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Geological Report

of the

CONSTITUTION MINE

Yreka Mining District, Shoshone County

Idaho

Thomas E. Gillingham
October 30, 1951
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GEOLOGICAL REPORT

on the

CONSTITUTION MINE

Thomas E. Gillingham

Scope and Purpose of the Investigation:

The detailed geological study of the Constitution mine was undertaken by the writer at the request of Mr. J. C. Kieffer, Manager of the Spokane-Idaho Mining Company. The work was a joint project of Spokane-Idaho and Bunker Hill and Sullivan Mining and Concentrating Company and was carried out on a part-time basis from June 1948 until October 1951. During this period all of the accessible lateral workings of the mine and much of the surface in the vicinity of the mine were mapped on a scale of one inch to 20 feet and one inch to 200 feet, respectively. In addition, most of the surveys were checked, recalculated, or rerun, and an entirely new set of base maps, longitudinal projections and cross-sections were prepared.

The aims of this study were to determine the geologic controls of the Constitution orebody, to provide periodic assistance to the mine operators, and to establish guides to future work.

Acknowledgments:

The writer is grateful for the encouragement and assistance shown by Mr. Frank N. Marr, Mr. J. C. Kieffer, and Mr. Curtis Redding of the Spokane-Idaho organization, and by Mr. J. B. Haffner, Mr. R. H. McConnel, and Mr. Veral Hammerand of Bunker Hill. Mr. Otto Haaland, Mr. Robert Gordon, and Mr. George McCall have helped in the detailed work. Special thanks are due Mr. E. L. Phillips, cartographer of Bunker Hill, whose assistance in the preparation of the final maps and the mine model was indispensable.

Location:

The Constitution zinc-lead mine is located in the Pine Creek (Ireka)

mining district of the Coeur d'Alenes, Shoshone County, Idaho. It lies 7 miles south of Kellogg, Idaho, and is reached by Highway 10 and a good, gradual-grade, county road along Pine Creek--a total distance of 17 miles from Kellogg.

Topography:

The mine buildings and the portal of the main tunnel level are situated in the valley of the headwaters of the main (East) branch of Pine Creek, just south of its confluence with a small tributary known as Gilbert Creek. The mine portal is at an elevation of 3048.25 feet (U.S.G.S. datum), and the hills surrounding the portal reach elevations of nearly 5000 feet. The relief is, therefore, rugged.

History:

The story of the Constitution mine illustrates remarkably well the difficulties and vicissitudes that have faced the operators of small mines in a once remote region. The exact date of discovery of the Constitution vein is not known, but was probably prior to 1898. The outcrop on the slope above Gilbert Creek must have been fairly obvious to a prospector making his way up the gulch. The original two claims, the Constitution and the American Girl, were staked in June 1901 by Thomas Gilbert; the names of the locators are given as Thomas Gilbert, H. J. Gilbert, Thomas Thwaite, and George Green.

On September 17, 1902, the Constitution Mining and Milling Company was incorporated, capitalized for 1,500,000 shares at one dollar par value. Apparently all the shares were soon issued. The original No. 1 tunnel, located 200 feet above Gilbert Creek, and about 500 feet of No. 2 tunnel had been driven prior to 1911, when the original group of claims were surveyed for patent. The Mine Inspector's Report for 1915 states that the ore shoot had been opened for 600 feet along the strike and in that year had yielded three carloads of rich ore.

On May 3, 1916, O. H. Hershey submitted a report on the property which has been lost. It appears, however, that he recommended the construction of a 100 ton mill to take advantage of the high metal prices then prevailing. He further

recommended, at that time, the crosscut into the west wall near the old portal of the Main Tunnel Level to explore a second vein that had been disclosed in a small tunnel on Gilbert Creek. Hershey submitted a second report on March 13, 1918, and a third report on December 16, 1926. Copies of these last two reports are in both Spokane-Idaho and Bunker Hill files.

In 1917, a mill, designed by Mr. W. L. Zeigler to treat 150 tons per day, was constructed. It proved inadequate to handle half that tonnage, the tailing losses were prohibitive, and the bulk concentrate, which was shipped to the Washoe smelter or to Trail, did not yield a profit. Hershey reports (1918), that the average content of 46 lots shipped to the smelter averaged 29.6% zinc, 15.2% lead and 8.2 oz. silver. A particular shipment sampled November 1, 1917, contained: 11.6% water, 29.4% zinc, 16.8% lead, 11.2 oz. silver, and 0.02 oz. gold. The net smelter return from this 89,940 lb. gross shipment was $808.09!

It appears that the mill feed during this early period carried about 11.5% zinc, 5.5% lead, and 3.5 ozs. silver per ton.

Late in 1917, Mr. R. H. Handy was employed to rebuild the mill into a selective flotation plant. Handy thought it reasonable to expect from the rebuilt mill a recovery of 40% of the lead in the feed in a product assaying over 35% lead and under 10% zinc, and 60% of the zinc in the feed in a product assaying over 40% zinc and under 10% lead. The end of the war in 1918 brought a sudden drop in metal prices, which forced the Pine Creek mines, including the Constitution, to curtail production. The original charter of 1902 was forfeited in 1920.

During these early years, transportation of concentrates to the railroad near the present town of Pinehurst cost $4.00 per ton--a high figure for those days. A projected spur rail line up Pine Creek valley was partly laid but was abandoned after a washout in 1918. This further deterred Pine Creek development.

Largely through the efforts of Mr. Handy, the Constitution resumed operation in 1924 with a 50 ton fine-grind selective flotation concentrator. In 1925

the mill capacity was increased to 250 tons, a new hoist was installed and considerable development performed. About this time Mr. William P. White became mine manager. Under his able direction the present shaft during 1927 and 1928 was sunk from the 200 level to the 400 level and raised to the Main Tunnel Level.

On August 31, 1929, the capitalization of the company was increased to 3,500,000 shares at $1.00 par value, and the revenue from the sale of stock enabled the company by June 1930 to sink the shaft to the 800 level, to bring development footage to a total of 11,280 feet, and to employ over 90 men. A small town occupied a site near the confluence of Gilbert Creek and Pine Creek. The fall in metal prices in 1930 caused the mine to be closed on June 1st of that year. Subsequently the Constitution Mining & Milling Company was liquidated and the property was completely stripped of all machinery and equipment.

On July 5, 1940, the Spokane-Idaho Mining Company was incorporated with J. P. Graves as President. The capitalization is 450,000 shares of 10 cent par value with all shares issued. During 1940 and 1941 the mine was re-equipped and rehabilitated, a new crosscut adit was driven from the Pine Creek valley, and a new 100 ton selective flotation mill constructed. Through the efforts of Mr. W. P. White as manager and Mr. Curtis Redding as mine superintendent, mining was resumed late in 1941, and the first shipment of concentrates was made to the Bunker Hill Smelter and the Sullivan Zinc Plant that year. With the exception of the period of the short labor strike in 1951, the mine has been a steady producer of zinc and lead ore since 1941. The mill capacity has been increased to about 160 tons per day.

Mr. Graves was succeeded as President of Spokane-Idaho by Mr. C. E. Marr, who in turn was succeeded in 1946 by his son, Mr. Frank N. Marr. After a few months Mr. White retired from active management and was followed, in turn, by Mr. S. K. Garrett (1941-1945), Mr. Charles Garrett (1945-48), and Mr. J. C. Kieffer (1948-present). Under Spokane-Idaho management the Constitution mine has been operated efficiently and profitably.

Production:

Early production records of the mine are sketchy, but records kept by Spokane-Idaho Mining Company are generally detailed and complete. The following figures are in part estimated:

	Tons Mine Ore
Production prior to 1929 (from 1929 prospectus)	165,000
Production 1929 and 1930 (estimated from stope maps)	33,000
Total production by old company	198,000
Production by Spokane-Idaho 1940 to 1950 incl.	342,000
Total production to end of 1950	540,000
Estimated production for 1951	54,500
Total approximate production to end of 1951	594,500

Mr. Kieffer has provided the following detailed production figures for the period of Spokane-Idaho management:

Production of the Constitution Mine
1941 to 1950 Inclusive

Year	Tons Ore	% Pb	% Zn	Lbs. Pb	Lbs. Zn
1941 (Est.)	10,000	4.00	10.00	800,000	2,000,000
1942	20,307	4.50	9.59	1,827,368	3,895,400
1943	21,317	3.10	7.31	1,320,120	3,114,980
1944	22,155	3.39	7.53	1,506,868	3,337,105
1945	26,151	4.55	9.12	2,378,555	4,771,685
1946	37,931	3.04	7.76	2,303,050	5,886,130
1947	38,468	2.66	7.35	2,044,110	5,651,870
1948	54,917	2.79	7.39	3,067,097	8,112,093
1949	50,623	2.79	7.33	2,828,382	7,418,564
1950*	60,902	3.52	8.22	4,282,373	10,007,602
Totals	342,771	3.26	7.91	22,357,923	54,195,429

*Lease Shipments Excluded.

Property:

Spokane-Idaho Mining Company has title to the following legal subdivisions, 21 patented claims and 26 unpatented claims, all shown on the 400 scale property map.

Legal Subdivisions:

S½ SW¼ Sec. 1 T47N R2E
S½ SE¼ Sec. 2 T47N R2E

Patented Mining Claims:

Survey 2167	Crescent	Survey 3023	Bennington
	Comet		Trainer
Survey 2620	American Girl	Survey 3116	Chicago
	Constitution		South Constitution No. 1
	Dakata		" " No. 2
	Defender		" " No. 4
	Fred		" " No. 5
	Percy		Spokane
			Thwaite
Survey 2803	Minnie		
	Nellie	Survey 3119	Dupont
			Dupont Fraction

Unpatented Mining Claims:

Judge	Martha	Lucky Peak
May	June	Fuett Peak
July	August	South Constitution No. 3
Alvin	September	" " No. 6
Joe	October	Saint Paul
Eve	McKinley	Saint Louis
Ruth	Toto	Westchester
Joker	Portland	Seattle
Hobo	Turner	

Geology:

The general geological picture of the area in which the Constitution ore-body lies has not been solved adequately. The present report will be confined, therefore, to the mine itself and to the area immediately adjacent to the mine, which will be called the "mine area."

The three sedimentary formations disclosed in the mine area are, from oldest to youngest, the Prichard formation, the Burke formation, and the Revett formation. All three of these belong to the so-called Belt series of Pre-Cambrian age and are among the oldest rocks of the continent. The superficial deposits of gravel and debris will not be considered in this report. In addition to the sedimentaries, numerous basic dikes, either diabasic or lamprophyric, or both, occurs in and near the vein.

Prichard Formation:

This lowest known formation of the Belt Series consists of thousands of feet of

predominately shaly and slaty rock, commonly called argillite, which, in at least two widely separated zones, is interbedded with white to light gray massive quartzites of variable thickness. The argillite is mostly dark gray to medium gray in color. Much of it shows fine laminations or varves of alternating dark and light shades, indicative of seasonal depositions. The writer has noticed in places that the gradations can be used to tell the tops and bottoms of the beds--a useful tool in solving structure. Especially near the quartzitic zones, the argillite may be quite massive, dark, and hard, without apparent laminations; it is then probably quartzitic argillite or argillaceous quartzite and the writer has used these categories more or less arbitrarily on the field notes.

Two principal quartzite zones have been observed in the Prichard. As shown in the area of Pine Creek between the Sidney and the Amy-Matchless mines, the first or lower quartzite zone is probably 3000 feet or more in thickness with its top quartzite bed several thousand feet below the top of the Prichard formation. It has been designated as the Middle Prichard. The second or upper quartzite zone occupies the top 600 feet of the Prichard, just below the Burke formation, and has been called the Transition Zone. Between the Middle Prichard and the Transition Zone is a great thickness, at least 5000 feet, of predominant argillite.

The Transition Zone has been carefully mapped and studied in the Constitution mine area. It consists of three thick beds and several smaller, apparently less continuous, beds of massive white to gray quartzite, separated by argillite. The quartzites have been shown on the mine maps in bright orange color. The approximate column is shown below in Figure 1.

The contacts between the argillite and the quartzites are generally quite sharp so that the latter become useful mappable units. The exception seems to be the top 150 feet which is quite variable in composition, consisting, in one section, of rock that is almost quartzite; in another, of a confusing mixture of argillite and

quartzite. The beds marked Q-I, Q-II, and Q-III, however, are persistent and fairly uniform, but several splits have been noted. Below quartzite Q-III the quartzite beds become smaller, variable in both thickness and continuity, and less easily traceable.

The Burke Formation:

Above the Transition Zone lies the Burke formation of predominately medium bedded, flaggy, sericitic quartzite of light-gray to buff color. Some of the Burke beds are indistinguishable from the Prichard quartzites or from the Revett quartzites, but the Prichard-Burke contact is generally recognizable, particularly on the slope above Gilbert Creek.

The Revett Formation:

In contrast to the Burke, the Revett formation is composed mostly of thick beds of hard, brittle, white quartzite, but the transition from Burke to Revett in the mine area is so gradual that for practical purposes no contact has been shown, and all the rock above the Prichard has been marked Burke on the maps. Actually, the Burke-Revett contact must be very close to the new portal of the Constitution main level; the rock in the adit west of the Pine Creek fault may be Revett. Certainly, the Revett occupies much of the Pine Creek valley south of the mine buildings, and should be mapped in the future.

Basic Dikes:

Numerous basic dikes are shown on the mine maps, but pending the results of microscopic studies now underway by Mr. Thon Jin of the University of Utah, the writer is reluctant to classify these dikes more exactly than "basic dikes." Hershey called them lamprophyres, but they appear to the writer to be, in part at least, diabase. The dike that parallels the vein in the north section of the mine is definitely later than the ore.

The host rocks of the Constitution orebody are the quartzites and argillites of the Prichard Transition Zone and the lowest beds of the Burke formation.

However, only one ore shoot, Old No. 5 on the Main Tunnel level, has Burke as one of its walls. One may conclude, from available evidence, that the orebody is almost entirely confined to the Prichard formation and especially to the Transition Zone.

Faults and Related Structures

Several faults are shown on the mine maps in both observed and inferred positions. The relations of the faults to each other and to the rocks are not completely understood and probably cannot be worked out satisfactorily until more areal geology is mapped. The principal faults are as follows:

The Pine Creek fault -- This strong structure lies a few hundred feet west of, and roughly parallel to, the Constitution vein. From observations in the mine area and from diamond drill cores, it appears to strike about N 20° W and to vary in dip from almost vertical in the south to steeply westward towards the north. It has an apparent net movement of perhaps a mile and has juxtaposed the younger Burke quartzite against the older Prichard formation. The Pine Creek fault is one of a series of normal step faults that have dropped off successive blocks of rock from the limbs of the regional folds.

