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In the Silver Star district, 11 miles south of Luning, are many quartz-adularia-calcite veins with gold and silver in sedimentary rocks and in Tertiary tuffs. In the Marietta district, 8 miles southwest of the Silver Star, veins in Triassic quartzite 2 miles north of a small granitic intrusive carry copper, lead, and precious metals.

Candelaria[1] district, 25 miles south of Luning, was vigorously worked in the past century, producing about $20,000,000 silver ore. Strong veins lie in Ordovician argillites and felsites and in serpentine with later acidic dikes. The veins carry oxidized manganiferous ore with silver, gold, and some lead and copper. The sulphides in the ore include pyrite, chalcopyrite, sphalerite, considerable jamesonite, and some arsenopyrite.

The Aurora[2] (Esmeralda) district, about 25 miles southwest of Hawthorne, is estimated to have yielded about $40,000,000 gold and silver, the metals having a ratio of 1 to 2. The deposits are veins in quartz-latite and associated andesite. Overlying these rocks are rhyolites, tuffs, and basalts. The veins carry quartz, adularia, argentiferous tetrahedrite, chalcopyrite, pyrite, gold, silver, and a selenium mineral.

In the Silver Peak[3] district, about 35 miles southeast of Candelaria, Paleozoic sedimentary rocks are intruded by granitic rocks, and gold veins with alaskite phases are found in the invaded sediments. The ore contains quartz, pyrite, and a little galena.

In the Palmetto[4] district, 25 miles south of Silver Peak, near the end of a granitic intrusive, Paleozoic limestones and slate contain veins and replacements which have produced about $7,000,000 silver-lead ore with some gold.

At Lida,[5] 25 miles southwest of Goldfield, veins and replacements of lead-silver ore with gold are found in Cambrian limestone which is intruded by quartz-monzonite porphyry dikes. Near Hornsilver,[6] about 12 miles southeast of Lida, quartz veins with gold and silver are found in shale and limestone near intruding granite.

At Tonopah,[7] a series of tuffs, breccias, flows, and sills are cut by acidic intrusives and strongly faulted. The ore deposits are in and near

[1] KNOPF, A., (Candelaria): U. S. Geol. Survey *Bull.* 735, pp. 1–22, 1923.

[2] HILL, J. M., U. S. Geol. Survey *Bull.* 594, p. 141, 1915.

[3] SPURR, J. E., U. S. Geol. Survey *Prof. Paper* 55, pp. 1–168, 1906.

[4] SPURR, J. E., *idem*, pp. 85–96.

[5] BALL, S. H., A reconnaissance of southwestern Nevada and eastern California: U. S. Geol. Survey *Bull.* 308, pp. 51–55, 1907.

[6] RANSOME, F. L., The Hornsilver district, Nevada: U. S. Geol. Survey *Bull.* 380, pp. 41–43, 1909.

[7] SPURR, J. E., U. S. Geol. Survey *Prof. Paper* 42, pp. 1–295, 1905.

SPURR, J. E., *Econ. Geol.*, vol. 10, pp. 713–769, 1915.

NOLAN, T. B., Univ. Nevada *Bull.* 24, 1930.

BURGESS, J. A., *Econ. Geol.*, vol. 4, pp. 681–712, 1909.

BASTIN, E. S., and F. B. LANEY, U. S. Geol. Survey *Prof. Paper* 104, pp. 1–50, 1918.

XEROXED FROM Gold "Deposits of The World"
W. H. EMMONS McGRAW HILL 1937

observed formation of oreshoots or enrichments at junctions of branching veins: that where present they are mainly due to the commingling of diverse magmatic ore solutions. I do not believe that they can be ascribed to the meeting of a magma ore solution with circulating ground waters or even hot-spring waters, as we understand these terms: this would probably tend to dilute the ore magmas and prevent precipitation. Moreover, we can conclude that there will be no enrichment (of the type which extends from the junction along the prongs of the fork, and back along the handle) where the stages of ore-magma solutions, though diverse, are found to have been distinctly separated in point of time as to their arrival; but only when they are contemporaneous or overlapping and hence can at some stage meet from different fissures. Exceptions will be noted to this rule, in the case of intersecting fissures, where a later vein is locally assisted in its precipitation by meeting an older sulphide vein, for at such a junction a certain enrichment may sometimes take place; but this is not due to the mingling of fluid solutions and is identical in nature with the accelerated precipitation of a vein where it intersects a basic, sulphide-bearing, or carbonaceous rock.

A slight difference in the character of ore-magma solutions which are in a transitional stage, involving even a slight alteration of chemical content, may be sufficient to bring about a somewhat more intensified precipitation of metals at or near junctions of branches, even where it is not very evident that more than a single stage of ore-solution magma is represented in the vein or veindike. And it is always best, therefore, in each district, by geological surveys and comparative assays, to ascertain the actual conditions.

Let me instance the remarkably interesting gold-quartz veins at Aurora, Nevada, which I have studied very carefully. These veins are in Tertiary andesite. Slightly later than the veins, but only slightly, so as to be contemporaneous with the last stages of silica injection, is rhyolite,

XEROXED FROM "THE ORE MAGMAS" J. E. SPURR McGraw Hill, 1923 SEE ALSO SPURR'S PROFESSIONAL PAPER LISTED IN THIS ARTICLE

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in dikes and great overwhelming flows. Still later, after erosion had exposed the veins, came flows of Pleistocene olivine basalt, referable to a recent crater which stands a few miles away, and whose products cover the extensions of the exposed mineral district. The veins are entirely of quartz, and are remarkably wide, regular, and persistent bodies, ranging in width up to 40, 50, or even 100 feet, sometimes extending at least a mile or two along the strike, and usually steeply dipping or even vertical. They strike N. 60° E., thus observing the rule of the easterly-westerly strike of mineral veins in the Cordilleran region of North America.[21]

The quartz has clean, sharp contacts with the wall-rock andesite, which is relatively fresh—except very close to the contact, where the biotites are bleached and there is a little silicification. The same sharp contacts and relatively slight alterations are true of angular fragments which occur, unsupported, in the quartz. There are no sulphides in the quartz, which is white and frosty, looking usually much like a broken surface of stone china. The values are probably in fine native gold, but are so disseminated as to be revealed only by the assay, which is in general the only way to distinguish between the very low-grade and the better-grade portions of the vein; the silver values (for the ore carries some silver) are very likely partly in sulphides, like argentite, but so finely disseminated, if this is the case, that only the faint bluish nature of some of the quartz betrays it. I have made no microscopic study. Ordinary sulphides, like galena and blende, are absolutely wanting.[22]

Clearly, these gold-quartz veins are veindikes; I may go further and call them gold-quartz dikes, for the lack of alteration of wall rocks and the included angular fragments shows the lack of any appreciable amount of surplus aque-

[21] Chapter X, p. 479.

[22] This statement is not intended to mean that a diligent search of the district might not reveal a few crystals of sulphides. I have seen some of pyrite, but none of galena, blende, or chalcopyrite; nor are there any copper or even iron stainings, as a rule, in the veins.

ous or gaseous components, such as would have been expelled on the consolidation of an aqueous quartz magma. No essential part of the quartz is due to replacement; it is a fissure filling; and the maintenance of great widths by the veindikes, and the inclusion of angular fragments of the wall rock which have not sunk in the quartz magma, show that gaseous tension of the magma enabled it to be intrusive and create its own fissure, quite like a dike of rhyolite, and the quartz magma was viscous enough *or under enough upward current* to support the certainly heavier andesite inclusions.[23] In other words, this was a relatively dry or aplitic quartz magma.[24] Actually, it is our old friend, the intrusive quartz dike or veindike, possibly a little dryer and a little simpler in composition than usual.

This district throws a great light on the intimate relations of gold-quartz Tertiary veins and silver-quartz Tertiary veins. As has long been known, in different districts such veins carry gold and silver in all proportions, from practi-

[23] I think I should summarize briefly my conclusions as to the occurrence of unsupported angular fragments in mineral veindikes. Where the fragments are of light material, it is likely in some cases that the fluid ore-magma solution had a greater specific gravity, which would account for the suspension of the fragments. But there are frequent cases where the inclosing vein material, as in the instances above, is, even after consolidation, lighter than the inclosed blocks and fragments, just as is often the case with igneous rocks (like rhyolite) and their inclusions. Viscosity of an injected vein solution and sudden congelation thereafter will explain some cases of suspended fragments heavier than the inclosing vein matrix. But where a vein having a banded structure, indicating more gradual consolidation, incloses such supported fragments (as is sometimes the case) we must look for still another explanation, for differences in gravity operate in time, even in a viscous fluid. A cork will work its way upward through a barrel of tar, it is said. Some force must have offset gravity, tending to push the fragments up, as gravity tended to pull them down, with the result that they were caught balanced or suspended when the vein solution in which they were swimming froze to form the vein. I suggest that gaseous-tension pressure may have been this gravity-antagonizing course, theorizing that the relief of this tension must have been upward more than downward at the stage in question; or possibly an upward flowage current of the vein magma may in part account for the phenomena.

[24] Chapter VII, p. 316.

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cally all silver and no gold, as at Pachuca and Guanajuato, to practically all gold, as at Goldfield. Goldfield, Tonopah, Divide, and Aurora all occur in the same general region of Tertiary mineralization. At Tonopah both gold and silver are present in the proportion of about 1 to 100 by weight.[25] At Divide, four miles away, the principal mine has ore containing gold and silver in the proportion of 1 to 200,[26] but there are other Tertiary gold-quartz veins of the same general period at Divide in which the values are nearly all gold. At Aurora, in veins which seem to be all of the same nature and age, the proportion of gold and silver varies from 1 to 2 or 3 by weight (as in the Humboldt vein) to 1 to 35 to 46 in the Old Esmeralda—both great wide quartz veins of the same type, in andesite. In the Juanita claim, of two veins lying side by side, and of identical appearance, one carries gold to silver equal to 1 to 7.6 by weight, and the other 1 to 2.6. In the Prospectus vein, the lowest-grade, or third-class, ore shows the proportion 1 to 7.3; the second-class 1 to 3.4; and the first-class or highest-grade, 1 to 1. Exhaustive sampling of these properties enables me to speak accurately. This illustrates how delicate were the conditions that determined the relative concentration of gold and silver in different portions in a common siliceous ore magma; and the close relation of districts of this Tertiary type which differ in their gold-silver ratio may be understood from this composite example.

