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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

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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 A. 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 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 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 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 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 Fine 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 Fine 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 preceded 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:

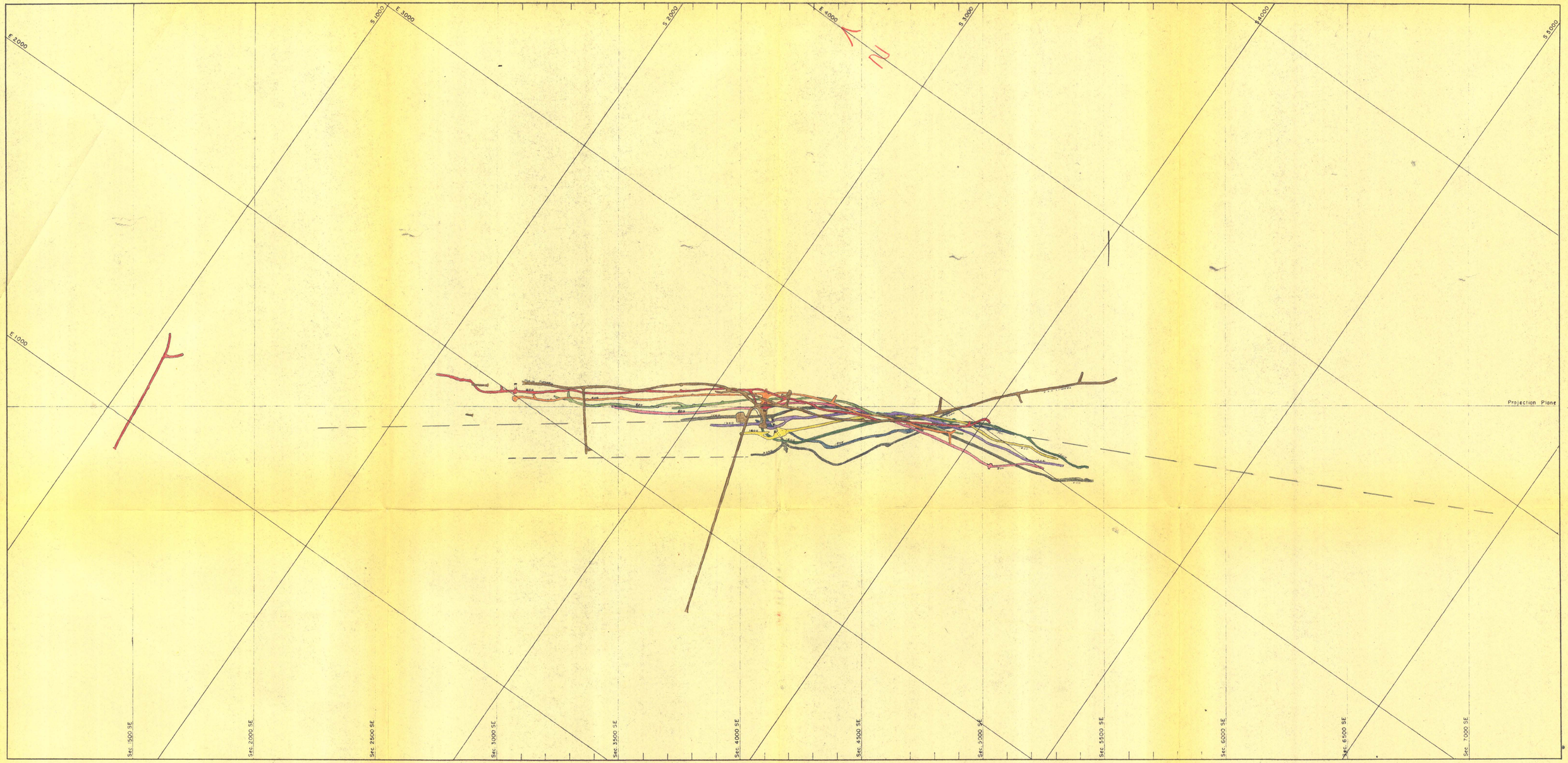
A number of samples should be taken over a wide vertical range to determine the iron content of the ore. Apparently iron has not increased with depth--a very favorable characteristic of the ore-body. This observation should be verified by assays. Any notable increase in iron content downward would be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

