UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
STRATEGIC MINERALS INVESTIGATIONS

WASHINGTON
1944

Lead and Zinc Deposits

of the

PINE CREEK AREA, COEUR D'ALENE MINING REGION
Shoshone County, Idaho

by

J. D. Forrester and Vincent E. Nelson

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ECONOMIC SUMMARY

A recapitulation of production and ore-reserve estimates of the active and semi-active 1/ mines of the Pine Creek Area, Coeur d'Alene Mining Region, Idaho is as follows:

Ore Reserves (All classifications and including those arbitrarily credited to semi-active mines)	Daily Production	Projected (possible future) Daily Production:
500,000 tons	315 tons	850 tons

The ore bodies of the Pine Creek area are distributed through several mining properties and they are so exposed as to be readily available to continued, sustained production by different mining enterprises. Thus, the failure or success of any single operation would not markedly curtail or increase the daily delivery of zinc and lead from the Pine Creek district.

The ore-bearing veins, which appear to be in two or more major zones are, as a rule, relatively narrow and lenticular, and show strongly developed post-mineral strike faulting along the veins. The ore-bearing zones may well be characterized as tracts of numerous, discontinuous sub-

1/ This classification would include such properties as the Hilarity, Nevada Stewart, Amy Matchless, Lynch-Pine Creek, Bobby Anderson, Northern Light, etc.

parallel shears, some of which are pre-mineral and thus control the ore shoots; others are post-mineral but follow the same general trend. As a result, there is a pronounced tendency for the ore shoots to be irregular in outline and discontinuous along both strike and dip. In most mines of the area this results in a necessarily high proportion of development work before ore can be blocked out. Hence the mining operations are generally marginal in character and successful mining enterprises are dependent upon "abnormal" metal prices or premium allotments.

The Constitution and Douglas mines are not situated on the same vein system as the Highland-Surprise, Nevada Stewart, Sidney and other mines.

In the writer's opinion, the Pine Creek area does not offer outstanding possibilities for the discovery of large, new ore bodies or for the eventual development of major ore-reserve tonnages. It is questionable whether surface diamond drilling can be used successfully as a prospecting medium in finding hitherto undiscovered mineral tracts of consequence. Continued production from the area can best be sustained by assurance of suitable metal prices to those mines that are already operating or are essentially prepared to operate. Such a policy, in addition to insuring a sustained production, would engender continued mine development work and would thus further the eventual prospecting of the Pine Creek area. It is hoped that the structural projections and correlations that have been prepared will be of assistance to the different mining companies in guiding and directing their current and future development projects.

INTRODUCTION

Location and Access

The Pine Creek area is in the western part of the Coeur d'Alene mining region, Shoshone County, Idaho. The area, as studied for this report, embraces approximately 15 square miles in the southern half of T. 48 N., R. 2 E. and the northern tier of sections of T. 47 N., R. 2 E., Boise Principal Meridian. The major portion of the mineralized tract lies on the northeast side of the East Fork of Pine Creek and, below the East Fork's confluence with the West Fork, on the east side of Pine Creek proper (Index Map). Mines of the area are accessible by road from Kellogg, Idaho, which is approximately 15 miles from the southeasternmost operating property and 7 miles from the northernmost operating property. From Kellogg a surfaced highway extends to the forks of Pine Creek and a good graveled road follows the East Fork to the southernmost producing mine. Fairly good, though commonly quite steep, dirt roads have been built from this highway to the various properties. These roads are kept passable during the winter months so that haulage of supplies, crude ore and mill concentrates can progress without major interruptions throughout the year. Snow blankets the region for about 4 months of each winter.

For the most part the ore is milled locally and the concentrates trucked to the Bunker Hill and Sullivan lead smelter or Sullivan zinc plant at Kellogg. Crude ore, when trucked from the area, moves to custom mills in the vicinity of Wallace, Idaho, a distance of approximately 25 miles.

Geography

The master stream which traverses the area is Pine Creek, a tributary of the South Fork of the Coeur d'Alene River. The region is in the physiographic stage of late youth. Dissection of the interstream divides is sharp and the topographic relief is essentially at a maximum Canyon walls are steep and the profiles of stream channels are irregular. The altitudes range from 2,400 feet (plus or minus) above sea level at the major stream up to as much as 4,800 feet on the higher divides.

During the late summer months (August-September) the smaller, tributary streams frequently cease to flow. This intermittent character of the runoff is a mining and milling problem for some of the operations situated near the head waters of the smaller creeks.

Although excellent timber for mining purposes is generally plentiful on the claims, most of the larger mines purchase such supplies from saw mills in the near vicinity.

History and Production

Although the oldest claims of the area were located shortly after discovery of ore in the Coeur d'Alene region, little work was done until around 1915. Not much is known of the earlier history of the older properties, but the Douglas group of claims was located in 1898 and the Highland-Surprise in 1900. 2/ No production is reported before 1910. In 1916 and 1917 a considerable production came from the area, chiefly from the Highland-Surprise mine, but also from the Douglas, Constitution, Nabob and Little Pittsburgh mines. The chief production from the area, however, came in the seven years from 1924 to 1930 inclusive, and was due principally to sustained mining activity through most of this period at the Constitution and Sidney mines, with other mines contributing a substantial tonnage for shorter intervals. From 1931 to 1940 inclusive, the production was intermittent and mostly small except in 1936 and 1937; all of it came from the Sidney mine except in the last year. Since 1940 several mines in the Pine Creek area have been actively worked under the stimulation of war prices for the zinc and lead.

2/ Jones, Edward L., Jr., "A Reconnaissance of the Pine Creek District, Idaho," U. S. Geological Survey Bull. 710-A, 1919, p. 3.

The following table gives the production of the Pine Creek area from 1910 to 1943, according to the figures compiled by the U. S. Geological Survey from 1910 to 1923 and by the U. S. Bureau of Mines from 1924 to 1943.

ORE PRODUCED IN PINE CREEK AREA, YREKA MINING DISTRICT
SHOSHONE CO., IDAHO, 1910-1943
AND CONTENT OF GOLD, SILVER, COPPER, LEAD, AND ZINC 3/