However, I am able, I think, to elucidate the problem still further from my studies at Aurora, for there are various bits of evidence that the silver was most abundant in the earlier veindike stage of consolidation, the gold in the later. In one end of the district veins containing gold to silver in the ratio of 1 to 2.1 were found to cut others having a ratio of 1 to 4.3.

My detailed description of the quartz of these Aurora

[25] J. E. Spurr: *Professional Paper* 42, U. S. Geol. Surv., p. 8.
[26] A. Knopf: Bulletin 715-K, U. S. Geol. Surv., 1921, p. 148.

veins, taken from my field notes made in 1910, is, I think, worth recording:

"The veins consist of fine granular quartz, the coarsest of which is like that of the first-period veins at Tonopah, but the commonest phase is finer and frosty-lustered, resembling the second-period West End vein of Tonopah From this most common type, the quartz increases locally in fineness, some bands having a porcelainic texture, and alternating with the frosty type. Such bandings, often beautiful to see, also form concentric rings about fragments of andesite inclosed in the vein." Please do not infer from the above description that there is any evidence of progressive fissure filling in these veins. There is none; the quartz is homogeneous from wall to wall. The phenomena are those of a crystallizing magma and are those of a pulsating crystallization, such as I have discussed for veins, as in some instances at Tonopah; and which sometimes occurs also in diorites and in granites.

THAT WAS WHEN Gold WAS $20.67/oz.
Possibly, THE WHOLE System Could be open PIT MINED. JSC

Reverting again to our main thread of thought, on which I have strung, like beads, these successive illustrations of different districts, with sidelights as to their concomitant characteristics: we find at Aurora, a distinct though slight tendency, in some parts of certain veins especially—the general vicinity of certain vein junctions—toward a greater precipitation of primary gold in the quartz (as indicated by comparative assays) than ordinarily is the case, thus forming oreshoots. Although the quartz magma at Aurora was auriferous throughout—out of thousands of assays of all kinds of quartz, I do not recall ever having had a blank, although the low-grade ore will often run much less than a dollar a ton in value—only in certain veins and certain parts of veins is there gold enough to have tempted mining. The big veins are not workable except for these "shoots." Therefore, we must assume some slight modification of conditions in these vein fissures in some places, arising from the meeting of the ore magmas at some junctions; and this modification we may believe to be due to the

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confluence of very slightly different stages, which are indicated by the observed transition between the earlier more argentiferous quartz and the later more auriferous quartz.

This is one of the factors forming these oreshoots (which are not very strongly marked at the best); but the description would not be complete did I not discuss another patent factor. Be it understood that in this district (in which it is not peculiar), some (but only some) of the narrow veins are relatively high grade (say $10) throughout, while others are low grade (say $1 to $2 or less) throughout; however, the big veins are never all pay-ore, but are very low grade except for local concentrations or shoots similar in nature and grade to the better class of narrow veins. Such a pay-streak in the big veins generally runs along one wall, or both walls, and may or may not be in the evidently favorable field of a junction of branches. Exceptionally, however, it may run in the middle of a big low-grade vein, as in the case of the Prospectus vein (Fig. 116) and other big veins at Aurora. Although in general no lines of contact can be observed between the high-grade streaks and the low-grade quartz, it is believed from the above relations that the higher-grade quartz is the younger; yet from the frequent lack of clear definition it must be nevertheless well within the general crystallizing period of the veindike, which, moreover, crystallized in one stage. In other words, the richer gold-quartz must be considered in the nature of a magmatic differentiation in the veindike.

Let us inquire, so far as we can, how this differentiation of richer streaks comes about. A selected specimen of rare rich quartz from one of the veins is bluish, and in this case (which is probably exceptional) distinctly cuts older quartz. The contact against the older quartz is marked by an especially dark streak, which is the richest, running around $100 per ton. I have collected a very similar specimen from the Valley View vein, in Tonopah, where new quartz forms fissures in old quartz, and has rich black precipitation rims against the old quartz. These rich precipitation rims of

veins and veinlets, against the walls, are common. I have previously ascribed them to physicochemical reaction between the vein solutions and the wall rock; and at Tonopah

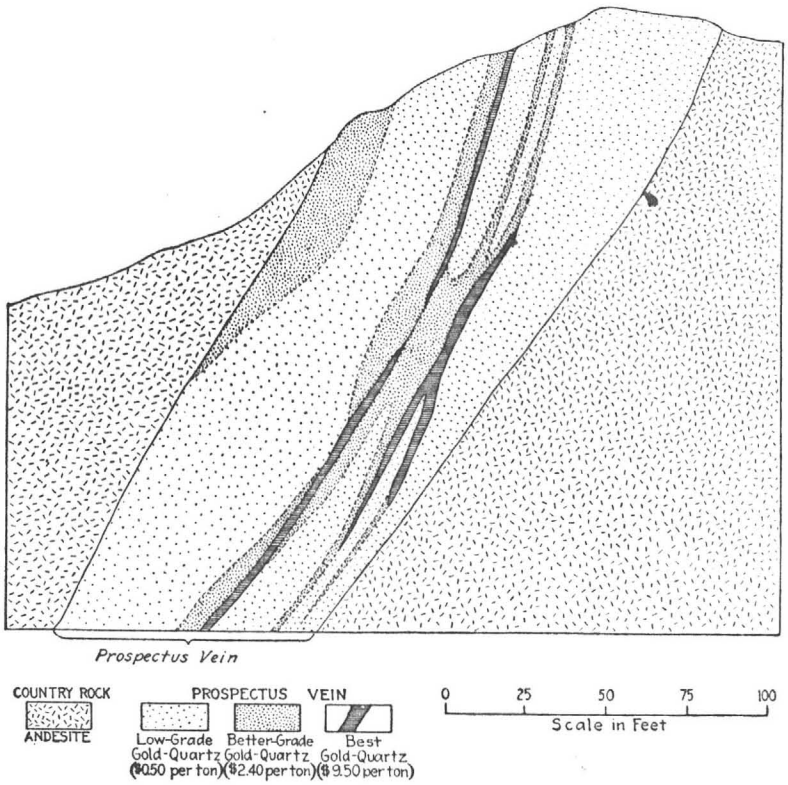

FIG. 116.—Cross-section of Prospectus vein, Aurora, Nevada, developed by mine workings; surveyed and assayed by J. E. Spurr and staff. A "true fissure vein" in spite of the great width, with sharp, clean walls; has not originated by replacement. This is not a compound vein, but a one-stage vein; the relative concentration of gold shown in the quartz was accomplished before or during the crystallization of the quartz, and belongs to the phenomena of "magmatic differentiation."

believed that the andesitic wall rock thus had a screening effect, which retarded and precipitated the metallic sulphides, but admitted the silica and potash—but soon precipitated these also, leaving only principally the gaseous components of the vein solutions, like carbon dioxide and

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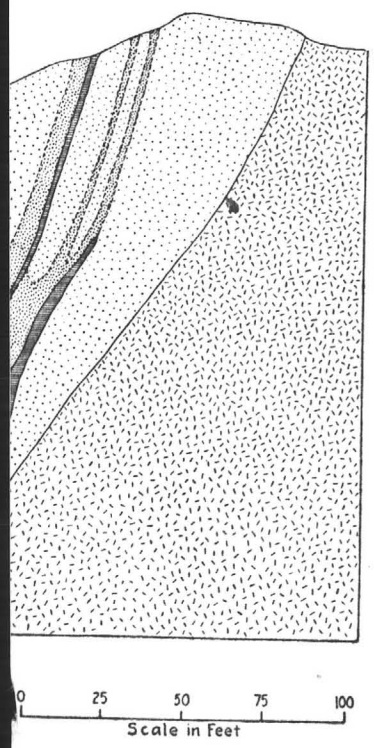

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sulphurous gases, to travel further on, and alter the rock. But what shall we say when we find this precipitation rim of quartz against quartz? No purely chemical reaction can have taken place; nor is the quartz wall absorbent, so that it could have served as a physicochemical screen. In the Aurora rich ore specimen above referred to the width of the black precipitation rim is invariable (about 1/12 inch), although the width of the whole later (richer) quartz vein which it borders varies from 2 inches to a mere crack. Therefore, where the veinlet is under about 1/6 inch in width it is entirely composed of this precipitate. Moreover, where fragments of the older quartz appear in this younger quartz veinlet, they are rimmed by the precipitation zone, of the same (1/12 inch) thickness; and this observation extends down to quartz fragments at least as small as 1/10 inch in diameter: where, locally, therefore, the whole vein is full of close-packed small inclusions of the older low-grade quartz, and is an inch wide, the entire cementing material is this black precipitate. These observations show clearly that the amount of precipitation is neither dependent on the width of the vein nor on the mass of the included fragments or wall rocks; but is directly dependent upon the surface area of the older quartz. It is further improbable that the temperature of these included fragments differed from that of the solution, for if such were the case the large fragments and the walls would have been cooler than the small fragments, and would show stronger and longer precipitation.

Therefore, as to the power which enabled the gold to travel through the siliceous magma to its margins, there to be precipitated, I suggest the action of differential gaseous tension, the metallic elements having, as I assume, a higher gaseous tension than the silica. This would explain the precipitative rim of equal width, whatever the width of the veinlet: it would also explain, in the wide quartz veins, which run from a score to several score feet in width, why

REPORT ON THE AURORA DISTRICT
Mineral County, Nevada

by

J. H. Farrell

August, 1934

Location. The Aurora District is in Mineral County, in west central Nevada, close to the California line. The nearest railroad point is Thorne, a station on the Southern Pacific railroad, 37 miles to the northeast. The district was known as Esmeralda in early days.

History. The discovery was made in August, 1859, by James M. Brady, J. M. Cory, and E. R. Hicks, who located the Esmeralda and other claims, and carried news of their find to the Mono placer diggings, from which other miners came and helped to organize in the district. The first shipment of ore was made by mule train in November, 1860.