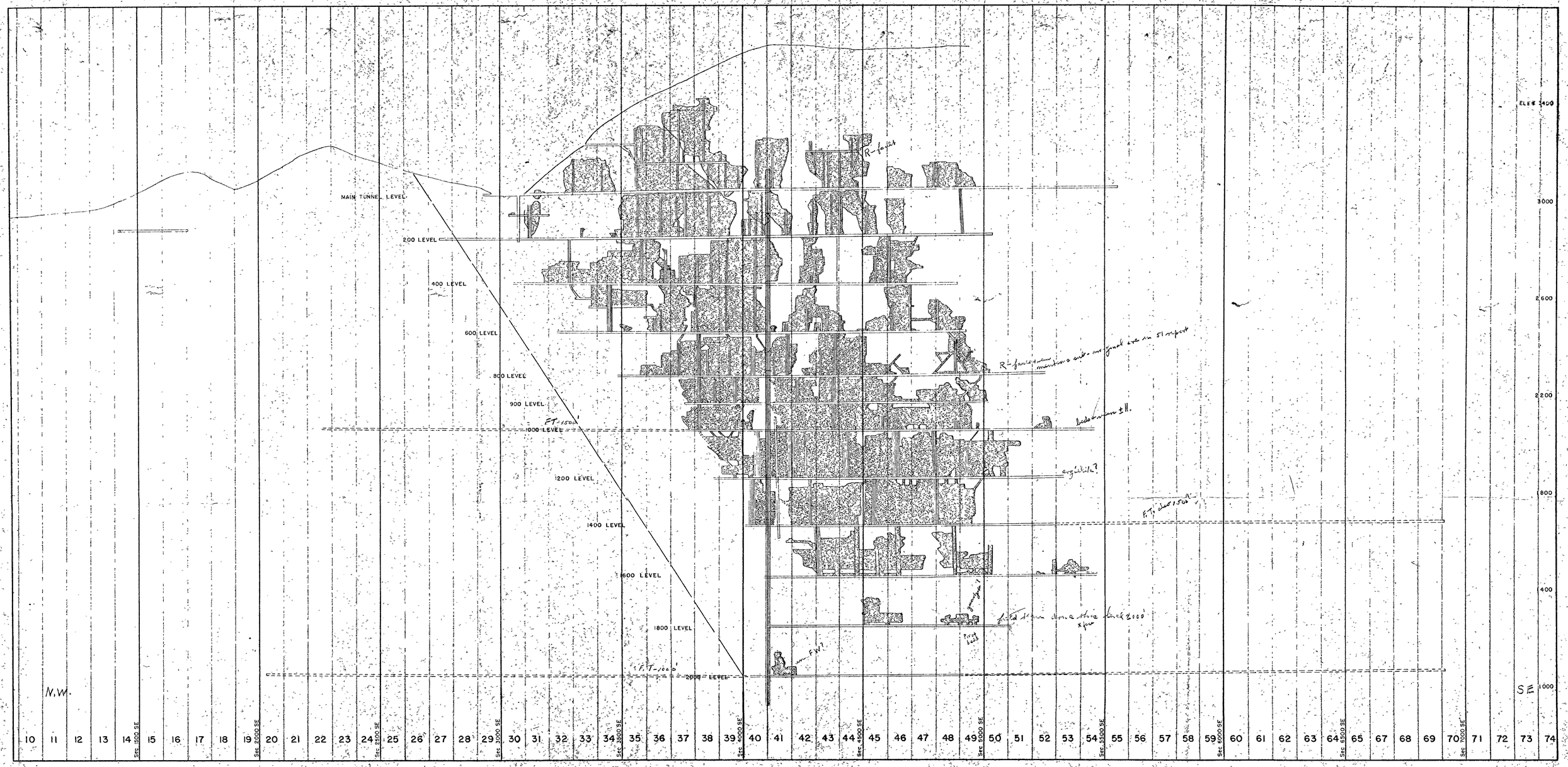
Thomas E. Gillingham

All of these
to Dave



CONSTITUTION MINE - COMPOSITE