	Crude Ore Tons	Gold Fine Oz.	Silver Fine Oz.	Copper Pounds	Lead Pounds	Zinc Pounds
1910	89	198	1,983		99,916	
1911	3,200	942	8,097	535,473	191,686	
1912	1,608	715	3,964	285,838	329,300	
1913						
1914	32	112	492	160	36,123	
1915	700	79	556	101	33,945	
1916	20,461	1,756	24,189	840	948,111	2,912,008
1917	33,857	6,100	62,275		1,878,587	7,288,114
1918	811	520	3,829		100,716	334,574
1919	25					12,000
1920	487	1,152	9,271		377,965	38,400
1921	437	1,464	9,892		314,657	
1922	735	2,279	12,169		443,448	
1923	309	1,064	5,198		198,066	37,000
1924	24,990	8,531	45,852		2,088,934	2,501,952
1925	53,808	16,529	117,553	16,934	4,060,330	7,111,914
1926	103,790	27,241	206,572	34,146	7,193,106	15,412,607
1927	90,997	15,128	174,503	22,802	7,022,308	15,609,642
1928	34,239	1,947	76,136	5,532	3,919,680	6,084,010
1929	62,465	4,524	107,012	46,509	5,062,221	10,863,023
1930	47,379	11,361	106,961	33,455	4,192,453	9,282,193
1931	12,069	1,600	27,663	9,033	1,295,038	2,236,175
1932	11,456	1,994	19,927	5,385	1,123,006	1,934,744
1933						
1934						
1935	6,015	1,200	10,482	3,600	521,578	1,153,458
1936	25,695	2,850	32,585	11,500	1,749,100	4,089,300
1937	18,824	1,800	25,879	10,000	1,191,060	2,866,500
1938	686		1,712		101,000	196,800
1939						
1940	375	200	685	366	29,100	39,500
1941	38,018	124	33,575	17,516	1,397,311	4,330,900
1942	57,039	176	85,412	28,003	3,196,468	7,486,188
1943	80,688	207	95,476	37,290	3,923,137	10,296,314
	731,284	111,793	1,309,900	1,104,483	53,018,350	112,117,316

3/ Table furnished by George E. Woodward, Supervising Engineer, Salt Lake City Section, Production and Economics Division, U. S. Bureau of Mines.

Earlier Reports

Several earlier publications have dealt directly or incidentally with the Pine Creek area. The more important of these are listed in the footnote below. 4/ In 1935 the U. S. Geological Survey, in cooperation with the Idaho Bureau of Mines and Geology, began a detailed reexamination of the Coeur d'Alene region. To date two publications have appeared as a result of this work, 5/ although the areas treated lie east of the Pine Creek area.

Scope of Field Work and Acknowledgments

Field work for this report was begun in June 1943, and completed in November of the same year. During the months of June and July, J. D. Forrester, assisted by G. A. Duell, undertook a comprehensive study of the underground workings of the larger properties. Geological mapping of the accessible workings of the following mines was completed during this period: Constitution, Douglas, Highland-Surprise, Nevada-Stewart, Sidney, Little Pittsburgh, Denver, Lynch-Pine Creek and Lookout Mountain. From August through November, Vincent E. Nelson and J. Fred Smith, Jr. mapped the areal geology of the region and completed underground mapping of numerous small prospects and one larger one, the Northern Light, which was unwatered during this period. They were ably assisted by G. A. Duell and R. M. Hutchinson.

The primary purposes of the field examinations were to determine the geologic setting of the mineralized tracts, the past, present, and potential ore production, and the ore reserve situation at each mine, considered both as a local unit and as part of a broader, regional picture. The United States Geological Survey should thus be in a position to offer recommendations to other governmental agencies concerning the operating

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4/ Jones, Edward L., Jr., A Reconnaissance of the Pine Creek District, Idaho, U. S. Geological Survey Bull. 710-A, 1919.

Ransome, F. L. and Calkins, F. C., The geology and ore deposits of the Coeur d'Alene District, Idaho, U. S. Geological Survey Professional Paper No. 62, 1908.

Umpleby, J. B. and Jones, E. L., Jr., Geology and ore deposits of Shoshone County, Idaho, U. S. Geological Survey Bull. 732, 1923.

Calkins, F. C., A geological reconnaissance in northern Idaho and northwestern Montana, U. S. Geological Survey Bull. 384, 1909.

5/ Shenon, P. J., Geology and ore deposits near Murray, Idaho, Idaho Bureau of Mines and Geology, Pamphlet No. 47, 1938.

Shenon, P. J. and McConnel, R. H., The silver belt of the Coeur d'Alene District, Idaho, Idaho Bureau of Mines and Geology, Pamphlet No. 51, 1939.

conditions of the mines and also render some direct assistance to the individual mining operators. The statistics and data herein treated with are, for the most part, as of June and July 1943.

The writers are indebted to the operators of the district for providing full access to the properties and for their willingness to offer assistance. Mr. J. B. Haffner, General Manager, and members of the geological staff of Bunker Hill and Sullivan Mining and Concentrating Company were most generous in placing office facilities at the disposal of the party and in giving access to data on the area which the company had compiled over a period of many years.

GEOLOGY

General Features

Sedimentary rocks of the Pine Creek area are all of pre-Cambrian age and are a part of the Belt series. A single formation, the Prichard, oldest of the beds exposed, underlies all of the mapped area (pl. 1) with the exception of the eastern and southwestern boundary areas, where Burke rocks crop out. A few small diabase and lamprophyre dikes intrude the sedimentary rocks. Terrace gravels of Tertiary age cap many of the lower hills adjacent to Pine Creek, but no attempt has been made to map them.

The rocks of the area have been deformed by close local folding on a small scale, on which has been superposed at least one broad open anticlinoral fold. They are further broken into large blocks by normal faults or by faults on which the movement has been essentially horizontal.

All known minable veins in the Pine Creek area are in the Prichard formation.

Belt Series

The Belt series, as exposed in the Pine Creek area, consists of argillites, quartzites, and quartzitic argillites of shallow water origin. Only two formations of the series, the Prichard and the Burke, are exposed in the map area. (pl. 1)

Prichard Formation. The Prichard formation is made up largely of dark gray to black argillites with thin regular laminations ranging in color from almost white to dark gray. The thickness of the formation, as measured by Shenon and McConnel 6/ probably exceeds 12,000 feet. There are two well-defined quartzitic zones within the Prichard, one near the top of the formation and one much lower in the section. The one near the top, which marks the transition zone between the Prichard and Burke formations, is about 800 feet thick. It consists of massive white quartzite beds, up to 50 feet thick, interbedded with dark gray, finely laminated

6/ Shenon, P. J. and McConnel, R. H., The Silver Belt of the Coeur d'Alene District, Idaho; Idaho Bureau of Mines and Geology, Pamphlet No. 50, p. 3, 1939.

argillite. The lower zone, which is the only horizon marker that may be readily used to work out structural relationships in much of the Pine Creek area, has been termed the Middle Prichard quartzite. It lies approximately 10,000 feet below the top of the formation. 7/ In the eastern part of the mapped area the Middle Prichard quartzite consists of two well-defined massive white quartzite units, the uppermost one having a thickness of about 150 feet and the lower one about 100 feet. They are separated by approximately 150 feet of argillite. As the Middle Prichard is followed westward there is a notable thinning of the upper quartzite band, but the quartzitic zone as a whole thickens and consists of several lenses of quarzite within argillite which pinch out in short distances. At the western extremity of the area the zone consists of four distinct quartzite bands ranging in thickness from 30 to 50 feet with interbedded black argillite. Here the entire zone has a thickness of approximately 900 feet. The discontinuity of the individual quartzite beds and prevalence of areas mantled with slope wash and vegetation make it extremely difficult to map all the individual quartzite units accurately or to correlate one with another. However, the topmost bed, even though it varies in thickness from place to place, is continuous across the entire area and it thus serves as an excellent horizon marker.

