care in additional spragging for which there is always plenty of timber available as most of the stope work is advanced drill work and not crowded.

Electric accidents due to trolley wire contact in the levels have not been uncommon, but these conditions have gradually been improved and the risk largely eliminated by the substitution of storage battery motors in sub-level

operations which are now commonly used with the exception of one big mine which reduced its current from 550 to 250 volts, a pressure ordinarily considered safe. The record, especially in connection with the extensive shaft handling of men in deep, steeply incline and vertical shafts, mostly from underground stations at a remote distance from the surface, is one that I am not ashamed of my connection with. I am not egotistical about these results at all, and while operators have occasionally convicted me of being exacting in safety requirements, I am willing to give the bulk of the credit where it belongs for these results, to the big mine managements and their modern mechanical equipments; to the superintendents, foremen, shift bosses in charge and, in recent years, to their live activity in first aid and safety measures. I also pay my respects and appreciation in this connection to the master mechanics and their associates, electricians, hoist men, cagers, rope men, and powder men, who have carried such large crews daily back and forth to their work suspended on a wire, for such a long period in such relative safety, particularly in big shafts which are also daily used for extensive modern skip hoisting methods.

I want to pay a tribute of appreciation to the principal managers of the large mines, who have generally considered my improvement orders and recommendations favorably, where they were economically feasible, and in fact have encouraged suggestions along these lines. Our principal operators are, I believe, conscientious in their efforts to prevent accident occurrences, a fact which is evidenced by their generous support and encouragement of modern, up-to-date safety first measures.

Miners generally demand that a practical miner be selected for Mine Inspector, and they are right and justified that the position be filled by such a man of practical underground experience, the more the better, but the work involves much more knowledge than the average practical miner generally possesses to reasonably execute its varied functions. Ninety-five per cent of the ground broken in Idaho mines is cut by machine drills. A man may be ever so good a judge of ground and a drill pusher, but, for instance, if his air stops coming through his machine, he is practically helpless to proceed with his work until a

higher grade worker remedies the trouble, which may be a mechanical, electrical or hydraulic cause, and may be located anywhere from 100 feet to 100 miles away from his operation, and whose remedy involves a high grade of technical training that is decidedly beyond the ability of an ordinary practical miner, who, while very essential, is only one of the many cogs that go to make up the complex mechanism and head work, as well as back work, involved in a big modern mine operation.

If the present method of administering the Mine Inspection work in this State is changed, its future effectiveness must be based on intelligent selection without political consideration and with an adequate salary sufficient to attract a man of the necessary experience and ability. To properly execute the law as at present framed would require a man of \$10,000 annual salary capacity as the position is called upon to criticize the work of men to that caliber and from that on down the line.

The present duties of the office require a man not only to be a practical miner, but he should also be a practical master mechanic, a master electrician, mine superintendent, foreman, shift boss, yard boss, geologist, mineralogist, ventilation engineer, lawyer, author and politician, as his work is called upon to criticize all these practical and highly trained technical and other abilities and the office work also involves, besides the encouragement of mining development, the conflicting pastime of fighting wild cats and protecting lambs, on the investment side of the business.

An ordinary mine foreman, under present conditions in the Idaho industry, receives \$250 per month, and many contract miners during the war period have exceeded that, and ordinary muckers \$150. Any future change in the personnel of the department should figure on a salary for the position of not less than \$3,600 per year.

The phase of the work of this department embracing the statutory requirements of encouraging the development of the new mineral resources of the State, has been covered annually with a fairly extended review of the big mine progress and more promising enterprise that have been launched or were in prospect and this has been a line of work that has been covered with reasonable satisfaction

to the people. In this connection I have always tried to pay due respect to that phase of the law that prohibits the discussion of the specific position of ore bodies, a feature that might involve complications of a legal nature in apex litigation, and have also tried to respect operators' interests and to discuss these matters with them before using such information. The big operators have been very generous in this respect in permitting me to outline their development progress for the community interest and the benefit of other local development enterprises, and, as previously stated, I have endeavored not to abuse this privilege and if errors have been made in this connection, it was due more to natural personal optimism than any ulterior motive.

My forecasts made early in my experience of the Coeur d'Alene ore resources in particular, and the State in general, have been very substantially borne out, and especially is this true of the Prichard formations in the Coeur d'Alenes, which, during the early years of my experience, were looked upon, both by local and imported technical talent, as unlikely to produce important commercial ore bodies. My enthusiastic support of the numerous promising prospects in this particular formation, I am gratified to state, has been demonstrated in several cases to be sound, and I have lived to see this technically discredited horizon of ore bearing rocks develop big dividend paying mines and offer employment and payrolls for as many as a thousand men at a time. My early contention of the probable ore carrying values and geologic importance of the Hecla dike, made more than ten years ago, has proven a sound guess.

Geology is a guessing science to a large extent and experience has shown that my early guesses of results have been as favorable to the progress of the district as those of some of the more capable, technical men who have participated in its progress during the past fifteen years. The position affords a rare privilege and one that has proven an attractive feature of the work; to see the top and in two cases the bottom of famous ore deposits that rank among the richest of their class in the mining world at large, and this has proven an instructive, practical lesson in such matters.

It has shown, in the Coeur d'Alenes, how insignificant and thin a crest an ultimately famous ore body may have, and aptly illustrates the speculative phase of the business and the necessity, in many instances, of encouraging development on rather indefinite ore showings. It also embraces the reverse of this condition and affords many interesting illustrations of ore deposits in different districts of the State whose maximum manifestation is at the surface outcrop.

This opportunity of underground study of these natural conditions, pursued without any previous technical training but quite a broad experience in both Idaho and adjacent metal mining States, emphasizes the prospects, in the opinion of the writer, for the continued permanency of Idaho as a whole, and the Coeur d'Alene in particular, as a large industrial factor in the production of desirable metallic minerals, and the South end of the State as the future principal factor of the world's most important resource of the universally necessary agricultural minerals in the form of soil fertilizer material, the most vital and primary factor in human existence.

#### **Mine Ventilation in the Coeur d'Alenes.**

In considering this subject, which has been one of the prevailing causes of unofficial complaint recently from the deeper mines of the Coeur d'Alene district, and whose improvement has been retarded by labor scarcity for the past three or four years, it is well to bear in mind the inevitable natural obstacles involved.

Wherever a hole is sunk in the earth, temperatures increase as depth progresses in a very uniform ratio of one degree for each sixty to one hundred feet of increased depth, influenced to some extent within this range by the nature of the formations penetrated, whether it be igneous or fire laid rock, sedimentary or water laid rock. The deepest vertical ore penetration in the world is, I believe, at the St. John Del Ray Gold Mine in Brazil, whose further progress is hampered at this time, not from lack of ore resources, but due to the excessive cost of maintaining livable temperatures and ventilation conditions at a vertical depth of 6,000 feet.

Mine ventilation in this country has been developed to its highest perfection in the coal mining industry, where with a mineral product whose production profits seldom reach and rarely exceed \$1.00 per ton, thorough ventilation by expensive double entry methods is necessitated, and fresh air must be delivered not only in sufficient volume for breathing purposes, but to sweep away dangerous explosive gases that emanate from coal deposits; such gasses, however, are seldom met with in metal mines whose chief air deterioration is due to a more inert gas carbon dioxide, proceeding from oxidizing timbers, lights, and the breathing of men in addition to this gas a little poisonous carbon monoxide is sometimes found in metal mines, which results principally from the incomplete detonation of nitro-blasting powders and whose principal manifestation is in gasey muck piles which occasionally produce headache among the operatives, but seldom manifest more serious difficulties. It would seem with better values and profits of metal mine operations that good ventilation should be maintained without being felt seriously from an economic standpoint.

The available literature on metal mine ventilation is conspicuously scarce in American practice. The most conspicuous practical example of this essential phase of metal mine progress in the West is in the Butte district in Montana, where the Anaconda and other big copper companies have literally spent and are at this time spending millions of dollars in mine ventilation, equipment and fire protection.

I enjoyed the courtesies of a personal examination of several of these big installations at Butte during the summer and found the natural conditions far more severe to overcome in that district in the way of exclusive shaft operations with little variation in surface elevations and igneous formation and an excess of heat developing sulphur mineral to contend with. Some splendid progress has been made in mechanical ventilation in this noted metal mining district and is being assiduously followed up and perfected. Divested of its technical details and algebraic trimmings, the success of metal mine ventilation is measured by the provision of plenty of power, plenty of fan capacity and well designed, smooth lined, main air courses. Air resistance due to timbering of an ordinary mine avenue

was aptly illustrated to me at one of the big Sirocco fan installations of the Anaconda Company, which showed that an exhaust fan of this type could pull more air through a 2,800 foot vertical shaft compartment, smooth lined with lumber or smooth concrete slabs, than the same fan could exhaust through two compartments of the same size of ordinary unlined shaft timbering, and aptly illustrates the retarding effect of air resistance even in high gravity pressure natural ventilating conditions of ordinary mine timbering.

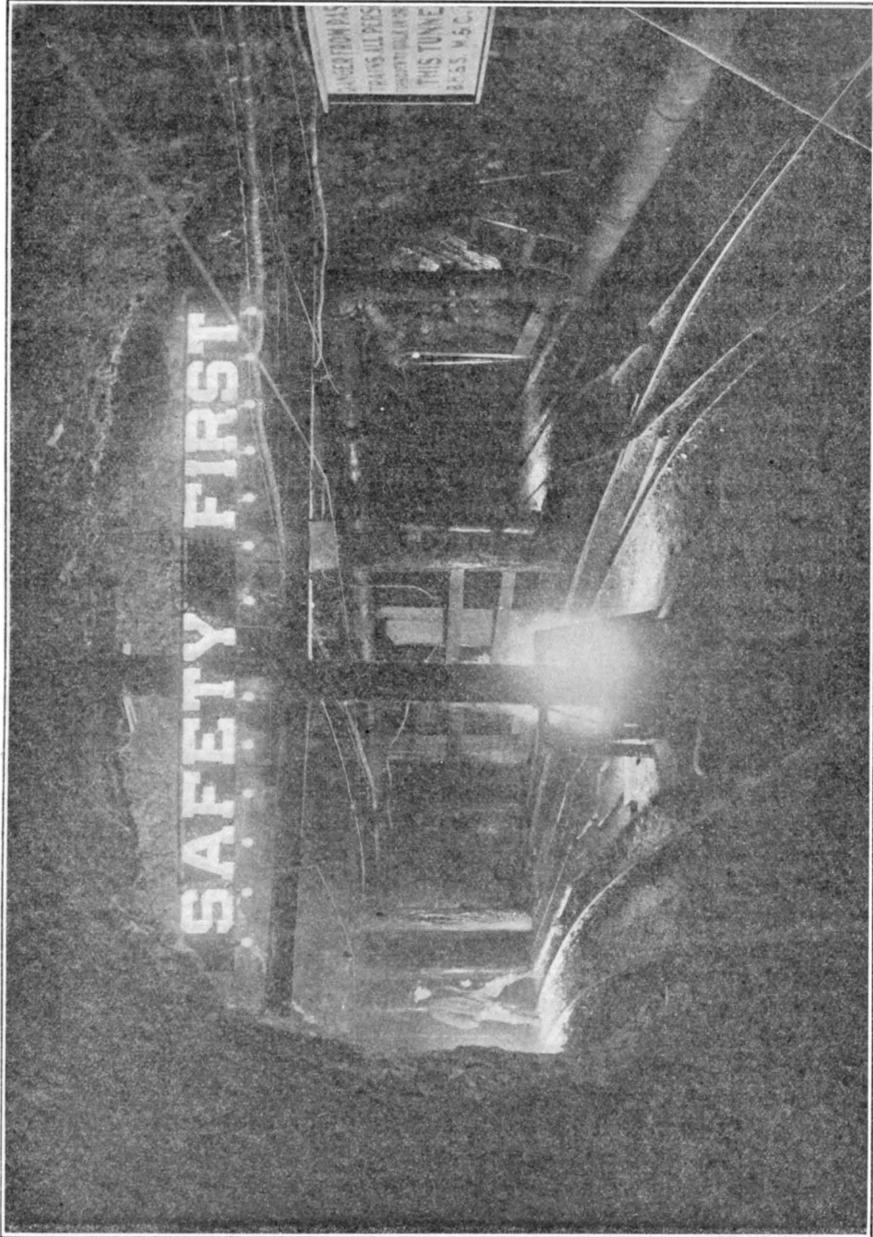
One of the ablest studies of metal mine ventilation I have seen was recently published in the Technical Press by Charles A. Mitke, based on Arizona experiences. The deductions of this authority, however, on what should constitute an economic deep mine atmosphere, seems excessive in the requirements expressed and is evidently based, not only on a warm climate, but on more than average rock temperature conditions, and would seem unnecessary for the cold northern climate, neutral low sulphur ore and formations of our northern district.

The metal mines of this State usually occur in high mountain sections. Those of the Coeur d'Alene have their vein apexes high up on the mountain sides and are developed by adit or cross cut tunnels to depths varying down to over 2,000 feet, which give ample natural gravity air pressure circulation that usually affords good ventilation and is easily controlled. The natural advantages of this district in this respect and its deep sedimentary formations are exceptional, but in recent years in three particular cases the ore penetration has been developed extensively below the lowest points of surface drainage entry, involving cross cut tunnels, three of which are two miles long, respectively. In these cases the tunnels are of a minimum size of 7x8 feet and are used for drainage, haulage and ventilation. They are costly avenues to drive and owing to the uncertainty of results to be found, a double entry tunnel was never warranted as it is in coal mine development and the further fact that return outlets are invariably provided at high elevations for air circulation.

Above these deep drainage levels, ventilation by natural gravity air currents was a simple matter, but each of these mines, and several others in less degree, have shown a

persistency in their ore occurrence to great depth below these lowest drainage entries, and the sub-levels thus developed have rapidly expanded in the past few years, which sets up a new problem in ventilation, where the long tunnel is depended upon for the main air supply by reason of the fact that the big electric ore trains that are used in these air courses act as a partial piston and resistance when in motion against the air and materially retard its flow. Sub-level ventilation by natural gravity air, even with these deep drainage advantages and numerous higher outlets, has lately proven inadequate in volume and velocity to fully supply the normal working requirements of the men and must be assisted by mechanical means. A ventilating system that will simply carry away the smoke and gases due to blasting and emanations from men and lights, is a mistaken economy in a big mine operation, as the great harm resulting from an insufficient supply of good air is markedly shown in the behavior of the men employed in such a mine. "Surliness, discontent, inefficiency and a general desire to cut work or taper" are often directly traceable to poor air and there is no investment that will pay a bigger return in resulting efficiency of the workers than good ventilation.

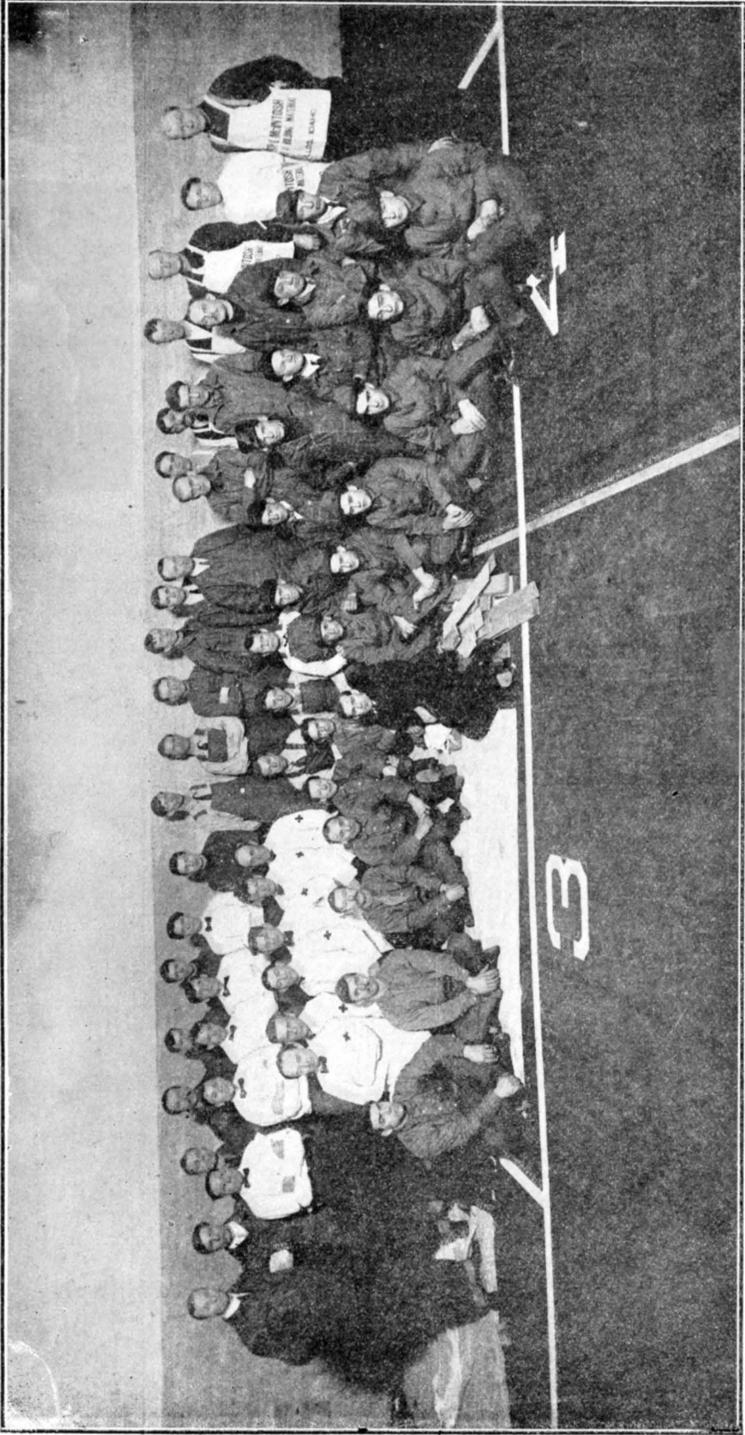
The long tunnels of the Morning and Bunker Hill & Sullivan Mines, due to the natural wall resistance and moving train, are incapable of carrying sufficient air to properly ventilate the extensive and rapidly deepening sub-levels of these properties without mechanical induction. Fortunately, both properties have several other outlets in addition to their long tunnels which, while at a much higher level, can be used and are used as additional sources of fresh air, with the return or up-cast directed through still other outlets. These matters have been under discussion for the past four years with this department, and the management of these mines have been entirely willing and anxious to improve their ventilation conditions. To do so, however, in addition to mechanical installations, involves the driving of several thousand feet of expensive straight line raise connections, and since the European war started, labor has been so scarce that this work has been decidedly retarded.



ELECTRIC SAFETY FIRST SIGN AND EXTRA AIR SUPPLY AVENUE—TWO MILE SWITCH, KELLOGG TUNNEL  
L. J. B. HILL AND SULLIVAN MINE

In this connection, as men have been available, over 900 feet of big raises have been driven at the West end of the Bunker Hill Mine and are now being extended, to be used exclusively as an air course, and during my visit to the property in December, a big station was being cut for the installation of a recently ordered 60,000 foot Sirocco fan to take fresh air not only from the Kellogg tunnel, but also from the adjacent Sweeney shaft and other West end outlets, which will afford an ample supply for all purposes, when mechanically driven and controlled, to the deepest point of the mine within the necessary air doors and stoppings. Present plans contemplate, if it is found necessary, the installation of another large Sirocco fan near the head of the No. 2 East shaft, which is a natural up-cast and will afford a permanent circuit through the East end outlets, above the Kellogg tunnel. This is the deepest mine in actual earth penetration in the plane of the vein in the Coeur d'Alene district. Its ore bodies are entirely in quartzite formation. They vary in size up to 100 feet in horizontal cross section and 900 feet in length. The mined spaces are uniformly timbered with square sets and closely filled with waste. The levels are 200 feet apart vertically and 300 feet on the dip of the vein, which is about forty degrees; the hottest place in the mine is 1,500 feet above the bottom level at the apex of the Cameron stope at the No. 10 level cross cut connection. This is one of the largest stopes in the mine that has been actively operated for the past twelve years. At this point the temperature is eighty degrees and the humidity reaches dew-point and is largely due to local faulting the friction of slowly packing fill, oxidizing timbers of the big stope and the fact that it is a converging point of return air.

The highest bottom level temperature in the mine at the new 15 level, which is 4,800 feet in the dip of the vein below its highest crest and 3,400 feet vertically under the mountain, registered only 70 degrees F. This point is 5,400 feet in the pitch of the main ore channel below discovery cut. The top of the big stopes at thirteen and fourteen levels registered seventy-five degrees, and the No. 2 shaft station main return air course at the thirteenth level, seventy degrees.



FIRST AID TOURNAMENT TEAMS, 1918, KELLOGG "Y"

These are comparatively low temperatures for such depths. The mine, however, is damp throughout and the relative humidity is high in all these sub-levels, causing men to perspire freely at work, and this gives the impression of much higher temperatures than actually prevails. The only remedy for this humidity condition is a greater volume and velocity of fresh air currents, and the Company is making a very earnest effort to attain this improved condition, which, I think, will shortly be accomplished.

At the Hercules Mine, with a drainage cross cut tunnel at its lowest point from Canyon Creek only a few hundred feet short of two miles in length, the natural ventilation in its new sub-levels is still good. Its new vertical four compartment shaft from this level is 1,400 feet deep, but only three sub-levels have yet been opened down to the 600. The big underground hoist stations are completely sealed with tight air doors, and the main shaft, in the winter carried 30,000 cubic feet of fresh air in December, affords ample ventilation for the present levels, by way of the shaft drifts stopes and up-cast through several big rock raises to the No. 4 tunnel outlet 600 feet above No. 5 a natural return circuit in the summer season. Stations are now being cut in the new shaft at the 800 and 1,000 sub-levels in this mine, where the natural temperatures are slightly under seventy degrees and well ventilated by an exhaust fan at the 600 station.

The Hecla Mine has a natural advantage in ventilation in the fact that its main working shaft starts at the surface and does not involve the long adit approaches of the other mines mentioned. It is ideally situated for natural gravity air ventilation and the management has taken full advantage of this condition. This mine has a drainage level driven on the course of its ore zone several thousand feet, which strikes directly into the East side of the abrupt slope of Canyon Creek, near the main surface shaft collar. The main shaft now has a maximum depth to its new bottom station 2,000 feet vertically. The bottom active level is at 1,600 feet and the lineal distribution of the ore bodies are strung out through fully 3,000 feet in length and duplicated with several parallel courses of ore with many raises, chutes and manways at short intervals.