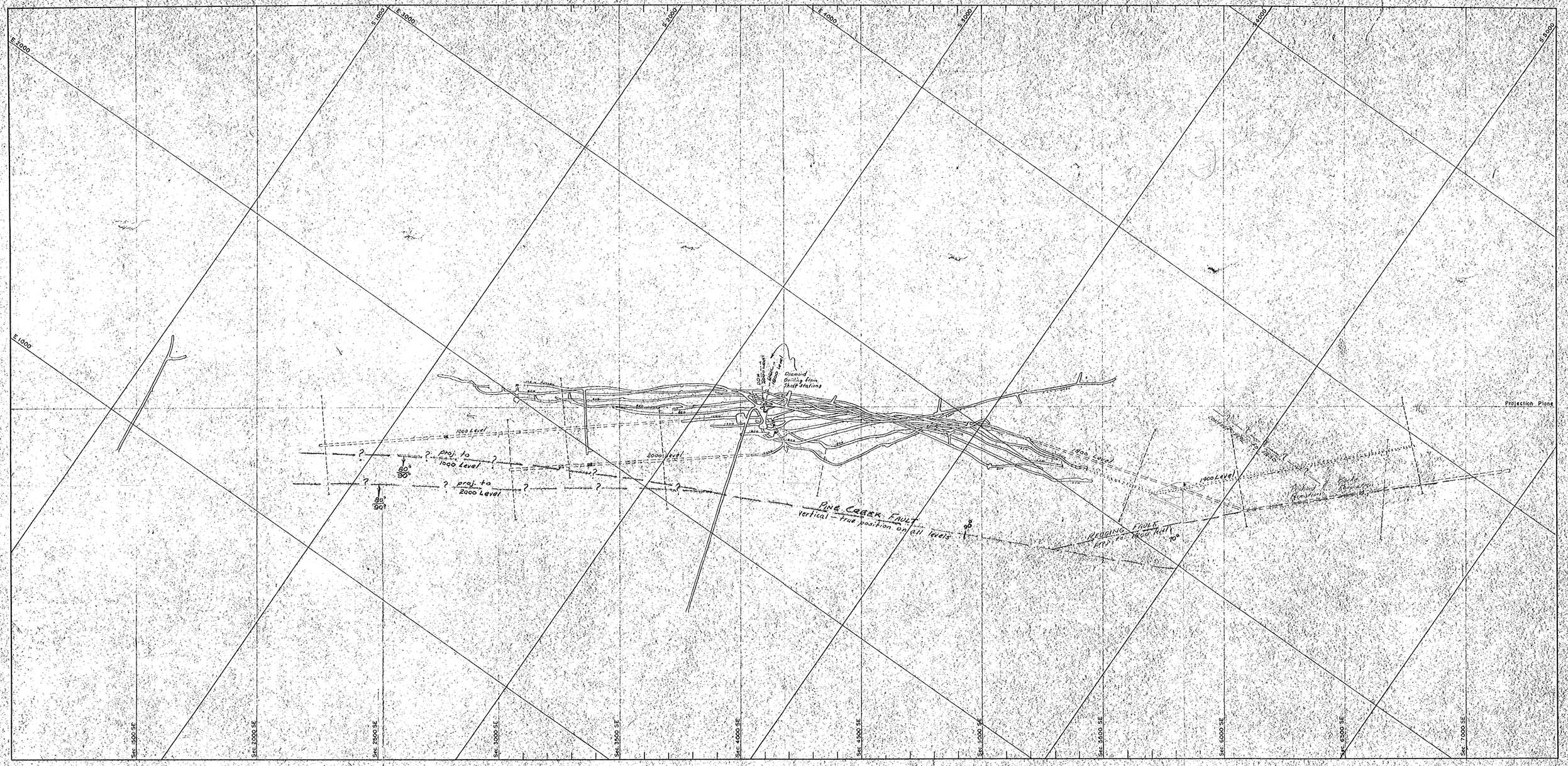
1" = 200'



CONSTITUTION MINE - VERT. LONG. PROJ.