The Marr fault -- The writer has assigned the name "Marr fault" to an important but generally obscure structure that traverses the bedding north of the mine. The Marr fault strikes about N 75° W and from its inferred position on the surface and its intersection with the diamond drill hole from the Fred tunnel, it appears to dip at about 65° toward the south. Its net movement is probably a few hundred feet. It is a reverse fault, shown by the fact that the Prichard Transition Zone has been juxtaposed against Burke formation in the northeast part of the mine area. Its southerly dip would bring the Marr fault into the Constitution main shaft at about the 3700 foot level. Since the fault is a strong water course any deepening of the shaft below the 3000 foot level should be preceded by an exploratory diamond drill hole toward the fault plane.

The Sherwood fault -- This fault, which is disclosed in the Sherwood tunnel north of the mine area and on the hill in the northeast corner of the area, has been mapped by the U.S.G.S. as a segment of the Pine Creek fault offset by the Marr fault. However, its 50° westerly dip is considerably flatter than any observed dip of the Pine Creek fault and until it has been more carefully studied it should be considered a separate, unrelated structure. The apparent strike of the fault is N 35° W.

The Redding fault -- This structure, which is hereby given the name "Redding fault," is a reverse fault with several hundred feet net movement, of which the horizontal component is about equal to the vertical component. The hangingwall (West wall) of the fault has moved upwards and southwards with respect to the footwall.

The Constitution vein -- The Constitution vein itself occupies a fault of considerable movement. As shown on the vertical longitudinal projection overlay, going south, the east wall quartzites are first encountered on the main tunnel level near the old portal in Block 3100 whereas the corresponding quartzites on the west wall are first encountered at 4300 south. Thus, a horizontal displacement of 1200 feet is indicated for the main tunnel level. On the 1400 level, however, the apparent horizontal displacement, measuring the base of quartzite Q-III, is only 230 feet. Consequently, it can be said that the vein structure is either a pivot fault or a scissors fault, with a gradually decreasing displacement toward the fulcrum. Judging from the attitudes of the beds on 1400 level, the corresponding quartzites on the two walls should become opposed a short distance below 1800 level in the portion of the mine south of Block 4900. The actual direction of movement along the vein fault is not apparent, but was probably slightly inclined upward with the west wall moving southwards. The importance of the relative movement of the vein fault will be considered below.

Other Faults:

A number of reverse faults of relatively small movement, sympathetic with

that of the Redding fault, are shown on the mine maps. These faults intersect the vein structure at small angles. They either cross the vein or concur with the vein for some distance and disappear into the opposite wall. These faults are particularly conspicuous in the upper half of the mine, where they have caused small offsets of the vein or have developed gouge zones generally inhospitable to ore formation. These faults were once considered strike faults, but they are, in fact, only locally parallel to the strike of the vein.

On 600 and lower levels in Blocks 41, 42, and 43, a conspicuous cross-fault displaces the vein a few feet with right-hand heave and drops the southern side 50 or 100 feet as shown by the displacement of the east wall quartzites. Fortunately, this fault has not affected mining beyond loosening the ground. Somewhere above 1600 level the fault has split into two branches which are both visible in the 1600 drift.

The relative ages of these faults and the directions of movement are by no means clear. Anomalous drags tend to confuse the problem and to lead one to the belief that each fault block probably moved in at least two directions at different times. Only by study of the positions of corresponding beds can the final net movements on some of the faults be approximated.

General Structure:

The present attitudes of the beds within the fault framework are best shown by the 200 foot maps, sections, and the model. The Transition Zone, the Prichard beds below it and the Burke beds above it, on the east side of the Constitution vein, all strike almost north and south and dip eastward at about 60°. These same rocks on the west side of the vein, while very much distorted, are in positions which suggest that they once formed a southwestward dipping flank of an anticline, the axial plane of which must have been very nearly parallel to the present plane of the vein or N 35° W. In other words, the Constitution vein developed along the axis of a fairly tight fold that plunged toward the south. This axial plane, being a plane of weakness, became faulted in a scissors-like or hinge-like movement that

has produced the present structural relations. It is likely that the vein fault was developed very early in the tectonic history. It has been distorted, offset, and resheared by subsequent fault movements, particularly by the same forces that produced the Redding fault, the small faults sympathetic with the Redding fault, the cross fault, and perhaps also the Pine Creek fault. Most of these movements preceeded the emplacement of the ore, for in only a few places is the ore itself badly fractured. Post-ore movement was probably less intense than pre-ore movement and seems to have affected the ore bodies only where the ore actually encountered the pre-existing faults. Thus, above the main tunnel level, for example, pre-ore movement along the Redding fault sheared and twisted the vein structure and probably some less intense post-ore movement along the same fault produced some shearing of the ore. The present attitude of the Prichard beds in the hangingwall of the Redding fault is not clear, and the maps have accordingly been left blank in that area.

The fact that the dikes are post-ore and are nearly parallel with the Pine Creek fault suggests that at least a part of the movement along that fault is post-mineral and of the gravity type.

Sketchy evidence suggests the following sequence of events:

1. Intense folding and development of the Constitution anticline.
2. Upward pressure developed the Constitution vein fault nearly parallel to the axial plane of the fold and displaced the wall rocks as shown in the 200 scale transparent overlay.
3. The Redding fault and sympathetic breaks developed as a final stage of the thrust movement and modified the Constitution vein structure with "strike-faults," zones of gouge, and areas of tension favorable for ore deposition.
4. Emplacement of ore, followed closely by relaxation of pressure, normal movement along the already existing faults, and intrusion of dikes in large tension cracks that developed parallel to the Pine Creek fault.

The time relations of the major movements on the Pine Creek, the Marr and the Sherwood faults are not known.

The Orebody:

The orebody is of the tabular, replacement-vein type with the length much greater than the width. So far as known, all the ore has been deposited in the Constitution vein structure itself, although mineralization does extend along the Redding fault to the south. The fact that the vein fault has a greater apparent net movement than the Redding fault on the Main Tunnel level suggests that the latter may have followed the vein south of their intersection and augmented the original movement on the vein.

The vein structure is remarkable for its persistence and relative simplicity. It shows very weakly in the Fred tunnel 1500 feet north of Gilbert Creek, where it is not orebearing. Old cuts indicate that it was traced a short distance north of Gilbert Creek and for about 1000 feet south to where it meets the Redding fault.

The orebody lies almost entirely in that portion of the vein structure south of Gilbert Creek. As a whole the vein there has steep but irregular dips, the average of the north half of each level being about 70° west, but the dips of the south half vary from steeply west to steeply east. The average strike of the orebody as a whole is N 30° W, but some sections strike N 50° W and other sections, particularly in the lower levels, strike nearly north. Especially noteworthy is the fairly consistent 50° south rake of the north margin of the orebody. The south margin of known ore is less regular.

Known ore shoots on the Main Tunnel level occur at intervals for over 2000 feet along the vein--from Block 29 to Block 49. On the 1000 level the shoots occur with fewer interruptions for over 1600 feet of the vein, from Block 37 to Block 52. On 1200 level there is continuous ore for over 1100 feet. On 1400 and 1600 levels the stretches of continuous ore appear to be shortening, but these

levels, as well as 1200, are not fully developed. In general, the interruptions in the orebody are more noticeable toward the south. This condition prevails in spite of an apparent merging of the principal oreshoots downwards, for, as deep as the 1000 level at least, isolated orebodies have been found south of the principal oreshoot. From the exploration standpoint, therefore, an understanding of the ore controls toward the south is very important.

Vertically, the orebody has been more or less continuous from an elevation of 3425 feet (360 feet above the main tunnel level) to an elevation of 1456 feet (1600 level) -- a distance of 1969 feet. The maximum proved vertical extent, therefore, is almost equal to the maximum known horizontal extent (about 2000 feet on the Main Tunnel level).

The ore minerals, sphalerite and galena, occur almost ubiquitously within the dimensions of the orebody just described, but the quantities vary from traces in a narrow streak to solid sulfide ore 10 or more feet wide. Consequently, the ore reserves vary according to the economics of mining, and shoots once considered unprofitable, have since been mined. Constant reassessment of reserves is, therefore, necessary.

The individual oreshoots are elongated lenses in which the generally fine-grained mixture of sphalerite and galena has been deposited in one or more of the following types:

1. As a fairly uniform single band of almost solid sulfides from a few inches to a few feet wide with almost no ore in the walls of the band. In some places the band is frozen to the wall rock with no gouge seam discernible. Elsewhere it parallels a distinct gouge seam, generally, but not always, along the footwall of the seam. More or less shearing can be observed around the bands. This form of oreshoot is typical of the more northern part of the orebody.

2. As (1) but with disseminations and small parallel veinlets in the wall of the principal band. Sampling of this type may show lead and zinc values over widths up to several feet.

3. As a number of more or less parallel streaks or veinlets of ore in a shear zone, which in places has been as much as 15 feet wide. Hershey reported that such a zone opened up about 100 feet above the main tunnel level in Blocks 36 and 37. Similar, somewhat narrower, zones have been encountered elsewhere.

4. As bunches or bands of fine-to coarse-grained sulfides in a gangue of white quartz; with minor amounts of calcite and coarse pyrite, and in places with a little chalcopyrite. This type of ore occurrence has been found almost exclusively in the southernmost stopes of the mine, particularly in the stopes in Blocks 48 and 49 on 600, 800, and 900 levels. The quartz gangue in places is as much as 4 feet wide.

In types (1), (2), and (3), quartz is generally a minor constituent of the ore and is most likely to occur as small, rounded remnants in the massive sulfides.

There are numerous evidences of replacement in the ore. Remnants of wall rock and of rounded fragments of early quartz are conspicuous. There were at least two periods of quartz deposition; one prior to the ore and one contemporaneous with and possibly a little later than the ore, but evidence of quartz actually cutting sphalerite or galena is difficult to find. The sphalerite and galena were probably introduced contemporaneously, with sphalerite crystallizing first.

The Ore Controls:

The irregularities in strike and dip described above and shown rather vividly on the structural contour sheet are responsible, at least in part, for the localization of the ore shoots. The causes of the irregularities are, first, the

differences in the competency of the argillite and the quartzite, and, second, the displacement of the beds by the vein fault. Both factors were essential for ore.

The transparent overlay shows that the southward rake of the north margin of the ore almost exactly parallels the quartzite beds on the east wall, and that ore has not developed far north of the quartzites. The contour map demonstrates that the principal structural valley follows roughly the same rake line until both the valley and the quartzite Q-III are offset downward to the south by the cross fault in Block 42. The offset valley then follows the same rake. The influence of the quartzites on the strike and dip of the vein is further shown by the level maps and the cross sections. It can be seen that the thicker beds of quartzite have deflected the vein.

The principal fault movement along the vein fracture (west wall up and to the south) opened channelways wherever that movement caused the walls to tend to separate. The most favorable areas are illustrated by foot-percent colors on the structural contour sheet. They are, for the most part, the flanks of the valleys where the contours are widely spaced. Steep unbroken slopes leading upward to the right are unfavorable in general, but "flats" on these slopes as shown in Blocks 48 and 49 between 900 and 1200 levels and in Block 43 above the Main Tunnel level are favorable. The actual direction of dip seems to be less important than changes in dip.

From the contour map a possible explanation for the relatively poor zone between 400 and 800 levels can be found. It will be noted that the structural valley rakes southward from the surface to near the 400 level where it encounters the almost vertical structural line of the cross fault and seems to become lost. The valley reappears just below 900 and rakes off to the south to 1400 level where it apparently becomes almost vertical down to 1600 level. The southward raking valley does not appear in the poor zone above mentioned. The

steepening below 1400 may explain the apparent narrowing and shortening of the principal oreshoot there. The cause of this steepening is not known; it may be due to another, as yet unobserved, cross fault.

The apparent merging of the oreshoots downwards is probably explained by the relative absence of strike faulting in the lower levels. Cross-section 4500 shows three faults affecting the vein above 600 level and none below 600. This is reflected in the obviously tighter vein below 600 level. Elsewhere in the Coeur d'Alenes orebodies have been found to be more compact at depth below the zone of easy breakage. Consolidation downwards does not of itself mean lower grade of ore. In fact it makes possible the development of a greater tonnage of ore for each foot of drift.

A local ore control seems to be the angle that the bedding makes with the vein. If other factors are favorable the ore is best where the bedding meets the vein at large angles. Parallelism of beds and vein is generally less favorable. This is well illustrated on 1000 level south.

The type of wall rock does not seem to affect the ore deposition from a chemical standpoint, but differences in the strength of the rock have created alternating zones of tension and compression. In general, argillite opposite argillite or argillite opposite quartzite are better than quartzite opposite quartzite, but there are many local exceptions.

Relation of Orebody to the Redding Fault:

The relation of the vein to the Redding fault has been a point of major consideration and of some controversy in planning exploration southwards. The irregularity of the south margin of the orebody has already been mentioned and it was natural to suppose that this was due in part to the influence of the fault in the vein.

Hershey concluded from the "drag" ore in the south stopes above the Main Tunnel level that the Redding fault was post-mineral and had probably offset

the orebody toward the south. The writer believes that the principal movement on the fault is pre-mineral but that post-ore adjustment locally sheared ore that had been deposited along the merged vein and fault. The evidence is as follows:

1. Hershey noted specks of galena in the east wall of the Main Tunnel in the now inaccessible Block 54, almost 1000 feet south of the junction of the vein and the Redding fault.
2. Old No. 5 stope in Blocks 48 and 49 above the tunnel level is over 300 feet south of the junction of vein and fault. The ore, which lay beneath the gouge, was sheared and broken. The ore in the backs of No. 3 and 4 stopes was similarly sheared and broken and the fault apparently cut off the ore in all of these stopes above the tunnel.
3. In the 800 level south drift in Block 51 and 52 solid "sub-marginal" ore has been disclosed recently. This ore lies along the merged fault and vein and, assuming there was only one general period of ore emplacement, is almost certainly later than the fault, for the sulfides are not broken or sheared.
4. Almost barren stretches have been found on the tunnel level and on 200 level south of the junction of vein and fault, but similar nearly worthless sections occur north of the junction on other levels such as 900 and 1000 levels south. Barren zones developed due to strike faulting or to other factors.

It seems more likely that the Redding fault has merged with the vein structure than that the vein has been actually cut and offset by the fault. The fault thus assumes a strike-fault relationship to the vein, augmenting the original movement along the vein.

The writer's conclusion is that ore has been deposited both in the vein structure and in the merged fault and vein, and that the "drag" ore is a result of relatively slight post-ore movement which naturally followed the Redding fault.

The vein has been affected by other pre-ore strike faults, sympathetic with the Redding. All of these faults have developed more or less gouge which in places has closed and sealed the channelways for the ore solutions. These faults, like the Redding, have undergone minor post-ore readjustments.