Near the East end of the ore development an expensive

straight line raise nearly vertical and 1,400 feet high was put through to the surface from the drain tunnel for ventilation purposes and gives a maximum gravity vertical range to the 1,600 level through connecting raises for natural air pressure of 3,000 feet with several other outlets above the drain tunnel to relieve the main West stopes, and this theoretically presents almost ideal conditions for natural gravity air circulation.

The main shaft has a large sized idle compartment and each station drift entry is provided with an air door, and in December this shaft, acting as a natural down-cast, was distributing 28,000 cubic feet of fresh air per minute at strong velocity through the lower levels with return through numerous outlets to the surface. The recent rapid expansion and duplication of the operating avenues and ore courses of this mine, all heavily timbered, develops a heavy resistance to free air circulation in spite of its extremely high chimney draft value, and retards the flow of the return air, which is believed to be due, in part, to lack of proper splits in the West ore body, a condition that the Company's engineers are now studying carefully with a view to remedying by additional doors and stoppings, and if this is not effective, a powerful Sirocco fan will be installed as an exhaust, probably at the head of the No. 3 tunnel, 1,400 foot raise.

The temperature at the new 2,000 station in this mine in December was 70 degrees, with relatively high humidity. Like all the other sub-level properties the maximum or warmest place tested in this mine, due to the same cause of temperature localization as the Bunker Hill & Sullivan and Morning mines was at the top of an exhausted stope on the 600 level, 1000 feet above the bottom working level, which gave a reading of 70 degrees F.

It would seem from the foregoing that the temperatures in the deepest mines of the Coeur d'Alene district are comparatively low and range around ordinary normal summer heat at the surface. There is prevailingly, as previously stated, however, a general dampness of the ground and the resulting humidity or moisture in the air.

At the Bunker Hill & Sullivan Mine, the stoping is all done on day shift and at the other mines the bulk of it is done on day shift, and when two shifts are working in

the stopes, the blasting is practically all done at the end of the second shift, which permits eight to sixteen hours' time for the mines to clear of smoke and gases resulting from the blasts. Exhaust fans are invariably used in dead ends and there is no point in the district where the air can be called bad at this time, but in several of the properties, at the end of a shift with a big crew of men working it is poor and can be greatly improved by the mechanical installations and new connections designed to facilitate the distribution of the currents, and I look for a big improvement in these conditions during the coming year in all the deep mines of the district and an ultimate full solution of the problems involved, as is possible.

### Mining Methods.

Aside from these growing ventilation problems, all the big mines of the Coeur d'Alene district are otherwise in good physical condition. The system of stoping in the different properties varies sharply and in fact varies in a single property. At the Hecla Mine its various new ore bodies are adapted to and mined by three different systems of stoping, which include Straight back stoping with heavy timbering and filling, Shrinkage stoping in narrower veins and hard walls where the men work on broken ore which is maintained close to the back and involves hardly any timbering and with care used in drawing the stopes, is one of the safest methods employed. Another system in other ore conditions in this mine is called Rill stoping, which is similar to the Shrinkage method, with the exception that the back is carried at an incline angle between two chutes, from which the stope is filled with waste, at the angle of repose and floored over with boards to within close drilling distance of the back. The ore is blasted down in one or two cuts with light stoper machines and drawn off from the top set of the protected second shoot at the bottom of the incline. The boards are then taken up and the space again filled with waste and the process repeated. For firm ground this system has proven a big economic advantage and in a year's time has resulted in only a very few minor accidents.

At the Hercules Mine, its big, hard ore bodies up to 40 feet wide are mined by Breast stoping methods with

liner machines, heavy square set timbers and close waste fill. At the Interstate-Callahan Mine back stoping and straight waste fill is used. The waste necessary for the purpose is either sorted from the vein or taken from waste raises especially driven. Crib chutes and manways at 30-foot intervals are the only timbers employed in the operation, except occasional stull or sprags to protect the men against a suspicious slab of ground. The formation is hard and tight and especially adapted for this method of mining, as the fill is kept up to within one or two cuts of the back all the time and floored over with three-inch planks with broken joints to prevent waste of the fine, high grade mineral. These are taken up and used over again as the shoots are brought up and each horizontal cut is finished and filled. All the above mines are operated on nearly vertical veins.

The big ore bodies of the Bunker Hill Mine are all handled by straight, square-set work and very close filling, by reason of the flat dip of the vein—40 degrees. A nearly vertical face or bottom slice method is carried up on the ore body, which permits the weight of the mass of the ore to rest on the foot wall and affords a reasonably safe system of extracting the mineral. It is seldom that more than two sets of timbers are open at a time between the fill and the face of ore being worked. A few of the narrower ore courses in this mine, where the ground is hard, are worked with stulls and waste fill methods, with the fill kept close up to the back.

At the Tamarack & Custer Mine, the ore bodies occur in hard ground, the nearly vertical main channel being 1,400 feet long with a maximum width of 50 feet and carrying several parallel courses of mineral of good stoping width. Uniform close stopeset timbering and filling is followed at this property and pillars of ore left at intervals in the wider spaces or where the parallel stopes are close together, which are substantially protected and accessible and can be safely drawn as the work recedes from the upper levels.

By virtue of its newness and liberal management its advantages of splendid natural ventilation to the thousand foot level, this mine is an absolute model of up-to-date methods of handling such a deposit. It produced an aver-

age daily output of 450 tons of ore with a crew of 120 men, has a splendid surface camp equipment and enjoyed a full crew throughout the year.

In the wider ore stopes of the district, especially toward their apex, the gradually packing waste fill results in a slow settling of the floors and occasional bending and cracking of the timbers, which subsequently involves lengthening the posts in the upper floors and sometimes necessitates close angle bracing. In the vertical vein big stopes, when bottoms are being taken out which represent the keystone of the arch of the stope, the progress is generally stopped three or four 9-foot floors below the succeeding level and end slicing is resorted to, taking out one set at a time under the track and filling the ground, together with the exhausted ore shoots and manways, with waste. This operation naturally weakens the back of the succeeding level, which frequently becomes heavy and low, but seldom results in any run of waste from the stope above, which, due to natural side pressure of the walls, is generally tightened and held in place.

Taking out bottoms, however, always develops ugly looking conditions in the level locally. The work is usually done by selected men and seldom results in any bad accidents, as great care is taken to prevent a run and in old levels that it is desirable to keep open for subsequent use, drifts have occasionally got to be run in the walls around such connections. These are conditions that give an ugly appearance to a level, to one unfamiliar with their cause, but for a number of years, through careful handling, they have generally been accomplished without serious accident troubles, and present methods are aimed at overcoming them in a measure by driving the drifts in the walls.

A man that could operate a big mine and extract the ore economically without broken timbers would be a valuable acquisition to the industry and could demand a high salary. The ugliest underground conditions that have ever existed in the Coeur d'Alene district was in the big rich ore body traversing the Stewart and Ontario Mines, which was unfortunately cut off abruptly and lost by a regional fault. This ore body was operated in a complex of faulting conditions that had crushed the enclosing formation to the consistency of a dump pile, and the ore bodies to

corn meal size jig feed. I doubt if there was a set of timbers ever put in this long ore channel, during the years of its operation and production, that ever stood either vertical or horizontal for thirty days after they were placed. Close timbering and filling was employed and these mines were operated for several years without a single fatal accident from fall of ground.

The ugliest mine ever operated in Idaho was the Delamar Mine in Owyhee County. This was a complex of closely parallel ore bodies in a naturally hot igneous formation of slow swelling ground throughout. It was operated for twenty years. The first ten years on high grade \$50.00 to \$100.00 gold-silver milling ore values, the treatment of which by the pan process cost \$15.00 per ton, and the ore below that grade was used for filling the subsequent treatment of this ore with a cyanide mill cost of \$2.00 per ton, which made all the old fills available for re-mining and added ten years to the life of the property. When these old fills were mined they were found to be packed tighter than the enclosing wall rock and the old timbers and lagging were reduced to a brown charcoal.

During the last ten years of the operation of this property with a crew of 150 to 200 men there was only one fatal accident recorded and that was due to a blast. I mention these conditions to show that it isn't always the prettiest timbered condition of a mine that presents its maximum safety.

It will be seen, from a brief review of the fatalities occurring in Idaho mines in 1918, that the natural and inevitable hazards of the industry were very largely to blame; that in other cases more personal care on the part of the victim might have prevented the occurrence.

The mechanical equipments of our big mines are inspected daily, which is true also of the operating shafts and their rope cages and attachments. The signal systems employed are ample and in some instances include five different lines covering flash light, electric, pull bells, buzzers and telephone. When plenty of labor is available the timber repair work and orderliness of the underground conditions are usually well maintained, modern sanitary provisions are provided underground and I think these big mines will compare favorably with those of any mines

in America of equal underground extent. The Coeur d'Alene camp elevations are moderate, ranging from 2,500 to 3,500 feet above sea level; it is a heavily timbered, well watered, normally healthy, mountain country. Tuberculosis of local origin is rare; the mines are damp, but seldom drippy. Dust killing devices are liberally provided and lead poisoning from mine work is rarely heard of since the shallow carbonate stopes were passed.

### COMPARATIVE CONDITIONS.

Comparisons are odious in metal mining, as relative conditions and established customs frequently cut a big figure, but, as comparisons in accidents and fatality matters are now the vogue, both nationally and internationally, a brief personal experience along this line may be of interest.

A year ago I was called as a witness in the Federal court at St. Louis to protect the good name of a Coeur d'Alene development enterprise against an eastern stock faker, and took occasion to visit one of the central western metal mining districts, the Komspelter district, where the majority of employes are American born and which has been operated constantly for fifty years. This field covers the corners of three states and I was decidedly interested in the method employed. The district is 26 miles long and at the time of my visit was said to be employing 10,000 underground workers. The ore bodies are operated through vertical shafts that range from 100 to 300 feet deep and their product is zinc and lead.

I visited underground in one of the oldest mines of the district, which had been operated on three horizontal veins of ore, varying from 10 feet to 40 feet in thickness respectively, one below the other, and had made a production of several million tons of mineral. The principal working shaft, on this property, was 285 feet deep, a single compartment affair equipped with a small single drum hoist, timbered through the first 50 feet of soft ground with three-inch planks, laid flat and cribbed on the corners. There were no timbers below this point to the bottom of the shaft, nothing but the bare limestone walls and metal hangers for the pumps and air columns. No cross heads or guides to control the loose swinging bucket used for

hoisting and no ladder in this single compartment entry to the underground workings. The mined spaces underground were very extensive and had a maximum height of 50 feet, supported on pillars of ore without any timbering, and to a man familiar with close timbering methods, looked like a rather wild situation for men to operate under. Appreciating that the mine was idle and one of the oldest in the district, I thought it was probably a back number.

I afterwards visited, in company with the local Deputy Mine Inspector, one of the newest mines on the belt at its southern end. This mine was one of the richest in the district. It had a horizontal ore body 40 feet thick of magnificent high grade concentrating zinc-lead ore. It was developed through a vertical shaft 300 feet deep, equipped with a substantial gallows frame about fifty H. P. electric hoist, placed half way up the gallows frame, where the hoist man could lean over the guard rail and look down to the bottom of the shaft. At the ground level the open shaft collar, without a guard rail, proved to be another single compartment hole 5x7 feet, identical in its construction with the old shaft I previously visited. This was also timbered with three-inch lumber for the first 100 feet and bare limestone walls for the balance of the distance to the bottom. The loose swinging bucket without guide or cross head, spun like a top before it reached the bottom, with myself and the three men accompanying me. There was no ladder and no other outlet at the time and the hole was decidedly gassey.

This mine was working a crew of 60 men and producing 500 tons of ore a day. Aside from the square wooden platform at the bottom of the shaft, the ties in the narrow radiating tracks and the muck sticks, there was absolutely no timber in evidence in the mine, whose high roof was only supported on staggered pillars of ore. The hard ore ground was drilled with liner machines with short advanced headings under the roof or back and 16-foot stope holes driven into the bench, "squibbed" or chambered for heavy charges of powder. The broken ore was handled entirely with very light trucks and tracks in 1,200-pound buckets, locally called "cans," and the muckers were the aristocrats of the crew, working in pairs by the piece, at

so much per "can," and earning from \$6.00 to \$10.00 per day each, but I was informed by my guide that they invariably broke themselves down in health in their efforts to earn this big wage, in from two to three years, and were glad to get back to a chuck-tending job at smaller pay, and that this contract system, while progressive from an operating standpoint, was serious in its effect on the general health of the workers.

The signal line in the shaft had a bell at both ends, the bottom bell where the cager or hooker stood was operated from a push button at the hoist man's seat, where he could see the rapidly ascending bucket and if it got to swinging too much on him and was likely to spill, his push button "Skidoo" bell—a statutory requirement—was provided to warn the hooker at the bottom to get from under. These conditions seemed decidedly crude and out-of-date compared to our far western standpoint of underground operating methods, but they were said to be decidedly effective in getting the muck and locally accepted as satisfactory.

The south end of this district, where this mine is located, has shown an astonishing development of rich zinc mineral in the past three years, and a view from the head of the gallows frame revealed 150 operating mines and mills of similar capacity and their numerous shovel bin piles of golden-brown rosen-jack concentrates of clean, high grade finished zinc mineral presented an impressive object lesson in the market competition that our more complex western zinc ores have been subjected to in the last two years.

#### Smelting.

The large, new lead smelter and refinery plant of the Bunker Hill and Sullivan Company at Bradley, a mile below Kellogg, was run very successfully and continuously throughout the year, handling about 10,000 tons a month of high grade finish mill product of lead-silver concentrates and crude ore. Its finish products of soft lead, refined silver and gold, and copper sulphate, were all of premium quality and found a ready market by reason of their superior quality.

## LEAD-SILVER.

## Coeur d'Alene Mines.

New mining progress throughout the year in Idaho was so seriously retarded by the scarcity of labor and the excessive cost of supplies that a number of promising ventures ceased operations and shut down to wait more favorable conditions, as development ventures are hard enough to finance in normal times, and during the war activities such speculative enterprises were decidedly difficult to get money for.

Some activity was shown in the search for rare mineral substances and in response to inquiries of the different Federal departments and boards handling these matters, considerable time was given to looking up possible Idaho sources of these rarer war minerals. Advanced development in the big mines of the north was nearly at a standstill and the principal properties were largely operated on proven ore resources. Such new work as was done, however, in some instances produced most gratifying results.

At the Bunker Hill & Sullivan Mine, the new No. 15 development sub-level, 1,800 feet below the deep Kellogg tunnel on the dip of the vein, the cross cut was completed and a drift extended to the line of the No. 2 shaft, the position of the main ore channels and subordinate fissures were opened disclosing the normal condition as to clean quartzite walls and clean, rich ore bearing character even in the smaller ore courses, with the most gratifying prospects of continued persistency below this great depth.

The ore body at the Morning Mine was cut at the No. 20 level, 1,200 feet vertically below the deep No. 6 valley bottom tunnel, where the vein was found in normal ore bearing condition.

The Hecla Mine made the best expansion and demonstration of new ore resources of any year in its history. The plan of systematic cross cutting of its extensive territory inaugurated by the management of this property several years ago has produced exceptional results, and while the mine, a few years ago, was looked upon as having one straight ore shoot, it now exhibits a series of duplicated parallel and diverging ore channels of big stoping width

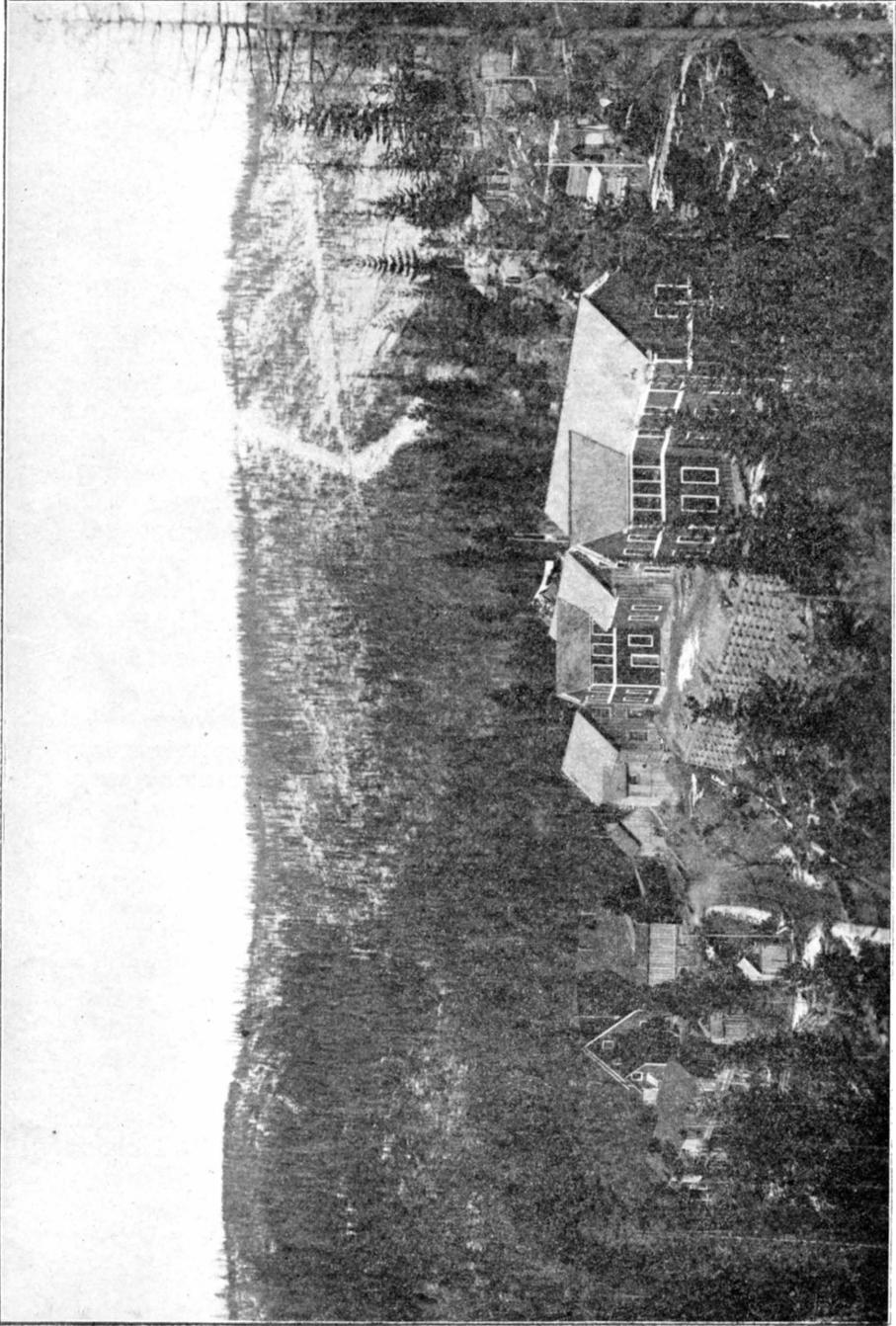
through a lineal zonal extent of fully 3,000 feet, which has attained a maximum production of 1,000 tons a day and is rapidly becoming one of the larger units of labor employment in the district.

The Hercules Mine was operated at three new sub-levels below the No. 5 Canyon Creek tunnel, where the normal big stope faces of high grade galena mineral are still exhibited and new stations were cut at the 800 and 1,000 foot levels, preparatory to further exploitation.

The banner expansion of new ore resources of the year was made at the Tamarack & Custer Mine, where systematic cross cutting and drifting, as well as stoping in all the productive adit levels of the mine to a depth of 1,000 feet, has revealed a remarkably interesting and important system of parallel ore courses, in addition to the main long ore shoot, which is now systematically stoped for a length of 1,400 feet. Like the Hecla, this property is now exhibiting a zonal occurrence of mineral that resembles a magnified Fahlband deposit or the Horsetail ore bodies of the Butte district, with each band a good stoping vein of itself.

Further development in the sub-levels of the Interstate-Callahan Mine continued to add clean new ore resources to the property and a new ore body of good promise was intersected from one of its deep levels on the company's Nipsic group.

On the opposite side of the mountain on the Beaver Creek drainage, the Amazon-Manhattan Mine was put in splendid shape for future production at the third level. The ore shoot was fully undercut and proven to be 700 feet in length and up to 14 feet in width. A cross cut was also run from the Ray-Jefferson tunnel, which penetrated this same ore body at a further depth of 1,000 feet, and this had been drifted on for a distance of 400 feet from where it was intersected late in the fall. This splendid ore channel carries rich milling values in zinc, as well as lead-silver ore and this new development demonstrates its persistency to great depth, totalling now nearly 2,000 feet below the apex, and insures a handsome future tonnage of valuable mineral.



PARTIAL VIEW AND CAMP BUILDINGS TAMARACK AND CUSTER CONSOLIDATED MINE, NINE MILE

On Canyon Creek, near Burke, the Sherman Mine was operated through the No. 4 Union tunnel, where a fine shoot of ore was disclosed four to eight feet thick, carrying an average value of 20 per cent lead that proved to be 180 feet long and was encountered at a depth of 1,000 feet below the apex of the vein. For the further development of this new channel of rich milling ore, the old Creek tunnel level of the Tiger-Poorman Mine was cleaned out and is now being extended. This ore body is believed to be on the strike of the Tamarack & Custer fissure, whose splendid exhibition of mineral at its deepest point offers decided encouragement for the future prospects of this promising ore body on the Sherman property at the new level now being run to intercept it at an additional depth of 640 feet, where a convenient outlet is afforded directly onto the railroad track at Burke.

At Mullan the Gold Hunter Mine maintained a steady output at full capacity throughout the year and under the most competent handling of its history increased its ore resources from the intelligent exploration of its big ore zone.