By the fall of 1861 most of the productive area had been staked, three small mills were in operation, and the town of Aurora had a population of 1500. In the spring of 1862 highgrade ore was found on the Antelope claim, and on Last Chance Hill where it was reported that 44 tons of ore yielded $11,000, or about $250 per ton. Many references are found in early descriptions of the camp to ore carrying from two hundred to five thousand dollars per ton, chiefly in gold, and it appears that the early production was exceptionally rich ore. No complete and authentic figures are available as to the total output.

Mining was very unsystematic and milling methods were crude, during the period of greatest production from 1863 to 1866. There was divided ownership of the bonanza area and armed conflict and litigation over the richer claims took much money that should have gone into development. By 1866 the known ore shoots opened at surface were exhausted, and such attempts as had been made to mine below a depth of 100 feet found little ore that could be profitably worked by the methods which had been successful with the Bonanza material on which operations had started.

An account by a contemporary observer says: "My idea of the cause of the decline of the district, and I believe the generally received opinion, is that just at the time (1864-5) the rich surface deposits became exhausted there was a great and general decline in all mining shares, and this, together with the great amount of litigation in regard to conflicting titles, caused stockholders in the various companies to refuse to pay (assessments) or furnish the money necessary to prospect the mines to any great depth below where the surface deposits had given out." (J. S. Jameson, judge of the District Court of Esmeralda County, in a letter written in May, 1878 to Joseph Wasson.)

The district declined until 1869, when it was practically deserted, and remained so for several years, except for two short-lived attempts to develop the Juniata vein. In 1877 a group of San Francisco men formed a company and took over the best of the claims on Last Chance Hill. The New Real Del Monte shaft was started and by 1881 was down between 800 and 900 feet, after much difficulty with water below the 500 foot level. A large (17") Cornish pump failed to handle the water, possibley when drifting was started on the 800 foot level, and the attempt was abandoned.

No production was made at that time. (A 17" Cornish pump with 10 foot stoke, 5 per minute, might handle 600 gallons per minute, but it is doubtful if more than half that amount could have been pumped from 800 foot depth with the Del Monte pump. The shaft has two hoisting compartments and the pump compartment, and may still be reached through the water discharge tunnel from the gulch about 100 feet below the shaft collar which is partly caved.)

There is no description of laberal work from the Del Monte shaft now available. It is reported that a station was established at 300 feet "where the shaft passes through a six foot body of quartz that assays well". (Quotation from pamphlet entitled "Bodie and Esmeralda", by Joseph Wasson, P. 52, published in 1878.) The flow of water was not excessive to a depth of 400 feet as it was handled by hoisting, and some work is reported to have been done at that level several years later. A level at 500 feet is also mentioned in an account of the shaft work as having been abandoned when the shaft was flooded.

Sometime between 1885 and 1887 an English company, name unknown to the writer, reopened the Real Del Monte shaft, but unwatered it to the 800 foot level with steam pumps, but they could not hold the water there and did not get into the level workings. They are said to have driven a crosscut southeast through the Philadelphia claim on the 400 foot level, crossing a wide vein which was not developed, probably because it was low grade, though it had some bunches of good grade ore. A drift was run to the southwest to the Durent shaft where some high grade ore had been mined above but the downward extension was not found.

This company sunk the Humboldt shaft 400 feet and did considerable work on several levels, but little mining as the ore was mostly too low in value to work profitably, the low limit was about $12. per ton. (Information regarding the English company's operation was given the writer in the course of a conversation, by J. F. Parr in 1934. He was employed by this company for several years as time keeper, assayer, and assistant to the superintendent.) Their work was hampered by shortage of funds, which were supplied intermittently, though a considerable expenditure was made over a period of years, little was accomplished. This was the last attempt at systematic development for a long time, and the camp was again turned over to "coasters", or leasers, who made very complete cleanup of all accessible workings, but opened little new ground.

By 1912 a large number of claims had been gathered in two groups which were consolidated and taken over by Aurora Consolidated Mines Company, afterward controlled and operated under Goldfield Consolidated Mining Company management. From 1915 to 1918 this company mined and milled 633,332 tons of ore yielding $1,842,482, a little less than $3 per ton with tailings averaging 50¢. This ore came chiefly from the Humboldt and Prospectus veins at the north end of the district. It was treated in a cyanide plant of 500 tons daily capacity. The operation proved to be a marginal one until the latter part of 1918, when war costs forced a shutdown and the mill was dismantled along with all camp buildings.

The Aurora Consolidated had little money to spare for general exploration of its holdings, which included most of the productive ground of the district. Records show that only 1 foot of development was done for 40 to 50 tons mined. The result was that little was done in the way of investigating the Last Chance Hill area which had most of the bonanza production in early days. No ore was found there, as was to be expected since the old workings are above water level and had been open to leasers for fifty years in 1918. Since then only sporadic work has been done by leasers working over the dumps, or by operators with limited means.

Production. Bulletin 594, U. S. Geological Survey, gives a brief description of the Aurora District, pages 141-150, with the following regarding production: "The records are incomplete. According to a statement of Wells, Fargo & Company the bullion shipped through them up to 1869 had a value of $27,000,000". This is followed by a statement showing bullion shipped without insurance from 1861 to 1869 amounting to $2,365,968.82. Others more or less familiar with the camp have estimated the early production at from twelve to sixteen million dollars.

Judge J. S. Jameson, writing to Joseph Wasson in 1878, in reply to an inquiry regarding the camp's production said:

"I was in the (express) office over five years, and made all the reports, but I have forgotten the exact figures. I have no recollection of the amount sent by each company respectively. My recollection is, however, that in the year 1864, between $7,000,000 and $8,000,000 were forwarded from the office here, and that about $12,000,000 altogether was sent away prior to the year 1869".

An owner of one of the assay offices of the camp stated that about half a million dollars worth of bullion was handled monthly through that office for about eighteen months in succession, presumably in 1863-'4.

These figures are almost incredible in spite of the large number of veins in the district. Neither the dumps nor surficial evidence of the workings indicate the removal of any large tonnage of ore, and it is very certain that most of the mining was done above a depth of 200 feet. Either the production has been greatly exaggerated, or else the ore was exceptionally high grade. Getting at this question from another angle, it is known that there were seventeen amalgamation mills in the district by 1864, most of them small, 5 to 10 stamps, the largest 30 stamps. The total number of stamps is given as over 200, but accounts show that the mills operated intermittently, stamps were light, and stamp duty did not exceed 1 to 1.5 tons per stamp per 24 hours. If we consider the period of maximum production to be 18 months of 1863-4, during which perhaps $10,000,000 worth of bullion was produced, with 150 stamps on an average, in operation for 500 working days, crushing 225 tons daily total, the total would be 112,500 tons, with an average recovered value of nearly $90 per ton. As extractions ranged from 60 to 80%, the ore must have been of exceptional grade. Information from contemporary accounts is that much of the production was from a small tonnage of even higher average grade than estimated above.

General Conditions. The town of Aurora is about 7500 feet above sea level, situated near the top of one of the main ridges east of the Sierra Nevada. The climate is good, though there is occasional severe winter weather.

Water. Is available in shallow wells, most of which are dry in the late summer following seasons of light snowfall. Springs at distances of 2 to 5 miles furnish ample water for camp use and for small milling operations. There is a fairly large flow of water from the Prospectus Tunnel at the north end of the district, and the Del Monte shaft would doubtless supply water for a large mill.

Power from the lines of the Mineral County Power Company is now being sold in the district at reasonable rates for small operations, and a large operator would probably be able to obtain a very low rate. The hydroelectric generating plants of the Southern Sierras Power Company are 30 to 40 miles distant.

Roads to Thorne, Bridgeport, and Bodie are all improved dirt roads, kept in good shape by the counties except in winter when they must be kept open by teams or tractors during severe storms.

Geological Conditions. No detailed study of the geology of this area has ever been made. The description in the Geological Survey Bulletin referred to above, was based on a field visit of only three days, and is necessarily incomplete.

The productive formation is a volcanic flow, or series of flows, classed as latite or andesite porphyry, having a known thickness of about 300 feet. It is intruded and capped by rhyolite, which is supposed to be of nearly the same period as the quartz veins. The latest flow is basalt from Aurora crater north of the camp, which covers the productive formation.

The vein system is exceptional, in the number seen on outcrop, their continuity, and the large amount of quartz which they carry. The known productive area is two miles long by a mile and a mile and a half wide, within which are 14 major veins, or vein systems. Widths range from a few inches to 80 feet, or more, in the Humboldt and the Esmeralda, at the north and south ends of the district respectively.

The prevailing strikes are N. 45 to 65 degrees E., with dips to the southeast. Exceptions are the Prospectus and Humboldt, dipping 80 degrees north, and the Esmeralda-Radical striking N. 10 degrees E., standing nearly vertical.

The number of smaller veins is very large, and in some localities they form extensive stringer zones which are probably too low grade, over great widths, to have attracted attention in the early period of prospecting, but which merit investigation with the present price of gold.

The origin of the veins appears referable to a period of general penetration of the andesite porphyry by silicious solutions, possibly accompanying the extrusion of the rhyolite. There may also have been a later downward concentration of quartz with enrichment of the metallic content of the ore shoots near the surface.

On the other hand, J. E. Spurr considers these veins to

be typical "vein dikes", forming as the last phase of magmatic differentiation, and very much like other intrusive masses. This theory favors the probability of persistence to considerable depth, as it is difficult to imagine a dike several thousand feet long as exposed on outcrop, disappearing entirely within three or four hundred feet or less.

There is no obvious theoretical reason why the veins of this area should not extend much deeper and continue to be productive well below the present limits of exploration in most parts of the district.

The metal content of the veins varies rapidly within short distances. All of the quartz carries some gold and silver, according to Spurr, but the high grade ores were localized along narrow sections on either wall, or occasionally toward the middle of the vein. Even within these limits it appears to have been an erratic or "pockety" occurrence for the most part, though one or two of the very rich stopes were "wide enough to swing a wagon", according to one of the mine superintendents of the Bonanza days.

It is probable that much of the ore handled in the early period carried over $100 a ton in gold and silver. The Humboldt and Prospectus, faulted sections of the same vein, were low grade averaging less than 0.2 oz. gold per ton, and rarely showing samples exceeding one ounce.