Whether the movement on the Redding fault is mainly pre-ore or mainly post-ore there is a fair chance that more oreshoots occur along the fracture south of the junction of vein and fault. If the fault is pre-ore and has merged with the older vein structure, favorable loci could exist farther south along the fracture or, if the two again separate, along the vein beyond the point of separation. If the fault is post-ore, the oreshoot may have been offset to the south several hundred feet, as Hershey postulated.

Zoning and the Direction of Movement of Ore Solutions:

Reference to the zoning chart in the 200 scale set of maps, shows clearly that the ratios of zinc to lead are highest along the north margin of the orebody, where, in the lower levels the ratios exceed 5 to 1. The lowest ratios, indicating proportionately more lead, are found near the south margin. The center of the orebody shows predominant ratios of between 2 to 1 and 3 to 1. There is a suggestion that the proportion of zinc may increase also along the south margins, indicating a sort of high zinc "envelope" around the orebody as a whole.

On the basis of the higher zinc towards the north, one can draw the inference that the source of ore was downwards and toward the north. Zinc is believed to deposit at the higher temperatures prevailing near the source of ore.

If this is true, the intensity of ore deposition should have decreased toward the south. In general, this has been proved by mining experience; but it must be remembered that ore solutions travel until they reach a locus favorable for deposition, even though that locus be far from the source of solutions.

Tons of Ore Per Vertical Foot:

From available records, the tons of mine ore produced per vertical foot

from several levels have been calculated.

Level	Interval	Total Tons	Tons per Vertical Foot
600	201	47,739	238
800	178	62,041	349
900	114	45,818	402
1000	108	57,574	533
1200	197		
1400	196		

Final figures for the comparable oreshoots on 1200 and 1400 levels are not available, but it appears that neither will match in tons per vertical foot the yield from 900 and 1000, which, certainly, have been the best levels of the mine.

It is interesting to note that O. H. Hershey, after examining the Main Tunnel level and the north half of the 200 level, in 1918, calculated that the portion he examined would yield 229.4 tons per vertical foot of ore averaging 15% zinc, 6% lead, and 4.1 oz. silver per ton. He predicted a yield of 229,400 tons from the Main Tunnel to the 1000 foot level. The mine has yielded, from the surface to the 1000 level, a vertical distance of about 1300 feet, a total of about 506,000 tons or about 390 tons per vertical foot. Hershey was high on grade but low on tonnage, although he did not see the full length of ore bearing ground.

In retrospect, 600 and 800 levels were lower than average, whereas 900 and 1000 levels were better than average. The orebody as a whole has not diminished in average yield at least down to the 1000 level, nor has a single poor level, such as 600, indicated a bottoming.

The average mill feed during the past few years has been about 11% combined metal, in the proportion of about 8 zinc to 3 lead. The silver content is about 0.4 oz. silver to 1% lead.

Recommendations:

1. Exploration to the North:

The absence of quartzites and the general weakening of the vein structure in the soft argillites toward the north are factors that discourage exploration in that direction. However, a little

more work should be done on 1000 level north, where a fair showing exists in the present face in Block 36.

No diamond drilling is recommended from the north end of the orebody.

2. Exploration to the South:

Fair to very good prospects for additional ore exist toward the south, particularly in the lower levels of the mine.

800 level south, which has been driven along the merged vein and Redding fault, has yielded encouraging assays. It should be extended, with particular attention to the west wall, for at least 300 more feet or until the last west wall quartzite has been passed. The prospects for this work are fair.

All of the levels below 800 have fair to very good prospects toward the south. The Redding fault has not been reached on these levels although 1000 south drift is close to the fault. Further work on 1000 level can well be deferred until 900 and 1200 levels are extended. Within another 100 feet 1200 level should pass into argillite beneath the small stope in Block 52 on 1000; the prospects for more ore on 1200 level are good. The future of 1400 will depend on what is found on 1200 level and further development of 1400 should be deferred until 1200 is extended. 1600 level has just penetrated the quartzite zone and, unless the quartzites show no displacement, additional ore should be encountered within the next 100 feet, that is, within Block 48 or 49.

3. Prospects for Ore at Great Depth:

If, on 1600 level, the corresponding quartzites are found to be opposed, it will indicate that the fulcrum of the vein faulting has been reached and will explain why 1600 level ore has been weaker

than 1400 ore. All that can be done, then, is to develop 1800 level to determine whether the movement is a hinge type or a scissors type. If a scissors type is indicated ore should persist downwards; if a hinge type is indicated, the prospects for the mine are, frankly, poor. If the quartzites show no displacement on 1800 level it is doubtful that the vein structure will be strong enough to make ore.

There is no indication that the orebody will be cut off at depth by any known fault. The Redding fault is far to the south on the lower levels. The quartzite zone should persist downwards, although it will be farther to the south on each level.

If the ore persists downward below 1600 level, it should be reached first in Block 45 on 1800 level at a projected distance of about 400 feet south of the shaft. The first quartzites should be reached in Block 49 on 1800 level.

4. Sunface Work over the Mine:

A limited amount of surface trenching or bulldozing on the Constitution claim south of the junction of the vein and the Redding fault, to determine the course and nature of the fracture might be advisable. This could be followed by a few diamond drill holes from about the 3500 contour, directed eastward and inclined slightly downward to explore the possible ore along the fracture between sections 4000 and 5000.

5. Prospects along the Sherwood Fault:

The diamond drill hole from the Fred tunnel cut some sheared rock that yielded a little metal in the sludge samples. This rock lies in the hangingwall of the Sherwood fault and indicates that further investigations of this fault should be made, preferably from the Sherwood tunnel.

6. Determination of the Iron Content:

A number of samples should be taken over a wide vertical range to determine the iron content of the ore. Apparently iron has not increased with depth--a very favorable characteristic of the ore-body. This observation should be verified by assays. Any notable increase in iron content downward would be unfavorable. Perhaps this information could be obtained from smelter sheets.

7. Reassessment of Ore Reserves:

The foot-percent colors on the contour sheet and the calculated figures for the blocks should be studied and, if necessary, checked to determine whether indicated ore actually exists or if there were errors in sampling or calculations. For example, Block 45 on 600 level shows blue, indicating 40 to 60 feet-percent ore, which should be mineable.

Thomas E. Gillingham

Geological Report

of the

CONSTITUTION MINE

Yreka Mining District, Shoshone County

Idaho

Thomas E. Gillingham
October 30, 1951
rc

GEOLOGICAL REPORT

on the

CONSTITUTION MINE

Thomas E. Gillingham

Scope and Purpose of the Investigation:

The detailed geological study of the Constitution mine was undertaken by the writer at the request of Mr. J. C. Kieffer, Manager of the Spokane-Idaho Mining Company. The work was a joint project of Spokane-Idaho and Bunker Hill and Sullivan Mining and Concentrating Company and was carried out on a part-time basis from June 1948 until October 1951. During this period all of the accessible lateral workings of the mine and much of the surface in the vicinity of the mine were mapped on a scale of one inch to 20 feet and one inch to 200 feet, respectively. In addition, most of the surveys were checked, recalculated, or rerun, and an entirely new set of base maps, longitudinal projections and cross-sections were prepared.

The aims of this study were to determine the geologic controls of the Constitution orebody, to provide periodic assistance to the mine operators, and to establish guides to future work.

Acknowledgments:

The writer is grateful for the encouragement and assistance shown by Mr. Frank N. Marr, Mr. J. C. Kieffer, and Mr. Curtis Redding of the Spokane-Idaho organization, and by Mr. J. B. Haffner, Mr. R. H. McConnel, and Mr. Veral Hammerand of Bunker Hill. Mr. Otto Haaland, Mr. Robert Gordon, and Mr. George McCall have helped in the detailed work. Special thanks are due Mr. E. L. Phillips, cartographer of Bunker Hill, whose assistance in the preparation of the final maps and the mine model was indispensable.

Location:

The Constitution zinc-lead mine is located in the Pine Creek (Yreka)

mining district of the [illegible]ur d'Alenes, Shoshone County, [illegible]ho. It lies 7 miles south of Kellogg, Idaho, and is reached by Highway 10 and a good, gradual-grade, county road along Pine Creek--a total distance of 17 miles from Kellogg.

Topography:

The mine buildings and the portal of the main tunnel level are situated in the valley of the headwaters of the main (East) branch of Pine Creek, just south of its confluence with a small tributary known as Gilbert Creek. The mine portal is at an elevation of 3048.25 feet (U.S.G.S. datum), and the hills surrounding the portal reach elevations of nearly 5000 feet. The relief is, therefore, rugged.

History:

The story of the Constitution mine illustrates remarkably well the difficulties and vicissitudes that have faced the operators of small mines in a once remote region. The exact date of discovery of the Constitution vein is not known, but was probably prior to 1898. The outcrop on the slope above Gilbert Creek must have been fairly obvious to a prospector making his way up the gulch. The original two claims, the Constitution and the American Girl, were staked in June 1901 by Thomas Gilbert; the names of the locators are given as Thomas Gilbert, H. J. Gilbert, Thomas Thwaite, and George Green.

On September 17, 1902, the Constitution Mining and Milling Company was incorporated, capitalized for 1,500,000 shares at one dollar par value. Apparently all the shares were soon issued. The original No. 1 tunnel, located 200 feet above Gilbert Creek, and about 500 feet of No. 2 tunnel had been driven prior to 1911, when the original group of claims were surveyed for patent. The Mine Inspector's Report for 1915 states that the ore shoot had been opened for 600 feet along the strike and in that year had yielded three carloads of rich ore.

On May 3, 1916, O. H. Hershey submitted a report on the property which has been lost. It appears, however, that he recommended the construction of a 100 ton mill to take advantage of the high metal prices then prevailing. He further

recommended, at that time, the crosscut into the west wall near the old portal of the Main Tunnel Level to explore a second vein that had been disclosed in a small tunnel on Gilbert Creek. Hershey submitted a second report on March 13, 1918, and a third report on December 16, 1926. Copies of these last two reports are in both Spokane-Idaho and Bunker Hill files.

In 1917, a mill, designed by Mr. W. L. Zeigler to treat 150 tons per day, was constructed. It proved inadequate to handle half that tonnage, the tailing losses were prohibitive, and the bulk concentrate, which was shipped to the Washoe smelter or to Trail, did not yield a profit. Hershey reports (1918), that the average content of 46 lots shipped to the smelter averaged 29.6% zinc, 15.2% lead and 8.2 oz. silver. A particular shipment sampled November 1, 1917, contained: 11.6% water, 29.4% zinc, 16.8% lead, 11.2 oz. silver, and 0.02 oz. gold. The net smelter return from this 89,940 lb. gross shipment was $808.09!

It appears that the mill feed during this early period carried about 11.5% zinc, 5.5% lead, and 3.5 ozs. silver per ton.

Late in 1917, Mr. R. H. Handy was employed to rebuild the mill into a selective flotation plant. Handy thought it reasonable to expect from the rebuilt mill a recovery of 40% of the lead in the feed in a product assaying over 35% lead and under 10% zinc, and 60% of the zinc in the feed in a product assaying over 40% zinc and under 10% lead. The end of the war in 1918 brought a sudden drop in metal prices, which forced the Pine Creek mines, including the Constitution, to curtail production. The original charter of 1902 was forfeited in 1920.

During these early years, transportation of concentrates to the railroad near the present town of Pinehurst cost $4.00 per ton--a high figure for those days. A projected spur rail line up Pine Creek valley was partly laid but was abandoned after a washout in 1918. This further deterred Pine Creek development.

Largely through the efforts of Mr. Handy, the Constitution resumed operation in 1924 with a 50 ton fine-grind selective flotation concentrator. In 1925

the mill capacity was increased to 250 tons, a new hoist was installed and considerable development performed. About this time Mr. William P. White became mine manager. Under his able direction the present shaft during 1927 and 1928 was sunk from the 200 level to the 400 level and raised to the Main Tunnel Level.

On August 31, 1929, the capitalization of the company was increased to 3,500,000 shares at $1.00 par value, and the revenue from the sale of stock enabled the company by June 1930 to sink the shaft to the 800 level, to bring development footage to a total of 11,280 feet, and to employ over 90 men. A small town occupied a site near the confluence of Gilbert Creek and Pine Creek. The fall in metal prices in 1930 caused the mine to be closed on June 1st of that year. Subsequently the Constitution Mining & Milling Company was liquidated and the property was completely stripped of all machinery and equipment.

On July 5, 1940, the Spokane-Idaho Mining Company was incorporated with J. P. Graves as President. The capitalization is 450,000 shares of 10 cent par value with all shares issued. During 1940 and 1941 the mine was re-equipped and rehabilitated, a new crosscut adit was driven from the Pine Creek valley, and a new 100 ton selective flotation mill constructed. Through the efforts of Mr. W. P. White as manager and Mr. Curtis Redding as mine superintendent, mining was resumed late in 1941, and the first shipment of concentrates was made to the Bunker Hill Smelter and the Sullivan Zinc Plant that year. With the exception of the period of the short labor strike in 1951, the mine has been a steady producer of zinc and lead ore since 1941. The mill capacity has been increased to about 160 tons per day.

Mr. Graves was succeeded as President of Spokane-Idaho by Mr. C. E. Marr, who in turn was succeeded in 1946 by his son, Mr. Frank N. Marr. After a few months Mr. White retired from active management and was followed, in turn, by Mr. S. K. Garrett (1941-1945), Mr. Charles Garrett (1945-48), and Mr. J. C. Kieffer (1948-present). Under Spokane-Idaho management the Constitution mine has been operated efficiently and profitably.

Production:

Early production records of the mine are sketchy, but records kept by Spokane-Idaho Mining Company are generally detailed and complete. The following figures are in part estimated:

	Tons Mine Ore
Production prior to 1929 (from 1929 prospectus)	165,000
Production 1929 and 1930 (estimated from stope maps)	33,000
Total production by old company	198,000
Production by Spokane-Idaho 1940 to 1950 incl.	342,000
Total production to end of 1950	540,000
Estimated production for 1951	54,500
Total approximate production to end of 1951	594,500

Mr. Kieffer has provided the following detailed production figures for the period of Spokane-Idaho management:

Production of the Constitution Mine
1941 to 1950 Inclusive

Year	Tons Ore	% Pb	% Zn	Lbs. Pb	Lbs. Zn
1941 (Est.)	10,000	4.00	10.00	800,000	2,000,000
1942	20,307	4.50	9.59	1,827,368	3,895,400
1943	21,317	3.10	7.31	1,320,120	3,114,980
1944	22,155	3.39	7.53	1,506,868	3,337,105
1945	26,151	4.55	9.12	2,378,555	4,771,685
1946	37,931	3.04	7.76	2,303,050	5,886,130
1947	38,468	2.66	7.35	2,044,110	5,651,870
1948	54,917	2.79	7.39	3,067,097	8,112,093
1949	50,623	2.79	7.33	2,828,382	7,418,564
1950*	60,902	3.52	8.22	4,282,373	10,007,602
Totals	342,771	3.26	7.91	22,357,923	54,195,429

*Lease Shipments Excluded.