Three miles east of Mullan the Carbonate Hill Consolidated Mine—a number of patented claims on the opposite side of the canyon from the producing mines in a highly mineralized territory—was the scene of active and intelligent development work, consisting of the reconstruction of a 1,200-foot tunnel cutting a big underground station, and the sinking of a 400-foot vertical shaft. This property, at the point operated, discloses a zone of mineralization that is 600 feet long, has a maximum width of 150 feet, with a very pronounced controlling fault fissure and well sheared ground that is richly impregnated with stringers of iron carbonate, lead and zinc sulphide and presents a most attractive prospect for further and deeper development. One band of galena ore now exhibited in this zone is six to sixteen inches thick of clean high grade shipping mineral as good as any in the district. Work was suspended on the property in December, shortly after my visit, due to unfavorable operating cost conditions, but will doubtless be taken up again later, as the property is in excellent shape for the further prosecution of its development. It occurs along a zone that is more than a

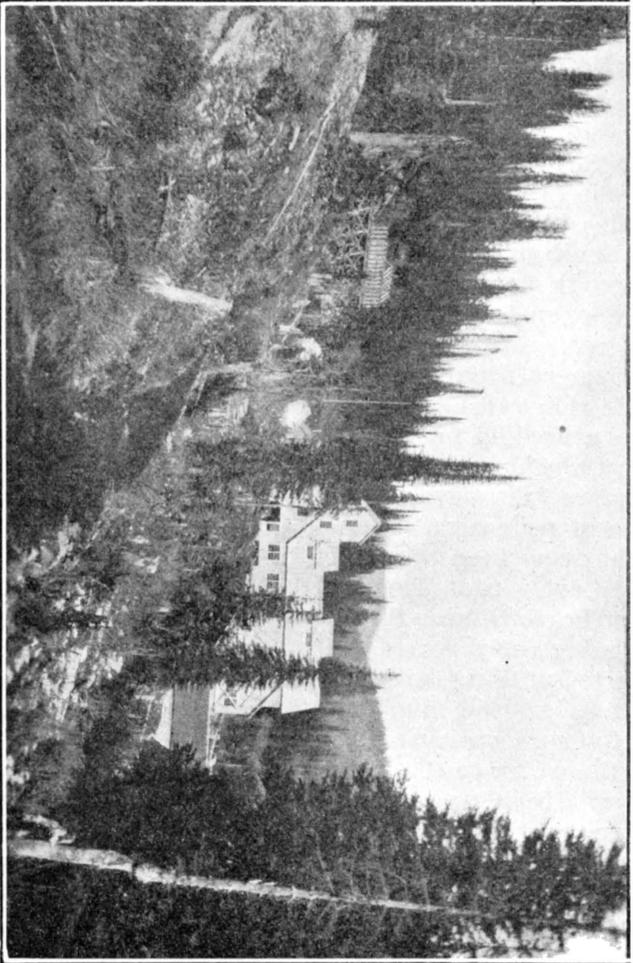
mile long and exhibits splendid surface and shallow development manifestations of mineral throughout its length. The successful opening of a profitable ore body on this zone would likely provide an important added asset to the lead-silver resources of the district and stimulate a further interest in the prospects along this side of the valley.

Another new venture that has been in slow process of development for several years was on the so-called dry belt between Wallace and Wardner, where the Big Creek Mining Company, Ltd., developed a splendid ore shoot in its 3,380 foot cross cut tunnel, that already has a proven length of 200 feet of high grade lead-silver mineral up to three feet thick. This property entered the list of shipping mines during the year with a production of crude ore and concentrates aggregating several hundred tons, that gave net smelter returns of 40 per cent lead and 40 ounces silver per ton. This new ore occurrence is being operated at a depth of 1,200 feet, to which its continuity has been proven through three cross cut tunnels. This vein has made occasional shipments of very rich ore containing bonanza values in silver, and with its favorable underlying formations and improved values at this deep level gives encouraging promise of continuing to the full range in depth of some of the more important galena ore courses of the district.

At Pine Creek the most important progress of the year was at the Nabob Consolidated Mining Company, where a splendid shoot of lead-silver-zinc mineral has been intersected through the lower Nabob tunnel; several cars of high grade, handpicked mineral were shipped and a mill of 150 tons daily capacity is now in process of construction for the treatment of a handsome reserve of well proven ore tonnage.

#### Other Districts: Idaho Continental Mine.

Among the other lead producing districts of Idaho, the Idaho-Continental Mine in the Boundary Creek district in Boundary County made important and marked progress in new ore development and in addition to a large output of clean crude lead ore and concentrates the normal stoping



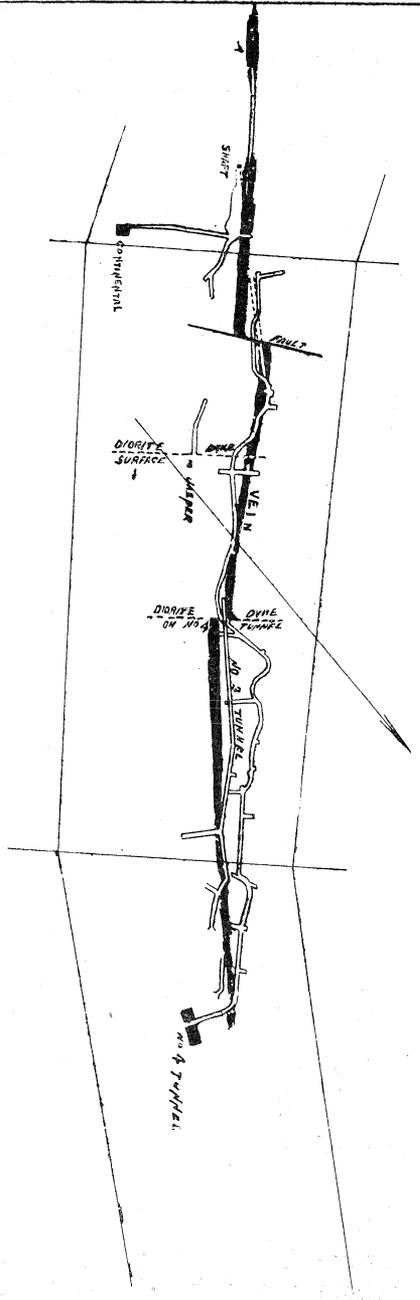
IDAHO CONTINENTAL, MILL, BOUNDARY COUNTY

and drift progress, together with a little additional cross cut work, greatly expanded the ore tonnage resources of this property and emphasized its growing importance and prospects. This mine is developed by three adit tunnels driven along the strike of the vein, the lowest tunnel being 1,600 feet in length and attaining a face depth of 500 feet. The ore was supposed to lie in three separate shoots, but the past year's development has demonstrated the likelihood that it is one persistent channel of stoping ground practically the full length of the lower adit and that the adit was previously driven off the course of the vein for considerable distance. Also a drift extension beyond a short fault at the south end added several hundred feet of additional stoping ground that can be readily undercut by the extension of the lower or No. 4 tunnel, and should very greatly enhance the ore resources of the property as development progresses at that horizon.

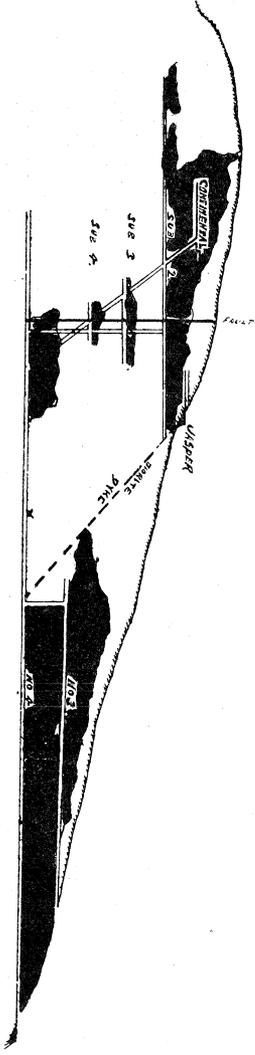
This vein carries other handsome virgin ore croppings and is traceable for 2,000 feet north of the portal of its lower tunnel. The recent disclosures indicate that when it is more fully developed it may carry one of the longest and most persistent channels of desirable galena mineral that has ever been opened in the state.

The Continental Mine is situated 26 miles from the railway at Porthill, near the Canadian line. Its isolated position has greatly retarded its progress. The property is connected with the railroad by a wagon road, whose route embraces a broad mud flat and overflow river bottom of the Kootenai valley and a rugged glacial canyon route from the valley to the mine. The road on this route, however, was built on a uniform grade with a maximum of four per cent, with a view to its ultimate equipment with a shay railroad and the rapid expansion of the ore resources of the property now afford the most promising encouragement for the construction of this improved means of transportation.

The vein is a steep pitching fissure in clean, thin, bedded quartzite walls and is intersected by minette dikes. Its ores are clean galena with no zinc and very little iron sulphide and present conditions more typical of some of the Coeur d'Alene deposits than any other mine in the state outside of that district. If its permanency in depth is in



PLAN & SECTION  
 of  
 IDAHO-CONTINENTAL MINE



any ratio to its lineal extent, at the surface, it should gradually develop into one of the more important lead ore resources of Idaho. The property is equipped with a concentrating mill of 150 tons daily capacity, an hydroelectric power plant on Boundary Creek, 12 miles below the mine. Both these installations have been greatly improved during the past year and the former difficulties from the shortage of power materially relieved. The metal contents of its ore shipments during the past year by motor truck haulage to the railway aggregated 7,000,000 pounds of lead and 129,000 ounces of silver, with 1,500 tons of high grade mill product left on the dump when the roads became too soft for hauling in the fall.

#### Wood River District: North Star Mine.

In the Wood River district of Blaine County the Federal Mining Company of Wallace continued their efforts until September to solve the serious metallurgical problems involved in the treatment of their extensively developed ore resources at the North Star Mine and at that date had gotten their 150 ton mill working to a favorable point of extraction and they were making a good production of zinc concentrates up to forty per cent zinc values.

This mine has developed large lodies of relatively rich zinc-lead ore carrying values around fourteen per cent zinc, eight per cent lead and eight ounce silver in bodies up to twenty feet thick and proven for several hundred feet in length and depth. This decidedly interesting ore deposit is complicated at the metallurgical end by the fact that the rich commercial mineral values are associated with an excessive proportion of arsenical iron sulphide and some antimony.

#### Independence Mine.

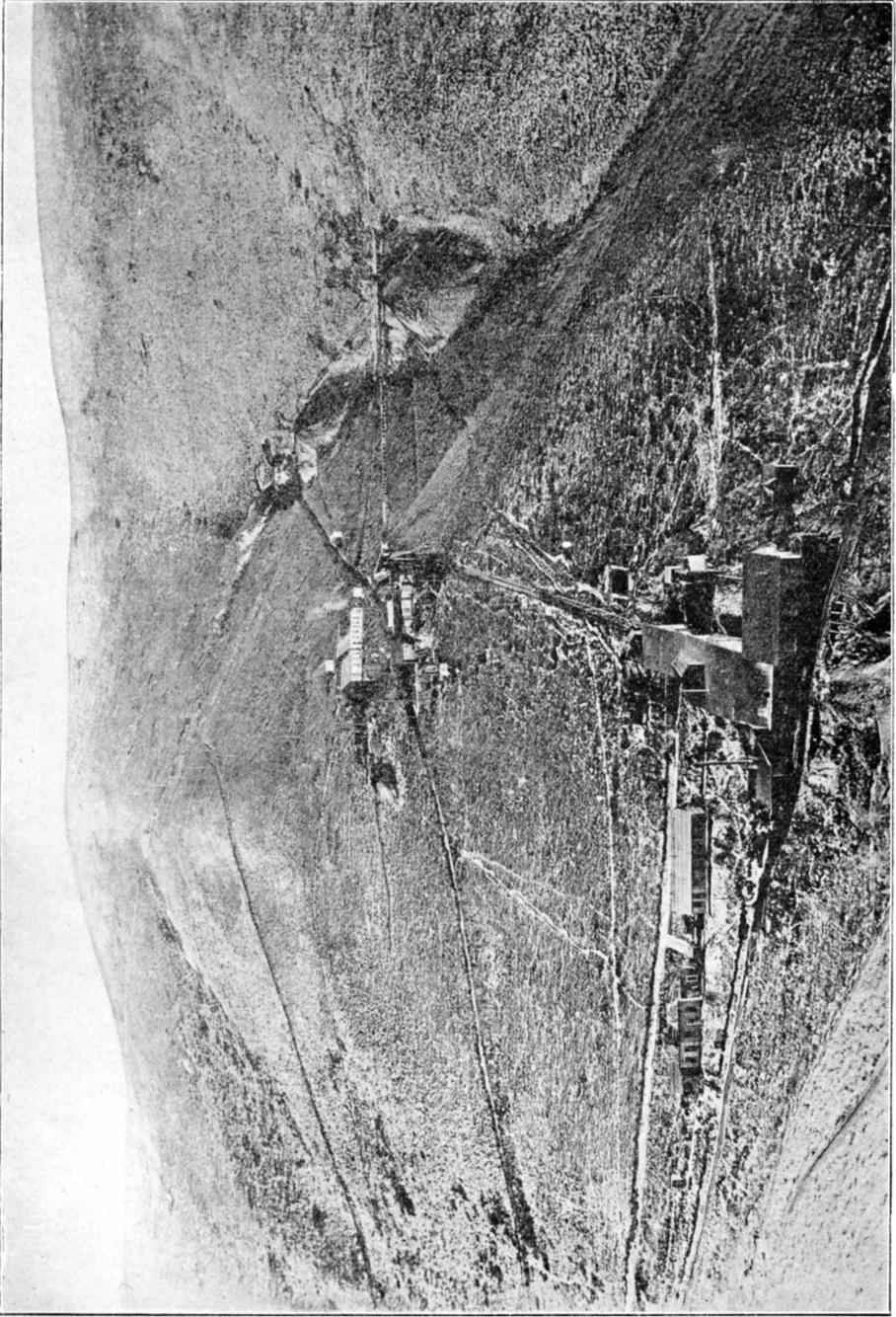
In September the slump in the zinc market made it practically impossible to dispose of the product and operations were suspended. This same Company, during its activities at the North Star Mine, had acquired the Independence Mine on the opposite side of the mountain less than a mile away. This property carries an ore course that is in sharp contrast with the Star Mine in that its ore values are practically free from zinc and decidedly simple and easy to

treat, consisting essentially of shattered quartz with coarsely crystalline galena and a little pyrite.

This mine has been developed with six levels at hundred foot intervals. Its main disclosure of the past year is an ore shoot eighty feet long with a maximum width of thirty feet. The property is equipped with a small mill and its older development has been materially extended at the different levels. From this work, with very little stoping during a large part of the year, a daily production of twenty-five tons of high-grade crude shipping mineral and concentrates were made carrying thirty to fifty per cent lead with over two ounce silver to each unit of lead.

The enterprise gives decided promise of a successful and profitable mine when it has been further developed. Plans are being considered to drive a cross cut tunnel from the deep level of the Star Mine to the Independence vein, a horizontal distance of a little over 3,000 feet, which will give several hundred feet of additional depth and provide a splendid outlet to the property and a brand new mill for the treatment of its product.

The Company is to be congratulated on the acquisition of such a promising prospect after its extremely expensive efforts to turn the complex ore bodies of the adjacent Star Mine to commercial account, and the district is also to be congratulated in getting such substantial mining operators so heavily interested in the demonstration of its mineral resources as there is no Company in the State better able or more competent to thoroughly develop and demonstrate the possibilities of a mining or metallurgical problem. Their work will not be stunted in either direction and it is more than likely that in their hands an ultimate demonstration of Wood River ore deposits at Maximum depth will be determined and there success would doubtless have a powerful influence on the revival of interest in several other noted old prospects of the district whose failure at moderate depth is believed, by some good authorities, to be due to faulting rather than exhaustion.



INDEPENDENCE MINE, WOOD RIVER

### Other Mines.

At the Golden Glow Mine on Boulder Creek above Ketchum a small force was engaged on development work during the year and some shipments of high grade lead-silver mineral were made that is of similar character in clean, rich silver and lead values to that of the Independence ore.

The Homestake Mine was also operated in a small way and shipped some good lead-silver mineral. A number of cars of high grade zinc carbonate ore was produced and shipped by the Kusa Mining Company on Lake Creek.

A new development enterprise was started in the Muldoon district, where a rich silver bearing ore deposit is being exploited by Montana capital.

The Mascot Mine at East Fork was under development with a small crew throughout the year. An extensive plan of new development and equipment in the way of water power and compressor plant with a deep tunnel project was negotiated for the property late in the fall with a view to the more permanent and deeper development of its big sulphide ore bodies.

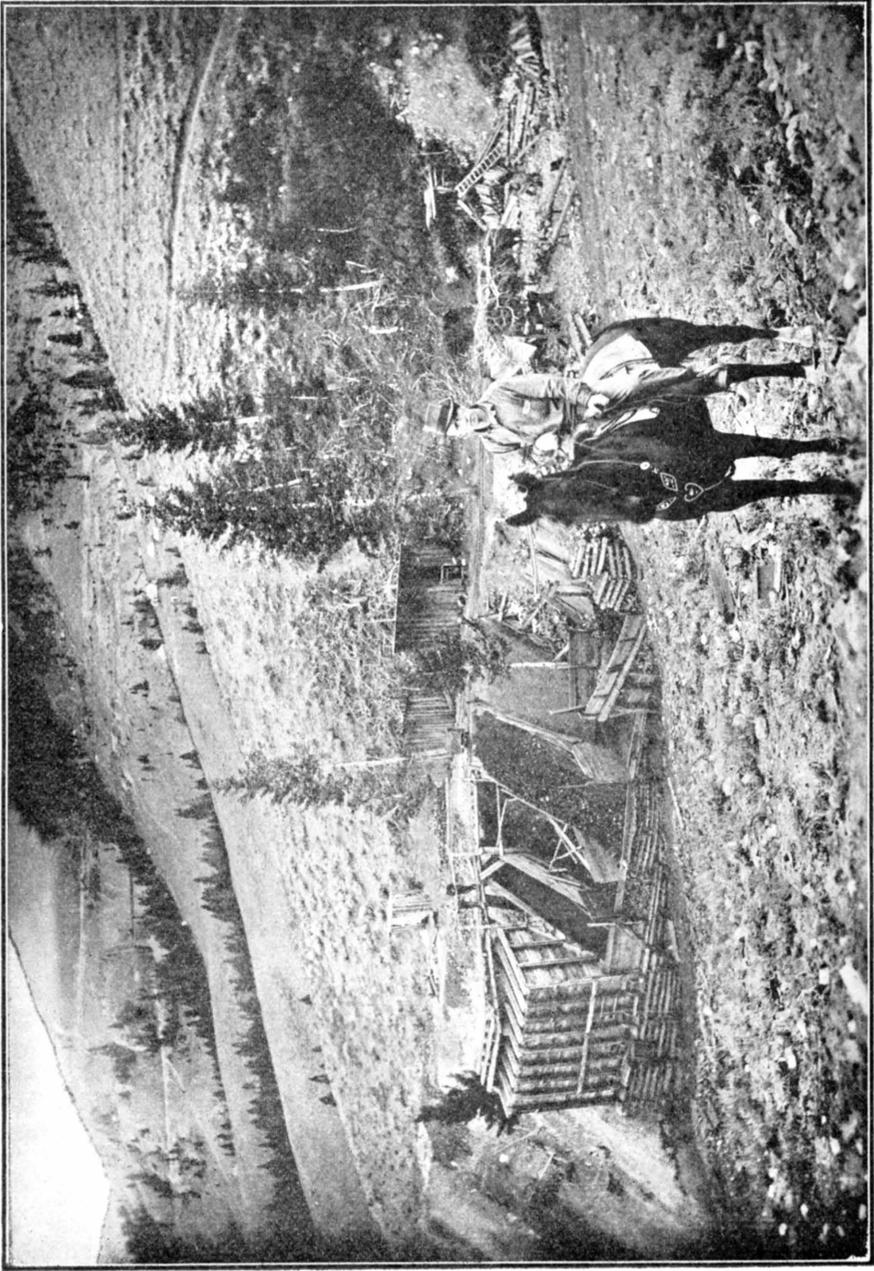
The mining districts tributary to Hailey are richly mineralized, have many important points of development and past production in lead-silver and zinc minerals. In some of the other leading districts of the county splendid prospects of ore resources in copper and gold are available and present a broad and promising field for intelligent mining development work.

## CUSTER COUNTY LEAD ORE.

### Red Bird Mine.

The most notable lead ore production in Custer County was from leasing operations at the Red Bird Mine on Squaw Creek, near Clayton, where a small crew of local leasers mined and shipped 2000 tons of ore carrying values approximating forty per cent lead and thirty ounce silver per ton.

At Mackay, the Keenan-Kennedy and Horseshoe Mines were under development throughout the year with a force of fifteen to twenty men. This property carries large porphyry-lime contact deposits of oxidized lead-silver ore



KEENON-KENNEDY MINE, NEW LEAD ORE DEVELOPMENT AT MACKAY

very rich in iron and sufficient silver and lead to make very desirable fluxing mineral. It is being operated by the U. S. Mining and Smelting Company and its big bodies of oxidized ore show some interesting improvement in silver values as depth is attained. Should these deposits carry a relative proportion of lead when the sulphide horizon is reached, it is likely that the mineral can be concentrated and afford a high grade shipping product and the establishment of a desirable important new tonnage resource of lead-silver mineral.

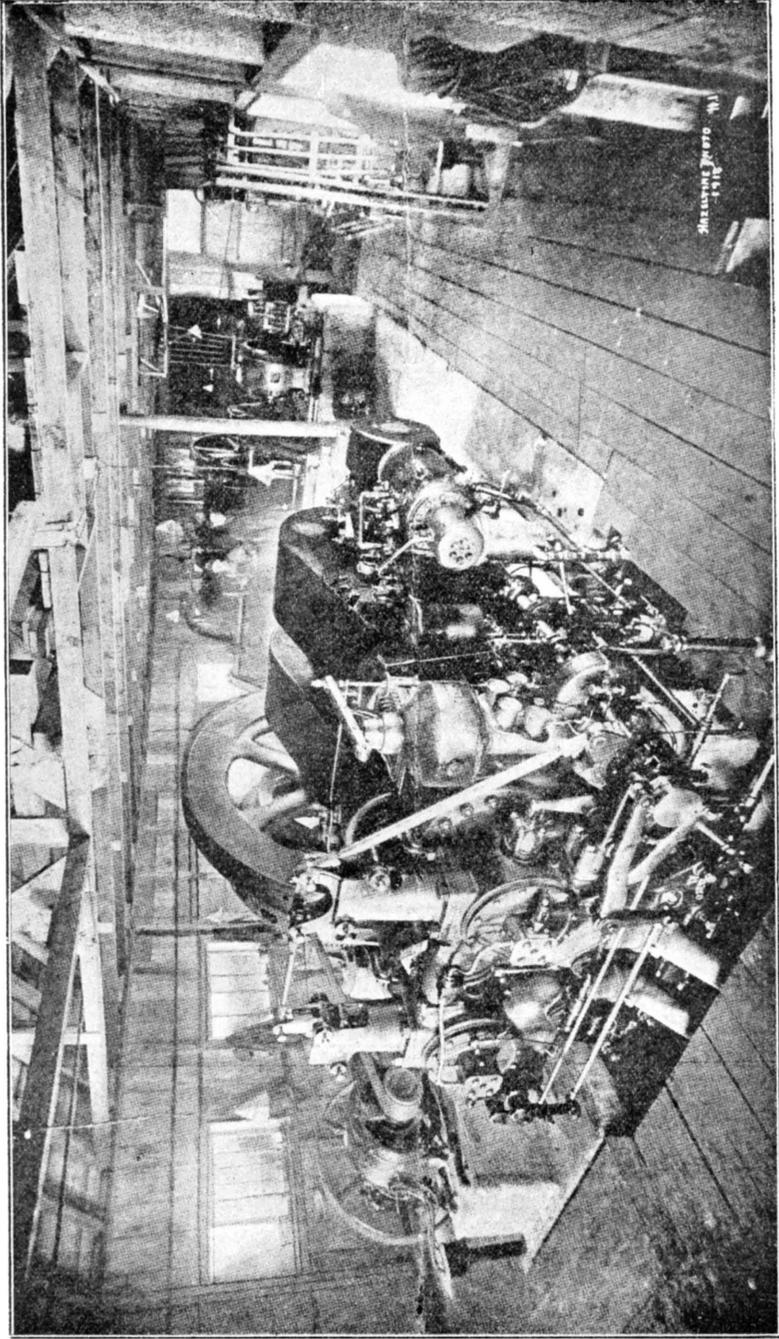
#### Wilbert Mine.