The ratio of gold to silver by weight varies from 1:2 at the north end of the district to 1:35 to 45 (Spurr) at the south end. It is not known if this variation is due to differences in the original content of the veins or to secondary concentration of the metals. There is nearly a thousand feet difference in elevation between outcrops in the two localities.

Faulting. One major fault has been recognized, known as the Humboldt Fault, having a strike No. 20 to 30 degrees W., dipping steeply, and with a horizontall displacement of over 600 feet. It has offset the Prospectus and Last Chance veins to the north from the Humboldt and Real Del Monte, which are presumably their respective continuations east of the fault. The Humboldt Fault appears to be the most prominent of a series of more or less parallel faults, and only detailed study and mapping will show the effect of the entire system. Many minor faults and slips are to be seen in the old workings on the Last Chance Hill, and the reports of exploration work by the Aurora Consolidated refer to faulting which interfered with the search for ore in the Humboldt and Juniata veins.

The solution of the various faults, especially in the "highgrade" stope area of Last Chance and Middle Hill, would seem to offer exceptional possibilities of finding new ore bodies.

Mine Development. The earliest work consisted of shafts started in the vein outcrops, from which stoping proceeded as soon as ore was found. In fact, the Wide West and other of the Last

Chance vein system, show stopes which were evidently started as open cuts without any regular shaft sinking. There was very little crosscutting in the course of this mining,--once a "pay shoot" was found, it was followed to its limits and almost no dead work was done either in the walls or along barren parts of the vein.

The next step was to drive tunnels, either for extraction of ore from existing stopes or known ore shoots, or as work by "tunnel companies" for the primary purpose of selling shares, and incidentally to look for "blind" veins. This accounts for the fact that some of the most productive ground was not adequately crosscut, either by the tunnels themselves or by branches.

A still later stage was the sinking of deeper shafts, such as the Humboldt, Juniata, and Durant. These were well away from the most productive area and opened lower grade material, which could not be profitably worked, except for a small body of ore in the Durant.

The deepest shaft in the district, the 900 foot Real Del Monte, made no production, and there is no record of any conclusive lateral exploration from it, though it is close to the area of bonanza production. Difficulties with water and dispersion of funds by the English company seem to have been the causes of failure there.

The last systematic development was done by the Aurora Consolidated, and consisted of several thousand feet of haulage tunnel, opening two low grade veins in the northern section, the Humboldt and Prospectus, and reaching the Juniata a long way from the central productive area. The writer has not been able to learn the extent of the work on the Juniata, but it seems not to have been extensive as it was carried out chiefly during the last year of the Company's operation. One branch of the haulage tunnel was headed toward Last Chance Hill and the Real Del Monte shaft, but it is not known how far it was driven in this direction. If it is true that the ore deposits are essentially shallow zone type, this tunnel and its various branches, at depth of 400 feet or more, are well below the productive horizon, and of little use for exploration purposes.

In summing up, it may be said that the central and northern parts of the district have had development work well started but never carried to a conclusive point, while the southern end of the area has never been adequately explored except as to the search for rich pockets at or near surface.

Available Ore. There is a limited tonnage on the old dumps which may now be profitably handled, but it is doubtful if this would total 50,000 tons carrying 0.15 ounces or over for the entire district.

In the Humboldt and Prospectus workings it appears from figures in the annual reports of the Aurora Consolidated, that there were left between 60,000 and 100,000 tons of grade worked in 1918, or about 0.17 ounces gold per ton, worth now approximately $6.00. Little is known as to the details of location, or

availability, except that it is above the haulage level, and doubtless includes the extensions of stopes worked in 1918, along with the ground between the level and the first sublevel above. Inspection of such assay plats as are available, suggests that it might be possible to add materially to the tonnage figures given above, in view of the present price of gold. It would not be difficult to make a revised estimate by surveying the sub-levels and stopes as far as they are accessible now, using the old assay plats. This would require first cleaning out parts of the crosscut tunnel, which is probably closed where faults were encountered.

The average grade is probably somewhat below that maintained in the 1915-'18 operations, as the assay plat of the tunnel level shows three crosscuts which average 0.134 ounces gold per ton, worth $2.68 at $20/oz., $4.69 at $35/oz. The average width is 30 feet and the known length of the ore shoot is 500 feet. Additional crosscutting would be advisable to determine possible extensions of the ore shoot, and also to check up on possible parallel ore shoots in the walls. It would be easy to prospect below the level to a depth of 200 feet by drilling from existing crosscuts. The only exploration below this level is said to have been a winze well out toward the east limit of the ore shoot, or beyond it.

The importance of ore in sight in the Humboldt vein is not enough to warrant the erection of a new mill, but in connection with the operations elsewhere in the district, it is worth consideration.

Open Pit Ore. There is no information at hand on which to base an estimate of possible tonnage from an open cut operation, but there are two sections of the Last Chance Hill area which ought to be investigated. One of these is the line of the Wide West-Last Chance vein system, together with the Real Del Monte vein east of the Humboldt Fault. These veins are 35 to 50 feet in width, including horses of mineralized country rock, and as they dip flatly, 25 to 35 degrees, they could be worked by power shovel, or by mill holes to the old haulage tunnels (not the Prospectus Tunnel). It would need a comparatively small outlay to start such an operation, if examination warrants it. As the early work did not include systematic crosscutting of these veins in which there are several "pay streaks" between walls, and possible parallel veins beyond the recognized walls, it is reasonable to expect that the grade of open pit ore might be materially increased by occasional pockets of high grade, and such richer shoots could then be followed below the limits of open cut work, or reached from below.

Another section worthy of detailed study and sampling, is southwest of the Del Monte shaft. Here for a width of 200 to 300 feet or more there is a "stringer zone" mineralization of the porphyry, including some larger veins that were mined in early days. This ground has apparently not been crosscut from any of the tunnels in the vicinity, but it would only require a few hundred feet of crosscutting from the nearest one to prospect a block 800

feet in length by 300 feet across, which may yield a large tonnage of low grade material. This area could be worked very cheaply by side hill open cut.

Future of the District. In the writer's opinion the Aurora District offers excellent opportunities for mining exploration. Even if it is admitted that the deposits are likely to be limited in depth, there is a very large area that has had little work done on it since early days. The faulting in the bonanza stope locality on Last Chance Hill makes it almost certain that the "old timers" did not find all the rich ore shoots.

There is no good reason for the limitation of ore bodies at slight depth. The productive formation is known to be 900 feet deep at least. The mineralization is strong, and the veins are exceptionally persistent along the strike. In other areas of Tertiary volcanics depths of 600 to 1000 feet are common, and in several districts the limit has been close to 2000 feet. It does not seem logical to assume that at Aurora 200 feet must be accepted as the limit with depth. It is more likely that some condition of the faulting or flat rake of ore shoots, not understood in the early period of haphazard development, obscured the downward extension of the rich ores in the Wide West-Last Chance-Del Monte vein system, which was the most productive in the district.

Another development chance is to be found in some of the big quartz veins, such as the Esmeralda-Radical. This vein may be traced several thousand feet with widths of 30 to 50 feet on outcrop. There was an active search for high grade silver ore in the period following discovery, evidenced by many pits and open cuts. Two or three tunnels were driven to cut the vein at depth, but evidently the high values were scattered, or lacking, the vein material was hard, and the size of the vein alone required much work to open it completely. This work was never carried out.

Conclusions. Most of the search for new mines in the Western field has consisted of routine sampling of old workings. If new ore bodies are to be found it will only be as a result of opening new ground.

The Aurora district offers a good chance for this type of work. It has an excellent record of high grade production, old workings are numerous above the water level, and are either open or may be entered with small outlay, giving many points from which properly planned new work may be started without delay. Water and power are available without incurring large expenditures.

It will be possible to determine quickly and at slight cost what the best chances are, and to verify them readily, starting operations on a small scale and ultimately building up an important district enterprise.

(Original signed) J. H. Farrell

August 1, 1934

RECONNAISSANCE REPORT

ON MINING CLAIMS

UNDER OPTION TO A. P. SCOTT, ESQ.,

AT AURORA, MINERAL COUNTY, NEVADA

Rogers, Mayer and Ball,
Mining Engineers,
26 Beaver Street,
New York, N.Y.

RECONNAISSANCE REPORT

ON MINING CLAIMS

UNDER OPTION TO A. P. SCOTT, ESQ.,

AT AURORA, MINERAL COUNTY, NEVADA.

INTRODUCTION:

As agreed with Walter Seligman, Esq., our Mr. Sydney H. Ball made between October 8th and 14th, 1936 a reconnaissance of the ore deposits of the mining camp at Aurora, Nevada. Due to certain conditions of the option existing during the examination, it had to be completed prior to October 18th.

Few of the workings of the famous old camp are open but Mr. Ball had access to the maps and sampling results of Mr. A. W. Stickney's party, who had been examining the district from July to October, 1936. He was also fortunate in having during his examination the expert guidance of Mr. John J. Moisan, one of Mr. Stickney's assistants, who was familiar with the district.

CONCLUSIONS:

The ground under option in the Aurora camp if vigorously developed would probably warrant at no very distant future date the erection of a 100-ton mill to operate on medium grade gold ore ($8 - $9 per ton). This ore should show a profit of from $1.00 to $2.00 per ton. There are in certain old workings some 47,000 tons of indicated ore averaging about $8.85, which could be opened up for mining at no prohibitive cost. The capital expenditure required for the enterprise on a 100-ton basis would be about $240,000. To repay such a sum would require about 4 years' operation of a 100-ton mill. Such

a life to the property does not seem impossible but it is not believed probable that enough further ore will be developed to furnish profits commensurate with the risk involved. This especially as the ore bodies appear to become non-commercial at relatively shallow depths. The camp at one time is reported to have produced bonanza ore but such ore bodies were probably small and it is believed that the old timers found the majority of them. From time to time, however, the inclusion of rich streaks of ore would doubtless for a day or two raise the mill heads above that mentioned above.

In short we do not feel that the profits likely to be made warrant risking capital in participating in the enterprise.