Property:

Spokane-Idaho Mining Company has title to the following legal subdivisions, 21 patented claims and 26 unpatented claims, all shown on the 400 scale property map.

Legal Subdivisions:

S½ SW¼ Sec. 1 T47N R2E
S½ SE¼ Sec. 2 T47N R2E

Patented Mining Claims:

Survey 2167	Crescent	Survey 3023	Bennington
	Comet		Trainer
Survey 2620	American Girl	Survey 3116	Chicago
	Constitution		South Constitution No. 1
	Dakata		" " No. 2
	Defender		" " No. 4
	Fred		" " No. 5
	Percy		Spokane
			Thwaite
Survey 2803	Minnie		
	Nellie	Survey 3119	Dupont
			Dupont Fraction

Unpatented Mining Claims:

Judge	Martha	Lucky Peak
May	June	Fuett Peak
July	August	South Constitution No. 3
Alvin	September	" " No. 6
Joe	October	Saint Paul
Eve	McKinley	Saint Louis
Ruth	Toto	Westchester
Joker	Portland	Seattle
Hobo	Turner	

Geology:

The general geological picture of the area in which the Constitution orebody lies has not been solved adequately. The present report will be confined, therefore, to the mine itself and to the area immediately adjacent to the mine, which will be called the "mine area."

The three sedimentary formations disclosed in the mine area are, from oldest to youngest, the Prichard formation, the Burke formation, and the Revett formation. All three of these belong to the so-called Belt series of Pre-Cambrian age and are among the oldest rocks of the continent. The superficial deposits of gravel and debris will not be considered in this report. In addition to the sedimentaries, numerous basic dikes, either diabasic or lamprophyric, or both, occurs in and near the vein.

Prichard Formation:

This lowest known formation of the Belt Series consists of thousands of feet of

predominately shaly and s[illegible]y rock, commonly called argill[illegible], which, in at least two widely separated zones, is interbedded with white to light gray massive quartzites of variable thickness. The argillite is mostly dark gray to medium gray in color. Much of it shows fine laminations or varves of alternating dark and light shades, indicative of seasonal depositions. The writer has noticed in places that the gradations can be used to tell the tops and bottoms of the beds--a useful tool in solving structure. Especially near the quartzitic zones, the argillite may be quite massive, dark, and hard, without apparent laminations; it is then probably quartzitic argillite or argillaceous quartzite and the writer has used these categories more or less arbitrarily on the field notes.

Two principal quartzite zones have been observed in the Prichard. As shown in the area of Pine Creek between the Sidney and the Amy-Matchless mines, the first or lower quartzite zone is probably 3000 feet or more in thickness with its top quartzite bed several thousand feet below the top of the Prichard formation. It has been designated as the Middle Prichard. The second or upper quartzite zone occupies the top 600 feet of the Prichard, just below the Burke formation, and has been called the Transition Zone. Between the Middle Prichard and the Transition Zone is a great thickness, at least 5000 feet, of predominant argillite.

The Transition Zone has been carefully mapped and studied in the Constitution mine area. It consists of three thick beds and several smaller, apparently less continuous, beds of massive white to gray quartzite, separated by argillite. The quartzites have been shown on the mine maps in bright orange color. The approximate column is shown below in Figure 1.

The contacts between the argillite and the quartzites are generally quite sharp so that the latter become useful mappable units. The exception seems to be the top 150 feet which is quite variable in composition, consisting, in one section, of rock that is almost quartzite; in another, of a confusing mixture of argillite and

quartzite. The beds marked Q-I, Q-II, and Q-III, however, are persistent and fairly uniform, but several splits have been noted. Below quartzite Q-III the quartzite beds become smaller, variable in both thickness and continuity, and less easily traceable.

The Burke Formation:

Above the Transition Zone lies the Burke formation of predominately medium bedded, flaggy, sericitic quartzite of light-gray to buff color. Some of the Burke beds are indistinguishable from the Prichard quartzites or from the Revett quartzites, but the Prichard-Burke contact is generally recognizable, particularly on the slope above Gilbert Creek.

The Revett Formation:

In contrast to the Burke, the Revett formation is composed mostly of thick beds of hard, brittle, white quartzite, but the transition from Burke to Revett in the mine area is so gradual that for practical purposes no contact has been shown, and all the rock above the Prichard has been marked Burke on the maps. Actually, the Burke-Revett contact must be very close to the new portal of the Constitution main level; the rock in the adit west of the Pine Creek fault may be Revett. Certainly, the Revett occupies much of the Pine Creek valley south of the mine buildings, and should be mapped in the future.

Basic Dikes:

Numerous basic dikes are shown on the mine maps, but pending the results of microscopic studies now underway by Mr. Thon Jin of the University of Utah, the writer is reluctant to classify these dikes more exactly than "basic dikes." Hershey called them lamprophyres, but they appear to the writer to be, in part at least, diabase. The dike that parallels the vein in the north section of the mine is definitely later than the ore.

The host rocks of the Constitution orebody are the quartzites and argillites of the Prichard Transition Zone and the lowest beds of the Burke formation.

However, only one ore shoot, Old No. 5 on the Main Tunnel level, has Burke as one of its walls. One may conclude, from available evidence, that the orebody is almost entirely confined to the Prichard Formation and especially to the Transition Zone.

Faults and Related Structure:

Several faults are shown on the mine maps in both observed and inferred positions. The relations of the faults to each other and to the rocks are not completely understood and probably cannot be worked out satisfactorily until more areal geology is mapped. The principal faults are as follows:

The Pine Creek fault -- This strong structure lies a few hundred feet west of, and roughly parallel to, the Constitution vein. From observations in the mine area and from diamond drill cores, it appears to strike about N 20° W and to vary in dip from almost vertical in the south to steeply westward towards the north. It has an apparent net movement of perhaps a mile and has juxtaposed the younger Burke quartzite against the older Prichard formation. The Pine Creek fault is one of a series of normal step faults that have dropped off successive blocks of rock from the limbs of the regional folds.

The Marr fault -- The writer has assigned the name "Marr fault" to an important but generally obscure structure that traverses the bedding north of the mine. The Marr fault strikes about N 75° W and from its inferred position on the surface and its intersection with the diamond drill hole from the Fred tunnel, it appears to dip at about 65° toward the south. Its net movement is probably a few hundred feet. It is a reverse fault, shown by the fact that the Prichard Transition Zone has been juxtaposed against Burke formation in the northeast part of the mine area. Its southerly dip would bring the Marr fault into the Constitution main shaft at about the 3700 foot level. Since the fault is a strong water course any deepening of the shaft below the 3000 foot level should be preceded by an exploratory diamond drill hole toward the fault plane.

The Sherwood fault -- This fault, which is disclosed in the Sherwood tunnel north of the mine area and on the hill in the northeast corner of the area, has been mapped by the U.S.G.S. as a segment of the Pine Creek fault offset by the Marr fault. However, its 50° westerly dip is considerably flatter than any observed dip of the Pine Creek fault and until it has been more carefully studied it should be considered a separate, unrelated structure. The apparent strike of the fault is N 35° W.

The Redding fault -- This structure, which is hereby given the name "Redding fault," is a reverse fault with several hundred feet net movement, of which the horizontal component is about equal to the vertical component. The hangingwall (West wall) of the fault has moved upwards and southwards with respect to the footwall.

The Constitution vein -- The Constitution vein itself occupies a fault of considerable movement. As shown on the vertical longitudinal projection overlay, going south, the east wall quartzites are first encountered on the main tunnel level near the old portal in Block 3100 whereas the corresponding quartzites on the west wall are first encountered at 4300 south. Thus, a horizontal displacement of 1200 feet is indicated for the main tunnel level. On the 1400 level, however, the apparent horizontal displacement, measuring the base of quartzite Q-III, is only 230 feet. Consequently, it can be said that the vein structure is either a pivot fault or a scissors fault, with a gradually decreasing displacement toward the fulcrum. Judging from the attitudes of the beds on 1400 level, the corresponding quartzites on the two walls should become opposed a short distance below 1800 level in the portion of the mine south of Block 4900. The actual direction of movement along the vein fault is not apparent, but was probably slightly inclined upward with the west wall moving southwards. The importance of the relative movement of the vein fault will be considered below.

Other Faults:

A number of reverse faults of relatively small movement, sympathetic with

that of the Redding fault, are shown on the mine maps. These faults intersect the vein structure at small angles. They either cross the vein or concur with the vein for some distance and disappear into the opposite wall. These faults are particularly conspicuous in the upper half of the mine, where they have caused small offsets of the vein or have developed gouge zones generally inhospitable to ore formation. These faults were once considered strike faults, but they are, in fact, only locally parallel to the strike of the vein.

On 600 and lower levels in Blocks 41, 42, and 43, a conspicuous cross-fault displaces the vein a few feet with right-hand heave and drops the southern side 50 or 100 feet as shown by the displacement of the east wall quartzites. Fortunately, this fault has not affected mining beyond loosening the ground. Somewhere above 1600 level the fault has split into two branches which are both visible in the 1600 drift.

The relative ages of these faults and the directions of movement are by no means clear. Anomalous drags tend to confuse the problem and to lead one to the belief that each fault block probably moved in at least two directions at different times. Only by study of the positions of corresponding beds can the final net movements on some of the faults be approximated.

General Structure:

The present attitudes of the beds within the fault framework are best shown by the 200 foot maps, sections, and the model. The Transition Zone, the Prichard beds below it and the Burke beds above it, on the east side of the Constitution vein, all strike almost north and south and dip eastward at about 60°. These same rocks on the west side of the vein, while very much distorted, are in positions which suggest that they once formed a southwestward dipping flank of an anticline, the axial plane of which must have been very nearly parallel to the present plane of the vein or N 35° W. In other words, the Constitution vein developed along the axis of a fairly tight fold that plunged toward the south. This axial plane, being a plane of weakness, became faulted in a scissors-like or hinge-like movement that

has produced the present structural relations. It is likely that the vein fault was developed very early in the tectonic history. It has been distorted, offset, and resheared by subsequent fault movements, particularly by the same forces that produced the Redding fault, the small faults sympathetic with the Redding fault, the cross fault, and perhaps also the Pine Creek fault. Most of these movements preceeded the emplacement of the ore, for in only a few places is the ore itself badly fractured. Post-ore movement was probably less intense than pre-ore movement and seems to have affected the ore bodies only where the ore actually encountered the pre-existing faults. Thus, above the main tunnel level, for example, pre-ore movement along the Redding fault sheared and twisted the vein structure and probably some less intense post-ore movement along the same fault produced some shearing of the ore. The present attitude of the Prichard beds in the hangingwall of the Redding fault is not clear, and the maps have accordingly been left blank in that area.

The fact that the dikes are post-ore and are nearly parallel with the Pine Creek fault suggests that at least a part of the movement along that fault is post-mineral and of the gravity type.

Sketchy evidence suggests the following sequence of events:

1. Intense folding and development of the Constitution anticline.
2. Upward pressure developed the Constitution vein fault nearly parallel to the axial plane of the fold and displaced the wall rocks as shown in the 200 scale transparent overlay.
3. The Redding fault and sympathetic breaks developed as a final stage of the thrust movement and modified the Constitution vein structure with "strike-faults," zones of gouge, and areas of tension favorable for ore deposition.
4. Emplacement of ore, followed closely by relaxation of pressure, normal movement along the already existing faults, and intrusion of dikes in large tension cracks that developed parallel to the Pine Creek fault.

The time relations of the major movements on the Pine Creek, the Marr and the Sherwood faults are not known.

The Orebody:

The orebody is of the tabular, replacement-vein type with the length much greater than the width. So far as known, all the ore has been deposited in the Constitution vein structure itself, although mineralization does extend along the Redding fault to the south. The fact that the vein fault has a greater apparent net movement than the Redding fault on the Main Tunnel level suggests that the latter may have followed the vein south of their intersection and augmented the original movement on the vein.

The vein structure is remarkable for its persistence and relative simplicity. It shows very weakly in the Fred tunnel 1500 feet north of Gilbert Creek, where it is not orebearing. Old cuts indicate that it was traced a short distance north of Gilbert Creek and for about 1000 feet south to where it meets the Redding fault.

The orebody lies almost entirely in that portion of the vein structure south of Gilbert Creek. As a whole the vein there has steep but irregular dips, the average of the north half of each level being about 70° west, but the dips of the south half vary from steeply west to steeply east. The average strike of the orebody as a whole is N 30° W, but some sections strike N 50° W and other sections, particularly in the lower levels, strike nearly north. Especially noteworthy is the fairly consistent 50° south rake of the north margin of the orebody. The south margin of known ore is less regular.

Known ore shoots on the Main Tunnel level occur at intervals for over 2000 feet along the vein--from Block 29 to Block 49. On the 1000 level the shoots occur with fewer interruptions for over 1600 feet of the vein, from Block 37 to Block 52. On 1200 level there is continuous ore for over 1100 feet. On 1400 and 1600 levels the stretches of continuous ore appear to be shortening, but these

levels, as well as 1200, are not fully developed. In general, the interruptions in the orebody are more noticeable toward the south. This condition prevails in spite of an apparent merging of the principal oreshoots downwards, for, as deep as the 1000 level at least, isolated orebodies have been found south of the principal oreshoot. From the exploration standpoint, therefore, an understanding of the ore controls toward the south is very important.

Vertically, the orebody has been more or less continuous from an elevation of 3425 feet (360 feet above the main tunnel level) to an elevation of 1456 feet (1600 level) -- a distance of 1969 feet. The maximum proved vertical extent, therefore, is almost equal to the maximum known horizontal extent (about 2000 feet on the Main Tunnel level).

The ore minerals, sphalerite and galena, occur almost ubiquitously within the dimensions of the orebody just described, but the quantities vary from traces in a narrow streak to solid sulfide ore 10 or more feet wide. Consequently, the ore reserves vary according to the economics of mining, and shoots once considered unprofitable, have since been mined. Constant reassessment of reserves is, therefore, necessary.

The individual oreshoots are elongated lenses in which the generally fine-grained mixture of sphalerite and galena has been deposited in one or more of the following types:

1. As a fairly uniform single band of almost solid sulfides from a few inches to a few feet wide with almost no ore in the walls of the band. In some places the band is frozen to the wall rock with no gouge seam discernible. Elsewhere it parallels a distinct gouge seam, generally, but not always, along the footwall of the seam. More or less shearing can be observed around the bands. This form of oreshoot is typical of the more northern part of the orebody.

2. As (1) but with disseminations and small parallel veinlets in the wall of the principal band. Sampling of this type may show lead and zinc values over widths up to several feet.

3. As a number of more or less parallel streaks or veinlets of ore in a shear zone, which in places has been as much as 15 feet wide. Hershey reported that such a zone opened up about 100 feet above the main tunnel level in Blocks 36 and 37. Similar, somewhat narrower, zones have been encountered elsewhere.