At the Wilbert Mine, in Butte County, on Little Lost River, the mine output was largely reduced compared to former years due to the loss of the Company's mill by fire and the sinking of a new shaft to the 800 foot level with the installation of a new surface hoist to replace a small underground plant. This deposit shows some of the best ore of its history in its bottom level and with its new shaft equipment, offers a far superior opportunity for the further extension of its development both in depth and laterally and with its favorable geological environments and a new mill now in process of construction, should again become a good producer when market conditions for its product warrants.

#### Gilmore District.

At the Gilmore district, in Lemhi County, the former leading producer, the Pittsburgh-Idaho Mine, was operated throughout the year by leasers, who made a handsome production of lead-silver mineral from the treatment of the old fills. The Company management finished the installation of a new power plant at the surface embracing a big Deisel type engine of 250 H. P. capacity for the operation of its new double drum hoist, compressor and pumps.

The illustration shows the oil engine generator unit. It was built by Allis-Chambers Manufacturing Company of Milwaukee, Wis., and is of the full Diesel type. The engine is an 18x27 duplex direct connected to an alternating current generator operating at 200 RPM., 3 phase, 60 cycle, 480 volt, and has a sea level rating of 135 KW. The engine is of the four stroke cycle horizontal type with an open fuel nozzle and a low pressure starting system.



POWER PLANT AND HOIST, PITTSBURGH MINE, GILMORE

This type of engine permits of the use of any kind of crude oil or distillates, provided that they are not too heavy to be pumped in small quantities.

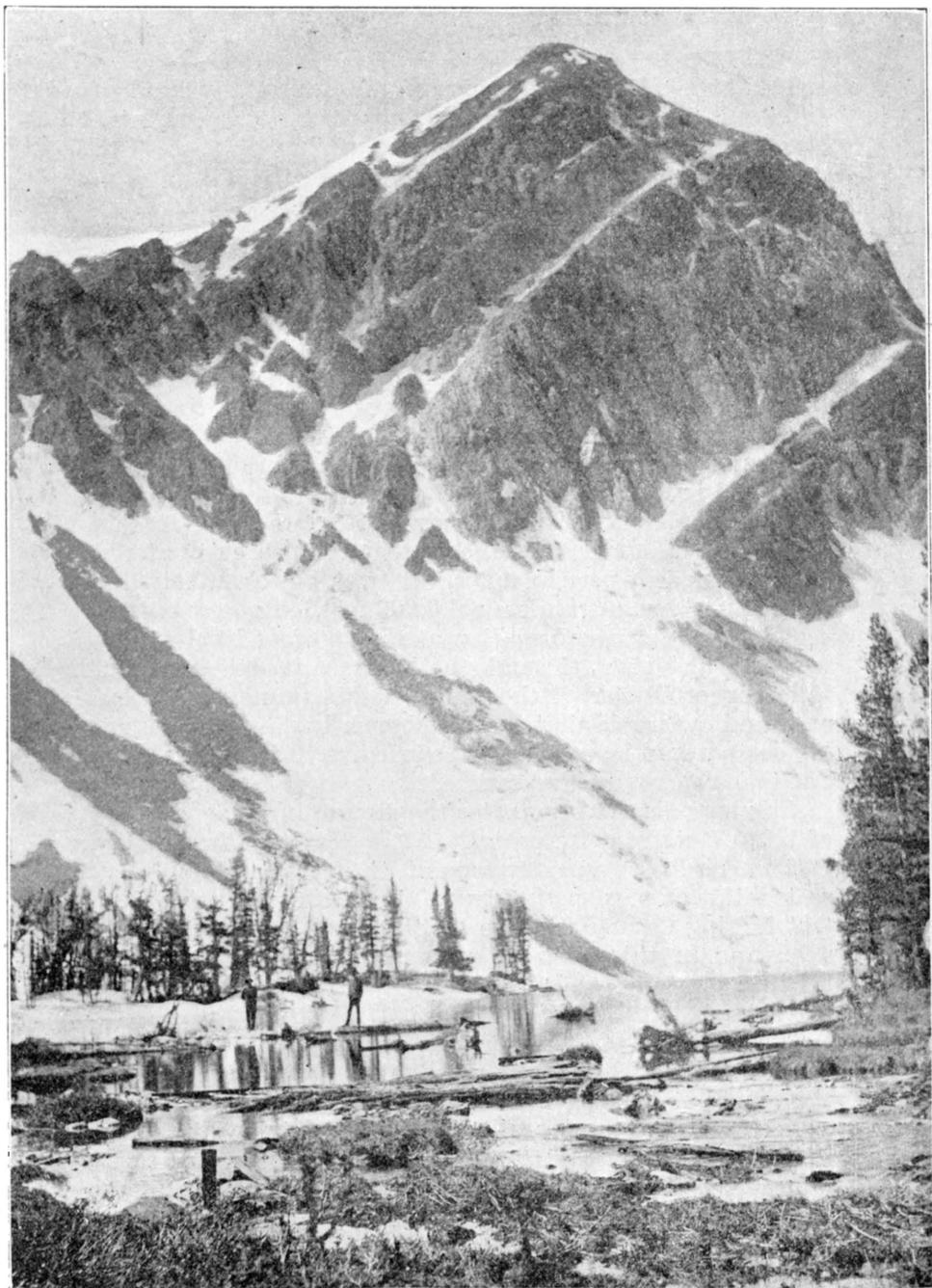
This Company's new 700 foot incline shaft was completed and put in working shape and the 700 foot level explored which, at the time of my visit in October, was showing decided evidence of permanency and the same ratio of ore in the main channel as found in the levels above, as far as the drifting has progressed. The ore, at this bottom level, was still almost completely oxidized. The work at this horizon had been decidedly retarded by an excessive flow of water which, however, at that time was well under control, since the completion of the power plant and development was progressing favorably with an increased production.

The completely oxidized character of the ore at this deep level indicates that the water troubles encountered do not represent permanent water level, but are likely due to leakage from a drain tunnel 6,000 feet long, that crosses the structure of the formation at the 400 foot level of this property and right through the heart of its stopping area. It is suggested that if the drain in this tunnel was deepened and concreted that the Pittsburgh-Idaho water pumping costs would be materially reduced as they are probably due to leakage from this source.

This long tunnel penetrates the mountain for a distance of 6,000 feet from its portal. After passing through the Pittsburgh-Idaho vein system at the 400 level it intersected the numerous fissures of the Gilmore and Latest Out Mining Companies at a depth of 900 feet below their apex and at this horizon, some rich lead-silver ore has been encountered and a number of car loads shipped to market.

The Latest Out Company, in common with the other Companies of this district, was short of men throughout the year, but it nevertheless made a handsome production of crude shipping mineral and continued to exhibit good ore resources in its bottom level and the future of these mines are still as promising as they ever were for further development and ore resources from a geological standpoint.

Small shipments of good lead ore were also made from the Spring Mountain district to the South and the district



GILMORE PEAK 11,000 FEET HIGH. QUARTZITE, LOWER EDGE GILMORE LIMESTONE AT LEFT OF PICTURE.

immediately West of Gilmore. In this direction the Brown Bull Mine worked by leasers shipped a small car load of mineral that netted \$150 per ton in silver and lead. This deposit is in the Cambrian quartzite formation underlying the limestone series in which the Gilmore fissures and ore deposits have been mined. It carries richer silver ore than any other mine in the immediate belt and is an indicator of the continuity through the limestone horizon 2,000 feet thick at Gilmore to the underlying Cambrian quartzite formation in which these rich silver-lead values lie.

#### Sunset Mine.

Twenty miles North of Gilmore, near Leadore, the Sunset Mining Company worked a small crew of men intermittently and shipped a number of car loads of oxidized ore carrying about eleven per cent lead and seven ounce silver per ton. The ore deposit on the property is one of the most interesting occurrences from a geological standpoint in this region and was originally known as the Leadville Mine by reason of its comparative geology to that famous district in Colorado.

It consists of a contact deposit in blue carboniferous limestone underlaid with a white silicious quartz porphyry dike or sheet. The best ore occurrence has been found under a red clay fault gouge that separates the ore bearing brecciated limestone from the overlying tertiary lake bed gravels which constitute the hanging wall. The deposit has a rather flat dip, has been developed through a shaft and a long drainage tunnel at the valley level to a depth of 500 feet. The ore above the bottom level consists of an ashy grey carbonate of lead. In the lower adit the mineral shows a dissemination of fine grained steel galena in a decidedly brecciated lime gangue with occasional segregations of clean shipping ore. The ore body is said to contain paying values for concentration through a width of ten to twenty feet by 200 feet in length at the 500 foot level. The enterprise has previously suffered for lack of proper financing, but now looks as if it might be made a source of profit and good, clean, shipping lead-silver concentrates with the help of an up-to-date concentrating mill in good hands, and I was advised that the Company was planning the installation of a plant in October.

## LEAD AND SILVER ORE IN GRANITE.

### Little Gem Mine.

There was very little activity in the lead ore prospects of the eruptive granite formations of Central Idaho during the year. A small crew was employed at the Little Gem Mine, near Grimes Pass in Boise Basin, which is being developed on a big, well mineralized porphyry contact fissure. Two car loads of ore were shipped from this mine last fall that gave returns of twelve and twenty per cent lead with fifty and seventy ounce silver per ton, respectively. The present prospects of the property, whose operation is being continued this winter, are decidedly encouraging for the development of a considerable resource of good concentrating ore in addition to the pay streaks of shipping values encountered.

### Fitzhugh Prospect.

Late in the fall a new lead-silver prospect was discovered two miles Northwest of the Gold Hill Mine at Quartzburg, on the North rim of Boise Basin. This discovery exhibited a vein four feet wide in a surface cut fifteen feet deep of fifteen per cent galena ore carrying about five per cent zinc and twenty ounce silver per ton. Specimen bunches of oxidized grey copper ore in this discovery cut gave results of 300 ounces silver per ton. The quartz croppings of this vein are traceable for a long distance in the granite formation in contact with a narrow dike of basic igneous rock. These croppings show the same spongy cellular condition at the surface as is exhibited in the rich sulphide ore cut and promises decidedly interesting results with further development.

### Silver Mines.

The cost of operation worked against the further development of straight silver ore deposits. Some activity was exhibited in the granite formations at the Banner, Vienna and Sawtooth districts of the upper Salmon and Payette Rivers, where there are a number of old properties that were famous producers in the early days of silver mining, and it is believed that their remaining resources are sus-

ceptible of profitable handling under modern milling methods and the strong position of the silver market.

#### Seafoam District.

In this connection, as mining conditions became more normal, the ore deposits of the Seafoam region in the upper tributaries of the middle fork of Salmon River should attract attention as this district carries some splendid values in silver minerals associated with good values in gold and some fine lead prospects.

#### Ramshorn Mine.

A small force was employed at the Ramshorn Mine during the year, in the Bayhorse district, and a number of car loads of rich silver bearing grey copper ore was shipped.

Handsome silver prospects occur in the pre-Cambrian formations of Lemhi County in the Fourth of July, North Fork and Sheep Creek Basins that are worthy of careful study by mining investors.

The bulk of the silver production of Idaho is derived from the treatment of Coeur d'Alene lead ores. Practically all the lead ores of the State carry relatively important values in silver and Idaho ranked fourth in silver production during the year, rubbing Nevada closely for third place among the most important silver producing States, with Montana and Utah leading. Our total output is, of course, influenced by the success of the lead producing industry, but good silver values are found distributed over the State in a number of counties. Owyhee County was formerly a large producer of silver from silicious silver-gold milling ores and one of its properties, the Demming Mines Company at Boulder Creek in this county, shipped several car loads of concentrates during the past year carrying excellent values in silver and gold about equally divided. There are several promising properties in this county in both silicious milling ore and associated with lead and copper minerals that carry high values in silver that will doubtless ultimately develop additional important sources of supply of the white metal.

## ZINC RESOURCES.

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The zinc ore deposits of Idaho suffered a rather serious set back during the past year due principally to slack market conditions for the mineral. The boom in the value of zinc that carried the price skyward three years ago, as a result of the European War demand, proved a tremendous incentive to zinc ore development. This mineral is of more liberal and broader distribution in the country at large than are lead minerals and the phenomenal new resources of zinc ore brought to light in this country, especially in the Komspelter district of Oklahoma, Kansas and Missouri, have proven hard competitors to Western zinc ores, excepting a few choicer varieties, and in case of previous contracts for the disposal of the mineral the market for Western ores was dull in spite of the fair price prevailing throughout the year.

### Interstate-Callahan Mine.

The Interstate-Callahan Mine, in the Coeur d'Alene district, continued to be the principal source of zinc ore shipments in Idaho. The stopes of this mine were idle for seven months in the year, but considerable development progress was made and increased ore resources developed in the lower levels, which still maintain their splendid quality of high grade zinc sulphide mineral. The Company's immense tailing pile, which was accumulated when shipping results were of more importance than high extraction two or three years ago, were retreated with excellent recoveries, and while considerably reduced over its previous annual records, the output of this property was still large and the chief factor in the total yield of the State.

### Success Mine.

In the same vicinity, after a period of idleness, the Success Mine was reopened, its lower levels operated and a number of shipments of both zinc and lead concentrates were made with some decidedly interesting mine results, especially from a geological standpoint in the disclosure of a dike of diabase with a strong band of rich lead-zinc

ore on each contact that is well worthy of serious study and consideration from its possible bearing on the persistency and expansion of the ore channel at still further depth.

An important by-product of zinc was made from the treatment of the complex lead ores at the Morning Mine and similar smaller by-product outputs were made by several other Coeur d'Alene properties. A few cars of high grade hand sorted ore was shipped from the Denver vein of the Nabob Consolidated Mine at Pine Creek but other handsome zinc ore developments of the Pine Creek district, especially the Constitution and Douglas deposits, were idle throughout the year, excepting limited development work due to the slack market for the mineral and the transportation difficulties that still prevail as a result of the failure of the Pine Creek railway branch to have been carried to completion, which was the direct result of a serious washout during the construction of this line early in the year, which badly damaged the two miles that had been completed.

This section of the railway, however, has recently been put in shape for transportation and earnest efforts are being made to have the branch completed on the original plans, which would give a transportation outlet to the many handsome prospects and proven ore deposits of the Pine Creek district. The only other important zinc ore shipments of the state were from the North Star Mine at Wood River and the Kusa Consolidated Mine in the same district.

#### Disseminated Zinc Ore.

An interesting deposit of clean, grey zinc sulphide ore in a white quartz vein was developed at the Azurite Mine and equipped with a small jigging plant producing two car loads of 60 per cent zinc concentrates during the year, near Ballards Landing, just North of the Iron Dyke Copper bonanza on the Idaho side of the Snake River canyon, near Homestead, Oregon. The vein varies from one to four feet wide with five to ten per cent zinc values and a little lead and occasional bunches of high grade, silver bearing, grey copper ore. It is developed 500 feet long by adit tunnels and traceable at the surface for 2,000 feet.

What promises to be a new and important source of zinc mineral and an enterprise on which considerable money is

now being spent in mill construction, is the property of the Drilling Development Company in Lemhi County, twelve miles East of Salmon City. The development of this property has so far been very shallow, but its surface manifestations indicate something in zinc ore resources of a comparative nature with the disseminated porphyry copper ores. The deposit is ideally situated for open work mining or quarrying on a very steep slope of the main range of the Rocky Mountains, which is made up in this locality of pre-Cambrian sediments consisting very largely of silicious shales, slates and quartzites. This highly mineralized deposit is believed to be an intrusive dike or sill of light colored silicious igneous rock related to rhyolite or quartz porphyry.

The deposit was first exposed by overflow boxes or breaks in a big hydraulic placer ditch that traversed the steep mountain side from Carmen Creek to Kirtley Creek and was exposed by surface washings of its thin soil covering. An area of this igneous formation, largely exposed, is estimated at 600x900 feet, whose surface manifestations is a yellowish brown outcrop intimately marked with a fine network of reddish oxide seams. The development consists of a number of open cuts and two short tunnels, which, after passing through a shallow horizon of leached and oxidized cap rock, presents a network of sulphide mineral bands and seams in which fairly clean zinc sulphide ore is the most conspicuous manifestation in bands up to two or three inches thick.

This zinc ore is associated with good lead values and iron sulphide with an occasional manifestation of copper mineral. The best area of this immense surface exposure of likely looking concentrating ore is said, by the operators, to contain from three to five dollars per ton in gold and silver, and at the time of my visit in the fall, a 200 ton mill was in process of construction for the purpose of treating the mineral for its gold and silver values with a view to subsequently building a much larger mill for the concentration and extraction of its base ore values. If the further development proves these sulphide mineral values to continue in depth on the deposit it is manifest that a new and important tonnage resource of zinc as well as other desirable mineral values will be found at this point.

# COPPER RESOURCES.

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## Empire Mine.

In common with the retarded progress of other ore development due to the shortage of labor, nothing of striking importance resulted from the year's work in Idaho copper deposits. The Empire Mine at Mackay continued to be the chief source of copper ore output and while its product was greatly reduced from the previous year, through the prevailing labor conditions and car shortage, the mine continued to manifest its normal resources of good copper sulphide ore and two features of its extensive development plans were consummated, which included the completion of its four compartment 500 foot vertical raise above the Alberta tunnel level and the completion and successful operation of its new three mile aerial tramway, which has a capacity of 100 tons an hour and greatly reduced the transportation cost between the mine and the Short Line Railway, as compared to the method of hauling the ore by the shay railway equipment that was formerly employed.

A start was made on the new three compartment raise from the face of the 6,000 feet Cassock tunnel at this mine to connect with the Alberta tunnel workings 900 feet above, but this work had to be suspended on account of the impossibility to get competent miners to run it, but will doubtless be taken up again as soon as operating conditions warrant as this deeper development horizon is well into the ore zone with a strong manifestation of the characteristic sulphide encountered above, and from which the life of the mine promises to be greatly extended with further development.

## Copper Basin Mine.

At Copper Basin, fifteen miles West of the Empire Mine, leasers worker on the properties of the Copper Basin Mining Company, disclosing some handsome bodies of carbonate ore and made several car load shipments of crude mineral carrying ten per cent copper values. The deposits on this property have a genetic relation to those of the

Empire Mine and while less favorably situated from a transportation standpoint, with more extended development, represents some encouraging prospects of important bodies of good copper ores, both oxide and sulphide.

#### Richmond Mine.

The Richmond Mine in the East Coeur d'Alene district, near the Montana divide, was successfully operated with a crew of twenty men and shipped nearly 3,000 tons of crude ore containing average values of better than seven per cent copper.

#### National Mine.

The National Mine at Mullen was another source of copper ore. This property was operated at less than half capacity of its 500 ton mill and made an interesting production of clean copper concentrates carrying good values in both copper and silver from an extremely low grade ore with mill heads running less than one per cent copper. The deposit has proven a disappointment to very extensive development work underground and while the production made current operating costs, due to the prevailing high price of copper, it is doubtful whether the enterprise can be successfully carried on at a lower market for the red metal than prevailed last year unless richer ore values are encountered in the development work now being prosecuted at the mine below the 1,500 foot level.

#### Lemhi County Copper.

In Lemhi County some decidedly interesting development progress was made by several small crews along an interesting belt of copper bearing formations immediately South of Salmon City, where they have convenient access to railway transportation. The formations consist of a broad belt of dark colored silicious schist and slate of pre-Cambrian age that are doubtless identical with the well known Prichard series of the Coeur d'Alene district and within ten miles of Salmon City at Worthington Creek, Warm Springs and Perrault Creek. Pronounced well sheared fissure veins were in process of development through adit and cross cut tunnels. These veins vary in size from two to ten feet and exhibit handsome showings

in copper carbonate and oxide ore containing average values of three to four per cent copper with chalcopyrite mineral manifested at the deeper points in several important instances, which, from vein structure and favorable geologic environments, gives decided promise of development into successful producing mines.

Each of these properties made car load shipments of crude ore during the year that gave net smelter returns ranging from five to seventeen per cent copper, respectively. On the Torney Mine at Perrault Creek in a cross cut tunnel with a face depth of 200 feet stringers of chalcopyrite ore are manifested through a zone fifty feet wide with strong bands of clean mineral on each wall and indicates a possible big tonnage resource of concentrating ore; another tunnel on this mine exhibited a ten foot vein well banded with ten to twenty per cent copper ore. At the time of my visit in the fall, the Pope-Shenon Mine on Warm Springs Mountain was planning the immediate erection of a volatilizing plant for the treatment of a handsome development of carbonate ore exhibited in a succession of adit tunnels driven on the vein.

The Harmony Mine at Worthington Creek is equipped with a modern aerial tramway, compressor and machine drills, was opening a new vein of recent discovery that gave excellent promise of rich milling ore results. The further extension of a deep cross cut tunnel now in progress on this property will intersect a series of five parallel fissures, each carrying good ore, both oxide and sulphide.

This interesting belt of copper bearing formations can be followed Southeast for 25 miles and exhibits a number of other handsome prospects, especially in the vicinity of McDevitt and Hayden Creeks, and following West from Perrault Creek, along its course, a number of fine copper ore prospects intervening, terminates in the extensive copper bearing district of Blackbird Creek, whose present activities are now being centered on the development of some big cobalt ore deposits to be referred to later. This belt of territory embraces a rugged steep mountain country of pre-Cambrian rocks; it is well watered and timbered and geologically favorable for the occurrence of permanent copper ore bodies. It is extensively intruded with igneous dikes and flows and presents a very likely field for investigation along this line of endeavor.