Looking N 55 E 1" = 200'

Docket No. DMEA-3333 (lead-zinc)



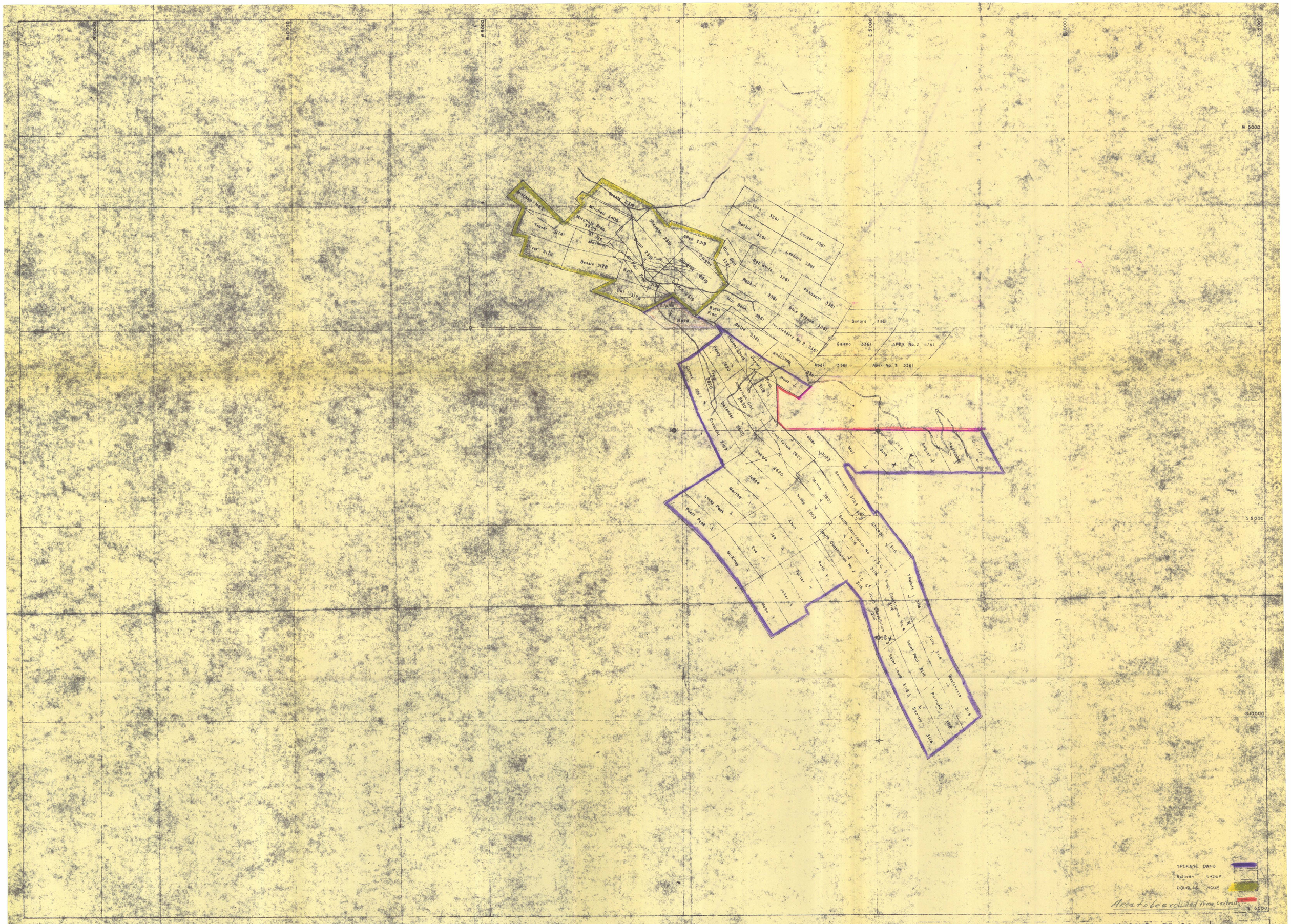
CONSTITUTION MINE - COMPOSITE

1" = 200'

Docket No. DMEA-3333 (lead-zinc)

CONSTITUTION MINE - VERT. LONG. PROJ.