4. As bunches or bands of fine-to coarse-grained sulfides in a gangue of white quartz; with minor amounts of calcite and coarse pyrite, and in places with a little chalcopyrite. This type of ore occurrence has been found almost exclusively in the southernmost stopes of the mine, particularly in the stopes in Blocks 48 and 49 on 600, 800, and 900 levels. The quartz gangue in places is as much as 4 feet wide.

In types (1), (2), and (3), quartz is generally a minor constituent of the ore and is most likely to occur as small, rounded remnants in the massive sulfides.

There are numerous evidences of replacement in the ore. Remnants of wall rock and of rounded fragments of early quartz are conspicuous. There were at least two periods of quartz deposition; one prior to the ore and one contemporaneous with and possibly a little later than the ore, but evidence of quartz actually cutting sphalerite or galena is difficult to find. The sphalerite and galena were probably introduced contemporaneously, with sphalerite crystallizing first.

The Ore Controls:

The irregularities in strike and dip described above and shown rather vividly on the structural contour sheet are responsible, at least in part, for the localization of the ore shoots. The causes of the irregularities are, first, the

differences in the competency of the argillite and the quartzite, and, second, the displacement of the beds by the vein fault. Both factors were essential for ore.

The transparent overlay shows that the southward rake of the north margin of the ore almost exactly parallels the quartzite beds on the east wall, and that ore has not developed far north of the quartzites. The contour map demonstrates that the principal structural valley follows roughly the same rake line until both the valley and the quartzite Q-III are offset downward to the south by the cross fault in Block 42. The offset valley then follows the same rake. The influence of the quartzites on the strike and dip of the vein is further shown by the level maps and the cross sections. It can be seen that the thicker beds of quartzite have deflected the vein.

The principal fault movement along the vein fracture (west wall up and to the south) opened channelways wherever that movement caused the walls to tend to separate. The most favorable areas are illustrated by foot-percent colors on the structural contour sheet. They are, for the most part, the flanks of the valleys where the contours are widely spaced. Steep unbroken slopes leading upward to the right are unfavorable in general, but "flats" on these slopes as shown in Blocks 48 and 49 between 900 and 1200 levels and in Block 43 above the Main Tunnel level are favorable. The actual direction of dip seems to be less important than changes in dip.

From the contour map a possible explanation for the relatively poor zone between 400 and 800 levels can be found. It will be noted that the structural valley rakes southward from the surface to near the 400 level where it encounters the almost vertical structural line of the cross fault and seems to become lost. The valley reappears just below 900 and rakes off to the south to 1400 level where it apparently becomes almost vertical down to 1600 level. The southward raking valley does not appear in the poor zone above mentioned. The

steepening below 1400 may explain the apparent narrowing and shortening of the principal oreshoot there. The cause of this steepening is not known; it may be due to another, as yet unobserved, cross fault.

The apparent merging of the oreshoots downwards is probably explained by the relative absence of strike faulting in the lower levels. Cross-section 4500 shows three faults affecting the vein above 600 level and none below 600. This is reflected in the obviously tighter vein below 600 level. Elsewhere in the Coeur d'Alenes orebodies have been found to be more compact at depth below the zone of easy breakage. Consolidation downwards does not of itself mean lower grade of ore. In fact it makes possible the development of a greater tonnage of ore for each foot of drift.

A local ore control seems to be the angle that the bedding makes with the vein. If other factors are favorable the ore is best where the bedding meets the vein at large angles. Parallelism of beds and vein is generally less favorable. This is well illustrated on 1000 level south.

The type of wall rock does not seem to affect the ore deposition from a chemical standpoint, but differences in the strength of the rock have created alternating zones of tension and compression. In general, argillite opposite argillite or argillite opposite quartzite are better than quartzite opposite quartzite, but there are many local exceptions.

Relation of Orebody to the Redding Fault:

The relation of the vein to the Redding fault has been a point of major consideration and of some controversy in planning exploration southwards. The irregularity of the south margin of the orebody has already been mentioned and it was natural to suppose that this was due in part to the influence of the fault in the vein.

Hershey concluded from the "drag" ore in the south stopes above the Main Tunnel level that the Redding fault was post-mineral and had probably offset

the orebody toward the south. The writer believes that the principal movement on the fault is pre-mineral but that post-ore adjustment locally sheared ore that had been deposited along the merged vein and fault. The evidence is as follows:

1. Hershey noted specks of galena in the east wall of the Main Tunnel in the now inaccessible Block 54, almost 1000 feet south of the junction of the vein and the Redding fault.
2. Old No. 5 stope in Blocks 48 and 49 above the tunnel level is over 300 feet south of the junction of vein and fault. The ore, which lay beneath the gouge, was sheared and broken. The ore in the backs of No. 3 and 4 stopes was similarly sheared and broken and the fault apparently cut off the ore in all of these stopes above the tunnel.
3. In the 800 level south drift in Block 51 and 52 solid "sub-marginal" ore has been disclosed recently. This ore lies along the merged fault and vein and, assuming there was only one general period of ore emplacement, is almost certainly later than the fault, for the sulfides are not broken or sheared.
4. Almost barren stretches have been found on the tunnel level and on 200 level south of the junction of vein and fault, but similar nearly worthless sections occur north of the junction on other levels such as 900 and 1000 levels south. Barren zones developed due to strike faulting or to other factors.

It seems more likely that the Redding fault has merged with the vein structure than that the vein has been actually cut and offset by the fault. The fault thus assumes a strike-fault relationship to the vein, augmenting the original movement along the vein.

The writer's conclusion is that ore has been deposited both in the vein structure and in the merged fault and vein, and that the "drag" ore is a result of relatively slight post-ore movement which naturally followed the Redding fault.

The vein has been affected by other pre-ore strike faults, sympathetic with the Redding. All of these faults have developed more or less gouge which in places has closed and sealed the channelways for the ore solutions. These faults, like the Redding, have undergone minor post-ore readjustments.

Whether the movement on the Redding fault is mainly pre-ore or mainly post-ore there is a fair chance that more oreshoots occur along the fracture south of the junction of vein and fault. If the fault is pre-ore and has merged with the older vein structure, favorable loci could exist farther south along the fracture or, if the two again separate, along the vein beyond the point of separation. If the fault is post-ore, the oreshoot may have been offset to the south several hundred feet, as Hershey postulated.

Zoning and the Direction of Movement of Ore Solutions:

Reference to the zoning chart in the 200 scale set of maps, shows clearly that the ratios of zinc to lead are highest along the north margin of the orebody, where, in the lower levels the ratios exceed 5 to 1. The lowest ratios, indicating proportionately more lead, are found near the south margin. The center of the orebody shows predominant ratios of between 2 to 1 and 3 to 1. There is a suggestion that the proportion of zinc may increase also along the south margins, indicating a sort of high zinc "envelope" around the orebody as a whole.

On the basis of the higher zinc towards the north, one can draw the inference that the source of ore was downwards and toward the north. Zinc is believed to deposit at the higher temperatures prevailing near the source of ore.

If this is true, the intensity of ore deposition should have decreased toward the south. In general, this has been proved by mining experience; but it must be remembered that ore solutions travel until they reach a locus favorable for deposition, even though that locus be far from the source of solutions.

Tons of Ore Per Vertical Foot:

From available records, the tons of mine ore produced per vertical foot

from several levels have been calculated.

Level	Interval	Total Tons	Tons per Vertical Foot
600	201	47,739	238
800	178	62,041	349
900	114	45,818	402
1000	108	57,574	533
1200	197		
1400	196		

Final figures for the comparable oreshoots on 1200 and 1400 levels are not available, but it appears that neither will match in tons per vertical foot the yield from 900 and 1000, which, certainly, have been the best levels of the mine.

It is interesting to note that O. H. Hershey, after examining the Main Tunnel level and the north half of the 200 level, in 1918, calculated that the portion he examined would yield 229.4 tons per vertical foot of ore averaging 15% zinc, 6% lead, and 4.1 oz. silver per ton. He predicted a yield of 229,400 tons from the Main Tunnel to the 1000 foot level. The mine has yielded, from the surface to the 1000 level, a vertical distance of about 1300 feet, a total of about 506,000 tons or about 390 tons per vertical foot. Hershey was high on grade but low on tonnage, although he did not see the full length of ore bearing ground.

In retrospect, 600 and 800 levels were lower than average, whereas 900 and 1000 levels were better than average. The orebody as a whole has not diminished in average yield at least down to the 1000 level, nor has a single poor level, such as 600, indicated a bottoming.

The average mill feed during the past few years has been about 11% combined metal, in the proportion of about 8 zinc to 3 lead. The silver content is about 0.4 oz. silver to 1% lead.

Recommendations:

1. Exploration to the North:

The absence of quartzites and the general weakening of the vein structure in the soft argillites toward the north are factors that discourage exploration in that direction. However, a little

more work should be done on 1000 level north, where a fair showing exists in the present face in Block 36.

No diamond drilling is recommended from the north end of the orebody.

2. Exploration to the South:

Fair to very good prospects for additional ore exist toward the south, particularly in the lower levels of the mine.

800 level south, which has been driven along the merged vein and Redding fault, has yielded encouraging assays. It should be extended, with particular attention to the west wall, for at least 300 more feet or until the last west wall quartzite has been passed. The prospects for this work are fair.

All of the levels below 800 have fair to very good prospects toward the south. The Redding fault has not been reached on these levels although 1000 south drift is close to the fault. Further work on 1000 level can well be deferred until 900 and 1200 levels are extended. Within another 100 feet 1200 level should pass into argillite beneath the small stope in Block 52 on 1000; the prospects for more ore on 1200 level are good. The future of 1400 will depend on what is found on 1200 level and further development of 1400 should be deferred until 1200 is extended. 1600 level has just penetrated the quartzite zone and, unless the quartzites show no displacement, additional ore should be encountered within the next 100 feet, that is, within Block 48 or 49.

3. Prospects for Ore at Great Depth:

If, on 1600 level, the corresponding quartzites are found to be opposed, it will indicate that the fulcrum of the vein faulting has been reached and will explain why 1600 level ore has been weaker

than 1400 ore. All that can be done, then, is to develop 1800 level to determine whether the movement is a hinge type or a scissors type. If a scissors type is indicated ore should persist downwards; if a hinge type is indicated, the prospects for the mine are, frankly, poor. If the quartzites show no displacement on 1800 level it is doubtful that the vein structure will be strong enough to make ore.

There is no indication that the orebody will be cut off at depth by any known fault. The Redding fault is far to the south on the lower levels. The quartzite zone should persist downwards, although it will be farther to the south on each level.

If the ore persists downward below 1600 level, it should be reached first in Block 45 on 1800 level at a projected distance of about 400 feet south of the shaft. The first quartzites should be reached in Block 49 on 1800 level.

4. Sunface Work over the Mine:

A limited amount of surface trenching or bulldozing on the Constitution claim south of the junction of the vein and the Redding fault, to determine the course and nature of the fracture might be advisable. This could be followed by a few diamond drill holes from about the 3500 contour, directed eastward and inclined slightly downward to explore the possible ore along the fracture between sections 4000 and 5000.

5. Prospects along the Sherwood Fault:

The diamond drill hole from the Fred tunnel cut some sheared rock that yielded a little metal in the sludge samples. This rock lies in the hangingwall of the Sherwood fault and indicates that further investigations of this fault should be made, preferably from the Sherwood tunnel.

6. Determination of the Iron Content:

A number of samples should be taken over a wide vertical range to determine the iron content of the ore. Apparently iron has not increased with depth--a very favorable characteristic of the ore-body. This observation should be verified by assays. Any notable increase in iron content downward would be unfavorable. Perhaps this information could be obtained from smelter sheets.

7. Reassessment of Ore Reserves:

The foot-percent colors on the contour sheet and the calculated figures for the blocks should be studied and, if necessary, checked to determine whether indicated ore actually exists or if there were errors in sampling or calculations. For example, Block 45 on 600 level shows blue, indicating 40 to 60 feet-percent ore, which should be mineable.

Thomas C. Gillingham

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Document Author: A.E. WEISSENBORN
W. G. AGNEW

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UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
WASHINGTON 25, D. C.
~~XXXXXXXXXXXXXXXXXX~~
So. 157 Howard Street
Spokane 4, Washington

August 25, 1954

Mr. George C. Selfridge, Chairman
Operating Committee, DMEA
Department of the Interior
Washington 25, D. C.

Re: Docket No. DMEA-3333 (lead-zinc)
Spokane-Idaho Mining Company
Old Constitution Mine
Shoshone County, Idaho

Dear Mr. Selfridge:

Enclosed are 4 copies of a cost analysis for Docket No. DMEA-3333 prepared by S. W. Zoldok, Bureau of Mines. This had been promised in our letter of August 10, 1954.

You will note that Mr. Zoldok has not made cost analyses for raising and winzing, inasmuch as your letter of July 6 does not favor this work.

The Field Team, however, feels that Mr. O. M. Bishop's comments on the raising and winzing are pertinent and agrees with him that some testing of vertical continuity can readily be justified as exploration. Should you agree to permit some raising and winzing, the costs of $70.00 per foot for raising and $110.00 per foot for winzing, as suggested by Mr. Erickson in his memorandum of May 29, 1954, would be appropriate.

By Field Team, Region II

W. E. Weissenborn, Executive Officer
U. S. Geological Survey

King C. Agnew, Member
U. S. Bureau of Mines

Enclosure
cc: USBM (4)
Campbell

Campbell

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION

1201 N. Division St.
Spokane 2, Washington
August 23, 1954

MEMORANDUM

To: DMEA Field Team, Region II

From: Stephen W. Zaldok, Mining Engineer, U. S. Bureau of Mines

Subject: Answers to questions and cost analysis concerning Docket No. DMEA 3333 (lead-zinc), Spokane-Idaho Mining Company, Old Constitution Mine, Shoshone County, Idaho

Answers to certain questions raised in Mr. Selfridge's supplementary letter of July 6, 1954 follow:

Number of men employed - 14
Average daily tonnage mined - 70
Ore reserves @ 11% zinc - 22,000
Ore reserves @ 13% zinc - 55,000
Contract rate per foot of drift or crosscut - $12.00
Contractor furnishes no supplies.
Timbering:
N. side of shaft: 100% timbering all levels.
S. side of shaft: 100% timbering to and including 1600' level.
S. side of shaft: 75% timbering on 1800' level.

The above information was obtained from Mr. Dellinger, Manager of Mines.

Cost Analysis

This analysis is meant to supplant that written by Mr. E. G. Erickson under date of May 29, 1954.

Inasmuch as Mr. Selfridge's letter of July 6, 1954 states that no consideration will be given to the proposed raising and winning, no analysis of these two items was made; only drifting costs will be discussed. The final costs were reviewed with the applicant and were acceptable to him.

Applicant's Schedule A, B & C.
Direct labor @ $12/ft (drift 6x7½ in clear).
This rate is applicable since it is the going contract rate at the Constitution mine.