Between this well-defined continuous upper band of Middle Prichard quartzite and the quartzites at the top of the Prichard, small discontinuous lenses of quartzite were observed at only a few places. One of these is located immediately east of the Nevada-Stewart Mine on Highland Creek, a second directly south of the Little Pittsburgh Mine on Denver Creek and a third approximately 1500 feet southeast of the Little Pittsburgh Mine. Other quartzite lenses whose exact stratigraphic positions are not known occur in the vicinity of the Hilarity Mine and in the acute angle of the faulted wedge near the mouth of Nabob Creek. Structural relationships indicate that these lenses also lie above the persistent upper bed of Middle Prichard quartzite.

Burke Formation. The Burke formation in the Coeur d'Alene region ranges in thickness from 1800 to 2400 feet. 8/ It consists primarily of gray to grayish green argillaceous quartzites which, except for the upper Prichard transition zone, are readily distinguishable from the underlying dark Prichard argillites. The upper limit of the Burke, however, is not easily chosen, for the overlying Revett formation, which consists predominantly of rather thick-bedded white quartzite, also contains some argillaceous quartzites indistinguishable from those of the Burke, and the Burke contains some white quartzites of the Revett type. In the Pine Creek mapping no attempt was made to establish the contact between these

7/ Shenon, P. J. and McConnel, R. H., The Silver Belt of the Coeur d'Alene District, Idaho; Idaho Bureau of Mines and Geology, Pamphlet No. 50, 1939.

8/ Ibid., (Pamphlet No. 50).

two formations. Consequently, in the extreme southern portion of the area near the Constitution mine, where faulting has complicated the relationships, some Revett rocks may be included in the area mapped as Burke.

Igneous Rocks

The only igneous rocks found in the area are a few diabase and lamprophyre dikes. They crop out in the southern part of the area, where they intrude the Burke quartzite. One such dike is exposed in the west bank of the South Fork of Pine Creek about one-half mile north of the Constitution Mine. At creek level the dike has a width of approximately 48 feet. Dikes similar to those found in the southern part of the area have been noted in underground workings elsewhere. In underground exposures they commonly show "ladder work" zones of calcite veinlets. Maximum width of the dikes seen underground is seldom more than 12 feet and the average is much narrower. All appear to be later than the main mineralization and hence tend to "blank out" the ore minerals where they intersect the veins. Contact metamorphism along the dikes is negligible, but the contacts with the wall rocks are nevertheless often indefinite and obscure.

STRUCTURE

Folds

One of the larger and more obvious structural features of the area is an anticlinal fold whose axis trends roughly northwest through the center of Pine Creek basin. The fold may be traced quite readily from the divide between Denver and Nabob creeks, where its two limbs are defined by the Middle Prichard quartzite, to the forks of Pine Creek (see Section A-A'). From this point the axis takes a more northwesterly course on the west side of Pine Creek proper. East of the Denver-Nabob divide the structural features are obscured somewhat by faulting and small scale tight folding, but the fold appears to continue southeast at least to Highland Creek (see Section B-B').

Many other smaller folds occur in the area but the absence of key horizons within the Prichard makes it impossible to trace them in detail. Also there are many areas within the Prichard formation where the folds are far too numerous and closely spaced to be plotted on a base map of the scale used for this study. Two excellent examples of this sort of folding may be seen in exposures along the road following the East Fork of Pine Creek. One centers near the mouth of the first gulch west of Nabob Creek. The second lies on the north side of the road between Highland and Blue Eagle Creeks. This type of folding is localized within comparatively small areas and seems to have little or no relationship to the major structural features.

Faults

A rather complex system of faults has been superimposed on the folded structures of the Pine Creek area. Nearly all of these faults, both

large and small, are high-angle faults trending approximately east-west or southeast-northwest with downthrow to the south or southwest.

Placer Creek Fault. The largest fault traversing the area has been named the Placer Creek fault. It has been traced east of the Pine Creek district for 35 miles. 9/ Within the Pine Creek area the position of this fault may be accurately located at only a few points, but these are well enough spaced so that the approximate position can be determined across the entire mapped area. (pl. 1) From the eastern edge of the area on the south side of Highland Creek, where Prichard rocks are faulted against Burke, the fault can be traced westward to where it cuts off the Middle Prichard quartzite lying to the north. The down-faulted segment of Middle Prichard again crops out on the south side of the fault in the lower part of Nabob Creek. From this point westward the fault is not evident until it enters the valley of Pine Creek proper. Here, approximately one-half mile south of the mouth of the East Fork, an eight-foot zone of deformation in the argillite marks its position. The total amount of displacement on the Placer Creek fault within the Pine Creek area is not known but near the mouth of Nabob Creek the faulted segments of Middle Prichard quartzite show a minimum vertical displacement of 500 feet. However, structural discontinuity on the two sides of the fault suggests that this figure may be far too small. It is also quite possible that there may have been considerable horizontal movement of unknown direction accompanying the vertical displacement.

Pine Creek Fault. A nearly vertical fault with a considerable throw can be seen in the south or main working tunnel of the Constitution Mine, where Burke on the west is faulted down against Prichard on the east. This fault is known locally as the Pine Creek fault. In his report on the district, Jones 10/ indicates that this fault can be traced northwestward to Section 29, T. 48 N., R. 2 E. On the map accompanying this report this would be approximately at coordinate 30,000 N., 15,000 E. More detailed work, however, has shown that the Pine Creek fault has a more northerly trend. From the Constitution Mine area it trends approximately N. 20° W. for 2700 feet. Here it is cut off by an east-west fault and displaced 1400 feet eastward. North of the east-west fault the displaced segment of the Pine Creek fault continues its north-northwestward course and may be followed with reasonable accuracy for 3000 feet before its trace is lost within the Prichard argillite.

North of Dry Gulch a pronounced saddle has developed in line with the projection of the Pine Creek fault, but good exposures in the saddle show no evidence of faulting. It is highly probable that the fault continues northward beyond the point indicated on the map in spite of the fact that its position could not be definitely traced.

9/ Jones, Edward L., Jr., A Reconnaissance of the Pine Creek District, Idaho, U. S. Geological Survey Bull. 710-A, 1919.
10/ Ibid., p. 7.

Divide Fault. The Divide fault, with a general trend of N. 45° W., is definitely traceable for nearly three miles across the map area and has a probable length of over four miles. A portion of it is the same fault mapped by Jones as the Pine Creek fault. On the map accompanying this report (pl. 1) the fault can be followed from coordinates 17,400 N., 25,300 E., where Burke rocks are faulted against Prichard, to coordinates 26,400 N., 16,400 E., a point a little south of the Placer Creek fault which it probably intersects farther to the northwest. On the line of cross-section C-C' a stratigraphic throw of approximately 1500 feet is indicated, but on the west side of Trapper Creek, where the fault cuts off the uppermost member of the Middle Prichard quartzite, the position of the Prichard-Burke contact south of the fault indicates that the throw has increased greatly to the northwest.