Looking N 55 E 1" = 200'

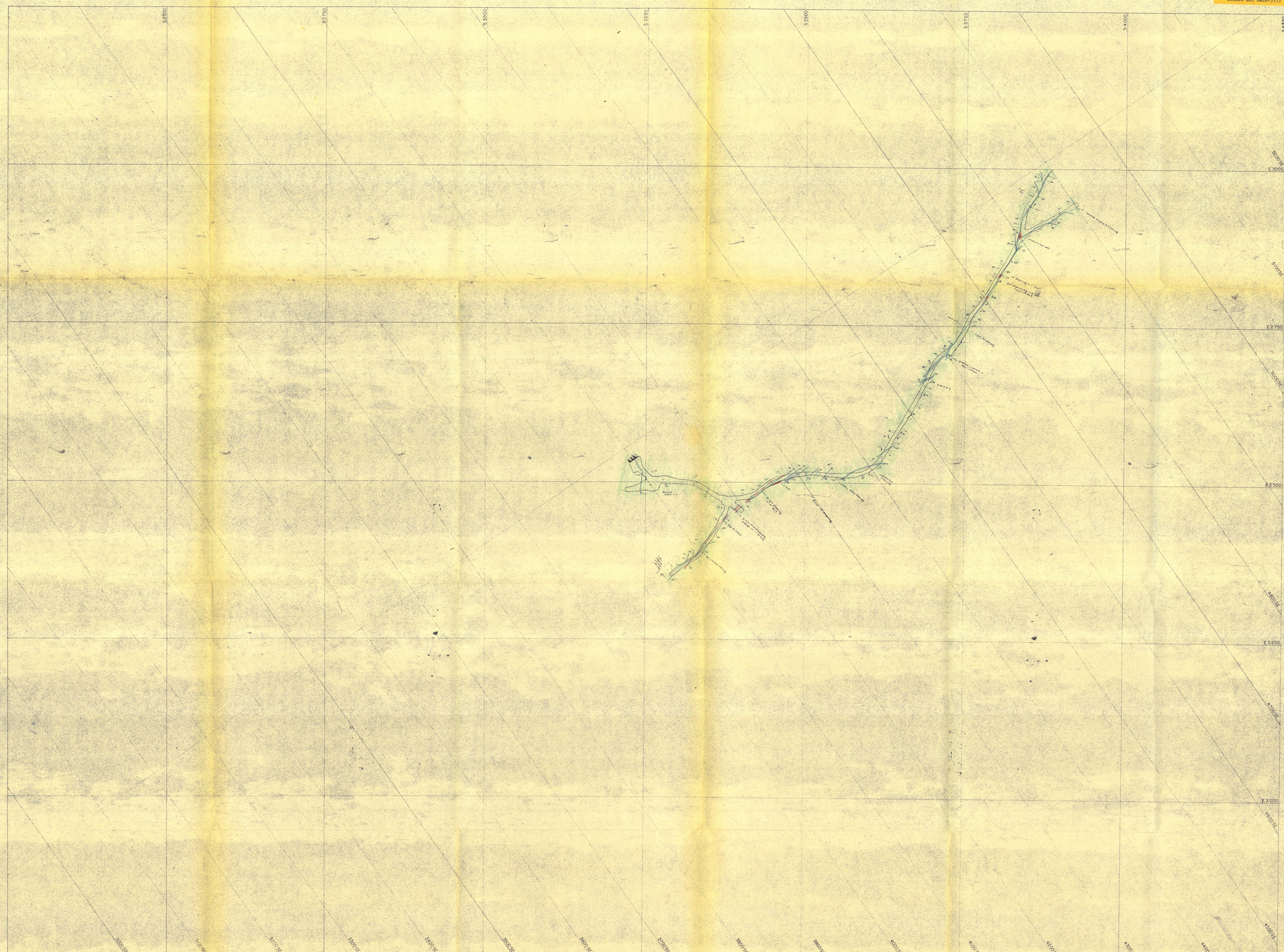


SPOKANE IDAHO – DOUGLAS KELLOGG IDAHO REVISIONS

Composite - Claims and Mine Workings