### Volcano District.

Some interesting new prospect development work was done during several months of the year at the old Volcano district near the head of Camas Prairie in Elmore County. This is an old district that was discovered thirty years ago and considerable work done at that time in the search for the source of some very desirable rich silver bearing float. The interesting points of present development are on the Elmore Copper, Falun and the Opportunity groups of claims. Each of these properties carry big fissured zones of sercitic granulite in which preliminary development has shown several ounces silver per ton and one to two per cent copper values. Some of the richest silver values found in the district are associated with clean galena mineral. The general formation is eruptive granite with aplite dikes. The size and strength of the ore bearing courses, the evidence of faulting and the favorable geologic surroundings, which are related in age to the Butte district in Montana, presents a decidedly interesting and promising situation for further intelligent development, which, it is believed, by reason of the favorable dip of the zones of mineralization, could have there deeper values substantially determined at reasonable cost by churn drill or diamond drill methods; the district carries several attractive prospects that are well worthy of the necessary capital to determine the persistency in depth of the ore values in copper, lead and silver exhibited at the surface outcrop and present shallow development.

### River Queen Mine.

The River Queen Mine is another interesting copper ore deposit on the Idaho side of the Snake River canyon in the strike of the now noted Iron Dyke copper bonanza and two miles North of Homestead, Oregon. This property carries a big zone of fissuring and two ore courses containing rich chalcopyrite mineral. Three car loads of hand sorted ore was shipped running twelve to fifteen per cent copper during the past year and two additional car loads were accumulated for shipment when the railway transportation was interrupted by an accident at the Copperfield tunnel.

# Idaho Gold Resources.

## Boston-Idaho Dredge.

In common with other gold producing States of the West, the adverse conditions of high operating costs retarded the progress of gold mining in Idaho during the year and the production showed a serious decline, which was accentuated by the exhaustion of the gravel deposits of the Boston-Idaho Company's big dredging enterprise near Idaho City, where the pay gravel supply was completely used up and the big plant dismantled.

This has been one of the most important single sources of gold output in the State for a number of years. It was a well financed, scientifically handled enterprise and its plant one of the largest dredging installations in America with sixteen cubic foot buckets that handled 10,000 cubic yards of gravel per day, and its important yield of precious bullion will be seriously missed in the future activity of gold mining in this State.

## Gold Hill Mine.

Fortunately, for the State and the Boise Basin district, the same Company has acquired the operating control of the old Gold Hill lode deposits at Quartzburg and under their competent and liberal management this enterprise, which is the oldest successful lode gold mining enterprise in the State and has been operated with short intermissions for fifty-four years, has been brought to a better stage of production than at any other period in its long previous history. A careful and competent study of the geological conditions surrounding these deposits, made by the Company's engineers and worked out by actual development to important conclusions, have already given markedly increased production and afford the basis of a much more expanded operation and large development plans which are now in prospect. These activities have given a decided impetus to and appreciation of the properties of the adjacent interesting and extensive belt of mineral and has already stimulated activity at several other promising points.

**Belshazzar Mine.**

Two miles West of the Gold Hill Mine, the Belshazzar Mine was taken over during the year by the Idawa Mining Company and worked a small crew of men in charge of Fred W. Brown, a competent operator, who was engaged in cleaning up the old works and sizing up and testing the ore resources of the mine, whose main feature consists of a pay shoot 500 feet long of good stoping width and values with one wide expansion over twenty feet that promises a square set stope of the type now worked in the Gold Hill Mine, which has proven such an important resource of pay mineral for modern methods of treatment. Equipment, with a milling plant in the near future, is likely at the Idawa, which should prove another new unit of gold production.

**Demming Mines.**

The new 100 ton mill of the Deming Mines Company, in Owyhee County, was operated for several months and shipped sever car loads of high grade gold and silver bearing concentrates, but the mine development was not sufficiently advanced to continue the mill in steady operation and this is being extended since the mill shut down after its initial run.

**Oro Grande Mine.**

The new 300 ton cyanide mill of the Oro Grande Mining Company, at Oro Grande, in Idaho County, was operated for a short period during the summer and a 10,000 ton run of ore was made from a big glory hole quarry for the purpose of a practical test as to average values of the big gold bearing zone 400 feet wide that traverses this property and to test the best method of extraction. I am advised, by the operators, that this test proved entirely satisfactory as to values, indicating an approximate average across the zone of \$3.00 per ton in gold. The run demonstrated the necessity of important mechanical and other changes in the process, in the matter of slime and sand segregations and mechanical concentration, which involved additional machinery. Owing to the difficulty of getting new mechanical supplies under war conditions the further elaboration of the treatment of the ores has

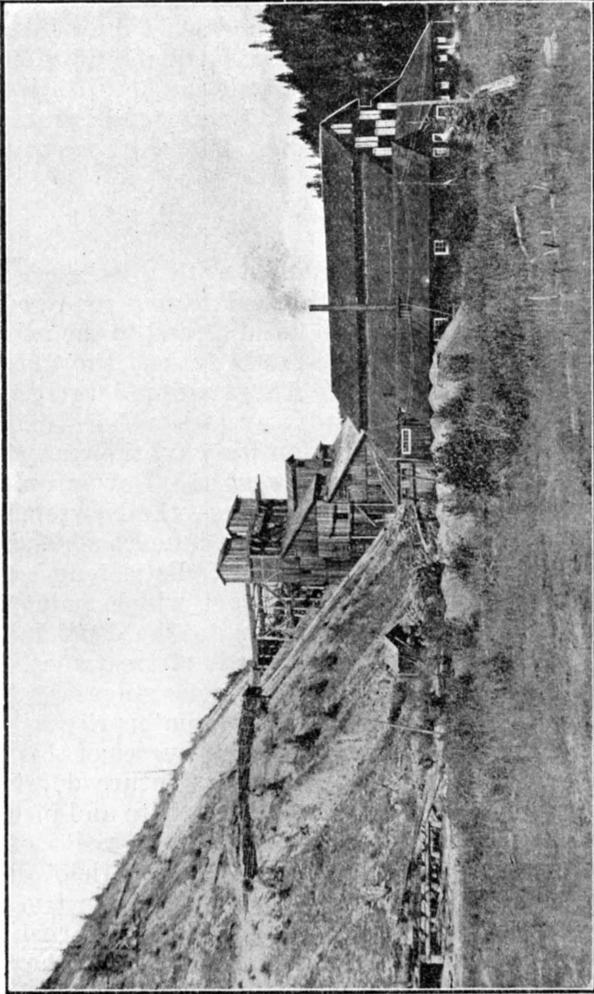
been deferred. Sufficient information was obtained from this test of this big lode deposit, which, I am advised, was carefully conducted with the advantage of competent and conservative technical talent, to indicate quite definitely that a close recovery of the important values in this big zone can be made and the more complete solution of its milling problem promises to result in the ultimate establishment of a big gold producing enterprise at this point that may warrant a milling plant of several thousand tons daily capacity.

#### South Fork Road.

This property is situated in a rather isolated district difficult of access over the present wagon road route. It would be entirely feasible to build a road to the mine from the railway at Stites up the South fork of the Clearwater River on a very easy grade. This route is largely through Federal Forest Reserve and traverses a fine timber and mineral country, embracing, on its way, the exceptionally promising copper-gold deposits of the Dewey and Evergreen Mines and adjacent properties—the Newsome, Dixie and Elk City districts, with their numerous deposits of lode and placer gold, the Ten Mile district and the Big Lode district of Oro Grande, from which point a well graded but narrow road extends to the Buffalo Hump district, where, with proper methods of treatment, a number of splendid ore deposits in various stages of development should afford profitable mining enterprises.

Gold predominates in all the ore resources of this region, better accessibility is essential to its future development and success. The residents along the route and of Grangeville and Stites are wide awake to the necessity of better means of transportation to this promising field and have made an elaborate study and survey of the cost of such a road, an enterprise that should be liberally assisted by the Federal Forest Service and is worthy of the serious consideration of the State Wagon Road Commission, and the National Government in its expressed desire to encourage gold production.

Other points of potential new gold supply in Central Idaho that are also worthy of Federal consideration would be improved auto truck road construction from the Payette



300 TON CYANIDE MILL, ORO GRAND MINE

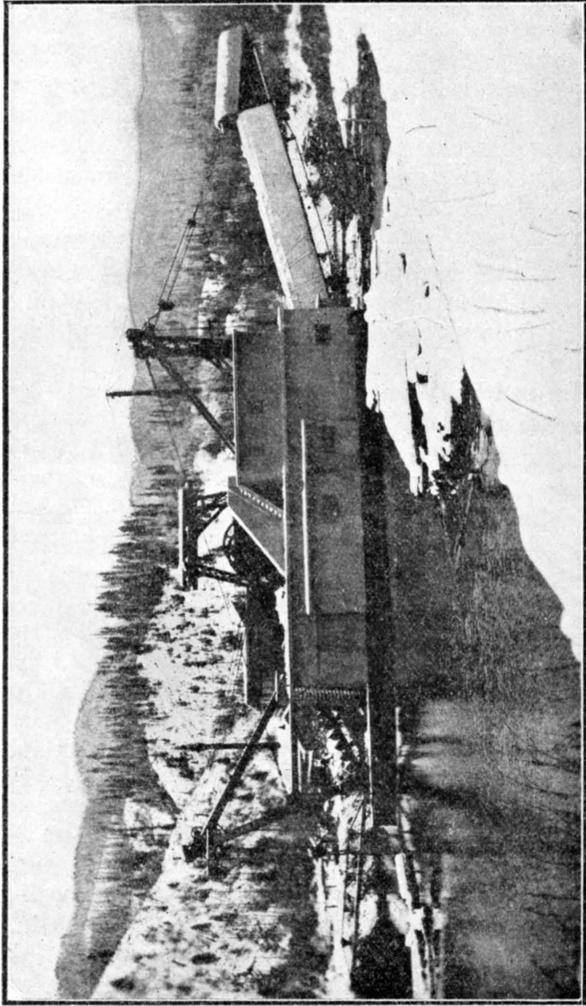
Lakes to the Marshall Lake gold mining district, which was the most prolific source of gold output during the past year in Idaho County from the Holt Mine, tributary to which are a number of handsome high grade gold ore prospects whose progress is retarded by their isolation and difficulty of access. Such a road could be extended to the Big Creek mining district, through Warrens, where rich ore deposits of both gold, silver and tungsten have been discovered, over a route already built in outline on a splendid average grade, but with too narrow a base to be serviceable for loaded vehicles.

The Big Creek district has a string of immense low grade gold ore deposits varying from 50 to 200 feet in width in which average values of \$2.00 to \$4.00 per ton in gold have been found, indicating the basis of big milling enterprises and a greatly increased gold supply which would be decidedly encouraged and facilitated by decent wagon road accessibility.

From the Big Creek district such a road could be extended on a favorable route and moderate grades thirty miles to the Yellow Pine district and connected with the railroad again at Cascade. The Yellow Pine district—to be referred to later—carries some splendid prospects and definite evidences of important resources of antimony and quick silver, as well as gold ores.

### Yukon Dredge.

Shoshone County came to the front with an important increase in gold production during the year, due to the steady and efficient operation of the big steel dredge of the Yukon Gold Mines Company at Murray, on Prichard Creek. This modern dredging plant was completed late in 1917 and enjoyed a full year's operation with an important yield of gold bullion, which, added to the by-product gold derived from the final treatment of Coeur d'Alene lead ores, gives that famous mineral country quite a desirable showing in total gold output; in fact, the total gold yield of this county aggregating 11,658 ounces for the first time in the mining story, gives it first rank in the gold producing counties of the State, as well as in lead, silver and zinc.



YUKON STEEL DREDGE, MURRAY

The Yukon Company's holdings cover several miles of Prichard Creek bottom that has been systematically tested by drilling and is known to carry good values in coarse gold that resisted all former and older fashioned methods of treatment by reason of the flat grade of the Creek and the depth of the gravel. It was freely predicted by old timers that this deposit could not be successfully worked by dredging by reason of the rough bed rock, but it appears that plenty of steel, intelligently directed and backed by ample electrical power, has substantially overcome these difficulties and established what promises to be an important and steady added source of primary gold supply for Idaho. The district is to be congratulated on the enterprise falling into such substantial hands.

This dredge is of all steel construction with a hull of 100x40x8 feet deep. The bucket line is of manganese steel closely connected and the buckets have a capacity of seven cubic feet each and dump at the rate of twenty per minute, and in spite of the rather heavy ground handled, the plant has given excellent satisfaction. It is electrically driven with six motors, aggregating 300 H. P., with juice derived from the Beaver Creek district, ten miles distant, which is taken on board at 6,600 volts and transformed down to 440. The extent of this gravel deposit is such as to promise continued operation for a number of years.

#### Boundary County Placers.

Another promising new source of gold supply in Northern Idaho is that of the Idaho Gold & Ruby Company's placer deposits at Boulder Creek, in Boundary County, a tributary of Kootenai River. Considerable activity was exhibited at this enterprise during the year in main canal construction which was so nearly completed it is confidently expected that the full practical hydraulic cross cut test of its immense gravel bars will be obtained during the coming spring.

This deposit carries an estimated resource of several hundred million cubic yards of gravel, and from the preliminary test work that has been put upon it, which is of considerable extent, the deposit is believed to carry big paying values for hydraulic methods of operation, for which the natural conditions, in the way of water supply,

dump and small gravel, are exceptionally fine and an interesting new source of virgin gold at this point is in quite definite prospect of being established during the coming year.

#### Atlanta District.

This interesting district, with large, well developed deposits of silicious milling gold-silver ore, experienced a dull year with only a limited amount of development, due to isolation and adverse operating conditions.

#### Minerva Mine.

The Minerva Mine carried a small crew throughout the year, which was increased in December, and a systematic plan of development work is being carried out under a competent manager with a view to sinking on the main ore shoot, which was formerly a handsome producer of good gold values. In the event this preliminary test proves satisfactory, it is the intention of the Company to run a long tunnel and tap the deposit at the mill level, which will give several hundred feet of new backs. Considerable talk has been in the air of a big consolidation of the older properties of this district, embracing the Monarch, Buffalo and other mines, which have extensive proven ore resources, but it is believed that the venture has been temporarily set aside to await more favorable conditions.

#### Featherville Placers.

At Featherville, on the South fork of the Boise River, an extensive tract of well proven dredging ground, containing relatively high values, has been purchased by a strong California Dredging Company, and its equipment with a large dredge is under consideration at the present time by the owners, I am reliably informed.

#### Rocky Bar.

The Rocky Bar and adjacent districts a few miles above these dredge placers have made an important production of lode gold in the past, including one ore shoot with a \$3,000,000 production record. The development of their many promising old and new prospects has dragged for a

number of years, but has lately attracted the attention of conservative mining men whose present efforts give promise of production results at several points.

The gold production of Idaho for 1918, while showing a decided decline as compared to the previous year, is likely to increase to a marked degree in the future as operating conditions become more favorable from the principal points described and numerous other splendid gold bearing prospects through the mountain sections of the State. This branch of our industry, as previously shown, has suffered more from operating cost conditions than any other variety of metal output. Various remedies were proposed for this condition, common to all Western gold districts, to check the serious decline in gold output in the United States as a whole during the past year, but very little seems to have been accomplished.

The chief remedy proposed by the two conferences of gold producers held at Reno, Nevada, and Spokane, Washington, in August and September, was a Government bonus for new gold as a war measure, but the proposition seems to have met with very slim encouragement at Washington. The gold resources of the country have probably been more thoroughly exploited than those of any other metal and there seems little prospect of any sensational new bonanza source of supply being discovered in American territory, and if gold is to continue to be the basis of National credit, it looks as if the Government would have to give this particular branch of the mining industry more definite economic preference and assistance, where such can be rendered without direct cash appropriations or bonuses than has yet been devised, if a normal supply of this precious money metal is to be maintained.

There is one little suggestion I would like to offer in this connection, and that is, that the gold prospectors, and gold mine operators, be put on a permanent preference free use basis for their necessary timber supply from the National Forest Reserves, where they can be made available in place of being victimized for such use. This could well be extended without injury to the overripe fire trap National Forest resources, by offering gold producers free and unlimited use of timber supply from the Federal Forest Reserves as a specific encouragement to such a Nationally

important but declining industry. If the National gold output continues to decline at any such ratio as it has during the past two or three years, the ultimate remedy will have to be either bi-metalism, or, as outlined by a prominent writer on the subject of North Idaho, Mr. Chester T. Kennan, who advocates an International readjustment of the present standard of gold value at \$20.67 per ounce to a considerable higher figure as the present world supply seems totally inadequate for a single standard of credit basis, and such a move with proper covering of present credit obligations and a new standard of value for gold, say at \$30.00 per ounce, would stimulate gold mining activity more than any other scheme that could be devised. It would let in such an important potential source of supply, for instance, as the big low grade Alaskan mainland deposits near Juneau, to a very moderate margin of profit. These deposits were originally estimated by most competent engineers to have a potential capacity of producing \$20,000,000 worth of new gold per year. Idaho has a number of similar big low grade gold ore deposits that could doubtless be operated profitably with gold at \$30.00 an ounce, and from the limited progress made by the high authorities who have investigated this subject during the past several months, it seems likely that some drastic measure of this kind will have to be undertaken to rescue this vital branch of our National mining industry from practical annihilation. The sparse distribution of this precious money metal, both in this country and the world at large, is well appreciated by competent, unbiased authorities, as is also the narrow average profits possible in mining it from the earth. The danger of overproduction resulting from any kind of encouragement that can be devised can be safely discounted in advance and I doubt if any measure short of International consideration and action will revive the industry.

# WAR METALS.

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## Quicksilver.

Some interesting progress was made in Idaho during 1918 in the search for the rarer metals and minerals that were in heavy demand due to the Government's war activities, and considerable time was given during the year to an investigation of these matters. The search for quicksilver ore, which was stimulated by the high prices prevailing as a result of the war's demand for the metal, which is extensively used in the form of fulmate of mercury for explosive caps and primers of all descriptions, decidedly stimulated interest in the known quicksilver deposits of the Yellow Pine district in Valley County, where activity was inaugurated in 1917, at which time a small reduction furnace was installed but not completed until July of 1918.

The original discoveries of this mineral in this district were made in 1901 and 1902 by Mr. Pringle Smith of Warrens, when he discovered rich cinnibar float on a tributary of Sugar Creek, which was afterwards named Cinnibar Creek. This discovery is less than ten miles due West of the present site of the former boom town of Roosevelt, which is now a small mountain lake due to a subsequent landslide.

The Yellow Pine district, formerly in Idaho County, is now near the Eastern border of Valley County. It embraces a large area covering tributaries of the East fork of the South fork of Salmon River, and the principal center of activity in quicksilver ore development is seventy miles East of Cascade, a thriving lumber town on the Long Valley branch of the Oregon Short Line Railway. This isolated position is one of the chief drawbacks to the progress of these new discoveries. The approach is over the old Thunder Mountain road, which was built by the State and private subscriptions during the ill-advised Thunder Mountain gold boom.

As far as Knox on this road the route is largely in Federal Forest Reserve territory, and the splendid assistance rendered by this Federal institution, together with county support, has made a quite passable automobile

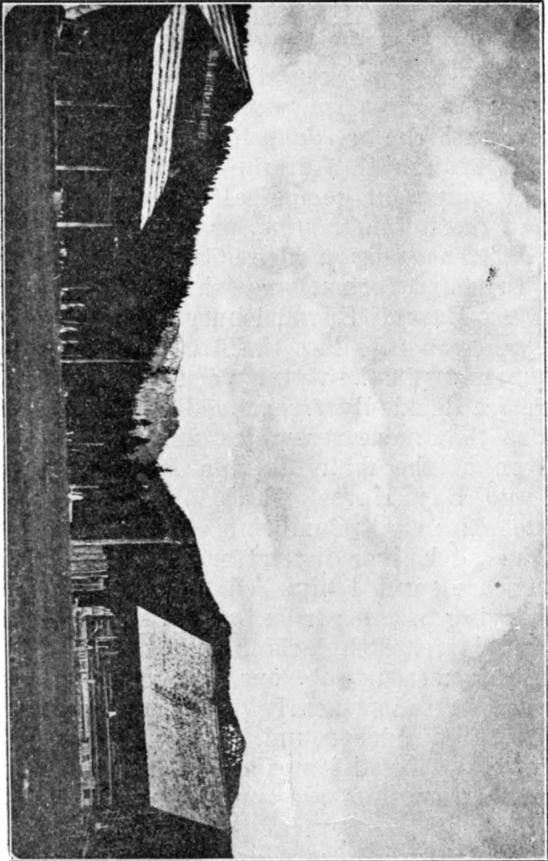
road of the route twenty-six miles out from Cascade. Beyond that point, however, the old road, which was poorly laid out originally, is almost entirely on territory uncovered by the National Forest Service. This part of the old wagon road has relapsed into shocking condition, due to uncontrolled summer sheep range activity, and is almost impassable for a heavy loaded wagon, resulting in a freight charge from Cascade to the quicksilver mines of approximately \$100 per ton, which is a serious handicap to the progress of the district.

The road to these mines could be greatly improved by diverting it at the Johnson Creek bridge and without materially increasing the distance, greatly reduce the excessive grades now involved, and it is believed that an excellent motor truck road could be gotten into the district at no excessive cost by taking advantage of the present route to Johnson Creek and improving the western approach of Cabin Creek summit. Such improved accessibility to vehicle transportation is worthy of serious consideration by the National Government not only as a factor in making available a promising new source of supply of quicksilver for possible future war uses, but also would make available some exceptionally promising deposits of high grade antimony ore in the same district.

The present activity in quicksilver ore development in this district is due to the personal efforts of Mr. Theodore Van Meter of Yellow Pine Basin, who discovered the Fern Mine at the head of Fern Creek, a mile South of the Smith discoveries. A few years ago Mr. Van Meter interested local Boise capital in the development of his discovery, which has been equipped with a small Johnson-McKay retort furnace. The geology of the district is decidedly interesting and favorable for the occurrence of quicksilver.