A fault is indicated on the map (pl. 1) intersecting the Divide fault at coordinates 24,700 N., 18,400 E. and extending northwest to the Placer Creek fault, producing a down-dropped wedge near the mouth of Nabob Creek. The outcrop of the upper bed of Middle Prichard quartzite is cut off to the north by this diagonal fault and thus does not reach the Placer Creek fault. A quartzite bed which is shown on the map as extending to the Placer Creek fault crops on the north side of this fault, but it is considerably thinner than the one south of the fault and probably represents a lens some distance above the persistent upper bed of Middle Prichard quartzite.

Trapper Creek Fault. The Trapper Creek fault follows along the west side of Trapper Creek from the southern edge of the map northward for two miles, where it makes a sharp swing to the east to intersect the Divide fault. Along most of its course Burke rocks are faulted down to the west against Prichard rocks, but in the extreme southern portion of the area the displacement is all within the Burke formation.

Amy and Matchless Faults. Two faults which appear to be similar in character cross Pine Creek in the northwestern portion of the map area near the Amy and Matchless mines. They both have a general east-west trend and are not more than 1500 feet apart. The southernmost of the two has been called the Amy fault and the other the Matchless. Each of the two faults has a stratigraphic displacement of between 700 and 1000 feet. Neither fault can be traced for any great distance beyond the quartzitic zone, since the argillite beds both above and below this zone are too similar lithologically to register offsets.

Many other small but mappable faults, having in general northwest strikes, cut across the Middle Prichard quartzite zone. Nearly all of these are high-angle normal faults with downthrow to the southwest.

Faults confined to the Prichard argillite. Faults of small throw and of the same general type as has already been described in the previous paragraph are very numerous within the Prichard argillite. They are especially prominent in the mineralized zones between the Highland-Surprise and

Liberal King mines. The ore zone might well be characterized as a belt of numerous discontinuous sub-parallel shears, some of which are pre-mineral and thus control the ore shoots, and others post-mineral but following the same general trend. Locating and plotting of many of these is difficult, if not impossible, because of their abundance and because they occur entirely within the homogeneous Prichard argillite.

ORE DEPOSITS

So far as known at present, the veins that comprise the ore deposits of the Pine Creek district are entirely within the Prichard formation. They are relatively narrow (18 inches to 2 feet as a mean), trend generally northwest and, with certain minor exceptions, dip rather steeply to the southwest. Post-mineral strike faults are numerous along the vein systems and this, together with the lenticular habit of the veins and the sporadic distribution of their mineral content, tends to add to the problems of mining and the delineation of ore shoots as well as to the complexity of the geologic structure. There are at least two major vein zone tracts that are roughly parallel in the district. The northern one is more extensively exposed in several mines along its strike than the southern zone which contains only the Constitution and Douglas mines.

The veins are characteristically composed of quartz, sphalerite (possibly in part marmatite), galena, pyrite, chalcopyrite, and pyrrhotite and probably silver-bearing tetrahedrite although the silver-bearing mineral has not been identified with certainty. The observed presence of the above minerals has been indicated on the geological maps by the following symbols, respectively: Qtz, Pbs, FeS_2, $CuFeS_2$, Pyrh. In some mines, particularly those in the eastern part of the district, the ore minerals are extremely fine-grained which contributes to the difficulty of making a clean separation in the milling processes.

Hydrothermal alteration of the wall rocks, which has served as an excellent criterion to indicate the proximity of vein mineralization in some parts of the Coeur d'Alene mining region, is poorly developed in the Pine Creek area. In only a few places are appreciable alteration effects observable and where alteration does occur, it is represented chiefly by relatively slight pyritization, seldom by sericitization.

Near-surface weathering does not appear to be extensive although in one or two cases oxidation of sulphides that was apparent for approximately 30 to 35 feet below the surface made the ore refractory to the milling methods now used.

MINES EXAMINED

by J. D. Forrester

In the course of the field study, the accessible underground workings of the following mines were examined:

Constitution
Douglas
Highland-Surprise
Nevada-Stewart
Sidney
Little Pittsburgh
Denver
Lynch-Pine Creek
Lookout Mountain

A master coordinate system was set up for the Pine Creek area and each mining property has been fitted into this base control. Thus, any of the mines may be oriented properly and located with respect to all others. The coordinate system and control are based upon plane table surveys made by the U. S. Geological Survey as shown on the "Smelterville and Vicinity" and "Kellogg and Vicinity" topographic sheets.

No attempt was made during this study of underground conditions to investigate titles or claim ownerships.

MINING PROPERTIES

Constitution Mine

The Constitution mine is on the East Fork of Pine Creek in Section 2, T. 47 N., R. 2 E. It is owned and operated by the Spokane-Idaho Mining Company, a closed corporation, capitalized for 45,000 shares at $1.00 a share par value. Mr. Jay P. Graves of Spokane, Washington, is president and S. K. Garrett is manager at the mine. Twenty-three claims, held by annual assessment work, and twelve patented claims comprise the ownership.

After having been closed down for some time, the mine was reopened and the mill reconstructed early in 1941. The following production records show the trend of the operation from that time:

		Tons Ore Mined	% Pb	% Zn	
1941					
Jan. 1 - Mar. 15		(Mine and Mill rehabilitation)			
Mar.		100			
Apr.		40			
May		1050			
June		1490			
July		1075			
Aug.		475			
Sept.		600			
Oct.		0			
Nov.		520			
Dec.		1623			
	Total	6973			
1942					
Jan.		1693	4.24	9.23	
Feb.		1626	4.59	9.86	
Mar.		1567	4.60	10.15	
Apr.		1867	4.80	9.70	
May		1941	4.90	10.30	
June		1873	4.50	9.40	
July		1782	4.50	8.80	
Aug.		1849	5.00	9.60	
Sept.		1757	4.50	9.10	
Oct.		1713	3.80	9.00	
Nov.		1385	4.10	9.70	
Dec.		1254	4.40	10.30	
	Total	20307	4.47	9.58	
1943					
Jan.		714	3.70	8.20	(Mill down 14 days. No ore from mine.)
Feb.		1744	3.90	7.20	(Mill down 3 days. No ore from mine.)
Mar.		2303	3.31	7.15	
Apr.		1987	3.70	8.00	(Mill down 5 shifts. No ore from mine.)
May		1792	2.90	7.50	(Mill down 5 shifts. No ore from mine.)
	Total	8540	3.48	7.50	

The Constitution Mine has been developed on 6 major levels by a total of approximately 12,000 feet of underground workings. Of this footage, about 8,400 are accessible and have been mapped geologically by the writer. (See accompanying maps, "Constitution") Except for some relatively recent development headings, such as the No. 2 level haulage crosscut and the 800 level drifts etc., which were surveyed by brunton and tape, the transit surveys of the mine workings were used as base maps for the examination.