LOCATION AND HOLDINGS:

Mr. A. P. Scott owns through the Aurora United Mines Corporation a large area in the north and northeast part of the camp and has under option the properties of the Aurora Consolidated Mines Company in the central part of the district. The first group has produced little ore but included in the latter group are most of the better known mines of the district. Mr. Scott's original option required a cash payment of $50,000 on or before October 18th, 1936; if the option was exercised at a later date the total payments were to increase. This option was, however, extended during the examination with no increase in payment; a reasonable option was also obtained on the Silver Lining group.

HISTORY:

The gold camp of Aurora was discovered in 1860 and by 1864 it was said to have had a population of 10,000 (1936, 8 or 9). Its prosperity continued till about 1882. An English company attempted

unsuccessfully to work some of the more important Middle Hill claims from 1887 to 1892. A subsidiary of the Goldfield Consolidated Mining Company, the Aurora Consolidated Mines Company, operated a large area in the central part of the camp from July 1, 1914 to October, 1918. An attempt to keep a 500-ton mill in ore resulted in much injudicious mining and the treatment of much country rock and the enterprise failed; a failure, also in part at least, doubtless due to labor difficulties during the World War period. During the four years there were milled 591,202 tons averaging $3.55 per ton, the average daily milling rate when the plant operated being 480 tons. This group of claims forms the center around which the present enterprise is built. The increase of the price of gold from $20.67 to $35 an ounce naturally transforms some waste of 20 years ago into ore.

Records of the camp's production are incomplete but it was large. Wells Fargo & Co. report that they shipped out from the camp up to 1869 bullion to the value of $27,000,000. Some of the workings are extensive though shallow and the central part of the camp is pot-holed with innumerable small holes, shaft, open-cuts and tunnels.

OPERATING CONDITIONS:

Aurora district is situated in an elevated desert region consisting of rather gently sloping hills and ridges cut by shallow valleys. Lower points in the district are about 7,400 feet above sea level and the higher, 8,700 feet. The climate is delightful in the spring, summer and fall, although during some four winter months snow is reported to be heavy.

The hills are covered by sage brush and a sparse growth of small trees of the pine family. Wood suitable for mine timber is lacking.

The Main Drain tunnel is reported to make about 45 gallons a minute and Fallon springs another 15 gallons. There is enough water for a small cyanide mill and for the population dependent thereon.

Power lines, the property of Mineral County, cross the claims. Rates are high, but through negotiations, fairly satisfactory rates could be obtained.

Labor would have to be imported.

Transport conditions are not at present overly favorable but if, as is reported, the Navy is to hard-surface the road from its ammunition dumps at Hawthorne west to the Los Angeles, Reno highway, they will be greatly improved.

The rock, judging from old workings, stands well and not much timber will be required underground. Dilution in mining should not be over 10 to 15%.

On the whole, conditions suggest that mining costs will not be either low or excessively high.

GEOLOGY:

ROCKS PRESENT:

The oldest rocks in the district are greenstones intricately intruded by a porphyritic granite outcropping over a small area 1-1/4 miles southeast of Aurora. On the rugged topography of this old rock series, volcanic flows were laid down.

The oldest and lowest flow rocks are flat-lying and grayish green andesites and related slightly more acid rocks (latites). These rocks are highly altered particularly near the veins. They are known to be at least 900 feet thick.

On top of the evenly eroded surface of the andesites, white to pinkish-gray rhyolites occur to the north and west of the camp and cap one striking hill, Granite Mountain, in the center of camp. The rhyolites are over 1,000 feet thick in places. Erosion must have been extensive between the intrusion of the rhyolites and the next youngest flow the basalts as the latter frequently lies immediately upon the andesites.

The youngest flow rock is black vesicular basalt which covers large areas to the east and north of the mining district. It probably flowed from several craters, not of the same age.

STRUCTURE:

The region, or more correctly the andesites, has suffered a succession of important faultings. The earliest of these in a broad way strike slightly north of east and south of west and are occupied by the veins of the camp. Shortly after the veins were deposited two major faults (Humboldt and Prospectus) about 600 feet apart cleaved the center of the district from north to south. These apparently successively threw the vein segments, going in an easterly direction, to the south. Some silicified gouge in the faults appears to have been mined in the past. Some of this does not appear to be drag quartz and in consequence the Prospectus and Humboldt faults may have originated before the mineralizing processes ceased. Still later faults exist and the Last Chance-Johnson Stope Country, presumably the locus of much of the old timers' bonanza ore, is a maze of faults both parallel to and at right angles to the main faults. Faulting will complicate the following of certain of the ore shoots.

ORE BODIES:

The mineralized area of the camp extends from the Hilda vein on the northeast to the Esmeralda vein on the southwest, a distance of 19,200 feet (3.6 miles) and has a width of about 3,000 feet (0.6 miles).

The veins are confined to the andesite flows and presumably antedate that of the rhyolite. The Hilda and Big Dike occur in a flow rock containing quartz phenocrysts but presumably this is one of the more acid rocks of the andesite series rather than a rhyolite.

The veins are of rather regular width. They vary from a few inches to 20 feet or more in thickness. Along their strike they are inclined to be rather continuous. They stand up above the andesite as rugged quartz walls except where the overburden is heavy, in which case their position may be indicated by residual boulders. The Humboldt, Juniata and many other veins are practically vertical but the Philadelphia and Last Chance vein-complexes dip some 30° south.

The veins consist predominantly of a white, very fine-grained, porcelain-like quartz; in which there may be vugs lined by quartz crystals. This appears to be the older quartz. The silicification of the crushed andesitic walls, common in the district, may be contemporaneous. Cutting such quartz is a younger type often well banded vertically. In this are streaks of dark-gray or bluish gray color, evidently finely divided sulphides. Quartz-lined vugs also occur in this type of quartz. The banded ore is reported to be of better grade than the massive. A little calcite occurs and some of the quartz appears to replace much more calcite than once existed.

The ore is notably lacking in sulphides but a little pyrite and chalcopyrite is reported. Native gold can be panned from the better ore.

Judging from the position of many old pits along the edges of the veins, the old timers found better values near the walls.

Little can be said as to grade of the vein filling: most of it is low grade: shoots containing $7 to $10 of gold per ton may be rather extensive: while short, narrow lenses must exist which after close cobbing furnished the old timers their high grade.

Most of the camp is a gold camp: perhaps 5% of the values being in silver. At Silver Hill in the southwest corner of the camp, however, at present precious metal price (gold $35, silver 77 cents an ounce) silver is as important as gold.

ORE BODIES IN RELATION TO DEPTH:

The Aurora ore bodies belong to the Tertiary gold-silver deposits, which are common in Nevada and other southwestern states. In such ore bodies the values decrease in depth and become unpayable at from 800 to 3,000 feet below the surface. With veins the size of those of Aurora, we would expect such original impoverishment at perhaps 1,000 feet.

While there has been little exploration in Aurora at depth (Del Monte shaft reported to be 900 feet deep with deepest crosscut at 500 feet; Drainage tunnel in places, 500 feet below the surface) such evidence as exists indicates that the ore becomes impoverished at much shallower depth than that mentioned above and that in most other camps with ore bodies of similar origin. The deepest ore known in the camp is on the Juniata No. 1, perhaps 400 to 450 feet below the surface and this ore does not occur in quantity. Ore is reported on the crosscut between the Del Monte and Durand shafts between 320 and 400 feet below the surface.

Instances of loss of values in veins at shallow depth follow: Hancock tunnel 75 feet below good surface ore on spur of Ann vein, non-commercial; Humboldt vein, northeast of Humboldt shaft, first level 4.2 feet of $11.44 ore; second level 4.9 feet of $7.04 rock; third and fourth levels respectively 5.91 of $1.94 and 8 feet of $2.02; Gladiator vein looses values between surface and 80-foot level and such diminution of values is characteristic of other veins in Silver Hill section: on the Saul Smith Russell claim values in old stopes 25 feet below the surface 2.42 feet of $6.05, on Upper Yellow Jacket tunnel 25 feet deeper 2.17 feet of $0.18 and 85 feet deeper 1.5 feet of $0.12; Stuart vein, surface 4 feet of $2.05 and 50 feet below in Stuart tunnel 3.4 feet of $1.18: No. 1 Juniata vein on Lower tunnel 220-280 feet below the surface outcrop 65 Goldfield samples for a length of 400 feet averaged over 4 feet width $9.42, 11 Stickney samples on Intermediate tunnel 130 feet deeper for 130 feet averaged over 4.5 feet $2.95: 37 Goldfield samples on Haulage level 100 feet deeper for 220 feet, average width not given, averaged $1.75. Other data in the camp suggests similar condition although it is less complete. To my knowledge, instances of the reverse, i.e., improvement of values in depth, are lacking.

These data indicate strongly that commercial ore is confined to a shallow zone immediately below the surface and suggest that depth development is unwarranted.

The cause suggested is a moderately deep erosion of the veins followed by secondary enrichment, although more work would be essential to prove or disprove this suggestion. Before the drainage tunnels were put in, springs are reported to have existed in most of the valley heads: and probably water was not over 100 - 150 feet deep on the ridges. Some manganese dioxide is present to act as a solvent of gold. Another possible

explanation might be that before the rhyolite flowed out, the andesite had been so deeply eroded that only the "roots" of the veins remain today.

INDICATED ORE:

During the course of Mr. Stickney's examination, he found five blocks of ground (two on the Juniata No. 1 vein, two on the Juniata No. 2 vein and one on the Juniata No. 3) left by the Goldfield Consolidated, which appear to contain (together with 4,000 tons of $5 fill) 47,300 tons of an average grade of $8.85. No great sum would be required to change this indicated ore into developed ore. Of the above total, 3,075 tons of $9.40 is in Last Chance ground - not until recently under option to Mr. Scott. The dumps and tailings piles are unimportant.

OTHER CHANCES OF ORE:

It is probable that further development of the Juniata vein system would develop more ore, as it is from 500 to 600 feet to the west before the Humboldt fault is encountered. Some trenching of the vein should be done here. Beyond the fault bounding the above blocks to the east, the Juniata vein system is known. This area has possibilities.

The Silver Lining tunnel, recently optioned on rather favorable terms, will probably prove up some rather low grade ore.

The Philadelphia vein on the Philadelphia and Last Chance claims would probably furnish some medium grade ore, if reopened further. Some work should be done on the narrow vein on Northern Belle.