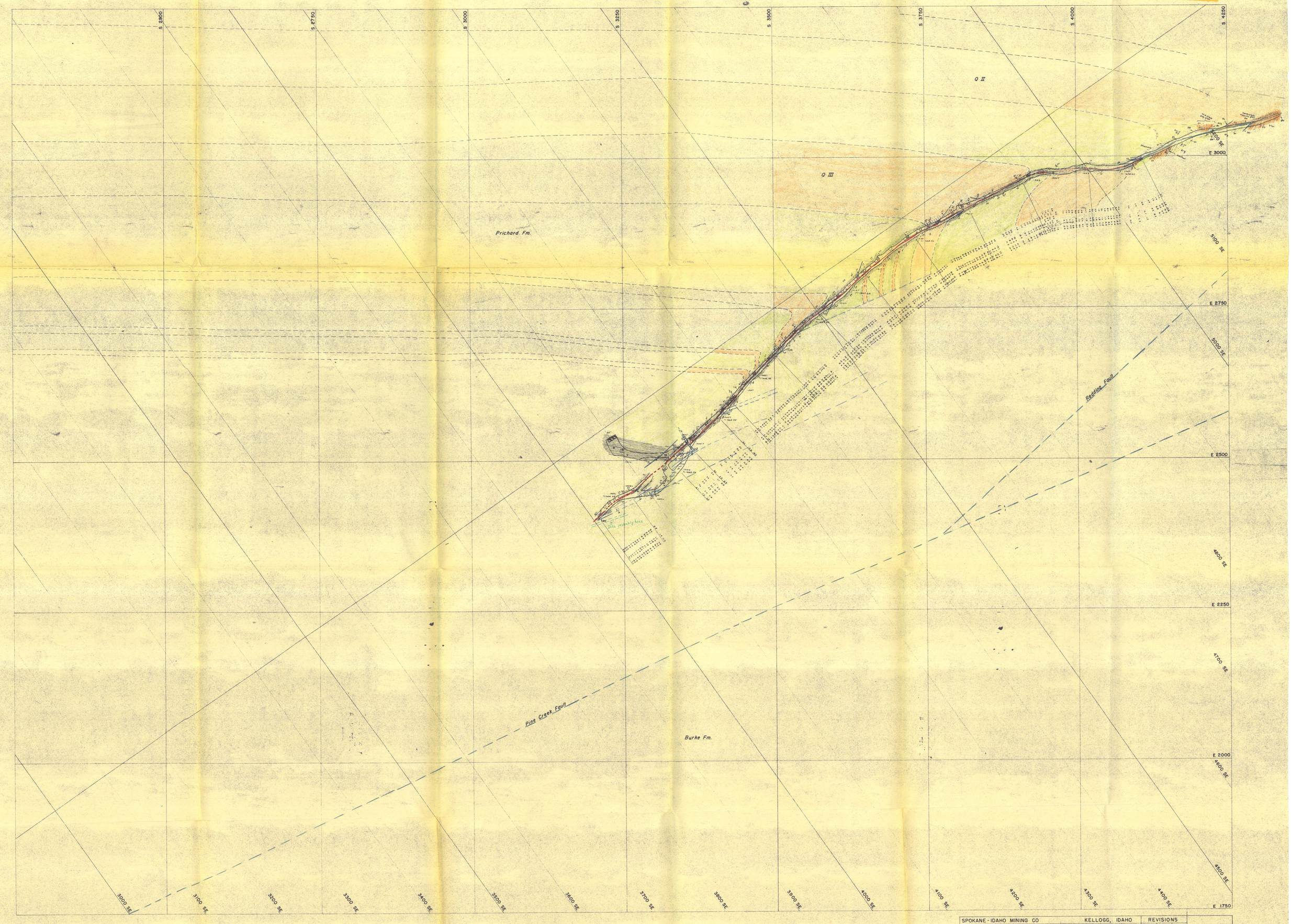
SCALE 1" = 1000'	COORD. Coordinates	DATUM	
SURVEY BY	DATE	DRAWN CJP DATE 3/1/60	NO.
GEOLOGY BY	DATE	TRACED DATE	