The mill capacity is 75 tons of crude ore per day and could, it would seem, be increased without difficulty to 150 tons if a new classifier, new ball-mine and some additional flotation cells were installed. However, as now operated, the mill is more than able to handle the ore produced. The chief factor which contributes to the relatively low mine production is a scarcity of underground labor and this is reflected in the sporadic mill runs (see production data above for 1943). Mr. Garrett stated in early July, 1943, when this examination was made, that his available labor supply was only 40% of normal and that whereas he was working 20 men on the average, he could have increased the tonnage markedly if he had been able to secure the services of 50 men. Mining equipment and facilities, together with working conditions in the mine, could readily accommodate an enlarged mining program.

The mill is recovering approximately 92% and 95% of the zinc and lead, respectively, as a bulk concentrate. Because of its fine-grained character, the ore is not amenable to differential separation with the present milling practice. A and B price premiums, based upon a zero quota, are in effect on zinc production from the Constitution Mine. The B premium reportedly is contingent upon a further sinking of the shaft from the 800 to the 1000 level but this, it would appear, is not feasible with the current available labor.

The major vein structure exposed by the underground workings strikes N. 32° W. and commonly dips very steeply near 90°. The principal ore minerals are sphalerite, galena, pyrrhotite, quartz and pyrite. Pronounced post-mineral faulting has occurred along and within the vein and this has contributed to considerable complexity of structures. The author's interpretation and projections are shown on the accompanying level maps.

According to Mr. Garrett, a width of 1 foot of ore can be mined at a profit if the tenor is at least 25.0% zinc. Width and grade relations which control minable ore limits vary as follows:

Ore	bearing	15.0%	zinc	need	be	only	1.5	feet	wide
"	"	12.5%	"	"	"	"	2.0	"	"
"	"	10.0%	"	"	"	"	2.5	"	"

Over the developed extent of the vein, the ore bodies are largely stoped out above the 400 level (see accompanying Longitudinal projection). However, current work on the 800 level has exposed ore over a length of 345 feet which averages 2.11 feet in width and assays 6.30% Pb - 17.0% Zn, and ore through a length of 150 feet which is 2.0 feet wide and assays 4.77% Pb - 10.25% Zn. The breast of both drifts (north and south) is in ore and it appears reasonable that the vein structure and ore bodies will continue for some distance below the 800 level.

The mine appears to be well-equipped and is splendidly managed.

On the basis of assay data and extent of stoped areas as furnished by the mine operators, together with the author's geologic structural interpretations the following ore reserve estimate for the Constitution Mine has been computed 11/.

	Tons	Estimated Grade % Pb	% Zn
Measured Ore	43,165	5.3	14.5
Indicated Ore	27,130	5.0	13.5
Inferred Ore	30,320	5.0	14.7
Total	100,615	5.1	14.3

Of the above tonnages, approximately 3500 tons are considered to be too low grade 12/ to mine at the present time and about 3600 tons are in shaft pillars and, therefore, should be classed as inaccessible.

Douglas Mine

The Douglas Mine is on the East Fork of Pine Creek in Section 3, T. 47 N., R. 2 E., and is under lease by the Small Leasing Company, a partnership, from the Douglas Mining Company, which is incorporated in Idaho for 1,200,000 shares at a par value of $1.00 a share. Control of

11/ A factor of 11 cubic feet to the ton has been used as a constant in making all ore reserve calculations for the Pine Creek area. The ore reserve blocks as delineated on the longitudinal sections have been designated by classification symbols and numbers. The symbols are explained by legend on the sections and the numbers simply indicate a sequence for listing and computation.

12/ Too low grade is used in this report in the sense that a given ore localization is of such tenor that the cost of opening and entering the ore-bearing tract would essentially exceed the produced returns that would be realized from the metal recovered at its present price value. Width and grade of the mass, however, are sufficient to class the body as "ore".

the Douglas Company rests in the Sullivan Mining Company which is, in turn, controlled jointly by the Hecla Mining Company and the Bunker-Hill Mining and Concentrating Company.

The partners of the Small Leasing Company are Leo J. Hoban, Wallace, Idaho, and James E. Small, Gem, Idaho. Nineteen full and fractional claims are included in the Douglas ownership.

At the time of the author's examination (late July, 1943) the property was not in active production although some ore (2700 tons, estimated to contain 11.0% Zn - 4.0% Pb and 4.0 oz. Ag per ton) was being stockpiled on the dump pending completion of the new 100-125 ton mill. The mill, as this report is written, has been brought into operation and is working on ore from the mine, supplemented whenever necessary to keep up mill tonnage, from the stockpile.

Former production records obtained from Mr. Hoban show as follows:

	Tons Ore Mined	Average Assay		
		Oz. Ag	% Pb	% Zn
1916-1918	5260	6.47	10.16	25.80
1925-1927	8537	4.75	7.76	24.31
1927-1942	318	4.91	7.23	23.29

The mine workings were extensively caved when the Small Leasing Company began their rehabilitation and repair program early in 1943 and the ore which was stockpiled at the rate of about 50 tons a day was taken from clean-up of drifts and from re-opening of old stopes and raises. Unmined ore tracts have only recently become accessible to stoping operations.

The mine has, in the past, been worked from 4 levels, the lower two of which were flooded and entirely inaccessible at the time of the examination. The portions of the No. 2, No. 3, and Harmion levels which could be entered were mapped geologically (see accompanying mine maps). The Small Leasing Company has an "A" and "B" premium rating with zero quota on lead and zinc and a "C" zinc premium on all production in excess of 125 tons of recoverable metal per month.

The management hoped to be able to make both a zinc concentrate and a lead concentrate in the mill which was being constructed. Because of the extremely fine-grained character and close association of the zinc and lead minerals, however, a bulk concentrate may be found to be the most economical product.

Mr. Rogers, Mine Superintendent, estimates that the minimum minable ore limit is an 18-inch width of 25.0% zinc. Upon this basis,

and if old records held by the company are reliable, it would appear that the mine has the following ore reserve. (The assay values and extent of stoped areas etc., used in the computation are those as furnished the writer by the Small Leasing Company).

	Tons	Estimated Grade % Pb	% Zn
Douglas Vein			
Measured Ore	15,525	6.2	22.6
Indicated Ore	16,840	6.6	20.8
Inferred Ore	12,170	6.7	20.3
Total	44,535	6.5	21.4
Marmion Vein			
Measured Ore	620	8.0	24.6
Indicated Ore	830	8.0	22.7
Inferred Ore	830	8.0	22.7
Total	2,280	8.0	23.3
Grand Total	46,815	6.7 ±	21.5

Highland-Surprise Mine

The Highland-Surprise Mine is in Section 25, T. 48 N., R. 2 E., near the head of Highland Creek, a tributary to the East Fork of Pine Creek. The property is owned and operated by the Highland-Surprise Consolidated Mining Company which was incorporated in Idaho, August, 1922, at a capitalization of 1,200,000 shares of stock, par value $1.00. Nine hundred eighty-nine thousand (989,000) shares of stock have been issued. Dr. Chas. R. Mowery, Spokane, Washington, is President, and H. M. Huemann, Wallace, Idaho, from whom these data were obtained, is Secretary-Treasurer. The ownership comprises 36 full and fractional claims, 12 of which are patented.