The spur of the Ann vein at the Garfield and Hancock stopes is ore, although it is probably shallow. This whole spur should be sampled, as should be the Hilda and the Big Dike.

The above are at present the most promising chances, in our opinion. We are sceptical of the successful outcome of any attempt to

find the extension of the Juniata vein across the valley east-northeast of the east end line of that claim, as we fear, due to the lower elevations there and the rhyolite cap, that the andesite, when found, will be below the horizon where ore may be expected in it.

In the normal course of development, it would be expected that from time to time small lenses of high-grade ore would be encountered, and presumably these would not be frequent enough to raise the grade markedly.

CONCLUSION AS TO POSSIBLE SCALE OF OPERATIONS:

At best it would be our judgment that enough ore of medium grade ($8 - $9 per ton) might be developed to warrant at no very distant date a 100-ton mill. The shallow depth to which the ore appears to extend and the considerable amount of ore stoped in previous operations apparently preclude hopes of a larger operation. Certainly no mill should be considered until the indicated ore becomes positive ore and until about 100,000 tons of ore is developed with good prospects of more ore. At that time it is probable that ore extraction will have to be carried out at two or more places with part of the ore trucked to the mill.

CAPITAL REQUIREMENTS:

At present, capital requirements, if the project was followed through, might be from $230,000 to $250,000 including property payments, mining equipment, mine development, 100-ton mill, and town and road improvements.

PROBABLE MINING COSTS:

Costs per ton in this district on a basis of 100 tons a day

should approach the following:

Development mining and milling.....	$ 5.25
Overhead.....	.30
Taxes and depreciation.....	.65
COST.....	$ 6.20
Add tailings loss.....	.50
TOTAL COST.....	$ 6.70

With a lo - 15% dilution in mining, ore would have to assay somewhat over $7.00 to be profitable.

While no recent mill tests have been made on the ore, Goldfield Consolidated from 1915 to 1918 got extractions ranging from 82.2% to 87%. As they milled not only quartz but much clayey kaolinized country rock, it is probable that a smaller operation, milling only quartz, and considering the improvements in milling gold ore during the past twenty years, would get an extraction of 90% or more. A little selenium and some antimony are, however, reported to be present in the ore and provided anyone decides to go ahead with the project, shipments of typical ore should be sent out for mill tests.

CONCLUSIONS:

See pages 1 and 2.

Respectfully submitted

Rogers Mayer & Ball (Signed)

ROGERS, MAYER AND BALL

New York, N.Y.,
October 22, 1936.

FEB 22 1983

SISKON CORPORATION

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February 18, 1983

Mr. Tom Netelbeek
Pioneer Nuclear
P. O. Box 151
Amarillo, TX 79189

Dear Tom:

Attached is the brief description of the Aurora Project that we discussed this morning. As I mentioned, we are currently evaluating the economics of a 150-200 tpd operation using equipment that Hanna has on hand. Assuming that the economics are not discouraging, we would look for a partner to fund all of the roughly $2.5 million that we currently estimate would be required for development drilling, flowsheet engineering, mine development and mill construction, in return for 50% of the cash flow.

As we develop more data on the project, I would be pleased to review it with you.

Regards,

John

John G. Stone
Vice President

JGS/lb
encl.

Pioneer Nuclear, Inc.
Plaza One/Amarillo National Bank Building, Post Office Box 151, Amarillo, Texas 79189, Tel. 806/353-7486

PIONEER

March 4, 1983

Mr. Lyall Lichty
P. O. Box 1267
Tubac, Arizona 85640

Dear Mr. Lichty:

At the request of Mr. Paul Eimon, I am enclosing a copy of some information on the Aurora Project that was sent to us from Siskon Corporation.

Sincerely,

Nancy Scherlen

(Mrs.) Nancy Scherlen
Executive Secretary

/ns

Enclosure

ESMERALDA MINING DISTRICT - sometimes referred to as AURORA
MINERAL COUNTY

(1)

SUR. NO.	NAME OF CLAIMS	OFF. NO.	SEC.	TP.	RG.	PAT.
37	Radical	1148	19,30	5 N.,	28 E.	Pat.
38	Spotted Tiger	1149	19,30	"	"	Pat.
39	Bald Eagle	1150	19	"	"	Pat.
40	Philadelphia	1151	20	"	"	Pat.
41	Philadelphia No. 2	1152	19,20	"	"	Pat.
42	Last Chance	1153	17,18,19,20		"	Pat.
43 A	Juniata (canceled)	1154	17,20	"	"	Pat.
44 B	Juniata Millsite (canceled)	1155	7,8,16,17	"	"	Not.
45	Antelope	1156	19	"	"	Pat.
46	Cortez	1157	"	"	"	Pat.
47	East Garibaldi	1158	17,18	"	"	Pat.
48	Lady Jane	1159	19	"	"	Pat.
49	Utah	1160	"	"	"	Pat.
50	Sonora	1161	"	"	"	Pat.
51	Golden Age	1162	18	"	"	Pat.
52	Empire	1163	17,20	"	"	Pat.
53	Esmeralda	1164	30	"	"	Pat.
54	Live Yankee	1165	19	"	"	Pat.
55	Durand	1166	19	"	"	Pat.
56	Prospectus	1167	17,18	"	"	Pat.
57	Northern Belle	1168	17,18	"	"	Pat.
58	Thanksgiving (Abandoned)	1169	20	"	"	—
59	Humboldt	1170	17	"	"	Pat.
60	Humboldt West	1171	17	"	"	Pat.
61	East St. Clair	1172	19	"	"	Pat.

LYALL, THIS IS THE CLAIM OWNED BY MY FRIENDS

ESMERALDA MINING DISTRICT
MINERAL COUNTY

SUR. NO.	NAME OF CLAIMS	OFF. NO.	SEC.	TP.	RG.	
62	Chimpanzee	1173	19	5 N.,	28 E.	Pat.
63	Sitting Bull	1174	"	"	"	Pat.
64	Langtry	1175	"	"	"	Pat.
65	Deane Claim	1176	10	"	"	Pat.
66	Evaleen	1177	"	"	"	Pat.
67	Bertie	1178	"	"	"	Pat.
68	Clara	1179	"	"	"	Pat.
69	Ophir	1180	18	"	"	Pat.
70	Eva	1181	"	"	"	Pat.
71	Thanksgiving	1182	20	"	"	Pat.
72	Martinez No. 2	1183	17,20	"	"	Pat.
73 Location	Humboldt East	Silver Lining Consolidated Claim 1184	17	"	"	Pat.
74 "	Curry No. 2	1185	"	"	"	Pat.
75 "	Mida	1186	"	"	"	Pat.
1967	Electric			"	"	Pat.
1968	Capital		19,20	"	"	Pat.
1969	Motor			"	"	Pat.
2026	Bell		18,19	"	"	Pat.
2027	Saul Smith Russell		19	"	"	Pat.
3941	Texas		18,19	5 N.,	28 E.	Pat.
"	Kentucky		18,19	"	"	"
"	W. Y. O. D.		18,19	"	"	"
4056	Sand Lot		17,18	"	"	Pat.
"	Gladus		17,20	"	"	no
"	[illegible]			"	"	

ESMERALDA MINING DISTRICT
MINERAL COUNTY

SUR. NO.	NAME OF CLAIMS	SECS.	TP.	RG.	PAT.
4067	Banner Fleece	17,20	5 N.,	28 E.	Pat.
4087	West Slope	19,20	"	"	Pat.
"	Emmie	19,20	"	"	"
"	Keystone Wedge	19,20	"	"	"
"	Summit	19,20	"	"	"
"	Good Hope	19,20	"	"	"
"	Lucky Sam	20	"	"	"
4162	War Eagle	18	"	"	Pat.
4179	O. K.	20	"	"	Pat.
4219 A&B	Southern	17,18	"	"	Pat.
"	Eastern	17,18	"	"	"
"	Western	17,18	"	"	"
"	Belle Weather	17,18	"	"	"
"	Mangum	18	"	"	"
"	Provo	7,17,18	"	"	"
"	Liberty Bell	7,18	"	"	"
"	Eastern Mill Site	8	"	"	"
4220	Silver Hill	19,30	"	"	Pat.
"	Wyandott	30	"	"	"
"	Black Hawk	19,30	"	"	"
"	Seminole	19,30	"	"	"
"	Monarch	19	"	"	"
"	The Gladiator	19	"	"	"
4221	Virginia	19,30	"	"	Pat.
4222	Clarence	19	"	"	Pat.

(4)

ESMERALDA MINING DISTRICT
MINERAL COUNTY

SUR. NO.	NAME OF CLAIMS	SECS.	TP.	RG.	PAT.
4269	Mary	19	5 N.,	28 E.	Pat.
"	Eleanore	19,20	"	"	"
4271	Victor	17	"	"	Pat.
"	Stuart	17,18	"	"	"
"	Bird	18	"	"	"
"	Aurora B	"	"	"	"
"	Humboldt Fraction	17	"	"	"
4286	Rambler	17	"	"	Pat.
"	Juanita Extension	17	"	"	"
4292	Ruth	30	"	"	Pat.
"	South End	"	"	"	"
4307 A	Eureka	19	"	"	Pat.
" B	Eureka Mill Site	8	"	"	"
4310 A&B	Astor	17,17,	"	"	Pat.
"	Interprice	17,18	"	"	"
"	Gladus	17,20	"	"	"
"	Alice C. Dennis Fraction	17	"	"	"
"	South Republic	"	"	"	"
"	Revenue	"	"	"	"
"	Last Chance	17,20	"	"	"
"	Southern Mill Site	17	"	"	"

AURORA PROJECT

Location

The Aurora/New Esmeralda properties consist of a group of 60 patented and 251 unpatented claims covering about 5,600 acres in the old Aurora mining district of west-central Nevada, some 75 miles southeast of Reno. The Aurora claims cover a large portion of the previously productive district, and the New Esmeralda claims cover a series of gold-bearing veins some 2-3 miles northeast of the main district.

Aurora was one of the earliest gold camps in Nevada, and produced around one million ounces of gold and some five million ounces of silver between 1860 and 1865, mostly from shallow stopes along a few of the many quartz veins exposed over an area of about two square miles. Goldfields built a cyanide mill and treated around 600,000 tons of ore averaging 0.14 oz. Au per ton between 1914 and 1918, and Siskon milled some 10,000 tons of ore in 1949-1950. Very little systematic exploration has been done in the district.