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Supplies:

Bits and steel @ $4.05/ft. or $0.09/cu.ft.

The indicated need would be near $0.04 per cu.ft. or $1.60 per foot of drift.

Explosives @ $4.85/ft. or $0.11/cu.ft.

The indicated need would be near $0.08 per cu.ft. or $1.60 per foot of drift.

Timber @ $3.02/ft. throughout.

Timber should be allowed for as a separate item. It is recommended that $4/ft. be allowed for standard roof bolting and $6/ft. for a standard timber set.

Pipe: 3" and 2" @ $1.29/ft.

The indicated need is: 3" black iron pipe @ $0.89/ft., 2" black iron pipe @ $0.43/ft., and pipe accessories @ 10%, or $1.45/ft.

Track: 16# @ $0.94/ft.

Adding 10% for track accessories would bring this item to $1.03/ft.

Fan line @ $0.95/ft. is O.K.

Miscellaneous @ $0.15/ft. is O.K.

Recapitulation - Direct labor and supplies

Direct labor	$12.00 ft.
Bits and steel	1.80
Explosives	3.60
Pipe and accessories	1.45
Track and accessories	1.03
Fan line	0.95
Miscellaneous	0.15
Total	$20.98 ft.

Indirect and Overhead - See analysis under Schedule H.

Schedule D, E and F - not applicable

Schedule G

Diamond drilling @ $5.16/ft.

Mr. Erickson's estimate of $4/ft. is reasonable.

Schedule H - Indirect and overhead

Only drifting costs are discussed in this memorandum.

Compressed air:

The compressed air cost at $1.12/ft. or $0.025/cu.ft. would not cover operating supplies. This item is believed to have been underestimated by at least 100%. The indicated cost is $2.24 per foot.

Hoisting:

Hoisting @ $2.98/ft. or ($2.98 ÷ $\frac{45}{12}$) = $0.79 per ton

Computed cost of hoisting:

1	hoistman @ $16.27 per day / O.T.	
1	cager @ $15.83	
1	top motorman @ $15.83	
1	bottom " @ $15.83	
1	surfaceman-mechanic @ $16.70	
	Total labor	$80.46

Depreciation on, say, an $18,000.00 hoist installation

Depreciation = ($\frac{1}{60}$ x 18,000) ÷ 26 = $11.54 per day

Assuming a 15' daily advance in a 6x7½ drift =

$\frac{6 \times 7.5}{12}$ x 15 or 56 tons of exploration rock

The mine also produces 70 tons of ore daily.

Computed cost of hoisting is

(80.46 / 11.54) ÷ (56 / 70) = $0.73 per ton

Other miscellaneous costs would bring the total to $0.79 per ton or higher. The applicant's request for $2.98 per foot for hoisting is considered reasonable and should be allowed.

Haulage @ $0.64/ft. or $0.17 per ton.

The indicated cost would approach $0.20 per ton or $0.75 per foot of drift.

Assaying @ $0.18 per foot.

This should properly be a separate item. The indicated need is for 1000 samples @ $1.80 each, or $1800.00.

Drilling machines @ $0.56/ft. or $0.15 per ton.

The indicated cost will be near $0.18 per ton or $0.48 per foot.

Pumping at $0.84 per foot.
This item is difficult to evaluate and the applicant claims his actual costs exceed this figure. Under the circumstances this item might be left at $0.84 per foot.

Ventilation @ $1.08 per foot. The applicant claims that his operating and maintenance costs run $1.08 per foot. This is difficult to see, and this item therefore is cut to $0.50 per foot.

Muking machine @ $0.24 per foot or $0.06 per ton. This item has been underestimated by over 100% and the indicated cost would be nearer $0.48 per foot.

Shop expense @ $1.48 per foot.
This charge is considered reasonable and should be allowed.

Miscellaneous underground expense @ $0.46/ft.
This charge is considered reasonable and should be allowed.

Administrative @ $0.50/ft.
There is a certain amount of cost involved in administering a contract from the Operator's standpoint. This item should properly be incorporated under Engineering and Supervision.

Engineering and Supervision @ $0.93/ft.
This item has been underestimated by at least 100% despite the fact that some of the supervisory personnel will split their time between the Constitution and Douglas mines.
The indicated cost is $1.86 per foot with an additional $0.14 per foot for accounting and office, or $2.00 per foot.

Office expense @ $0.64/ft.
This charge is considered excessive for a unit cost project and is allowed for under Engineering and Supervision.

Warehouse @ $0.08/ft.
This charge is considered reasonable and should be allowed.

General expense @ $0.82/ft.
The applicant's explanation of this item was a little vague and covered expenses already allowed for; it is therefore deleted.

Insurance and taxes @ $1.71/ft.
This item is applicable and should be allowed.

Depreciation @ $2.00/ft.
This item is applicable and should be allowed.

Recapitulation - Indirect and Overhead

Compressed air	$2.24 per foot
Hoisting	2.98
Haulage	0.75
Drilling machines	0.68
Pumping	0.84
Ventilation	0.50
Mucking machine	0.48
Shop expense	1.48
Miscellaneous underground	0.44
Engr. Supervision, accounting	2.00
Warehouse	0.08
Insurance and taxes	1.71
Depreciation	2.08
Total	$16.30 per foot

Total drift costs $37.18 - Say $37.00

Recommended Unit Costs

Item	Units	Unit cost	Total
Drifting (6'x7½' min)	4500 ft.	$37.00	$166,500.00
Roof bolting	3500 ft.	4.00	14,000.00
Standard timber	500 ft.	6.00	3,000.00
Diamond drilling	3000 ft.	4.00	12,000.00
Assaying	1000 samples	1.00	1,000.00
			$197,500.00

Orig. & 3 cys - Wash.
USGS (2)
USBM
Engr

Stephen W. Zelánk

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J.S. VHAY

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Reviewer: A PALUTI

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UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
~~WASHINGTON 25, D.C.~~
Spokane, Washington
August 10, 1954

Mr. George C. Selfridge, Chairman
DMEA Operating Committee
Department of the Interior
Washington 25, D. C.

Re: Docket No. DMEA 3333
Spokane-Idaho Mining Company
Old Constitution Mine
Shoshone County, Idaho

Dear Mr. Selfridge:

This letter will try to answer the many questions raised in your two letters of July 6, 1954. We should point out at the start that we realize that those well acquainted with a district sometimes forget that others at a distance may not be as well acquainted with the details of a district as they are, and so leave out essential information from their memorandums. Mr. Campbell's memorandum thus tries to fill in some of these gaps.

We hope, moreover, that the additional information contained in Campbell's memorandum will relieve you of that "uneasy feeling that (you) are in an insecure and poorly qualified position..." by putting some confidence in the Field Team and its field men; Mr. Campbell has been studying the geology of the general Coeur d"Alene district for six years. The whole Coeur d'Alene project of the Geological Survey has been studying the district for eight years and they do not believe that it is possible to "correlate ore occurrences and controls...and stratigraphic relationships," because the controls of ore shoots are apparently not tied in with the stratigraphy in any usable manner. In general the stratigraphic units are so gross and the over-all characteristics so uniform that detailed relationships between such relatively small geologic units as ore bodies and mappable stratigraphic units have not been proven in any known mining area in the Coeur d'Alene district.

Considerable thought has been given to this mine and to the deposits of the general area by A. B. Campbell and S. W. Hobbs, but it is impossible at present to give you all the information for which you ask. A memorandum on the whole Pine Creek area by S. W. Hobbs and V. C. Fryklund, (dated August 3, and mailed to you on August 10) is

recommended to you for careful reading, as it gives an excellent background for considering exploration projects in the Pine Creek area.

We might point out, in connection with the second paragraph of your first letter of July 6, 1954, that sometimes raising (or sinking) on a favorable-looking zone is necessary before a discovery is made. Moreover, O. M. Bishop of the Bureau of Mines in Washington, makes the statement in his memorandum of June 29, 1954, to W. R. Griswold,"... 200 feet of raising on any ore discovery made...is essentially sound and is recommended."

We trust that most of the questions raised regarding geology are answered in Mr. A. B. Campbell's memorandum, four copies of which are enclosed. The questions regarding costs, number of men employed, daily tonnage mined, etc., will be covered in a subsequent memorandum by Mr. S. W. Zoldok.

We are aware that overhead, in the sense of general administration can not be covered by DMEA contracts. It is believed, however, that by 'overhead' the applicant is referring to such charges as hoisting, etc.

The ore reserves in the mine are difficult to estimate as the company has only 'fringe' ore left, and are about breaking even at the present price of metals. If the prices of metals goes up the company could keep going for several years; a drop in prices would probably close the mine down. At present prices a rough estimate gives the mine about 20,000 tons of ore.

By Field Team, Region II

Wing G. Agnew, Acting Exec. Officer
U. S. Bureau of Mines

John S. Vhay, Acting Member
U. S. Geological Survey

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Document Title: RE: ANSWERS TO QUESTIONS CONCERNING DOCKET NO. DMEA-3333 (LEAD-ZINC), SPOKANE - IDAHO MINING CO CONSTITUTION MINE SHOSHONE COUNTY, IDAHO RAISED BY G.C. SELFRIDGE.

Document Author: A.B. Campbell

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Reviewer: C. PALUT.

STATUTORY PRIVILEGE OF CONFIDENTIAL BUSINESS & PROPRIETARY INFO

Campbell

UNITED STATES
DEPARTMENT OF THE INTERIOR
Defense Minerals Exploration Administration
So. 157 Howard Street
Spokane 4, Washington

August 9, 1954

Memorandum

To: DMEA Field Team, Region II

From: Arthur B. Campbell, Geologist, U. S. Geological Survey

Subject: Answers to questions concerning Docket No. DMEA-3333 (lead-zinc), Spokane-Idaho Mining Company, Constitution mine, Shoshone County, Idaho, raised by G. C. Selfridge, in two letters dated July 6, 1954.

The following comments are made in reply to the questions raised in the subject letters. They are numbered to correspond to the numbered questions in Mr. Selfridge's second letter of July 6.

1. The main tunnel level drift is inaccessible beyond a point approximately 800 feet southeast from the junction with the crosscut. The only geologic data available on the last 600 feet are presented on pages 17-19 of the Gillingham report. As that portion of the mine was inaccessible to Gillingham, the information is quoted from an earlier report by OscarErshey.

2. The only information immediately available is contained in the Gillingham report and in 200 feet to the inch geologic level maps which accompany the report. According to the level map, and as mentioned on page 18 of the Gillingham report, the intersection is apparently barren on the 200 level. The Redding fault was cut by a short southwest-trending crosscut near the end of the 400 level, but the drift was stopped in submarginal ore short of the vein-fault intersection. The southeast end of the 800 level was stopped in submarginal ore occurring in the merged Constitution vein and Redding fault. As stated on page 18 of Gillingham's report, this ore is not broken or sheared. In general, on all levels there is an increase to the south in amount of quartz gangue, an increase in lead content, and an increase in grain size of the sulfide ores.

3. Attached to this memorandum is a vertical longitudinal projection showing the projected trace of the intersection of the Redding fault and the Constitution vein and the trace of the bottom of bed QIII on the east and west walls of the vein. It should be stressed that because of the sub-parallel arrangement of the vein

and the fault a slight change in the strike of either will have a pronounced effect on the position of the intersection. Although the application states that the Reading fault has apparently been cut on the 1400 and 1600 levels, there seems to be little positive evidence that this is true. The applicant has since expressed doubt that the small fault cut on these levels is the Redding. At the time of the application, the 1600 level had not been mapped so that such a correlation was very unsound. As shown on the attached longitudinal section, the fault is believed to lie well ahead of the present faces on both levels.

4. and 6. The 800 level was not driven southeast as suggested by Gillingham. Why a mine operator fails to follow the advice of a geological consultant, whose advice he pays for, is sometimes a mystery--apparently it's one of the idiosyncrasies common to the profession. As stated in my earlier memorandum, "the mine has been grossly underdeveloped and underexplored."

5. Quartzites are present on both walls in blocks 51 and 52 on the 1200 level. The same area on the 1400 level has quartzites on the hanging wall and argillite on the footwall.

7. The 1600 level has only recently been mapped by the company but I have not seen a copy of the map. A telephone conversation with the mine manager revealed that the offset relationship of the quartzites on the 1600 level seems much the same as on the 1400 level.

8. No positive evidence has been found to substantiate either idea.

9. I would like to stress again the point presented in my June 1, 1954, memorandum that the work to the southeast is designed to test <u>two</u> geologic targets: (1) the quartzite zone as projected from levels above; and (2) the Redding fault-Constitution vein intersection. The first of these must be tested on the 1800 level. The second presents a choice of locations for prospecting. The possibility of doing the work from the 1000 level was of course considered as it is obviously the level extending farthest southeast. Two major items ruled this possibility out: (1) the level is very badly caved in several places between the shaft and the southeast face and would require an extensive rehabilitation job before being usable; and (2) drilling has indicated the Redding fault is nearly parallel to the vein on this level so that the intersection would lie well ahead of the present face (see attached longitudinal section). The decision to drive the 1800 level through the projected quartzite zone to the intersection of the vein and the fault was made in the interest of economy, and the contingent stage of drifting on the 1400 level was included as a guarantee that the fault-vein intersection would receive an adequate test in case of difficulties on the 1800 level. Should this arrangement seem unsatisfactory, I would then suggest that only the quartzite target be tested on the 1800 level by 1,000 feet of drifting and the fault-vein target be tested only on the 1400 level by 1,500 feet of drifting as proposed. Diamond drilling of the walls should be included on both levels.

10. According to the mine superintendent, the amount of iron in the vein has remained very constant with depth. Actually the only apparent change has been a decrease of iron in the zinc sulfide with depth.

11. The beds apparently flatten on both walls below the 1600 level, for as stated in my memorandum of June 1, 1934, a drift being driven to the southeast on the 1800 level has not encountered any of the quartzite beds. The Constitution vein "occupies a fault of considerable movement" (Gillingham, p. 10) and the beds adjacent to it are contorted so that a correct determination of flattening would be impossible to obtain.

12. The stope has not been worked out. It cannot be said with certainty that this mineralization is on a split from the main vein. Since the location of the main vein on this level is unknown (see question 13) it seems wise to drift along a shear which is known to be mineralized and to diamond drill the walls. If the drilling picks up the "main" vein and then proves to be mineralized, it might be wise to turn the drift toward it.

13. The location of the main Constitution vein is unknown on the 2000 level. It does not, however, appear that the present drift is on the main structure and diamond drilling will be necessary to obtain additional evidence of the vein location.

14. According to Gillingham, who saw surface cuts no longer accessible, the vein could be traced on the surface for about 1,000 feet north of the Redding fault. Few surface indications were found from there northward to the adit shown in block 1500; however, he states that the adit cuts the vein but found it was "not orebearing." According to the applicant, diamond drilling to the northeast from the face of this adit encountered scattered stringers of galena and sphalerite within a short distance. No favorable intersections are known to exist between the present face of the 1000-foot level and the Pine Creek fault.