Current mining operations were begun in late 1941 when a new mill was built but the activity was sporadic until April, 1943. Since April the mine has worked continuously. Mining activity is being carried on from the 4 lower levels below the No. 4 haulage level and from two inclined shafts, namely the Highland and the Surprise.

Production and operating data are:

	Tons ore mined	% Pb	% Zn	
1914-1916	24,872	No assay record		
1925-1927	57,861	4.5	11.5	Mine operated at a net loss of $60,000.00
1941	11,816	1.51	8.49	Mine operated at a net loss of $40,000.00
1942	17,808	2.21	10.26	Net profit $40,000.00
1943				
April	2,103	2.7	13.25	421.27 tons concentrate produced
May	2,544	2.9	11.23	516.36 tons concentrate produced
June	2,121	2.35	13.63	499.82 tons concentrate produced
Apr.-June, 1943	6,768	weighted average 2.67	12.63	

An "A" premium on zinc and lead was in effect at a zero quota at the time of the author's examination in July, 1943, but it was indicated by the management that in order to increase production from the mine a "B" premium was necessary. The proposed new program for operating the mine includes the sinking of a new shaft and the driving of several level development headings. In addition, the mill, under an increased mine delivery, will probably require a new ball-mill assembly and motor, and supplementary crushing equipment. The present mill capacity of 100 tons per day is to be increased to 200 tons per day. A zinc-lead bulk concentrate which averages about 49.0% Zn - 8.0% Pb is made in the mill. The operators estimate that a "B" quota would enable them to double the mine production and contemporaneously carry on the necessary projected development work. The two inclined shafts now being employed for ore hoisting will be abandoned except for use as supply and service shafts when the proposed new shaft is completed.

The mine is worked by approximately 40 men on a 2 shift - 6 day per week basis. The mill is operated 3 shifts for 6 days a week.

Two veins have produced ore in the Highland-Surprise Mine. They have been here designated the Main Vein and the Footwall or Dike Vein. The author's projections and correlations of the major geologic features are shown on the accompanying plan maps and longitudinal projections. On the basis of this geologic study together with assay records and mine records of stoped area, etc., made available to the writer by the Company, an ore reserve estimate has been computed as follows:

	Tons	Estimated Grade % Pb	% Zn
Main Vein			
Measured Ore	54,915	4.5	12.4
Indicated Ore	21,840	4.5	12.5
Inferred Ore	48,490	4.5	13.0
Total	125,245	4.5	12.7
Footwall or "Dike" Vein			
Measured Ore	1,325	4.5	10.7
Indicated Ore	1,995	4.5	10.5
Inferred Ore	2,605	4.5	10.2
Total	5,925	4.5	10.4
Grand Total	131,170	4.5	12.6

Of the above, approximately 7,715 tons are too low grade to mine and 4,400 tons are in shaft pillars and, therefore, inaccessible to mining.

Sidney Mine

The Sidney Mine is in Section 22, T. 48 N., R. 2 E. near the head of Denver Creek, a tributary to the East Fork of Pine Creek. The property, which comprises a unit of 21 full and fractional claims, is controlled by the Sidney Mining Company, incorporated in Idaho and capitalized for 1,500,000 shares at a par value of $1.00 per share. All shares of stock are issued. Mr. Harvey M. Ross, Seattle, Washington, is president of the Sidney Mining Company and William Beaudry is manager at the mine.

Mr. Beaudry states that the mine has yielded a gross total production worth $4,850,000. The present mining operation was begun on August 1, 1942, and 1,634 tons of crude ore were produced up to January 1, 1943. Production for May and the first 15 days of June (pro-rated), 1943, was approximately 1,000 tons per month at the rate of from 35 to 40 tons each working day. The mine, at the time of the examination in the fore part of June, 1943, was being operated on a single shift basis by a crew of 14 men (6 miners, 8 trammers and muckers). The ore is trucked approximately 25 miles from the mine to the Galena Mill of the Triangle Sand and Gravel Company at Wallace, Idaho. Two concentrate products are made in the milling process, a zinc concentrate and a lead concentrate, with a metal recovery of 90% and 92% respectively. As of May 22, 1943, the zinc concentrates assayed: moisture 10%; zinc 43.7%; lead 6.8%; iron 14.1%; insoluble 3.6%; sulphur 29%; and silver 3.2 oz. The lead concentrates average approximately 60% lead and 12% zinc, and according to the operators, the zinc content in this concentrate is subject to penalty. A mill certificate for the month of May, 1943, from the Triangle Sand and Gravel Company will serve to show the tenor and production of ore from the Sidney

Mine as follows:

Average mill feed (heads)	= 7.03% Pb - 11.1% Zn
Base milling charge	= $2.35 a dry ton
Charge on lead over 5% @ $0.05 per unit	= 0.10
Charge on zinc over 10% @ $0.05 per unit	= 0.05
Total Charge	$2.50 a dry ton

838.103 dry tons milled @ $2.50 per ton = $2095.26

Haulage costs are $1.75 a ton, crude ore to mill, and $0.90 a ton for moving the concentrates to the Bunker Hill Smelter. Mr. Beaudry estimated that his mining and milling costs, including all haulage charges, are each $5.00 per ton of crude ore.

Some mill machinery is at the site of the Sidney property and, according to Beaudry, a milling operation will be installed to treat the ore as soon as additional necessary materials can be obtained.

At the time of the study, the mine was operated upon an A bonus allotment of 2 3/4 cents per pound over the quoted market price for both zinc and lead. On the basis of the above values and charges, Beaudry suggests that, as a minimum, ore which averages 12% zinc and 7% lead must be at least 18 inches wide. The zinc and lead content would have to be 18% and 10.5%, respectively, if the ore width were only 12 inches.

The major ore-bearing vein presently developed in the mine is the Sidney Vein which trends N. 60° W. and dips 70° to 80° SW. It is, to all economic purposes, completely stoped out from the 800 level to the surface except for a new ore shoot recently developed on the 600 level at the southeast end of the mine. Since the examination, it has been reported that this same ore body also has been exposed on the 500 level but this report has not been verified by actual observation of the writer. The 700 and 800 levels were flooded and, therefore, inaccessible but various map data secured from Mr. Beaudry and from the Bunker Hill and Sullivan Mining and Concentrating Co., by the author, and considered to be reasonably reliable would indicate such a condition as is shown on the accompanying maps and longitudinal projection.

In addition to the Sidney Vein the eastward extent of the Denver Vein and related miscellaneous vein splits have been partially developed on the 500 and 600 levels. The Denver Vein is ore bearing in the Denver property to the west but in the Sidney Mine is composed dominantly of quartz although, of course, there are some localizations of sphalerite and galena within it. Strike (post ore ?)faulting is particularly pronounced along and within the Denver Vein.