#### **Yellow Pine Geology.**

Extending from Cascade to within a mile of the Fern Mine, the wagon road crosses the broadest expanse of the great Idaho batholith of eruptive granite. The country presents a rugged topography of high mountain ridges and deep canyons. The mountains are well timbered with pine and fir and the canyons are all good water courses. The quicksilver bearing formations are ancient, highly



KNOX STATION ON ROAD TO QUICKSILVER DISTRICT  
AND CABIN CREEK SUMMIT APPROACH

metamorphosed and steeply folded sedimentary rocks, representing what is probably a pendant remnant of a much more extensive area of similar formations that have been removed by erosion. This belt of sedimentary formations is about two miles wide by three or four miles in length in this particular district, but is succeeded to the North by a succession of smaller remnant of similar formations, notably at the Big Creek low grade gold ore district about thirty miles North and ten miles West, where highly metamorphosed quartzites, limestones and schist formations are associated with the ore deposits, and it was suggested, on a personal examination of these rocks by Mr. Paul Billingsley, a competent geological authority of Butte, Montana, that, due to their structural relation to the granite and a broad cross-section of pre-Cambrian slates, representing the Prichard formations exhibited in the Big Creek canyon, just East of Edwardsburgh, that these particular sediments might ante-date the pre-Cambrian slates.

The quartzites in the vicinity of the quicksilver deposits, however, are decidedly fresh, medium grained and fairly pure silica that more resembles similar thick horizons in the canyon of the main Salmon River notably between Challis and Bay Horse, which have been classified by U. S. geologists as of Cambrian age. The limestone horizons in the quicksilver district, which, in common with the quartzites, are several hundred feet thick and all steeply folded, varying in color from brownish to dark blue at the surface, the latter with decidedly cherty lines. The brown magnesium limestone outcrops, which weather to a sandy soil surface, present a nearly pure white, medium grained marble texture underground. The margins of the main quartzite beds show distinct and conspicuous horizons of white pebbly conglomerate and narrow included beds of black schisty slate. Several porphyry dikes traverse the district that vary in size up to twenty feet in thickness and are notably in close relation to the best ore showing. These dikes were believed by the writer to be syenite by reason of their excess of soft felspar crystals and are believed to be definitely associated with and are responsible for the genesis of the quicksilver ores.

The minimum elevation of the Yellow Pine district in the canyon bottom is a little over 5,000 feet and the maxi-

imum elevation at the highest points about 9,000 feet, presenting a decidedly rugged topography notable for deep winter snow conditions with exceptional advantages, however, for adit tunnel development.

### Smith Mine.

The quicksilver district is bordered to the East by the Thunder Mountain field of tertiary volcanoes, consisting of silicious andesites, rhyolites and quartz porphyries. The most attractive ore showing of the district is carried on the original discovery on the Smith property, which is now under option to and is being operated by the Monumental Mining Company, a new Boise organization. This deposit presents a condition of contact shear zone fissuring of very pronounced character that traverses the steep canyon side of Cinnibar Creek in a Northwesterly direction and stands nearly vertical. This zone is fully fifty feet wide at a contact with rather soft bluish limestone beds and one of the massive quartzite members. At the lowest point of development on the canyon slope this deposit shows a surface exposure of sheared formation fifty feet wide by 150 feet in length.

This has been prospected with a tunnel driven principally in the limestone side of the deposit and 130 feet long without definite regard to either wall. A twenty foot cross cut at the face of this tunnel showed several feet of limestone well impregnated with granular red cinnibar mineral. Near the quartzite wall an open cut run in the floor of the tunnel portal approach exhibited a bench of mineral five feet high and five feet wide in which there was a band of gougy silicious breccia a foot thick that averaged five per cent quicksilver and the balance of the face, to panning tests, indicated two per cent ore.

About 100 feet above this opening and starting from the quartzite wall a cross cut fifteen feet into the deposit gave an average assay result of 18 pounds of quicksilver per ton. The present operators have started a new tunnel a short distance below this lower work, which has already attained a length of sixty feet, and recent reports indicate that it is in fine ore across the whole face, and specimen samples recently sent to Boise gave assay results of forty per cent quicksilver.

From this development along the strike of the big zone up the canyon side 1,000 feet distant, the intervening space being largely covered with slide rock debris, there is exhibited another bold outcrop of brown stained silicious lime and quartzite breccia fully fifty feet wide and twenty-five to thirty feet high. This interesting bluff of mineralized ground was believed, by the writer, to be a continuation of the same zone just described. It exhibits some narrow bands and bunches of clean, high grade cinnibar ore and several float boulders in the draw a few hundred feet below it, some of them as large as a small cabin, are also richly impregnated with high grade specimens of cinnibar mineral.

This second outcrop has not been cross cut by underground development and its commercial values in quicksilver are still undetermined but decidedly promising from surface appearances. Between these two exposures a tunnel is driven without regard to direction in the bluish limestone beds, which gave light pannings of red mercury concentrates throughout its length and exhibits a soft rotten porphyry dike near the face over twelve feet thick. The property extends to the divide between Cinnibar Creek and East Fork and just over the summit 1,500 feet West of the second big outcrop, a short tunnel driven into the ground near the center of a low saddle in the ridge exhibits four feet of mineralized limestone carrying .80 of one per cent, or sixteen pounds of quicksilver per ton as an average sample. Mr. Smith advised me that good pannings of mercury concentrates could be obtained under the line of this long zone of fissuring and, in fact, on down Cinnibar Creek for three miles to Sugar Creek at a point 2,000 feet lower in elevation, where some old gold placer bar diggings produced some big pebbles of pure cinnibar mineral, from this quite extensive surface display of ore bearing formations the size and manifest permanency of this zone, which was probably one of the chief sources of this extensive run of cinnibar float. Important and permanent tonnage resources of workable quicksilver values are indicated on this interesting deposit and the condition certainly presents a well warranted opportunity for intelligent prospecting development work to determine the localization and extent of the better quicksilver ore courses in this big deposit.

The Fern property is about a mile South of this deposit and over the summit dividing Cinnibar and Fern Creek in the margin of a weathered glacial cirque. The conspicuous surface features of the Fern deposit is a bold reef of the yellow-brown limestone outcrop on the steep mountain side carrying a nearly vertical central fissure course of rich cinnibar ore that varies from a foot to five feet wide and has been opened by an adit tunnel 100 feet long, which has exhibited average values in quicksilver at several stages along its course of one to five per cent. I was advised this vein throws out cherty quartz spurs and bunches varying from a narrow seam to bunches a foot thick of high grade cinnibar ore mixed with crystalline hematite, indicating a rich pyrite mixture at moderate depth.

A little less than 100 feet below this upper tunnel, a second tunnel has been driven in about the same distance, which is believed to start in the margin of a porphyry dike, passing through a zone of crushed quartzite and is extended well into the white marbleized limestone, but is off the course of the vein and is being extended at this time as a cross cut to tap the main fissure exhibited in the upper tunnel.

There are several other parallel cherty quartz veins on the property, each one exhibiting specimen values in cinnibar mineral. This property was equipped with a small Johnson-McKay furnace in 1917, which, however, wasn't completed and put in running order until the time of my visit in July, 1918. An experienced California operator was engaged to run this furnace, which consists of a battery of steel cylinders built into an oblong brick structure about six feet high, eight feet wide and twenty feet long. These cylinders are twelve inches in diameter and six feet long with four inch incline discharge pipes at the back for condensing the fumes and are furnished at the front with double metallic lids or doors, which are clamped on and sealed with a paste made of wood ash. There are twelve of these simple retort cylinders, each of which has a charge capacity of 150 pounds of ore. A fire brick flue extends from the furnace under and over this battery of retorts from one end of the structure to the other to a smoke stack placed directly over the furnace. The furnace

is fired with cord wood, requiring about one cord to one and a quarter cords in twenty-four hours. The furnace man in charge believed from the free granular nature of the ore that a charge could be run through in eight hours.

The process is simply to heat up these retorts to a red heat, driving off the volatile metal in the form of a fume, which is condensed and precipitated in the exposed cool discharge pipes at the back end of each retort and dropped into containers as metallic quicksilver, from which it is ladled out and bottled in the ordinary steel quicksilver tanks ready for shipment.

This is a decidedly interesting and simple process and its only drawback is the limited capacity of the plant, which, at eight hours for a charge, would treat, at best, 5,400 pounds of ore per day. This little plant was not yet in operation at the time of my visit, but a few weeks later was started and made a run on the best ore obtainable from the upper Fern tunnel nearby, giving a result of a tank of quicksilver per day for several days. The total yield of the run made by this furnace during the summer was twenty-two and one-half tanks of quicksilver, and I am reliably informed that the average feed throughout the run approximated a little over two per cent quicksilver. The operations of the furnace was suspended after this brief run by reason of the inability of the management to supply the necessary ore through lack of advanced development, but this test showed the feasibility of treating the mineral on the ground with a very simple process and of obtaining a finished shipping product of high value at present market prices for quicksilver, which, if maintained, promises profitable results, even in this remote district, provided sufficient ore is developed to run the plant steady.

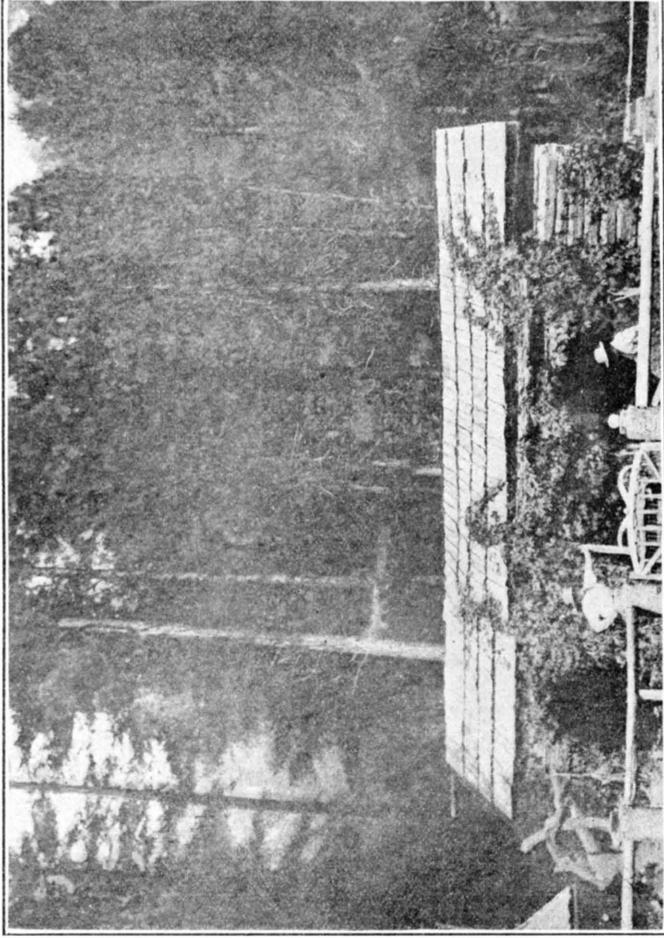
The result of the operations of the Fern Company was to create quite an incipient boom in the district and a great many claims were located covering the sedimentary formations of the district for nearly their full area, but aside from the two properties mentioned hardly any underground development was available that would determine the permanency of the ore occurrences at the time of my visit. Most of the other work was in the form of shallow location cuts. These, however, at several other points, indicated some promising showings of specimen cinnibar

mineral, notably on the Buck Bed claim of the Yellow Pine Mining Company's property, where a big, bold outcrop of cherty quartz fifty feet wide in the same limestone formation as the Fern, exhibiting some fine bands and spurs of rich cinnibar ore, and near it the Quicksilver Hill Mining Company has some similar interesting bluish cherty quartz veins and lenses in the lime carrying excellent values in quicksilver, but there was no underground development on which to base a guess as to the permanency or continuity of these values.

In the granite contact, with the sedimentary formations a mile further down Fern Creek, an interesting series of surface prospects exhibiting garnet and other contact metamorphic ores in good, strong outcrops, including massive iron oxide that made a quick change, at a shallow penetration, to pyrite. Other showings contained carbonates, oxides and sulphide of lead and also of copper.

On the Hennessy claims, a mile further North, another wide zone of brown stained silicious breccia, similar in volume to the Smith property, was said to have thrown off some rich cinnibar float and to contain good gold values and was a decidedly attractive prospect for further investigation. Along this Western margin of the sedimentaries, about a mile West of the Smith property on the East fork slope, but well within a magnesium limestone horizon, showing a conspicuous development of fibrous metamorphic minerals, another Hennessy group of claims exhibited some remarkably interesting deposits of rich antimony ore with several big surface cut exposures, disclosing deposits in apparently nearly vertical veins varying from clean, high grade stibnite mineral containing fifty to sixty per cent antimony to brecciated quartz veins five to fifteen feet thick of good concentrating antimony mineral that, from surface appearances, indicated average values of five to twenty-five per cent antimony. Two of these larger quartz breccia veins were closely paralleled by big porphyry dikes.

Fifteen miles Northwest of the quicksilver deposits and crossing the high mountain divide between the East fork of the Salmon River and Johnson Creek, the Yellow Pine Antimony Mine, which is an old property that has been held for a number of years, attracted the attention of



YELLOW PINE POST OFFICE, 20 MILES NORTH WEST OF QUICKSILVER DISTRICT

capitalists, and some efforts were made, during the summer, to treat the ore and reduce it to metallic antimony on the ground, but these efforts did not prove successful. This property carries a remarkably interesting surface display of high grade antimony sulphide ore in a friable granite formation consisting of a nearly vertical fissure vein that has been opened by surface cuts and short tunnels at close intervals for a distance of fully 1,000 feet, exhibiting in several of these openings a fissure of clean stibnite mineral varying from a few inches to several feet in thickness and indicating a decidedly promising tonnage resource of this mineral.

On the opposite side of Johnson Creek a wide zone of silicious formation in granite that resembles a remnant of highly metamorphosed quartzite was well seamed with pure quartz veins and carries some promising exposure of concentrating antimony ore said to carry good associated values in gold. Antimony is a war mineral and, it is said, was used extensively by our Government and the Allies during the progress of the war as an alloy metal for hardening lead in shrapnel bullets and in the manufacture of smoke bombs. It also finds important uses as an alloy with other metals in the manufacture of babbitt and as type metal, where it has the virtue of slightly expanding on cooling, giving a sharp outline to the finished type in a linotype machine.

The principal source of supply of antimony metal in this country is from ore shipped in from China and Japan produced by cheap Oriental labor. The excessive price paid for antimony during the early part of the war, as a result of the shortage of shipping facilities to import the mineral from abroad, stimulated a decided interest in the development and search for domestic resources of antimony, but under present prices for the metal, which now ranges around eight cents per pound, it is hardly possible to produce it from domestic sources under American mining costs, without special tariff protection, and the Federal Government would be amply justified, under its already existing war minerals law, in making this manifest and decidedly promising source of supply of both antimony and quicksilver more available by better transportation facilities. It is devoutly to be wished that the present Peace Conference will devise a permanent preventative

for war's sacrifices, but history definitely casts doubt on the permanency of any remedy that may be devised, and it would be a move of intelligent National preparedness for the Government to make available such important sources of mineral supply as here indicated, for emergency use in the event of trouble developing in the Orient, where we might have to meet hard bullets with soft ones, due to our present dependence on foreign sources of this item of war mineral.

The Yellow Pine quicksilver district development has so far been financed almost entirely by local Boise capital. There is, at this time, three small crews of men at work in the district on these properties, embracing three men at the Fern property, two at the Smith property, now being operated by the Monumental Mining Company, and two at the Yellow Pine property. Aside from these points of operation, and a small crew at the Yellow Pine Antimony Mine, near the Basin Post Office, the discoveries are idle. The many promising prospects exhibited are worthy of further intelligent investigation with the likelihood that several important resources of commercially valuable quicksilver ore will be developed, but it will only be the better grades of ore that can be handled at a profit in such an isolated district, unless its transportation facilities and accessibility are materially improved either by Federal or other aid.

These notes on the Yellow Pine district were gathered during an eleven day trip to the district started July 4th, 1918, and the information published by this department in the form of a small bulletin on July 25th. The sampling tests are limited by reason of limited funds with which to have them run. The district was subsequently visited by Professor D. C. Livingston of the University of Idaho and Professor Larson of the U. S. Geological Survey, the result of whose work, it is expected, will be published in bulletin form and will doubtless give a much more detailed scientific and dependable description of these discoveries.

## COBALT.

### Blackbird District.

During a two weeks' trip to Lemhi County properties in the fall one of the most interesting new mining development enterprises investigated was that the Haynes-Stellite

Company in the Blackbird district, thirty-six miles West of Salmon City. The Blackbird district was originally discovered by an Indian and the writer was the first white man to make a location there. This original discovery was made on a handsome display of rich red oxide and green carbonate copper ore float and the location was made on October 20, 1893. Subsequently quite a little boom developed as numerous other copper prospects were discovered, which resulted in very considerable preliminary development being made on the principal showings.

These copper deposits varied from a narrow fissure carrying chalcopyrite ore at shallow depth below the outcrop to wide zones of disseminated copper sulphide mineral in schist formation up to 150 feet thick. Such a zone on the Brown Bear claim was developed to a depth of 300 feet and I was advised by the manager at the time this operation was in progress that a horizontal cross section of this deposit gave an average value of two and one-half per cent copper and a ratio of fifty cents gold for each unit of copper, together with quite an appreciable value in cobalt and nickel. The geology of the district is principally Prichard slates and schist well intruded with basic dikes of diabase, diorite and other igneous rocks.

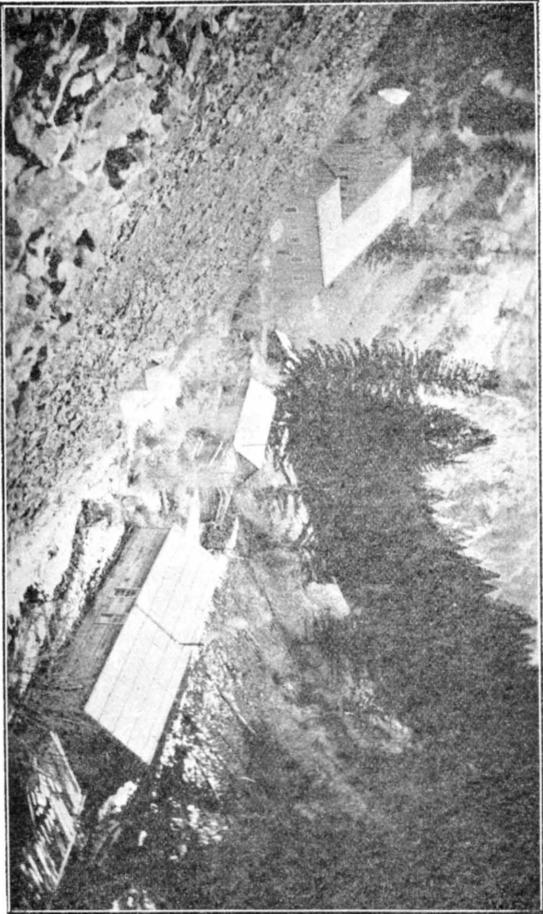
The West side of the district verges into eruptive granite and the East side into very silicious blocky black slate formation. The present activity is based entirely on cobalt values; the property being operated was formerly recognized as the best cobalt prospect of the district and carried very little copper, the concentrates now being produced showing only a fraction of one per cent in copper. The Company owning this property is a well known manufacturing firm of Kokomo, Indiana, who are the owners of a series of patents on metal alloys under the trade name of Stellite, of which cobalt forms the most important factor, and for which purpose this deposit is said to produce an ore that is unequalled by any other source of cobalt supply.

According to the best authorities available "Stellite" is said to be as superior to tungsten steel as tungsten steel is to ordinary tool steel, and the values of these ores, based on \$3.50 per pound for the cobalt contents, makes a good mining value for ore containing a substantial fraction of one per cent in this serviceable metal.

This enterprise was promoted by a well known Idaho engineer, Mr. James W. Caples of Salmon City, who is now in charge of the property. The present purpose of the enterprise is to substantially determine its tonnage capacity and values by development through adit tunnels being driven on the course of the main ore zone which has proven, after more than 1,000 feet of drifting and systematic cross cutting, a vertical fissured zone in the black silicious slate formation that is 60 to 100 feet wide and is demonstrated to carry big pay values in cobalt by concentration throughout its entire width, and in addition a fairly well defined course of enrichment six to ten feet wide containing relatively high values up to more than \$100 per ton at the present market for this rare metal. The property has been equipped with a small milling plant of twenty tons daily capacity, which is now being used for the purpose of practical experiment on the treatment of the ore and incidentally is said to be producing enough concentrate shipments to cover current operating costs.

A short aerial tram connects the mill with the main tunnel portal of the mine and a steam driven compressor and machine drills are in use all housed in substantial camp buildings, and the deposit is being systematically tested out with a view to its much more extensive equipment. The property is an extensive one, embracing a very large group of claims and promises an ultimate ore deposit that is likely to warrant a milling plant of 1,000 tons daily capacity.

The production of clean cobalt sulphide concentrates made by the present little testing plant during 1918 were shipped to Kokomo, Indiana, for further reduction. The Blackbird district is quite an extensive one and has a number of prospects in various stages of development. Practically all the copper ores of the district carry appreciable values in cobalt and nickel, and the elaboration of the Haynes-Stellite enterprise is likely to stimulate interest in several of the other promising ore showings of the district, both for cobalt and copper-gold values. The principal drawback to the district is its isolated position, separated as it is from the railway at Salmon City by thirty-six miles of steep mountain wagon road, climbing a summit 4,000 feet high in nine miles from the Salmon Valley,



HAINES STELLITE COHAIT CAMP, BLACKBIRD CREEK

which makes wagon transportation slow and expensive. There is a very feasible route to the district for an auto truck road or railway construction by way of the Salmon River and Big Creek canyons on an easy water grade the entire distance, which is about eighty miles, that would give a much more desirable transportation outlet.

#### TIN.

Six miles above the mouth of Blackbird Creek at Prairie Basin an interesting deposit of stream tin ore occurs in the Minert placer diggings. This deposit of small well worn gravel in the bed of Panther Creek has been tested by a pit in the middle of the channel, exposing forty square feet of bed rock and the product run through sluices which yielded \$20.00 in coarse, easy saveable gold and 130 pounds of mixed stream tin and iron pebbles giving an average assay value of thirty per cent tin. The bulk of the values are on bed rock which consist of schisty slate formation standing at a high angle and across the course of the gravel deposit.

Panther Creek carries 500 miners' inches of water on a fair grade and with other adjacent streams the conditions are favorable for hydraulic operations and treatment of the deposit, which has a length of several miles as proven by other test pits, and in fact extends over the divide onto the adjacent Silver Creek, where another small placer operation found handsome specimens of coarse stream tin pebbles in the clean up boxes. No thorough search has been made for the source of this tin ore. The prevailing formation is pre-Cambrian sediments with wide zones of silicious igneous rocks and tuffs.