Docket No. DMEA-3333



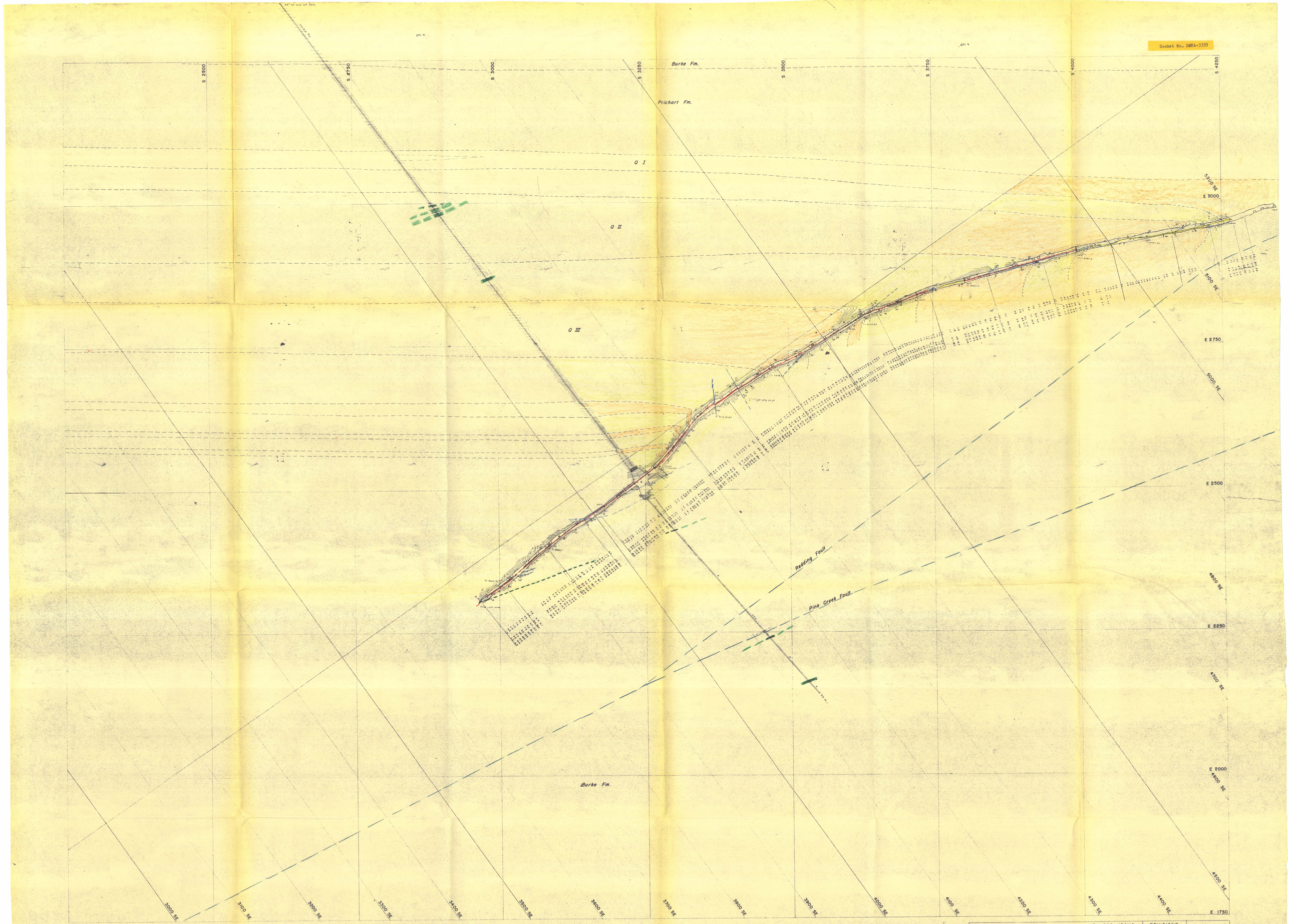
LEGEND								REVISIONS
	BEDDING	CONSTITUTION MINE-2000 LEVEL						
	FAULT							
	JOINTS	SCALE 1" = 50'	COORD CONSTITUTION	DATUM U.S.G.S.				
	CLEAVAGE	SURVEY BY	DATE	DRAWN	DATE 1918			NO.
	FOLDS	GEOLOGY BY	DATE	TRACED	DATE			