The author's interpretation of the geologic relationships together with the observed underground geological data are shown on the accompanying maps. The information as to the extent of stoped ground and assay values was obtained from the operators. The ore reserve estimate for the Sidney Mine is as follows:

	Tons	Estimated Grade	
		% Pb	% Zn
Measured Ore	9,082	7.0	15.0
Indicated Ore	1,034	7.0	15.0
Inferred Ore	13,394	7.0	15.0
Total	29,510	7.0	15.0

Of the above, approximately 2,927 tons of measured ore are in shaft pillars and are, therefore, inaccessible to mining. Much of the ore listed as indicated and inferred should, if mining records are reliable, be classed as developed or measured ore. It has been here classed in the lower grades of reserves from the fact that it occurs in a presently inaccessible area below the 600 level and was not observed by the writer. Its presence is probable but has not been definitely verified by the writer. (See accompanying longitudinal projection)

All of the above ore is on the Sidney Vein.

Little Pittsburgh Mine

The Little Pittsburgh Mine is on Denver Creek about one-third mile south of the Sidney property. It is operated by the Denver Development Company, an unincorporated partnership, under a lease from the Pine Creek Lead-Zinc Mining Company, 419 First Avenue South, Seattle, Washington. The partners of the Denver Development Company are Claude E. Nugent, Kellogg, Idaho; Dunham Bell, Osburn, Idaho; Clarence E. Dunkle, Pinehurst, Idaho; Inar Norgaard, Kellogg, Idaho. The Denver Development Company controls 7 full and fractional claims and, in addition, holds the right to prospect and to store water in the underground workings of the contiguous Denver and Nabob Mines. The Company also owns 130 acres along the East Fork of Pine Creek for mill tailings disposal and such similar uses. Both the Nabob and Denver Mines are to a large extent inaccessible at this time. In fact, the Nabob Mine was intentionally flooded for water storage to provide water for the continued operation of the Little Pittsburgh mill during the dry season which usually occurs between July 1 and September 30 each year.

Unfortunately, a severe loss was experienced by the Denver Development Company when, on July 14, 1943, a fire and explosion of 5 tons of dynamite completely wrecked the entire surface plant at the Pittsburgh Mine. This catastrophe resulted in the abrupt curtailment of mine and mill production which until that time had been comparatively excellent and sustained. It is the author's understanding that some mill rehabilitation has been accomplished to date and that ore which is currently mined is being trucked to the Amy mill on Pine Creek for concentration.

Prior to the explosion the operating reco of the Little Pittsburg mine and mill from April, 1942, was as follows 13/:

	Tons ore mined	% Pb	% Zn
April to June, 1942	3,145	2.10	7.69
July	1,848	3.39	5.87
Aug.	1,132	4.16	11.54
Sept.	1,790	1.96	7.70
Oct.	750	3.74	10.37
Nov.	1,295	3.34	8.74
Dec.	1,697	2.91	7.59
Jan., 1943	2,279	3.26	7.79
Feb.	1,980	3.26	8.29
Mar.	2,026	3.53	8.92
Apr.	2,189	3.35	8.58
May	2,170	2.44	8.40
Totals and average	22,301	3.00	8.13

The mine and mill were worked by a crew of 35 men and all underground operations (except tramming, etc.) was done on a contract basis. There is a total of approximately 3700 feet of underground level workings, all of which have been mapped geologically. Mr. Nugent states that he can, as a minimum limit, mine ore that is 10 inches wide, the tenor must be 2.0% Pb - 6.0% Zn or better in such a case. These figures are remarkably low.

A concentration ratio of 6.5 to 1 was used in the milling process with a water consumption of 80 gallons a minute. Nugent's records reveal the following content for mill concentrates:

	Zinc Concentrate		Lead Concentrate	
	Zn%	Pb%	Pb%	Zn%
Dec., 1942	48.5	8.7	59.9	15.2
Jan., 1943	48.4	7.5	57.9	16.0
Feb.	48.1	8.9	55.7	18.1
Mar.	47.2	10.1	60.5	15.0
Apr.	47.4	10.9	63.8	13.3
May	47.9	10.3	No record available	

The Company has had an "A" premium on zinc concentrates.

The vein strikes generally N. 30° W., and dips 60-70° SW. A gradual swing in trend exists, however, and the arcuate structure (convex to the northeast) changes from N.-S. near the portal to N. 60° W. The mineralization is quite similar to that exposed in the Sidney Mine although it appears that pyrrhotite is somewhat more abundant in certain localities.

13/ Note rather sustained increase in production to January and the then continued uniformity.

The Author's structural interpretations and projections are shown on the accompanying maps and, on the basis of sample data, secured from the company records, the following ore reserve analysis of the Little Pittsburgh Vein has been made:

	Tons	Estimated Grade % Pb	% Zn
Measured Ore	22,500	3.5	8.5
Indicated Ore	40,205	3.5	8.5
Inferred Ore	32,185	3.5	8.5
Total	94,890	3.5	8.5

Much of the ore in mine reserve has been revealed since the present operators assumed control and their enterprise is efficient and highly commendable.

Denver Mine

Although the Denver Mine, which is adjacent to the Sidney group on the west, was largely inaccessible to examination by the writer, Mr. Nugent made available such assay records and maps to permit the computation of what is considered to be a reasonable estimate of the ore in the mine.

The mine is, as before noted, controlled by the Denver Development Company. The underground development work, it would appear, has been chiefly upon the Denver Vein and, therefore, ore reserve tonnages are for a different vein than those of the Sidney Mine. The mine probably could be brought to the state of at least a limited production within a reasonably short time and without too much expense. The longitudinal projection of the Denver Vein, which served as a basis for the writer's ore computations, accompanies this report.

	Tons	Estimated Grade % Pb	% Zn
Measured Ore	8,725	10.0	17.0
Indicated Ore	15,475	10.0	14.7
Inferred Ore	9,480	10.0	13.5
Total	33,680	10.0	14.9

Nevada Stewart Mine

The Nevada Stewart Mine was surveyed and mapped geologically during the latter part of July, 1943. The property is in Section 26, T. 48 N., R. 2 E., about $\frac{1}{4}$ mile down Highland Creek from the Highland-Surprise Mine. The development work is probably upon the same, or closely associated, veins as those exposed in the Highland-Surprise.

Mr. Mike Sinclair, who lives at the mine site, was in control of the property at the time of the writer's examination, but it is reported that the ownership has subsequently been reorganized.

Two main tunnels (upper and lower) comprise the chief underground workings. The lower tunnel consists of a long northerly trending crosscut from which drifts have been driven, chiefly to the southeast. The upper tunnel is much shorter than the other but has exposed essentially an equivalent amount of vein mineralization. The extent of mine workings and the character and attitude of geologic features together with the author's interpretation and projection of the veins and faults is shown on the maps accompanying this report.

The development on the property at the time of the study had not extensively exposed ore bodies of major significance and a tonnage estimate of ore reserve has not been attempted. There was no mill on the ground and the mine was not in active operation, but Sinclair indicated that work would soon be resumed. Since the writer's visit it is believed that some activity has begun.