#### MICA.

##### Latah County.

During the spring an examination was made of the mica bearing deposits of Latah County at Mica Mountain, about thirty miles east of Moscow. In common with other mineral substances, the war seems to have created an urgent demand for an increased supply of good mica, and this investigation was made to satisfy the request for information of one of the war mineral boards.

This Latah County mica district carries a number of very promising deposits consisting of lenzy zones of coarse pegmatite in a schisty gneiss formation. It has been under development intermittently for a number of years. The principal point of operation and production was the Muscovite Mine, which, up to 1910, had produced and shipped a total of forty twenty-ton cars of crude mica books containing about five per cent clear, high quality sheet mineral, and the balance divided between insulator material and scrap. The mica books in this and other deposits of the district occur in all sizes up to 10x18 inches and the better quality is probably as good as any found in America, being quite clean and free from iron stains.

The progress of the Muscovite Mine development was interrupted by conflicting claims. The productive zone was opened to a depth of 200 feet by 500 feet long and it is believed would have continued to yield a good production if its operation had been continued, as some of the best mineral produced was obtained from the bottom level.

At the time of my visit the Idaho Mica Company was working a crew of six men and driving a cross cut tunnel to tap a big pegmatite lenze thirty feet wide that had previously produced five car loads of crude mica, which was worked up into a good proportion of sheet material at the Company's works near Spokane.

This district carries a number of good mica prospects that are worthy of systematic development and are likely to afford a permanent supply of this mineral of good quality.

Near the Northern border of Latah County the Hoodoo Mining district has a number of interesting gold ore deposits and formerly made a good production of placer gold values. This same district carries on the property of the Merger Mines Company, a decidedly interesting copper ore deposit which was under development and shipped several cars of relatively high grade crude copper sulphide ore containing average values of twenty-four per cent copper and has a good reserve of excellent concentrating ore developed sufficient to warrant the Company in deciding to build a small mill for its treatment during the coming year. This county also has some extensive resources of fire clay which are of notably high quality.

### Washington County Mica.

A new discovery of mica was made during the year on a tributary of the Weiser River in Washington County, from which some excellent small books of the mineral were examined in sizes up to 4x6 inches, including some clear silver white sheets. This deposit has not yet been examined by this department, but I am advised that its occurrence is in a big lenzy vein in eruptive granite formation and efforts are being made to finance the further development of the discovery by Boise mining men at this time.

### SULPHUR.

Sulphur was another war mineral in urgent demand, either in the form of pyrite or native sulphur, for the production of sulphuric acid so extensively used in the manufacture of explosives, fertilizers and other industrial uses. All sources of domestic supply were urgently sought for during the war as the consumption of sulphur bearing minerals was at high tide and had to be derived largely from domestic sources through lack of shipping to import the mineral from the principal points of supply, which had formerly been in Europe. An interesting enterprise was launched for the production of brimstone during the year near Soda Springs, in Bannock County, by the Idaho Sulphur Company. A retort plant with an estimated capacity of fifty tons of finished product a day was built, using super-heated steam for melting the native sulphur out of the gangue in closed retorts. The deposits on this Company's property consists of a series of beds of hot spring sinter, and the Company's drilling tests and surface explorations on these deposits lead them to believe they have more than a million tons of sulphur bearing rock of good grade. Practical tests made with these retorts indicate a good extraction of the contained sulphur value, and it is expected to have the plant more fully completed and in operation during the coming spring.

Near the vicinity of these sinter deposits there are several large live springs of decidedly acid water. These are cold springs bubbling out of the floor of a cirque in the mountain known as Sulphur canyon, six miles East of Soda Springs station on the Oregon Short Line Railway,

and immediately adjacent to some of the best rock phosphate deposits of the Western phosphate field, which prevail in that vicinity. These springs of strong acid water flow a total volume of fully fifty miners' inches and it would seem might possibly be turned to commercial account.

Surrounding the town of Soda Springs, on the Oregon Short Line, the county affords dead mineral spring sinter deposits of great volume, indicating a former thermal spring activity of geiser proportions. The principal live springs near the town now are both warm and cold flows of sparkling effervescent soda water (where the well known "Idanha Water" is bottled for commercial use), and this district presents fine chances for a health resort establishment with some of the finest hunting and fishing ground to be found anywhere in the State in its nearby mountains, lakes and streams.

### IRON ORE AND PYRITE.

#### Segwine Mines.

Several investigations have been made since the war started of the iron ore deposits of Idaho, most of which, however, have proven too low grade on the average for commercial use as a source of pig iron. One of the most promising iron ore districts in the State is that of Iron Mountain, in Washington County, six miles in an air line East of the Huntington-Homestead branch of the Oregon Short Line Railway, at Mineral station, and 4,500 feet higher.

The geology of the Iron Mountain district is decidedly favorable for the occurrence of iron and copper minerals, as it consists of a series of ancient sedimentary rocks very extensively intruded and replaced with eruptive granite, schisty green stone, diorite and biabase dikes. These ore deposits have been examined by several prominent engineers during the past three years, whose estimate of the tonnage resources varied from a few hundred thousand to several million tons of available Bessimer ore carrying sixty per cent metallic iron contents and very low phosphorus.

The principal deposit consists of a flow of iron boulders varying up to twenty tons in weight down the very steep

slope of Iron Mountain for 1,000 feet. On the highest crest of the mountain the source of these bounders is exhibited in lenses of clean crystalline hematite up to twenty-five feet thick and 100 feet in length succeeded with a zone 100 feet wide of silicious porphyry breccia carrying about twenty per cent iron in disseminated hematite values.

Another deposit half a mile East of this one is a lenze 100 feet wide of undetermined length of practically pure hematite. Still another deposit shows a succession of lenses up to fifty feet in thickness and traceable by surface croppings for 500 feet. This is known as the Abundance Mine and has been developed by an adit tunnel attaining a face depth of about 100 feet on the ore. This limited underground work demonstrates that the crystalline hematite at this comparatively shallow depth is underlaid with massive pyrite containing values in copper approximating one per cent. A fifteen foot cross section test from the footwall of this deposit gave one and one-half per cent copper with an ounce and a half in silver and a trace of gold. The properties above described are evidently nearly vertical lenses, or pipe shaped shoots of ore that have a permanent appearance and may ultimately prove of commercial importance. Mr. John Segwine of Weiser, Idaho, is the owner.

#### **Barton Mine.**

On the Barton group an immense outcrop of clean hematite mineral is fifty feet wide and over 150 feet in length at a contact with greenstone schist and white marbleized limestone. Another outcrop on this property is softer and of a more gosseny nature, and in one surface cut fifteen feet deep show a cross section assay value averaging six per cent copper with six ounces of silver per ton twelve feet wide.

#### **Little Gem Mine.**

The Little Gem Mine is still another nearby property with a long succession of gosseny surface outcrops. It has been developed with a cross cut tunnel 700 feet long to a maximum face depth of 200 feet. This tunnel crosses a zone of garnet rock ninety feet wide impregnated with low values in pyrite. It also cuts a pronounced vein of

clean massive pyrite seven feet thick carrying one and one-half to two per cent copper and two to three ounces of silver per ton. It seems very likely that these interesting ore deposits would afford an immense tonnage supply of desirable pyrite ore, with proper development and if its potential sulphuric acid value could be turned to commercial account locally, it is further likely that the sinter thus produced would afford a profitable resource of copper and silver values. It is further possible that with the perfection of the electric smelter for the treatment of iron ores in the production of steel, that the clean surface Bessimer ores of this district may ultimately be turned to account as electric power is available along the Snake River canyon and the district presents decidedly interesting possibilities along this line of thought.

#### Washington Mining District.

Three miles West of these iron deposits in the old Washington mining district, interest was revived during the year in the further development of a series of replacement fissure veins of copper-silver ore in the same formations as at Iron Mountain. This district is locally known as the Mineral district; was operated quite extensively fifteen to twenty years ago when silver and copper ruled at low prices. Its principal properties are reported to have produced half a million dollars in gross value. Several car loads were shipped from small operations this year on some of the old veins that gave results of fifty to seventy ounces silver and five to ten per cent copper. Late in December the Eagan Mine in this district had two car loads of rich ore ready for shipment and exhibited stope faces up to five feet wide of fifty ounce ore, and the McCorkle Mine exhibited a twenty inch paystreak of high grade grey copper mineral carrying 150 ounces silver per ton.

The ores of this district were formerly treated in a small pyretic smelter for the production of matt and it is believed that an extensive tonnage supply of ore is still available for treatment by modern concentrating methods with flotation attachment, as the deeper developed ore deposits are principally chalcopyrite and pyrite with a little grey copper and should afford high grade shipping mineral with proper milling methods.

### MANGANESE.

At Sturgil Creek, six miles North of the Mineral district, an interesting deposit of manganese ore was examined presenting a succession of large lenses of manganese mineral twenty-five to thirty per cent grade, which, however, proved too silicious for commercial use.

Another interesting deposit of very high grade manganese oxide was examined at Paris canyon, in Bear Lake County. This deposit occurred as a net work of high grade seams and bunches of pure manganese ore in a sandy contact between limestone and red conglomerate in a zone ten feet wide. Its development was confined to shallow open cuts and a few hundred pounds of the selected ore was sacked on the ground that would run fifty per cent manganese, but the development was too limited to justify quantity production, but was sufficient to warrant the encouragement for further work.

### Chrome and Serpentine.

On the opposite side of the Snake River canyon, in Oregon, from Mineral and Sturgil Creek, some interesting deposits of chrome ore were examined in a broad belt of serpentine that traverses that district extending North and South for twenty miles. Four to ten miles back from the canyon and railroad this district produced several car loads of thirty-five to forty per cent chrome ore and at one point exhibited a decidedly interesting deposit of pure green serpentine ten feet thick, suitable for the different uses to which talc is put commercially, including the manufacture of iron workers' pencils, for which purpose it gave very satisfactory results on special tests.

### MOLYBDENUM AND TUNGSTEN.

Idaho's numerous prospects of tungsten and molybdenum ore made no progress during the year in the matter of production worthy of mention, altho some decidedly interesting prospects occurred in these rare and desirable minerals at different points in the State that seem worthy of more extended development.

### PLATINUM.

Investigations were made of reported big platinum ore deposits in the Priest Lake district of Bonner County,

from where some specimens of ore were received that gave two-tenths of an ounce platinum per ton, but an examination of the large and small deposits of pyrrhotite ore in silicious schist from which the specimen was said to have been derived, failed to show appreciable values in platinum in average samples.

#### IDAHO COAL.

The transfer of the Teton Valley Coal Company's property on Horseshoe Creek in Teton County, referred to in my last annual report, has resulted in a vigorous campaign of development during the year and of essential railway spur construction. These important fuel deposits were purchased by R. S. Talbot, a successful industrial operator of Spokane, Washington, and his associates. Considerable time was given in assisting Mr. Talbot in co-operation with Honorable Frank R. Gooding, then State Fuel Administrator, in the early part of the year in getting the sanction of the U. S. Railway Administration for the construction of a very necessary ten mile railway spur from Tetonia to the mine. This important railway enterprise was finally sanctioned through the vigorous efforts of Mr. Talbot with the enthusiastic assistance of the leading citizens of the upper Snake River Valley, together with the help of our Congressional delegation at Washington.

This new branch line starting at Tetonia had been completed and equipped with rails and was operated for seven miles in December and the remaining three miles to the mine was under construction, which, with favorable weather, will be completed within a few months. At the mine a large force of men were employed throughout the year and extensive improvements made in the way of surface equipment and underground development. A full description of this fuel resource made by competent engineers recently employed by this Company is as follows:

"The Horseshoe Creek Coal Field is located on the Eastern slope of the Big Hole Mountains, twelve miles due West of Driggs, Teton County, Southeastern Idaho. Driggs is an agricultural center and county seat of Teton County of 1,000 population, near the end of the Teton Valley branch of the Oregon Short Line Railway. The elevation is 6,000 feet. The Big Hole Mountains comprise an 'L' shaped spur of the Tetons, one of the major ranges of the great

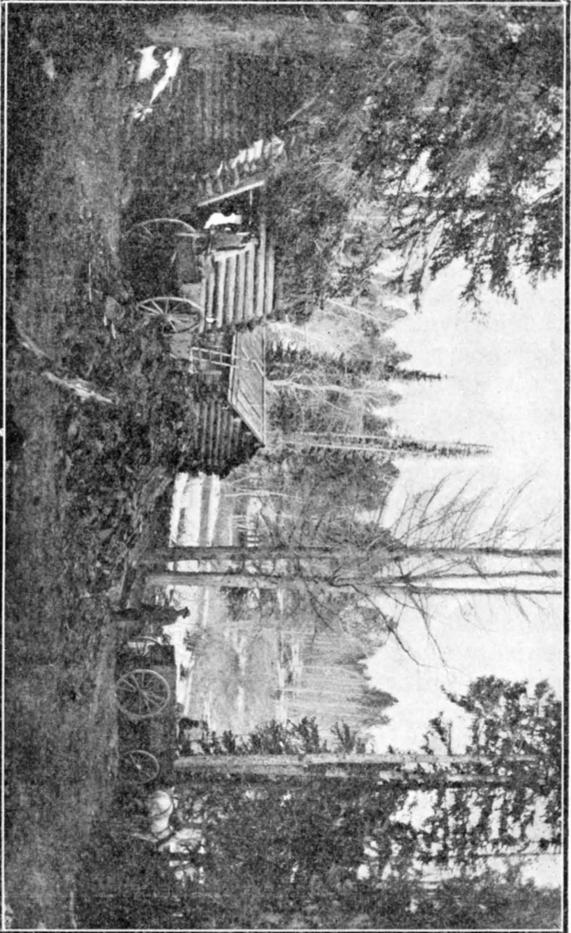
Rocky Mountain system. The 'Grand Tetons,' as they are called, have some of the steepest and most spectacular as well as the highest peaks in the United States. They are plainly visible across the valley from the coal property towering to an elevation of nearly 14,000 feet.

"During the past fifteen years four different companies, known as the 'Packsaddle,' 'Brown Bear,' 'Boise' and 'Horseshoe' Coal Associations, have operated in the field. All of these were controlled by local people, who were without the means to push development to a point where a large tonnage could be produced. This in connection with the long wagon haul over rough mountain roads to Teton Valley, kept the output limited strictly to the local demands of that agricultural community. The only noteworthy single outlet has been for grain threshing during harvest time.

"In December, 1917, all of these properties were taken over and placed under one head by R. S. Talbot of Spokane, who successfully developed the large magnesite deposits of Eastern Washington. The area of the property involved in the transactions is upwards of 1,200 acres. It is roughly in the shape of an oblong along the N. W. and S. E. strike of the coal seams. The workable seams are nine in number and range from thirty inches to twelve feet in width. They are interspersed with shales and sandstones of cretaceous age. The average dip is sixty degrees to the South-west. The seams on which development work has been done produce a remarkably clean, low-ash coal, which cleaves readily from the walls. A typical analysis is given herewith:

Moisture .....	3.60 pct.
Volatile .....	41.50 pct.
Fixed carbon.....	52.20 pct.
Ash .....	2.30 pct.
Sulphur .....	.40 pct.

"The present development work is being confined to the Brown Bear seam and it was on this five foot seam that the only noteworthy development work was carried out by any of the old concerns. The old development work consists of a 400 foot cross cut tunnel and 2,000 feet of gangway on the same level. From this gangway stoping has



ORIGINAL COAL BIN BROWN BEAR MINE NOW BEING REPLACED  
WITH 350 TON HICKERS

been done and about 50,000 tons of coal were removed prior to the taking over of the property by the Talbot interests.

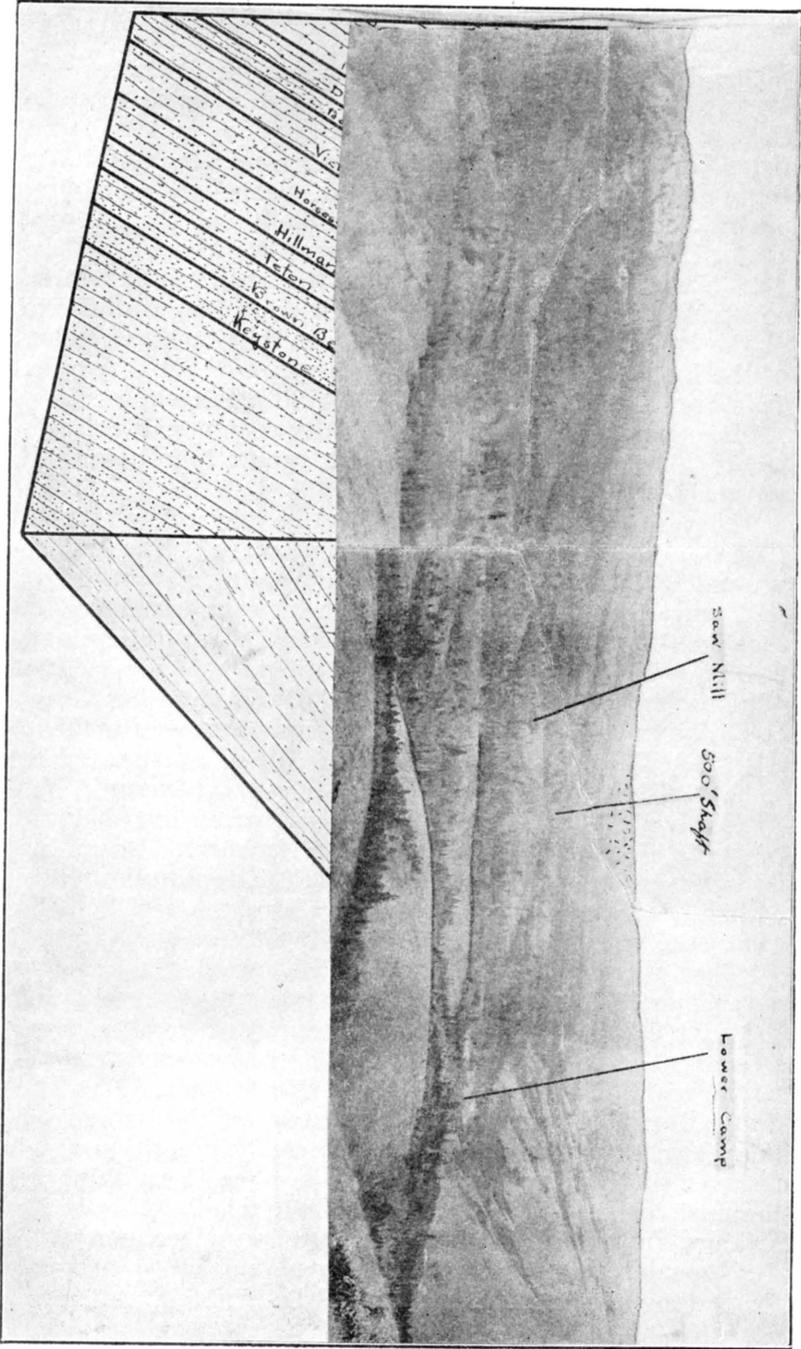
“As soon as the new management took control, a 500 foot slope was sunk, and at that depth, to, date, about 800 feet of gangways have been run along the strike of the seam. Mining will be by the shrinkage system, working on 100 foot breasts and leaving 100 foot pillars between. There has been built and installed a modern head frame, hoist and skip, together with all the necessary surface equipment. It is possible with the skip to deliver twenty tons per hour to the bunkers. This, however, is beyond the present capacity of the underground development, but that is being extended as rapidly as possible. The coal on being brought to the surface is run over a set of grizzlies, which grade it into lump, egg, nut and slack. All except the slack is delivered to 350 ton bunkers, and at the present writing is being disposed of to the ranchers and others who come with wagons.

“A 9x7 foot cross cut tunnel to be nearly 6,000 feet in length is being driven to intersect the whole series of coal seams. The portal of this tunnel is slightly lower than the gangways at the bottom of the Brown Bear slope. When the Brown Bear seam is reached, the first seam to be encountered—connection will be made with the present workings. For making the connection it will be necessary to construct about 2,000 feet of gangway. The tunnel will then furnish haulage, drainage and ventilation.

“The tunnel entrance is about a mile toward the mouth of Horseshoe canyon from the upper camp, or Brown Bear workings, already described. The lower camp has been established at the tunnel entrance and will be the terminus of the railroad spur, about to be described. The upper camp will be abandoned when coal is reached in the cross cut tunnel. A modern tipple capable of handling 1,000 tons per day will be built at the lower camp. A power house, almost completed, contains boilers, Atlas-Corliss engine, an A. C. dynamo of 125 K. W. capacity and a Laidlaw-Dunn-Gordan compressor—the latter for supplying air to the drills in the tunnel.

“A railway spur ten miles in length is under construction from the main line in Teton Valley and will terminate at the tipple site. The grading on the spur has been com-

GENERAL VIEW AND SECTIONAL DIAGRAM HORSESHOE BASIN COAL FIELD, TETON COUNTY



pleted to the mouth of Horseshoe canyon, a distance of seven miles, and track laid to this point. Owing to some rock exposures in the canyon, grading has been delayed there, and it may be some months before the remaining three miles are completed. In the meantime, a loading platform having been built at the mouth of the canyon, coal will be hauled from the present workings in sleds. For this purpose a water grade winter road has just been constructed. When the railroad reaches the tippie site at the lower camp, the sled haul, pending the completion of the long tunnel, will be for a distance of about a mile. This over a good, easy graded road recently completed.

"It is expected that the initial daily output will be from 200 to 300 tons—after the cross cut tunnel is in operation upwards of 600 tons.

"There are about forty men on the payroll, of whom fifteen are engaged in underground work. The underground force is to be augmented as rapidly as conditions will warrant in order to get out the tonnage intended. During the past summer and autumn about thirty new buildings have been constructed and include family cabins, quarters for single men, boarding houses, store buildings, etc. A saw mill was installed to supply lumber for these. All the buildings of the upper camp are so constructed as to be readily moved when the camp is to be abandoned.

"The various coal seams have been traced out and the property thoroughly explored at the surface. From the data obtained as a result of this work, it is conservatively estimated that the coal available above the level of the cross cut tunnel is in excess of 13,000,000 tons.

"The future of this field is decidedly promising, chiefly on account of the geographic location and the quality of the coal. Though close to the border of Wyoming, high mountains shut off communication and consequent competition with that State. The haul from the field to the Snake River Valley, the principal market, is far shorter than from Utah, the only likely source of competition. Coal famines in that section will, from now on, be a thing of the past. The Great Snake River Valley being only in its infancy, and with all the various centers undergoing rapid development, it appears that a good market is assured for as long a time as the mines will last."