Geology and Reserves

The orebodies in the Aurora/New Esmeralda district consist of steeply dipping quartz veins in an altered Tertiary andesite host rock. The surrounding area is overlain by a veneer of post-mineral volcanics, and the known productive veins occur in windows in the post-mineral cover. The major veins in the district are remarkably continuous, and several can be traced for distances of half a mile or more. The veins themselves exhibit several generations of quartz deposition with earlier quartz breccias cemented by quartz, and the vuggy, banded structures typical of epithermal veins. Mineralization consists of sparse sulfides and very fine-grained native gold. Although virtually all of the veins contain detectable traces of gold, mineable grade material appears to be confined to distinct ore shoots. The early bonanza ores (1-5 oz. Au/ton) were apparently confined to a zone within 100-200 feet of the surface, but in both the Humboldt and Juniata mines, material grading 0.1-0.3 oz. Au/ton persisted to depths of at least 400 feet.

New Esmeralda

Drilling on the Ann vein system in the New Esmeralda area has indicated a probable reserve of some 75,000-100,000 tons of open pit ore grading 0.17 oz. Au and 0.63 oz. Ag to a maximum depth of about 100 feet. The stripping ratio (ore to waste) is about 1:6.

The precious metal content of the vein decreases with depth, and the potentially mineable portion of the vein system is confined to a zone within 100-150 feet of the surface. The veins disappear along strike beneath a cover of post-mineral basalt, and although the apparent continuation of the vein system has been intersected in a drill hole some 400 feet back from the edge of the cover under 50-100 feet of basalt, ore grade material, if present, is apparently confined to a near-surface zone above the depth at which the hole penetrated the vein (approximately 225' below the pre-basalt surface).

In addition to drilling on known vein structures, one "wildcat" hole on unpatented claims east of the patented claim group intersected a 10 foot vein grading 0.225 oz. Au and 0.633 oz. Ag at a depth of 10-15 feet below the surface.

Aurora

Juniata Mine: Drilling and sampling in the Juniata mine area has located extensions of several veins mined around the turn of the century, and has found ore-grade material in at least one previously unknown vein. Additional drilling will be required to block out a mining reserve, but the work to date indicates a potential for 100,000-150,000 tons of ore grading 0.1-0.3 oz. Au/ton, most of which would lie above the existing haulage level, and some of which could be considered as semi-developed.

Prospectus Vein: The Prospectus is a major vein structure traceable for several thousand feet on the surface, that appears to represent the faulted continuation of the productive Humboldt vein system. Surface mapping, old mine records, and one 1977 diamond drill hole suggest a potential for some 100,000-200,000 tons of ore grading 0.1-0.2 oz. Au, a large portion of which should be mineable by open pit methods.

Other Veins: In addition to the veins mentioned above, old sampling records suggest that further drilling is likely to develop additional reserves in the Philadelphia, Last Chance, New Thought, Electric and Morning Glory claim areas, and there is little doubt that a systematic exploration program would identify other veins that should be drilled.

Mining

Portions of the Ann vein system in the New Esmeralda area and of the Prospectus vein could be mined by open pit methods. Past underground mining has demonstrated that both open stope and shrinkage stoping methods can be used, and that the ground stands reasonably well. In some areas, the veins are wide enough and are sufficiently continuous that trackless mining should be possible.

The Juniata mine is open, and much of the principal haulage level has recently been rehabilitated. Track, air and water lines are installed, and natural ventilation is excellent. A second opening connects to the surface, and a winze from the main haulage level reaches the water table approximately 100 feet below the level. In the past, this winze supplied 50-75 gpm of water for mining and milling operations, and there is little doubt that this supply would be adequate for a 150-250 tpd mill.

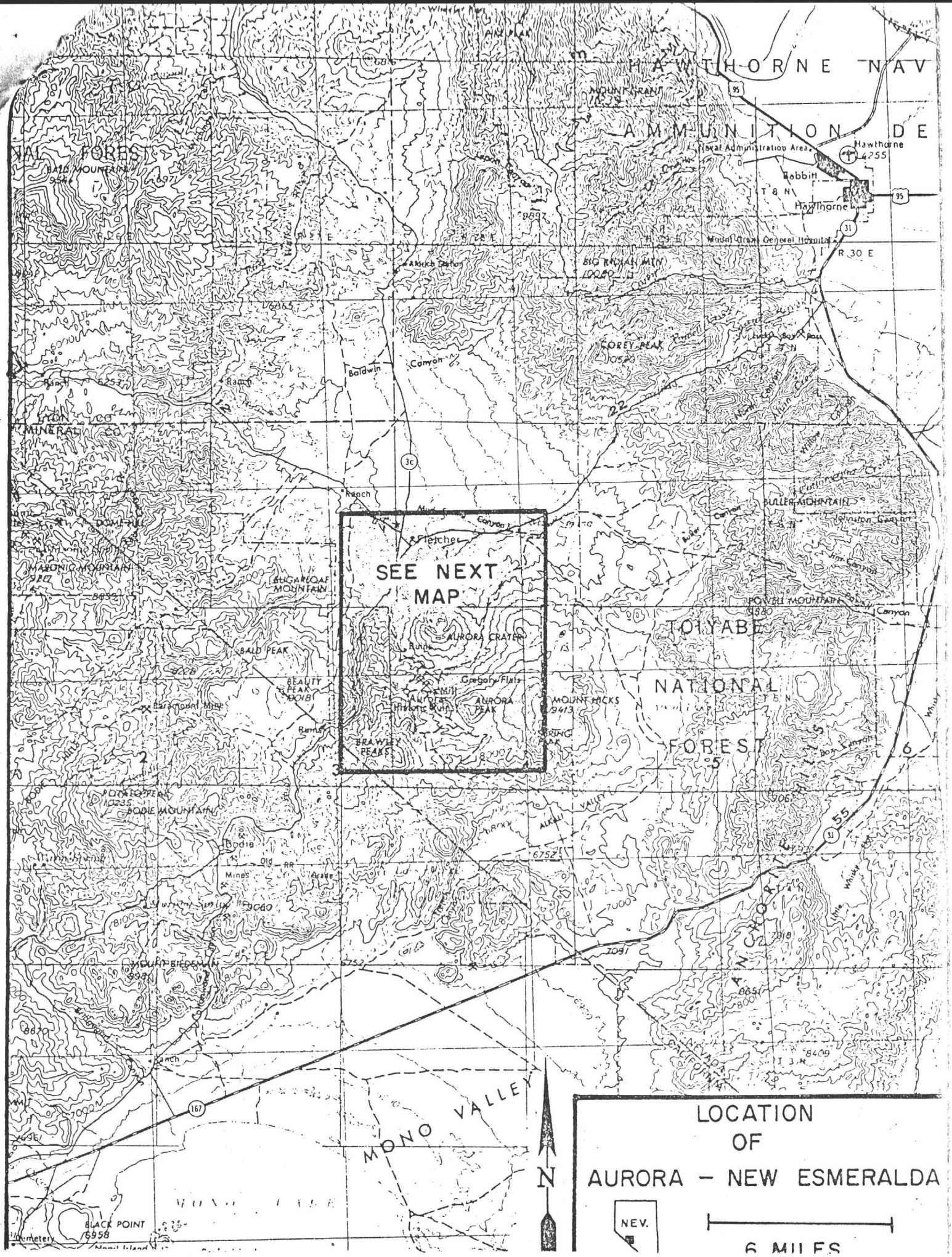
Metallurgy

Both straight cyanidation and flotation have been practiced in the district in the past. Recent testwork at Hanna's Research Lab indicates that a 24 hour straight cyanide leach of material ground to a nominal -100 mesh ($\pm$ 80% -200) will extract in excess of 95% of the gold and 80-85% of the silver in the crude ore. Lime and cyanide consumptions are low, and the ground ore settles readily.

A 100 x 35 foot mill building at the Juniata is in usable condition, and with minimal repair could be adapted to a 150-200 tpd carbon-in-pulp cyanide

mill. The old grinding mill foundations would probably have to be modified, but the existing ore bins, tank foundations and basic structure are all usable.