The information gained from the geologic study of the crosscut exposures should prove to be of considerable aid when a regional analysis of structural conditions is undertaken.

Lookout Mountain Mine

The Lookout Mountain property, which includes approximately 19 claims in Section 21 (?), T. 48 N., R. 2 E., is under lease and bond by the Lookout Leasing Company, an unincorporated partnership consisting of John B. Penney and Wm. L. Penney, both of Kellogg, Idaho.

No development work was in progress at the time of the examination in the latter part of July, 1943, and all of the ore recently produced has been taken from old stoped areas. The vein matter is composed chiefly of galena, sphalerite, and quartz. Pyrrhotite, pyrite, chalcocite (secondary) and malachite were also noted in relatively minor amounts. The accessible portions of the mine were surveyed and mapped. These data as well as an interpretation of the geologic structural trends are shown on the accompanying maps.

The Penneys in the past several months have mined approximately 200 tons of crude ore which, upon being concentrated on the dump by a hand-jig, and shipped in April, 1943, yielded 20 tons of lead concentrates that assayed:

Moisture	Au	Ag	Pb	Fe	Insol.	S.	Zn
1.5%	0.015 oz.	6.0 oz	50.5%	2.5%	26.2%	8.7%	Trace

At the time of the author's examination the partners hoped to have a second comparable shipment concentrated by September, 1943. It is believed that no ore reserve of consequence exists in the mine in its present state of development.

Lynch-Pine Creek Property

The Lynch-Pine Creek property is controlled by the Lynch-Pine Creek Mining Company, an Idaho corporation capitalized at 1,000,000 shares--par value of 2.5¢ per share. Nine hundred thousand (900,000) shares of stock have been issued. The Company also controls the Amy Matchless Mining property by a lease and bond agreement.

Current operations of the Company were largely confined to tunnel work at the "V" Prospect in Section 21, T. 48 N., R. 2 E., and in making some repairs of the Amy mill and mine.

The tunnels at the "V" Prospect are short and, although a metals content of 4.0% Pb-9.8% Zn has been indicated, no ore reserve of importance has been developed. The vein which is predominantly quartz, is comparatively strong, and as the regional geology is determined and projected, it may prove to be of considerable interest in "setting" the structural picture as a whole.

The data gathered in July during the examination of the underground exposures are shown on the accompanying maps.

Northern Light Mine 14/

The Northern Light Mine, which is on Pine Creek in Section 18, T. 48 N., R. 2 E., has not been in production for a number of years. During October 1943, unwatering operations were completed at the mine, which had been inaccessible from 1917 up to this time.

Mr. Benj. G. Harmon has a 20-year lease with purchase option from the Northern Light Mining and Milling Company, owners of the property. The Reconstruction Finance Corporation has granted a $9,500.00 loan for the necessary reopening expenses of the mine down to the bottom (No. 4 or 400) level. There is no mill on the ground and Mr. Harmon proposes to ship the crude ore that will be produced to one of the custom mills at Wallace, Idaho. According to Mr. Harmon, 20,000 tons are in reserve.

Geologic mapping of the mine has revealed several minor vein structures which carry no commercial ore, and a single vein on the 400-foot level which contains commercial grade ore. This vein has a general strike of N. 65° W. but, unlike most of the veins of the district, has a comparatively low dip (25°-30°). It is an excellent example of the replacement type vein developed on the footwall side of a low-angle shear.

Drifting has exposed the vein over a lateral distance of 240 feet, but commercial ore does not extend over a lateral distance of more than 160 feet. At the west face of the drift the vein has pinched to a stringer only one inch wide. The eastern termination of the ore body is exposed within the limits of drifting, for it terminates abruptly against a premineral high-angle fault which in turn is cut by the vein fault. Nevertheless, gouge along this high-angle fault served as a trap preventing further

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eastward migration of solutions below the gently dipping vein shear.

Where best developed, mineralization on the Northern Light vein reaches a width of four feet. About 2½ feet of this is high-grade ore. At this portion of the vein a 28-foot raise and a 100-foot winze has been driven on it. The ore extends into the raise but narrows to one inch at the top. At the time of examination the winze was filled with water so that no data was available regarding downward projection of the vein. Workings on the 200 level have not exposed a comparable structure.

The highly irregular character of the vein structure, as shown on the 400 level, is an undesirable feature of the mineralization from an economic standpoint.

Bobby Anderson Mine 15/

The Bobby Anderson portal is on the east side of Pine Creek directly across from the Northern Light Mine. It is under lease by Benj. J. Harmon, operator of the Northern Light property. Workings consist of the main tunnel, approximately 1,050 feet long, with five short crosscuts driven southward from this tunnel at irregular intervals. The longest of these crosscuts is approximately 130 feet long. In addition to these workings a winze has been sunk at a 69° angle 550 feet from the portal, with an unknown amount of drifting at its bottom. This winze is filled with water to the level of the main drift.

Vein material carrying sphalerite, galena and pyrite in appreciable quantities occurs only along a small portion of the main drift, having a stope length of approximately 80 feet. This vein strikes N. 74° W. and dips 65 to 70° S. Ore of commercial grade evidently extended for only 40 feet. This portion of the vein has been stoped vertically about 40 feet above the drift level. Maximum width of the vein here was 3½ feet, but mineralization became spotty near the top of the stope. Eastward from the stoped area the vein becomes progressively weaker and fingers out into a number of veinlets carrying quartz with occasional shines of sulphide. Westward the vein enters the south wall of the main drift and mining has not determined its extent, although it appears to be pinching out in that direction. The winze was sunk 100 feet below the main drift level along the pitch of the ore shoot in the vicinity of the stoped area, but according to local information little drifting was done at the bottom, indicating that values along the richer portion of the vein decreased with depth.

As developed at present, no ore of commercial grade can be said to exist in the Bobby Anderson Mine, and further exploration does not seem warranted.

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OTHER PROPERTIES

There are several mining properties in the Pine Creek area in addition to those which were examined and mapped. However, so far as the writer was able to determine, none were in active production although a few were being rehabilitated and repaired for mining in the immediate future. The mines in this category are the Hilarity, Amy Matchless and possibly the Liberal King.

Hilarity Mine

The Hilarity Mine in Section 27, T. 48 N., R. 2 E., is reportedly in process of being reopened and further developed through a loan from the R.F.C. and it probably will produce some zinc-lead ore in the near future.

Liberal King Mine

No attempt was made by the Geological Survey party to make a detailed study of this property. A detailed mine map has been made by Roger McConnel of the Bunker Hill and Sullivan Mining and Concentrating Company. This map was placed at the disposal of the Survey party for examination.

A cursory examination was made of the accessible portions of the mine workings during the course of the Survey's study of the district, and it was decided that little could be added to the information already obtained by McConnel. Several good vein structures exist in the mine but nowhere do these carry any appreciable quantities of commercial sulphides. The general impression gained from the hasty examination was that suitable vein structures exist on the property, but that solutions were deficient in sulphides so that, in the main, vein quartz was the only material to be deposited in considerable amounts.