15. As is usual in such cases it is difficult to evaluate an exact "degree of reliance" of a projection. Such reliance varies among individuals and certainly among locations. I can only present the data on which I based my interpretation of a projection and which I feel is a reasonable one. The Pine Creek fault has been cut in the following locations: (1) surface; (2) main tunnel level; (3) in small adit in block 1500 northwest of main mine; (4) in a diamond drill hole southwest from the north end of the 400 level; (5) in diamond drill hole southwest from near south end of the 800 level; and (6) in diamond drill hole southwest from shaft station on 1000 level. The exact location of the fault has little bearing upon the desirability of the exploration on the 1000 level as it is a post-mineral fault and there is certainly a substantial block of ground between the shaft and the projected vein-fault intersection.

16. For the reasons presented in my June 1, 1954, memorandum I believe the statement is correct. The work on the 1800 level has indicated a pronounced flattening of the dip of the transition zone quartzites between the 1600 level and the 1800 level. As it is reasonable to expect an approximate parallelism between these transition zone beds and the adjacent overlying Prichard-Burke contact, it follows that the contact is also flattening between the 1600 level and the 1800 level.

Enclosure

Distribution:
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Document Title: DOCKET NO. DMEA-3333 (lead-zinc) SPOKANE-Idaho MINING CO. OLD CONSTITUTION MINE, Shoshone County, Idaho

Document Author: AE. Weissenborn
W. G. AGNEW

Original Document Attached: Y (N)

If not attached, Original Document Current Location
(must be segregated from other documents)

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Reviewer: C. PAUTI

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UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
~~WASHINGTON 25, D.C.~~
So. 157 Howard Street
Spokane 4, Washington

June 10, 1954

Mr. George C. Selfridge, Chairman
Operating Committee, DMEA
Department of the Interior
Washington 25, D. C.

Re: Docket No. DMEA-3333 (lead-zinc)
Spokane-Idaho Mining Company
Old Constitution Mine
Shoshone County, Idaho

Dear Mr. Selfridge:

Enclosed are four copies of reports on the cited application by A. B. Campbell, Geological Survey, and E. G. Erickson, Bureau of Mines. Copies of geologic maps to accompany Campbell's report are included.

With reference to your letter of May 12, 1954, we recommend that the proposed project at the Constitution mine be treated separately from the applicant's project at the Douglas mine.

These two mines are about one mile apart on the surface and are not connected by any underground workings. They are serviced by separate surface plants. The Constitution mine is owned or controlled outright by the Spokane-Idaho Mining Company, whereas the Douglas mine is operated under a lease agreement. As the two mines are on different properties, exploring different veins and having different exploration objectives, it is believed each project would function more advantageously if operated under a separate contract.

The proposed exploration work is shown on the longitudinal section map of the Constitution mine and on the composite map, both of which accompany Campbell's report. It will be noted that work shown on the longitudinal section has been revised somewhat from that shown on the section submitted with the application.

We have discussed with the applicant the land suggested to be included in the contract. This land includes the patented and unpatented claims listed in the application, and which are shown on the composite claim map submitted with the application. The claim map shows two claims, the Alpha and the Beta to be separated from the rest of the claims by an unclaimed block of ground. The map also shows a block of ground in sections 1 and 2, lying north of claims

Trainer, May, June, July, August, September, and October, which is included in the proposed ground but which is not described in the application. To avoid complications that might arise from including ground in the contract whose legal description is not clear or which will not be benefited by the proposed work, the Field Team and the applicant have agreed that the following ground should be deleted from that listed in the application or shown on the applicant's claim map.

1. Alpha and Beta claims.

2. That unstaked block of ground in sections 1 and 2, north of claims Trainer through October and east of the Dupont Fraction and Wade claim.

The block of ground that we believe should be included in the contract is shown on the one copy of the claim map attached to this letter, the proposed areas to be deleted being outlined in red. As all exploration will be on or near the Constitution vein, we believe the remaining block of claims will be more than adequate for contract purposes.

From the above-described block of claims to be included in the contract, we recommend the following be excluded from royalty repayment:

1. All mine dumps, tailing ponds, or other stockpiled accumulations of mine products.

2. That area of the Constitution vein containing working stopes or known ore reserves, which is specifically delineated on the vertical longitudinal section map, copies of which are enclosed, and which is described as follows:

(a) That area of the Constitution vein enclosed on the north by an inclined plane passing through the north face of the 800 level and the north face of the 1400 level, and which extends from the surface to its intersection with the shaft at a point 1,500 feet below the main haulage level, said plane dipping 50 degrees to the south; thence by a vertical plane in the north wall of the shaft from the point of its intersection with aforementioned inclined plane to the sill of the 1800 level; thence by a plane along the sill of the 1800 level to the south for a distance of 1,150 feet, to that point marked on attached vertical longitudinal section as representing the face of the 1800 level south drift on May 18, 1954; thence by a vertical plane to the surface.

It will be noted that the above-outlined block does not exempt from royalty payment one stope on the 1700 level south and one stope on the 2000 level. The 1800 drift south was being advanced at the time our examiners visited the mine and they marked the face as of May 18. As this drift face may be at any point to the south by the time the contract becomes effective, it is believed that a southern boundary limit would be more effective through a known point than by passing it through a section line as proposed by the applicant. The Field Team would not, however, object if the southern boundary were placed through section line 55, as shown on the vertical longitudinal section, and as proposed by the applicant.

The stope on the 2000 level is believed to be on a vein in the hanging wall of the Constitution vein. As the vein location between the 1800 and 2000 levels is indefinite, and as diamond drilling and drifting on the 2000 level may explore either the Constitution vein or parallel structures it is believed that ground between the 1800 and 2000 levels stands to benefit from proposed exploration and should therefore be subject to royalty repayment.

The Field Team concurs with the examiners and recommends that a unit-cost contract be granted the applicant to explore the Constitution mine, the contract to incorporate the proposed unit costs in Erickson's memorandum.

By Field Team, Region II

A. E. Weissenborn, Executive Officer
U. S. Geological Survey

Wing G. Agnew, Member
U. S. Bureau of Mines

Enclosures 3
cc: USBM (2)
Campbell

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Document Author: A.B. Campbell

Original Document Attached: Y (N)

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(must be segregated from other documents)

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Reviewer:

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XXXXXXXXXXXXXXXX
So. 157 Howard Street
Spokane 4, Washington

June 1, 1954

Memorandum

To: DMEA Field Team, Region II

From: Arthur B. Campbell, Geologist, U. S. Geological Survey

Subject: Recommendations concerning an application for DMEA exploration assistance by the Spokane-Idaho Mining Company, Box 930, Kellogg, Idaho, for work at the Constitution Mine, Shoshone County, Idaho

The subject company has made application for an exploration program at the Constitution mine, Shoshone County, Idaho. The following report is based on two trips to the property, several conferences with the applicant, and a study of geologic maps and sections of the property made available by the applicant.

Summary of Recommendations

The geologic objectives of the applicant's proposed exploration are sound but can be tested by a less extensive program. I recommend that favorable consideration be given to a DMEA exploration contract for the following work (also shown on the accompanying section and plan):

Stage I

1. Drift 2,000 feet southeast on the 1800 level plus raising 200 feet on any promising oreshoot. A total of 1,200 feet of diamond drilling into the walls of the 1800 level.

2. Drift 1,500 feet (or until the Pine Creek fault is intersected) northwest on the 1000 level plus 200 feet of raise on any promising oreshoot and a total of 800 feet of diamond drilling into the walls.

3. Drift 1000 feet (or until the Pine Creek fault is intersected) northwest on the 2000 level plus a 200-foot raise and a 200-foot winze on any promising oreshoot and a total of 1,200 feet of diamond drilling into the walls.

Stage II (contingent upon results of item 1, Stage I)

1. Drift 1,500 feet southeast on the 1400 level plus 800 feet of diamond drilling into the walls to test for parallel structures.

Description of the Property

The Constitution mine is located in secs. 2, 3, 10, 11, 12, 13, and 14, T. 14 N., R. 2 E., in the Yreka mining district, Shoshone County, Idaho. It is 7 miles south of Kellogg, Idaho, and is reached by U. S. Highway 10 and a graded county road along Pine Creek--a total of 17 miles from Kellogg. The property consists of 21 patented claims and 29 unpatented claims.

The application adequately covers such matters as manpower, materials, and supplies, etc. The maps accompanying the application show the extent of the underground workings.

The mine appears to be well equipped and the company adequately staffed to enter into an exploration program of this size. Exploration at this property would be supervised by the same personnel who are directing the work under Docket No. DMEA-2862 (Douglas mine).

Geologic Setting

Description of the geology of the mine area is included in reports by Jones 1/ and Forrester and Nelson 2/; a surface geologic map of the Pine Creek area by Nelson and Smith 3/ is available.

Enclosed with this memorandum is a copy of a report on this property prepared in 1951 by Thomas E. Gillingham. Mr. Gillingham is well known as a capable geologist whose experience has included duty with the U. S. Geological Survey and with Bunker Hill and Sullivan Mining Company, Kellogg, Idaho. He is currently employed as a staff geologist by the Atomic Energy Commission in the New York Operations office. Although I do not agree with some of the details of his report, I include it as a comprehensive review of the geology at the mine. Mr. Gillingham spent considerable time at this property and was very familiar with the operation. Additional comments by me concerning the geologic setting of the Constitution vein would be repetitious, so the part of this memorandum which follows is intended to supplement the Gillingham report. Unfortunately, the maps which should accompany his

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1/ Jones, Edward L., A reconnaissance of the Pine Creek district, Idaho: U. S. Geol. Survey Bull. 710A, pp. 1-36, 1920.

2/ Forrester, J. D. and Nelson, V. E., Lead and zinc deposits of the Pine Creek area, Coeur d'Alene mining region, Shoshone County, Idaho: U. S. Geol. Survey Strategic Minerals Investigations mimeographed report, 1944.

3/ Nelson, V. E. and Smith, J. F., Jr., Surface geology of the Pine Creek area, Shoshone County, Idaho: U. S. Geol. Survey Strategic Minerals Investigations preliminary map, 1944.

report are not available for distribution but have been available to me during the preparation of this memorandum.

Some comments concerning the lower levels of the mine opened since Gillingham's report are in order. The longitudinal section which has been submitted with the application, and geologic maps of selected levels included with this report will be found useful in the consideration of this application.

From the 1000 level down, it has appeared that the productive strike length of the vein was diminishing, although the grade of ore has not changed significantly. The first significant structural change with depth was that the massive quartzite beds which had been dipping parallel to the rake of the ore in the stoped areas have apparently flattened suddenly and markedly between the 1600 and 1800 levels. A drift being driven to the southwest on the 1800 level has not as yet found these quartzite beds which are believed to be one of the oreshoot controls above, although the face of this drift is east of where the quartzite beds should have projected. The work done since Gillingham's report has not yet substantiated his prediction that "the corresponding quartzites on the two walls should become opposed a short distance below 1800 level." Another point of importance is that a small oreshoot has been found on the 2000 level at a point considerably north of the main ore body and apparently in the footwall of the Constitution vein.

Recommendations

It should be emphasized that the mine has been grossly underdeveloped and underexplored. Past mine management was apparently interested in nothing except production, an attitude which has resulted in the present condition of the property.

The exploration program proposed by the applicant appears excessive when the exploration targets are considered. In addition, certain phases of the program represent development work. I do feel that an exploration program is justified at the mine and that a program modified from that requested by the applicant is worthy of favorable consideration for a DMEA contract. The modified program presented below has been discussed with the applicant and meets with his approval.

The applicant proposes to drift southeast 2,000 feet on the 2000 level and 1,600 feet on the 1400 level. The 2000 level drift would be driven to test the downward projection of the quartzite zone which has been productive above. As mentioned before, this zone has apparently flattened between the 1600 and 1800 levels, and it should be noted that such flattening of bedding has localized the ore in some other Pine Creek veins. The drift southward on the 1400 level would be run to test the intersection of the Redding fault with the vein and to see if the vein would again make ore in the more brittle quartzitic Burke formation in the footwall of the Redding fault. Ore was found in this same structural

environment on the main tunnel level south but none of the levels below have been driven far enough south to test the downward extension of this fault intersection. The fault is pre-mineral, according to Gillingham.

I believe that these two geologic objectives justify a moderate amount of exploration; however, both of these objectives can be tested adequately on one level. The 1800 level could be driven on the vein to the southeast to intersect the quartzite zone (target 1) and then driven farther to test the Redding fault and Prichard-Burke formation contact (target 2). Currently the face of the 1800 drift is about 30 feet southeast of the 5200 section line shown on the longitudinal projection and composite plan submitted with the application. About 900 feet of drifting will be needed to reach the projection of the Redding fault and from 300 to 600 feet of drifting on the fault to reach the Prichard-Burke contact. The latter figure is indefinite because the dip of the contact is apparently flattening significantly above the 1800 level. Thus, I believe that a total of 2000 feet of drifting southeast on the 1800 would be adequate to test both targets.

The amount of raising and winzing requested for this work to the south is unrealistic for an exploration program. No raising or sinking would be warranted on any ore in the quartzite zone, as it is known to be a productive horizon above, and I feel that any work in addition to a drift should be considered as development. An ore discovery on the Redding fault or in the walls of the fault, however, would be a new discovery and would require a limited amount of raising. I believe that a 200-foot raise on the ore-bearing structure would be sufficient.

The walls of the new drifting on the 1800 level should be diamond drilled to test for parallel structures. The persistence of the mineralized structure on strike at this mine and at the adjoining Douglas mine indicates that closely spaced drilling is not necessary. Two 200-foot holes to the northeast and two 200-foot holes to the southwest should be sufficient. The location and direction of these holes should be decided as the work progresses. In addition to this drilling, I would recommend a 200-foot diamond drill hole northeast out of the shaft station on the 1800 level and a 200-foot drill hole southwest at some location in the current 1800 level drift to test for possible parallel structures, such as that found on the 2000.

The exploration work proposed to the northwest is also primarily designed to test two targets: (1) the drift on the 1000 level will explore the continuation of the Constitution vein into virgin ground; and, (2) the 2000-level drift will explore a parallel mineralized structure which has produced ore from a small stope on that level.

The narrowing of the vein toward the northwest is very striking in this mine. The longitudinal section shows this fact very well. At no place in the mine has any attempt been made to drift on the vein to the northwest beyond the ore so there is no geologic knowledge of this

structure out of the stoped area. Exploration to the north on the 1000 level will indeed be a "shot in the dark" but one that is warranted and would have been made before now in a mine where proper emphasis had been placed on exploration and development. This 1000 drift should be run on the vein for 1500 feet or until the Pine Creek fault is intersected, in which case the drift should be stopped. Allowance should be made for 800 feet of diamond drilling into the walls of this drift. It should be pointed out that there is submarginal ore in the present northwest face of the 1000 level; the grade appears to be quite high but it is too narrow to mine.