## PHOSPHATE MINING.

Interest in the Idaho phosphate deposits, which constitute, to my mind, the greatest potential resource of mineral wealth in the State, continues to lag and the mineral proves difficult to introduce in desirable markets to the East, particularly in the upper Mississippi Valley grain States. The Waterloo Mine, situated near Montpelier, in Bear Lake County, was operated until March, when its market, which was at the Company's acid works on San Francisco Bay, where the mineral was made into superphosphate, was overstocked and the operation of the property was suspended.

On the opposite side of the Bear River Valley to the South, near Paris, the Western Phosphate Mining and Manufacturing Company worked a small force of men throughout the year and shipped a total of 10,000 tons of high grade crude rock phosphate with a guaranteed average contents of seventy per cent tri-calcium phosphate with less than one per cent of iron and alumina, and constituting one of the cleanest bulk shipments of this class of mineral to be found anywhere in America.

This enterprising Company is making a vigorous effort to broaden its market, especially to the East, but has met with the serious difficulty of exorbitant freight rates for this class of product, which it is able to mine and deliver on the railroad crude for a few dollars per ton and, I think, if given a coal traffic rate consideration, should be laid down as far east as Chicago for ten or twelve dollars per ton, and also throughout the extensive region and likely market intervening, at which rate that great American grain region, with its rapidly waning soil phosphate contents, could afford a rapidly broadening future market and produce decidedly beneficial results not only in the mining of the mineral in this field, but in the subsequent increased food crop yield from its economic use and application to the soil.

The bulk of the shipments from this deposit this year were marketed at Honolulu, H. I., where lack of shipping facilities doubtless interfered with normal sources of supply in the Pacific Islands. The development on this property has proven decidedly interesting and successful. Its main feature is an adit tunnel driven on a phosphate vein

six to seven feet thick that has now attained a length of 800 feet. The vein stands at a dip of about forty degrees, is mined by overhead stoping methods in 100 foot rooms and 100 foot pillars similar to steep vein coal mining, using the same kind of tools and embracing about the same operating costs as coal. This vein is very clean, requires little sorting to produce the relatively high grade average phosphate contents described, in fact, a number of car load shipments have been made from this particular deposit giving eighty per cent tri-calcium phosphate. This development is typical in size and values with the main rich phosphate veins of the Southeastern Idaho series that can be followed in duplicated outcrops for scores of miles. This Company is to be congratulated on its insistent efforts to establish the phosphate mining industry in Idaho, an industry destined to ultimately assume immense proportions. The market is broad enough for this product in the Middle West States to accommodate the substantial development of this field, as well as those of Southeastern States, if properly encouraged, and the Railway Administration could well afford to look upon this traffic in transportation rates at least on the same basis as coal, which would be a fitting recognition of an infant industry that is susceptible of doubling the present tonnage of higher class agricultural freights and profits from the present area of cultivated land.

This tardiness of appreciation of this important resource of vital soil fertilizer mineral is due principally to the excessive freight rate charged for transporting the mineral to Mississippi River points, which ranges about \$9.00 per ton, a rate that amounts to an embargo against the use of this mineral in that field. It seems unreasonable that such high charges should be made for a crude low grade ore of this class in view of its vital importance as a producer of increasing crop yield. It is suggested that the heavy vested interests in the smaller mineral deposits of this class in the Southeastern States are working against the possible competition from this field, as there isn't any logic in charging any more, or as much freight rate on this mineral in its crude form than there is in coal traffic, which is much cheaper and not of any more vital importance in ultimate industrial results.

In the interest of increased crop yields of the Middle and North Central-Western States and the ultimate benefit to general land values and living costs, the Federal Government would be justified in taking a vigorous hand in the introduction and beneficial utilization of these immense Western rock phosphate deposits, as a specific lever and influence in the direction of lowering the present and prospective excessive cost of living, which is the present bane of American industrial progress with our rapidly increasing population.

As I have shown in former reports, the three vital and costly elements to supply in soil fertility, are nitrogen, potash and phosphorus, whose use now is based on the established propaganda of costly prepared complete mineral fertilizer mixtures which are too costly for ordinary crop production.

According to the authority of the late Charles R. Van Hise, one of America's ablest scientists of recent times, "phosphorus is the crucial, the limiting factor in the productivity of the soil" and it has been amply demonstrated by the able and extensive work of the Illinois Agricultural Experiment station, that worn out soils that have been almost completely depleted of their fertility by constant cropping, can be revived and their vital force in productive capacity re-established by comparatively simple treatment with a cheaper form of this most important factor of soil fertilizer.

It is shown by these authorities that the soils of several of the Central-Western grain States have suffered a serious depreciation, through fifty years of cropping, in their phosphorus contents and that this element can be renewed economically by putting the mineral on the lands in its raw state, provided it is finely pulverized. This treatment accompanied by first sweetening the soil with cheap crushed limestone where it has become acid, and obtaining the necessary nitrogen from the air through the medium of legume forage crops at a nominal cost to the farmer he can, in a few years, renew the virgin fertility of the soil in all its original productive capacity. In this grain region of America, soil potash is still abundant and it is only necessary to supply these other vital elements which can be done at a low cost by this method. The phosphate min-

eral is obtainable at a low tonnage cost at its source in this Western field of exceptionally high quality, unexcelled by that of any other source of supply in the world and running into billions of tons of this mineral in Idaho alone. The beneficial effects of the broader use of this potential basis of increased food supply, it would seem, should command the first preference in railway transportation rates and the Federal encouragement of its application and use in the interest of National progress.

Some of the present State and National agitation looking to the reclamation of arid lands and swamp lands in the interest of the returning soldiers could be, I think, well directed to the millions of acres of exhausted and worn out farm lands of the Eastern and Southern States, extensive areas of which exist within modern canon shot of the National Capitol itself, and while they are more depleted than the progressively waning soil fertility areas further West, I believe, from my study of the subject, that large tracts of that cheap worn out abandoned farm land could be rehabilitated to favorable productive capacity and at as low a cost per acre as many of the irrigation enterprises, swamp lands and cut over timber land projects now being so seriously considered.

I recognize that this is an agricultural subject and properly belongs to agricultural institutions. These institutions, however, are more concerned in the current phases of the industry, of which soil fertility in Idaho does not as yet cut much figure for the reason that our soils are largely of composite rock origin, very rich in the essential salts of vegetation with the exception of a very few limited areas, and our agricultural people naturally take a keener interest in the more pressing problems and methods of crop production, which in this connection, is a subject more of National than of State concern. I may be convicted of "butting in" to a line of industrial endeavor that does not properly fit a report of this nature. It can be definitely shown, however, that mineral and agricultural progress are, in more ways than one, intimately inter-dependent on each other. For instance, the biggest outlet and market for Idaho's great annual lead production is with the manufacturers of paint pigment, who use, I am reliably informed by competent authority, the biggest per cent of our immense total annual yield of lead.

The successful utilization of this metal for paint in oxidized form, is dependent on its mixture with a vegetable oil made from flax seed, and there seems to be absolutely no other substitute that can successfully replace this oil for this purpose. The present market value for this oil is almost prohibitive for this use and it would seem a fit subject for Government agricultural expert study to increase the cultivation of flax, in the regions to which it is adapted, and to furnish the necessary mineral elements to stimulate its yield with a view to relieving the present excessive market price on this decidedly important variety of seed oil and in addition to linseed oil, a most desirable and fattening stock food residue after the oil is extracted.

My personal interest in pursuing this subject annually in my reports is with a view to the inauguration in Idaho of a new and expanding mineral industry in the mining and treatment of this extensive resource of the State, whose progress, it is believed, in common with that of adjoining phosphate States, has been and now is retarded by the political influence at Washington of heavily vested interests in the complete fertilizer industry with a selfish and alien disregard to the general National welfare in the direction of improving domestic food production and cheaper living costs.

Prior to the European War, according to competent authorities, the complete fertilizer industry of our south-eastern states, based principally on the ownership of phosphate deposits in Florida, Tennessee and the Carolinas, represented a combined cash capital investment of \$300,000,000, and that its annual production of fertilizer minerals had a selling value of \$120,000,000 per year. This vast industry, prior to the war, was under the complete control and direction of European capital, whose selfish interests worked against rather than for American agricultural progress and soil fertility conservation.

According to the late James J. Hill, under present methods of soil robbing and fertility waste, if left unchecked, this country will be unable to feed itself and its rapidly expanding population, let alone having surplus products to ship to Europe 50 years hence, that with proper recognition of soil fertility maintenance and its splendid geographic position, the United States can con-

tinue, from its present cultivated area, not only to economically supply its own citizens with ample food and clothing from soil products at reasonable prices, but can continue to produce a big surplus for the European market.

Germany, during the past four years, with its comparatively limited area, primarily poor land, and dense population, according to recent press reports, has not suffered so seriously from food shortage as the continual propaganda cry indicated, and this aptly illustrates the virtue of scientific soil treatment, which is said to be carried out to a high degree of perfection in that country. Germany is as absolutely dependent on foreign sources of supply for phosphorus as the balance of the world has been until lately been dependent upon Germany for potash, but the potash problem is now likely to be successfully solved in this country from domestic sources.

Soil fertility conservation, the one most important factor of our National success, was ruthlessly neglected, disregarded or insidiously double-crossed at our National Conservation Congress, inaugurated over twelve years ago, a subject that was ably pointed out by competent and unbiased authorities at the time, but probably for reasons already suggested was successfully side tracked in the face of the expanding great areas of smooth but exhausted, agriculturally abandoned lands of our eastern and southern states. This is a subject of National welfare and industrial progress of the most vital import to this country at large at this time.

The following quotations are decidedly pertinent to this subject and are copied from an address by the late James J. Hill, one of the ablest American students along this line, which was delivered at the Minnesota State Fair on September 3, 1906. Mr. Hill figured at that time in his estimates of population progress in America without the European war and its check on immigration, but in substance his arguments are sound:

“Only two states in the Union show an average total value of farm products in excess of \$30 per acre of improved land. The figure for Illinois in 1900 was \$12.48; for North Carolina, \$10.72; for Minnesota, \$8.74. By proper cultivation these returns could easily be doubled and still leave the soil's resources unimpaired. The dou-

bling of all products of the farm would add to the wealth of this country from \$5,000,000,000 to \$6,000,000,000 every year, according to the crop yield of the season and the range of market prices."

"Therefore, and this is the focal point of the whole matter, the country is approaching the inevitable advent of a population of 150,000,000 or 200,000,000 within the lifetime of those now grown to man's estate, with a potential food supply that falls as the draft upon it advances. How are these people to be fed?"

"The government should establish a small model farm on its own land in every rural congressional district, later perhaps in every county in the agricultural states. Let the Department of Agriculture show exactly what can be done on a small tract of land by proper cultivation, moderate fertilizing and due rotation of crops. The sights of the fields and their contrast with others, the knowledge of yields secured and profits possible, would be worth more than all the pamphlets poured out from the government printing office in years. The government ought not to hesitate before the comparatively small expense and labor involved in such a practical encouragement of what is the most important industry of our present and the stay and promise of our future. Disseminate knowledge of farming as it should and must be, instead of maintaining the pitiful bribe of a few free seeds. Declare everywhere, from the executive chamber, from the editorial office, from the platform, and, above all, from every college class room and from every little schoolhouse in the land, the new crusade. Let the zeal for discovery, for experiment, for scientific advancement that has made the last century one of multiplied wonders focus itself upon the problems of the oldest sciences and arts; the cornerstone of all civilization; the improvement of tillage and making grow two grains where only one grew before. Only this way may a multiplying population secure its permanent maintenance. Only this way may the struggle for existence that has power to either curse or bless be brought to any other termination than the peace of death."

Phosphorus is the main key that can unlock the door to the fullest and most successful solution of these vital agricultural problems of such broad National interest, and



SEVEN FOOT VEIN HIGH GRADE ROCK PHOSPHATE NEAR  
MONTPELIER, IDAHO

is an element that exists in the richest and cleanest mineral form found anywhere in the world and in practically exhaustless quantities in the mountains of Southeastern Idaho.

In my opinion the two outstanding factors that can solve the serious and rapidly growing problems of American progress are soil fertility, conservation and renewal, and the electrification of our railway transportation systems. Our continued criminal disregard of the first, and continued cumbersome handling of the second of these factors will peonize our people in a few generations just as surely as did the faulty soil handling systems of Oriental history.

In regard to transportation problems, it has been shown that present methods are a stupid waste of man power and good coal, that, by modern practice, about 75 per cent of our American railway coal traffic, which constitutes about 50 per cent of their present total tonnage business, can be eliminated to the advantage of higher class freight movement and terminal use, by electric substitution of heat and power transmission. It would be about as logical to deliver our water supplies in the form of ice as it is to haul our coal supplies on railway cars to the point of consumption, and then, under present methods of use, waste from 90 to 95 per cent of their heat value back into the air, when by centralized plants this low grade, heavy, railway-cluttering traffic can be conveyed on a wire at an enormous advantage in economic results—and with the full development of our idle water power resources, a desirable conservation of our coal supply.

In the present general methods of American agriculture, even in the most advanced systems of crop rotation and soil sanitation, our farmers simply defer the day of ultimate soil exhaustion of its vital fertility elements and crop producing capacity.

The bulk of American farmers under past and most of the present methods of soil treatment are robbing their own bank of its principal capital value, just as inevitably as the mine operator who hurries to cash in and gouge out a splendid ore body to its inevitable and relatively shallow roots with no possibility of its renewal.

The farmers' opportunity is different and more advantageous if he checks his soil deterioration before it is too late, for, in this Country, he has these vast resources of concentrated mineral fertilizer to draw upon with which to replace the elements in his soil that are removed and shipped away in annual crop production, and by intelligent appreciation of his soil functions and capacity he should be able to economically and profitably renew and maintain his soil fertility in all its primary capacity.

These are subjects of such vital National import as to be worthy of the most serious and immediate consideration and assistance of our statesmen and government authorities in the interest of the public good, particularly the public stomach, but with as little interference in the way of government ownership as is practicable.

To my way of thinking the true functions of central government is service to the people in the way of a magnified and elaborated police power, to be employed in strictly regulating and equalizing their natural-born selfish human instincts, and in scientifically guiding them in human progress, but not to go into competition with them in their business affairs much, if any, beyond the necessities of National defense, as to do so would not only create envy and dissension, but would strike a hard blow at its own essential revenue resources and financial support at the expense of individual opportunity, the most important factor and foundation of our present National success.

A strict, fair and impartial knowledge and control of business, both big and little, and a due regard to the just, fair and legitimate participation of its resulting profits to all its participants, together with a broad appreciation, development and use of our varied magnificent natural resources. These are desirable governmental functions, whose intelligent, unbiased execution present elaborate opportunity for distinction in statesmanship and can perpetuate the present enviable position and glory of America indefinitely.

# METAL PRODUCTION FOR 1918 BY COUNTIES.

## ADA COUNTY.

Gold, fine oz., 343.74.....	\$	7,105 10
Silver, fine oz., 406.65.....		393 51
Total value .....		7,498 61

## ADAMS COUNTY.

Gold, fine oz., 28.45.....	\$	588 06
Silver, fine oz., 770.....		745 13
Copper, lbs., 30,000.....		7,386 00
Total value .....		8,719 19

## BLAINE COUNTY.

Gold, fine oz., 898.40.....	\$	18,569 92
Silver, fine oz., 261,000.....		252,569 70
Lead, lbs., 2,725,000.....		201,922 50
Zinc, lbs., 2,035,000.....		165,852 50
Total value .....		638,914 62

## BOISE COUNTY.

Gold, fine oz., 10,810.....	\$	223,442 70
Silver, fine oz., 24,682.....		23,884 77
Total value.....		247,327 47

## BONNEVILLE COUNTY.

Gold, fine ozs., 157.....	\$	3,245 19
Silver, fine oz., 19.....		18 38
Total value.....		3,263 57

## BONNER COUNTY.

Gold, fine oz., 70.....	\$	1,446 90
Silver, fine oz., 2,004.....		1,939 27
Lead, lbs., 190,000.....		14,079 00
Total value.....		17,465 17

## BOUNDARY COUNTY.

Gold, fine oz., 60.....	\$	1,240 20
Silver, fine oz., 129,644.....		125,456 50
Lead, lbs., 7,494,000.....		555,305 40
Total value.....		682,002 10

**BUTTE COUNTY.**

Gold, fine oz., 49.....	\$	1,012	83
Silver, fine oz., 6,600.....		6,386	82
Lead, lbs., 436,000.....		32,307	60
Total value.....	\$	39,707	25

**CLEARWATER COUNTY.**

Gold, fine oz., 217.24.....	\$	4,490	35
Silver, fine oz., 4,400.....		4,257	88
Total value.....	\$	8,748	23

**CAMAS COUNTY.**

Gold, fine oz., 245.....	\$	5,064	15
Silver, fine oz., 70.....		67	73
Total value.....	\$	5,131	88

**CUSTER COUNTY.**

Gold, fine oz., 2,758.....	\$	57,007	86
Silver, fine oz., 153,000.....		148,058	10
Copper, lbs., 3,500,000.....		861,700	00
Lead, lbs., 2,200,000.....		163,020	00
Total value.....	\$	1,229,785	96

**ELMORE COUNTY.**

Gold, fine oz., 270.....	\$	5,580	90
Silver, fine oz., 87.....		84	19
Total value.....	\$	5,665	09

**FREMONT COUNTY.**

Gold, fine oz., 50.....	\$	1,033	50
Silver, fine oz., 500.....		483	85
Copper, lbs., 100,000.....		24,620	00
Total value.....	\$	26,137	35

**IDAHO COUNTY.**

Gold, fine oz., 3,587.....	\$	74,143	29
Silver, fine oz., 1,700.....		1,645	09
Total value.....	\$	75,788	38

**LATAH COUNTY.**

Gold, fine oz., 30.....	\$	620	10
Silver, fine oz., 170.....		164	50
Copper, lbs., 85,000.....		20,927	00
Total value.....	\$	21,711	60

**LEMHI COUNTY.**

Gold, fine oz., 1,189.....	\$	24,576	63
Silver, fine oz., 143,000.....		138,381	10
Copper, lbs., 68,000.....		5,038	90
Lead, lbs., 4,744,000.....		1,167,972	80
Total value.....	\$	1,335,969	33

**OWYHEE COUNTY.**

Gold, fine oz., 900.....	\$	18,603	00
Silver, fine oz., 34,000.....		32,901	80
Total value.....	\$	51,504	80

**SHOSHONE COUNTY.**

Gold, fine oz., 14,628.....	\$	302,360	76
Silver, fine oz., 8,234,389.....		7,968,418	23
Lead, lbs., 273,059,425.....		20,233,703	39
Zinc, lbs., 49,656,000.....		4,046,964	00
Copper, lbs., 1,449,000.....		356,743	80
Total value.....	\$	32,908,190	18

**WASHINGTON COUNTY.**

Gold, fine oz., 17.....	\$	531	39
Silver, fine oz., 4,270.....		4,132	08
Copper, lbs., 8,400.....		2,068	08
Total value.....	\$	6,551	55

**TOTALS FOR STATE FOR YEAR 1918.**

Gold, fine oz., 36,307.83.....	\$	750,482	83
Silver, fine oz., 9,572,214.....		8,709,988	63
Lead, lbs., 290,848,425.....		22,368,310	69
Zinc, lbs., 51,691,000.....		4,212,816	50
Copper, lbs., 5,240,400.....		1,278,483	78
Total value for 1918.....	\$	37,320,082	43
Total value for 1917.....		56,292,210	00
Decrease .....	\$	18,972,127	57

# 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
Total value.....	\$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., 86,499,506.....	3,760,553 00
Copper .....	60,000 00
Total value.....	\$ 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
Total value.....	\$ 8,551,103 94
Through the U. S. Assay Office.....	1,699,760 22
Estimated from other sources.....	1,000,000 00
Total value.....	\$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
Total value.....	\$ 6,902,194 76

## TOTAL FOR THE STATE FOR THE YEAR 1902.

Gold, fine oz., 119,363.....	\$ 2,567,233 21
Silver, fine oz., 5,259,778.....	3,655,866 80
Lead, lbs., 119,223,000.....	4,172,805 00
Total value.....	\$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.....	4,338,312 60
Lead, lbs., 220,857,956.....	9,386,213 13
Copper, lbs., 2,524,000.....	336,954 00
Total value.....	\$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 value.....	\$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., 8,626,794.55.....	5,196,270 51
Lead, lbs., 260,791,456.....	12,257,198 43
Copper, lbs., 6,661,400.....	1,025,189 46
Zinc, lbs., 2,174,960.....	127,887 89
Total value.....	\$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.....	14,487,680 30
Copper, lbs., 11,640,565.....	2,252,449 32
Zinc, lbs., 1,447,000.....	91,426 30
Antimony, lbs., 90,000.....	20,700 00
Total value.....	\$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.....	12,470,341 74
Copper, lbs., 10,487,905.....	2,241,177 17
Zinc, lbs., 9,192,551.....	534,087 21
Total value.....	\$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 value.....	\$15,561,131 64

**TOTAL FOR THE STATE FOR THE YEAR 1909.**

Gold, fine oz., 70,898,938.....	\$ 1,465,487 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.....	1,034,651 50
Zinc, lbs., 1,906,200.....	104,841 00
Total value.....	\$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.....	10,761,057	70
Copper, lbs., 5,837,639.....	753,055	40
Zinc, lbs., 5,995,600.....	33,513	60
Total value.....	\$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.....	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 value.....	\$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.....	13,223,650	00
Copper, lbs., 7,392,280.....	1,224,161	00
Zinc, lbs., 16,243,840.....	1,127,316	00
Total value.....	\$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 value.....	\$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 value.....	\$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 value.....	\$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

Total value.....\$49,102,693 00

**TOTALS FOR THE STATE FOR THE YEAR 1917.**

Gold, fine oz., 41,326.....	\$ 826,520 00
Silver, fine oz., 12,496,017.....	10,173,000 00
Lead, lbs., 395,883,000.....	34,758,506 00
Zinc, lbs., 96,123,000.....	8,555,947 00
Copper, lbs., 7,282,000.....	1,979,247 00

Total value.....\$56,292,210 00

**TOTAL FOR THE STATE FOR THE YEAR 1918.**

Gold, fine oz., 36,307.83.....	\$ 750,482 83
Silver, fine oz., 9,572,214.....	8,709,988 63
Lead, lbs., 290,848,425.....	22,368,310 50
Zinc, lbs., 51,691,000.....	4,212,816 50
Copper, lbs., 5,240,400.....	1,278,483 78

Total value.....\$37,320,082 43

Total value of all metals for 21 years since State records were kept.....	\$465,513,764 43
Total value all metals for preceding 38 years (estimated).....	381,815,312 00

Grand total since discovery 59 years ago.....\$846,829,076 43

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