Docket No. DMEA-3333



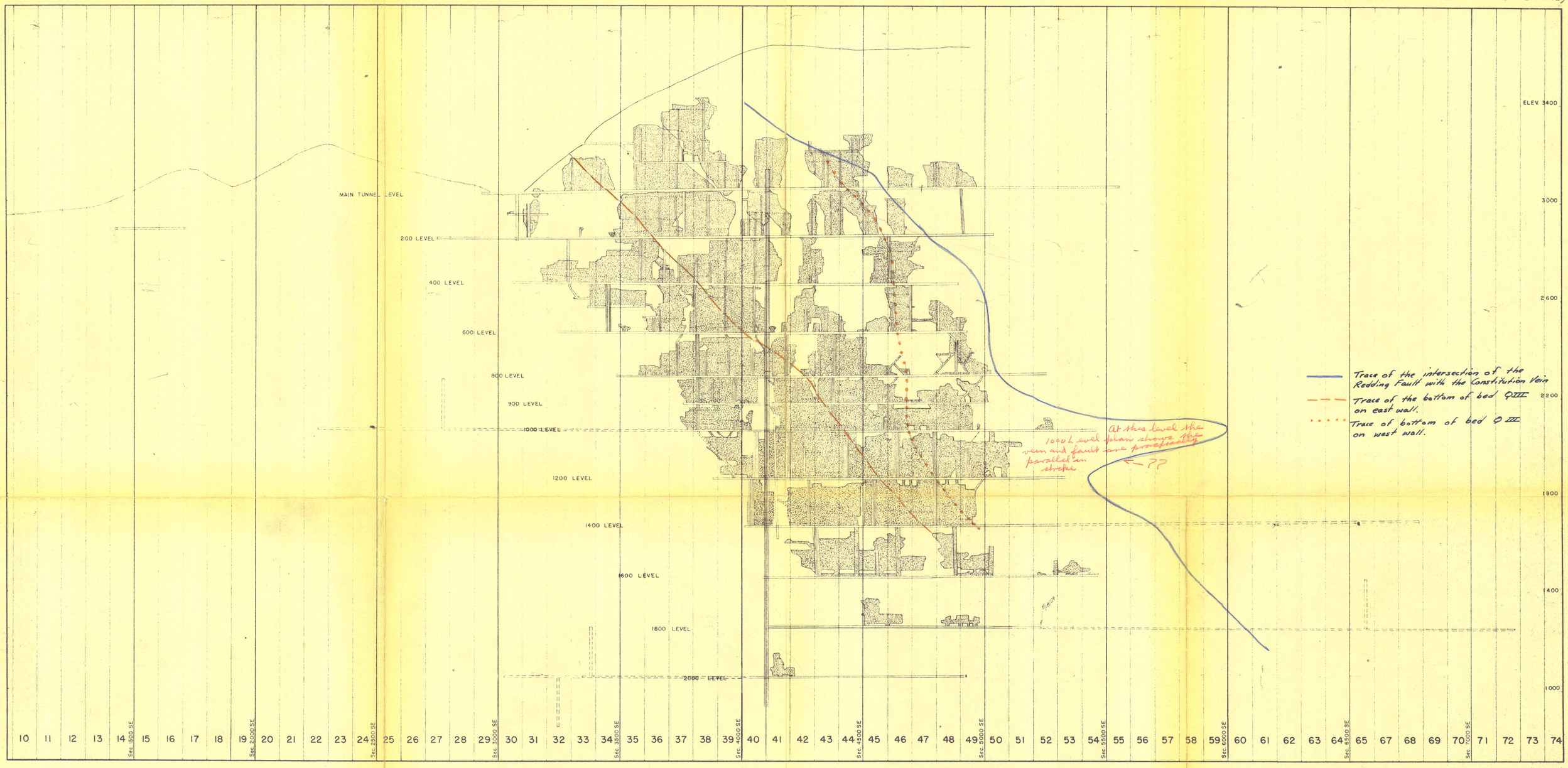
SPOKANE-IDAHO MINING CO		KELLOGG, IDAHO	REVISIONS
CONSTITUTION MINE-1400 LEVEL			
SCALE 1" = 50'	CO-ORD CONSTITUTION	DATUM U.S.G.S.	
SURVEY BY O.E. HAALAND	DATE 1950	DRAWN J.E.G. DATE 1951	NO.
GEOLOGY BY T.E. GILLINGHAM	DATE 1950	TRACED DATE	

Docket No. DMRA-3333



SPOKANE - IDAHO MINING CO		KELLOGG, IDAHO		REVISIONS	
CONSTITUTION MINE-1000 LEVEL					
SCALE 1" = 50'	CO-ORD CONSTITUTION	DATUM U.S.G.S.			
SURVEY BY: VARIOUS	DATE	DRAWN J.E.S	DATE 1950		
GEOLOGY BY T.E. GILLINGHAM	DATE 1949	TRACED	DATE		

Docket No. DMEA-3333 (lead-zinc)



CONSTITUTION MINE - VERT. LONG. PROJ.

Looking N 55 E 1" = 200'