The discovery of a significant oreshoot in the 1000 drift northwest would warrant a 200-foot raise on the structure. This would be justifiable exploration in a virgin block of ground where the vertical continuity of ore could not be predicted.

The structure found on the 2000 level in the footwall of the main Constitution vein is probably a split from the main vein and deserves some exploration. An additional 1000 feet of drifting to the northwest on this level will adequately explore the block of ground between the shaft and the projection of the Pine Creek fault. If this fault is intersected the drift should be stopped.

The applicant's request for 2,000 feet of drifting to the northwest on the 2000 level cannot be considered in view of the presence of the Pine Creek fault. Here again I feel that a significant showing of ore in the drift would require some raising and/or sinking to complete the exploration. In this case I would recommend a 200-foot raise and a 200-foot winze on any promising oreshoot.

Allowance should be made for 1000 feet of diamond drilling from this level. Tentatively this would involve a 200-foot hole northeast from the 2000 level shaft station, two 200-foot holes northeast from the drift, and two 200-foot holes southwest from the drift, as shown on the enclosed maps.

A second stage should be considered as contingent upon the results of the southeast drifting on the 1800 level. As mentioned above, one of the targets of this drift is the exploration of the vein in the Burke formation. The projections of the Constitution vein, the Redding fault, and the Prichard-Burke contact (all shown on the accompanying composite plan) used in laying out the work on the 1800 level are subject to some question, therefore, it is possible, though not probable, that the proposed 1800-level drift will not intersect the Burke formation. The amount of flattening of the contact below the 1600 level is unknown so that a more exact projection is not possible until more information is gained. In order to assure a fair test of the Burke formation objective, I recommend that allowance be made for 1500 feet of drifting to the southwest on the 1400 level plus 800 feet of diamond drilling into the walls.

This drifting and diamond drilling should be done only if the Burke formation could not be explored in the footwall of the Redding fault on the 1800 level. This stage should not begin until the completion of the drifting on the 1800 level and then only with the approval of the Field Team.

The location, direction, and extent of all diamond drilling, winze sinking, and raising should be decided as the work progresses and by mutual consent of the operator and the Field Team.

Diamond drilling for intersections below the 2000 level has been considered but I would suggest that exploration possibilities on present levels be exhausted first. Such drilling would involve extensive preliminary crosscutting to establish a drill station and this does not appear to be warranted at this time.

Enclosures (6)

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Document Author: E.C. ERICKSON

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UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
WASHINGTON 25, D. C.

1201 N. Division St.
Spokane 2, Washington
May 29, 1954

MEMORANDUM

To: DMEA Field Team, Region II

From: E. C. Erickson, Mining Engineer, Bureau of Mines

Subject: Analysis of costs, Docket No. DMEA 3333 (lead-zinc), Spokane-Idaho Mining Company, Old Constitution Mine, Shoshone County, Idaho

The applicant has proposed to explore the Constitution mine on the 1000, 1400 and 2000 levels. His project includes 7100 feet of drifting, 960 feet of winzes, 800 feet of raises, 13,000 cubic feet of station and pocket excavation, and 4,000 feet of diamond drilling, which he estimated would cost $555,716.60.

Mr. A. Campbell, geologist, U. S. Geological Survey, presented a program which is designed to explore the vein south on only one level (1800) and which reduced the drifting to the north because it is indicated that the Marr fault will cut off the vein sooner than anticipated by the applicant. The total drifting was reduced from 7100 feet to 4500 feet.

Field Team representatives discussed the revised drifting program with the applicant on May 26, 1954, and he accepted Mr. Campbell's suggestions. It was further decided that raising be reduced to an estimated three 200-foot raises and that only one 200-foot winze be included in the recommended project. The winze is problematical but it was decided to include a winze on the northwest 2,000 level as it may be justified if certain conditions arise.

The revised project is recommended for a contract and includes the work items, recommended number of units, and unit costs tabulated below:

Item	Recommended units	Operator's estimated unit cost	Recommended unit cost	Recommended total cost
Drifting (6'x7½' min.)	4,500 ft.	$ 43.51/ft.	$ 42/ft. 1/	$189,000
Winze - 1 (8'x6' min.)	200 ft.	129.01/ft. 2/	110/ft. 3/	22,000
Raises - 3 (20'x5' est.)	600 ft.	$90.18-$97.68/ft.	70/ft.	42,000
Diamond drilling	3,000 ft.	5.16/ft.	4/ft.	12,000
Total				$265,000

1/ Includes necessary ground support.

2/ Does not include cost of hoist room, station, rope raise, pocket, and necessary installations.

3/ Does include items outlined in subscript 2/ above.

Note: Unit costs include all costs to complete work items to the satisfaction of the Government. Regarding diamond drilling, all cores must be boxed and preserved until a final disposition is agreed upon by the Government.

DISCUSSION OF COSTS

The applicant has a DMEA contract at the Douglas mine, Docket No. DMEA 2862 (lead-zinc), Contract Idm-2482, which specifies a unit price of $38.75 for drifting, including timber when necessary. The original contract, No. Idm-2372, Docket No. DMEA 2383, specified a maximum price of $55.50 per foot for timbered drift. When the writer was assigned the contract and made an inspection of the drift site, he informed the Operator that it would not be possible, under the existing conditions, to justify an amount anywhere near the maximum allowable cost. After further discussions the Operator was willing to agree to a unit cost of $38.75 per foot of drifting, including necessary timbering.

However, on the proposed project at the Constitution mine, a unit cost of $42/ft., including necessary ground support, is justified because of the badly sheared vein and costlier operating conditions, such as longer trams, larger equipment and plant with a curtailed operation, higher maintenance costs, ventilation, etc. It is believed that the above items will more than offset the additional $3.25/ft. recommended for this project.

Winze Costs

The applicant's estimate of $129.01 per foot of winze, which did not include hoist room, station, rope raise, pocket, and installations, was reduced to $110/ft. which does include cost of these items. The applicant estimated the additional cost of these items to be $25,660.00 for two winzes (960 ft.) which would be equivalent of about $27/ft. of winze. If the cost of these items was reduced to as low a cost as $4,000 for each winze of 200 ft. depth, the cost would then amount to $20/ft. The applicant's estimate, including stations and pockets, was about 42% greater than the recommended unit cost. This recommended cost was agreed to by the applicant. It is considered ample and just for performing the winze sinking.

Raising

The applicant's estimated minimum raising cost of $90.18/ft. for a 200 ft. raise was reduced to $70/ft., a reduction of $20.18/ft. His estimate was about 29% above the unit cost of $70 that he agreed to after a discussion of costs. The applicant stated that the costs he submitted were experienced when the last raising was performed at the mine.

The writer agrees with the applicant that the ground conditions are not the best for raising, but they are not so bad that a near $90/ft. cost is indicated. It was brought out that the greatest reason for the high cost was inexperienced miners.

The recommended $70/ft. is in line with other raising costs in the district under like conditions.

Diamond Drilling

The applicant's estimated cost submitted for diamond drilling of $5.10/ft. was reduced to $4/ft. The agreed unit cost of $4/ft. is about the average price for diamond drilling in the district when it is contracted.

The applicant does not have the drilling equipment nor a driller at the mine at present. Experience has been at other properties that unless a sustained drilling program is contemplated, it has not been profitable for the operator to purchase drilling equipment and perform the drilling.

A cut-off for "fixed costs" and depreciation allowance, as recommended in my recent memorandum regarding costs in the Sidney Mining Company's latest application, is not believed necessary. The curtailed program has reduced the applicant's chances of a sustained three heading operation which he states in his application was the basis for his prorating of indirect costs.

When the rate of advance used for prorating costs is reasonable and the unit prices are pared so that fixed costs and depreciation are considered low, it is not necessary to make a cut-off to guard against possible pyramiding of these costs to the Operator's advantage.

Orig. & 3 cys - Wash.
USBM (2)
DMRA
HHE/he /fw /iml

H. G. Erickson

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U.S. v. ASARCO

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Document Title: LETTER RE: POINTS

Document Author: JACK WILSON

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Reviewer:

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PROPRIETARY INFO

NESS OFFICE: PEYTON BUILDING
SPOKANE 8, WASHINGTON

MINE: BOX 930
KELLOGG, IDAHO

SPOKANE-IDAHO MINING CO.

P. O. Box 930
KELLOGG, IDAHO

May 22, 1954

Mr. A. B. Campbell
U. S. Geological Survey
S. 157 Howard Street
Spokane 4, Washington

Dear Art:

I made arrangements with Veral Hammerand to have the 1800 sheet ready as soon as they possibly can. They have to post Nugent's work and make an intermediate print and color up one final print, so I imagine it will be next Tuesday or Wednesday before I get them.

That will bring 1800 up to date to within 200 feet of the present face. I expect to survey and map this portion next week, if everything goes according to schedule. So I will try to have it for you by the 1st of the month.

So, unless I hear differently from you, I'll hold the prints until I can get them up to date.

Very truly yours,

Jack

Jack Wilson
Chief Engineer

JW:er

SCAN COVER SHEET ONLY

U.S. v. ASARCO

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Document Date: 4/29/54

Document Title: APPLICATION FOR DMEA CONTRACT (lead, zinc) Spokane-Idaho Mining Co. OLD CONSTITUTION MINE Shoshone County, Idaho

Document Author: T.H. Kiilsgaard

Original Document Attached: Y (N)

If not attached, Original Document Current Location
(must be segregated from other documents)

Type of Privilege:

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Reviewer: C. PALUT

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Compiled

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
~~WASHINGTON 25, D.C.~~
So. 157 Howard Street
Spokane 4, Washington

April 29, 1954

Mr. George C. Selfridge, Chairman
Operating Committee, DMEA
Department of the Interior
Washington 25, D. C.

Re: Application for DMEA Contract (Lead-Zinc)
Spokane-Idaho Mining Company
Old Constitution Mine
Shoshone County, Idaho

Dear Mr. Selfridge:

Enclosed are the original and 2 copies of an application submitted by the Spokane-Idaho Mining Company. One copy of the application has been retained for the files of this office. The applicant has proposed an extensive exploration program to further explore the Old Constitution mine. The program appears to have geologic merit and to have reasonable possibilities of success.

Our field men are currently preparing a report on the geology of the proposed operation, as well as an analysis of the exploration costs. This will be forwarded to your office as soon as possible. In the meantime we would appreciate any comments the Operating Committee might care to make as to those particular points they believe should be stressed in our report.

Sincerely yours,

Thor H. Kiilsgaard
Acting Member, DMEA
Field Team, Region II

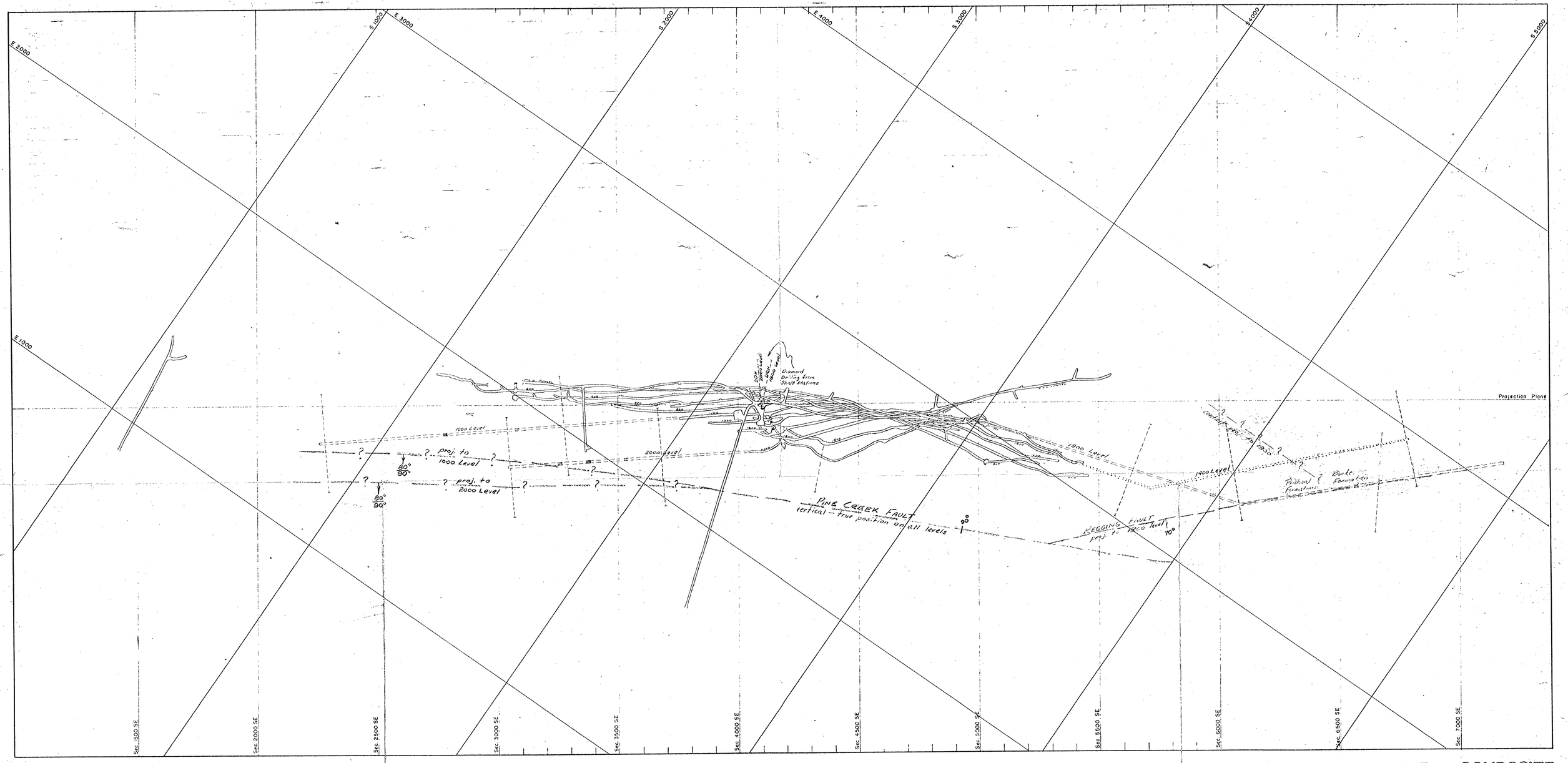
Enclosure
cc: USBM (2)
Geologist

Docket No. DMEA-3333 (lead-zinc)

CONSTITUTION MINE - VERT. LONG. PROJ.

Looking N 55 E 1" = 200'

Docket No. DMEA-3333 (lead-zinc)



CONSTITUTION MINE - COMPOSITE

1" = 200'