A 10-15 tph airfall grinding mill, a choice of several small ball mills, and miscellaneous classifiers, motor controls, transformers, pumps, screens and similar miscellaneous mill, laboratory and office equipment is on hand at various Hanna properties, and could be available for use at Aurora. An existing power line passes within a mile of the old mill, and Sierra Pacific Power Company is currently estimating the cost of upgrading this line to provide the ± 1000 KW required by a 150-200 tpd mine and mill.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SUGARLOAF MOUNTAIN
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POWELL MOUNTAIN
Canyon
SEE NEXT MAP
Fletcher
AURORA CRATER
Ruins
BALD PEAK
BEAUTY PEAK
Gregory Flats
Mill
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MOUNT HICKS
BRAWLEY PEAKS
TOIYABE
NATIONAL
FOREST
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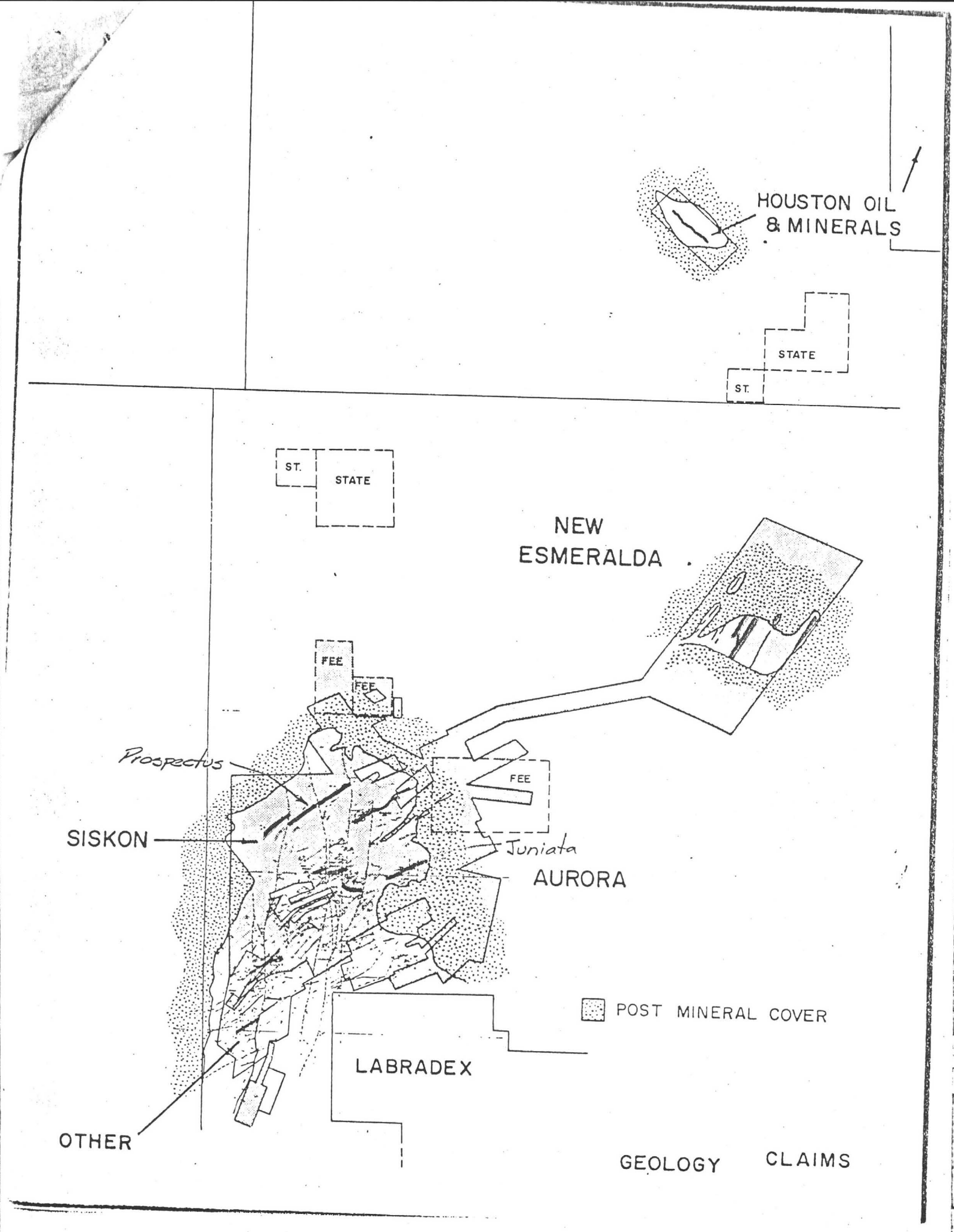
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POST MINERAL COVER
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OTHER
GEOLOGY CLAIMS

Office copy

April 20 1940

BRIEF MEMORANDUM

ON THE

JUNIATA-LAST CHANCE VEIN SYSTEM

IN THE

AURORA DISTRICT, MINERAL COUNTY, NEVADA

By

A. W. Stickney

LOCATION:

The Aurora District is situated in western Mineral County, Nevada three miles east of the California-Nevada boundary line. It is 28 miles southwest of Hawthorne, Nevada by graded dirt road. Hawthorne is 7 miles by road from the Southern Pacific railroad station at Thorne. The mining town of Bodie, California lies 10 miles to the west of Aurora. The district is an elevated semi-desert region consisting of rather gently sloping hills and ridges cut by shallow valleys. Lower points in the district are around 7200 feet above sea level and the higher 8400 feet.

HISTORY:

The gold quartz veins of Aurora were discovered in 1860 and a spectacular rush ensued. By 1864 the town of Aurora had a population of 10,000. But by 1869 the bonanza ore near the surface became exhausted and a considerable part of the population moved to Virginia City. The mines, however, continued to produce up to 1882.

The early-day records of production are incomplete, but the following quotation is from a report by the United States Bureau of Mines - "According to the records of the Wells Fargo Company, the bullion shipped through them up to 1869 had a value of $27,000,000. In addition, there is a record of $2,365,969 shipped without insurance; therefore it can be safely stated that the output of the district between the years 1860 and 1869 was about $30,000,000. This sum appears conservative if statements of production from some of the higher grade stopes are considered. " From 1910 to 1920 the Mineral Resources of the United States record a production of $1,882,861 in gold and 128,808 ounces in silver.

The latter production came dominently from operations of the Aurora Consolidated Mines Company on the Humboldt-Prospectus vein system from 1915 to 1917. The two roughly parallel veins of this system, which averaged around 10 feet in width and 0.25 oz. gold per ton, are separated by 30 feet of essentially barren country rock.

This company installed a 500-ton all sliming cyanide mill and mined by gloryhole and shrinkage stope the 50-foot width of veins and separating country to obtain feed for their large mill. They treated a total of 591,202 tons averaging $3.35 per ton (Gold at $20.67 per ounce); an average daily milling rate of around 500 tons. Operating at this rate resulted in much injudicious mining and the treatment of much country rock, and the enterprise was not successful; a failure to which labor and supply difficulties of the World War period contributed. In 1918 work was stopped and the plant and equipment sold. Since then there has been little mining activity, and until last year the general atmosphere of the camp was one of neglect and decay.

HOLDINGS:

The property, held under lease by Evans, Stickney, Nell and Kingsbury, a co-partnership, from the Goldfield Consolidated Mines Company, consists of eight contiguous patented claims in the heart of the district, namely - the Juniata, Juniata Extension, Martinez Lost Chance, Gladus, Philadelphia No. 1, Philadelphia No. 2, and one-half of the Last Chance. These claims cover the Juniata-Last Chance vein system.

The terms of the lease call for a royalty of 10% of the assay value of the mill feed after deducting 10% for mill losses and $2.50 a ton to cover costs of milling, marketing, etc. On $9 mill heads, this is a royalty of 56 cents a ton. The purchase price is $50,000 due in 1948 with no time payments. Royalty payments apply on the purchase price.

ECONOMIC GEOLOGY:

The auriferous quartz veins of this system fill fissures in Tertiary andesite and latite They are of rather regular width, averaging around 4½ feet, striking northeast-southwest and dipping around 80° to the south in the Juniata and Martinez area, and flatten to about 45° in the Last Chance area. There are three roughly parallel veins making up this system and they are separated in the developed area by about 40 to 200 feet of country rock. The veins are persistent along the strike and are known from the development done to persist over a length of 500 feet with the drift faces still on the veins.

The veins consist predominantly of an earlier white, very fine-grained, procelain-like quartz which shows a recementing after brecciation and a banding with darker streaks. These darker steaks are the richer portion and they consist of quartz, adularia, and a little very fine pyrite, chalcopyrite, galena, sphalerite, tetrahedrite, argentite, and a gold selenide but the ore is notably lacking in sulphides. A very little fine free gold occurs which is rarely visible even under a pocket lens.

A wieghed composite of one hundred and fifty samples, cut on the Juniata veins during the writer's examination of the Aurora district for a client in 1936, analyzed as follows:

Au	0.263 oz/ton
AG	1.08 oz /ton
CU	Trace
PB	Trace
ZN	Trace
FE	1.40%
S	0.11%
Insoluble	97.52%
Specific Gravity	2.65%

0.263) 1.080 (4
1052

1:4

In the Juniata developed area the veins are known to be displaced by two steeply dipping nearly parallel post-mineral faults, the Juniata and the East faults, which show horizontal displacements of around 50 feet. A thousand feet to the west beyond the Juniata developed ground, the vein system is cut by the steeply dipping Humboldt fault zone with a horizontal displacement of nearly 400 feet. Five hundred feet farther west the veins are displaced by the Prospectus fault showing a horizontal displacement of 500 feet. These two latter fault zones appear to be later than the earlier rather barren quartz of the veins, but may be contemporaneous with the auriferous mineralization.

To the east beyond the Juniata mine development the country is covered by recent "lake bed" sands for a distance of one-half mile and beyond this by a thin post-mineral basalt flow. To the west beyond the Juniata mine development and up to the Humboldt fault, there is also a sand covering over the thousand feet along the strike of the veins. Over these covered areas along the veins no prospecting nor development has been done. We consider that the indicated longitudinal extensions of the veins under these considerable covered areas afford promising ground for development. This is especially true on the Western extension adjacent to the Humbodt fault zone where the small amount of development work done has shown higher grade ore. Both the Humboldt and Prospectus faults cut the Humboddt-Prospectus vein system which lies one-half mile north of and roughly parallel to the Juniata-Last Chance vein system. The better grade ore of the Humboldt and Prospectus veins occurred within two hundred feet of these faults.

At vertical depths around 350 feet in the Juniata mine the veins widen rather abruptly from 5 feet to 10 and 20 feet, calcite comes in with the quartz, and the gold content falls below 0.10 oz. per ton. Some still deeper development was effected at a depth of 500 feet below the outcrops with no improvement in gold content of the vein. This is the deepest development on veins anywhere in the district.

MINE DEVELOPMENT:

The Juniata mine development is best shown by the accompanying plan and vertical longitudinal projections. We estimate in this section around 30,000 tons of partially developed ore averaging Au 0.25 oz. and Ag 1 oz. per ton, with a width of 4.5 feet and no place less than a stoping width. Every 100 feet of longitudinal extension on the three Juniata veins with a combined width of 13 feet affords 30,000 tons to a depth of 300 feet.

Beyond the East fault in the Juniata mine the early operators did some work but their workings are caved. Late in 1917 the Aurora Consolidated Mines Company, who were operating the Humboldt-Prospectus vein system in the district, attempted to open up this part of the Juniata ground. Their manager, J. W. Hutchinson, reported as follows: "On the hanging wall (east) side of the East fault in the old Juniata workings a vein has been exposed for 170 feet which has been stoped by square setting and filled by the early-day operators for a length of 130 feet. How far to the east these workings extend is not known, since they are caved and inaccessible beyond this point. This vein is from 12 to 18 feet wide and has been stoped over these widths. It is the strongest vein in this section and has every appearance of persistence in both dip and strike. The condition of the old workings does not permit an accurate sampling to be made, but cuts over 10-foot widths indicate a value ranging from $8.00 to $20.00 (gold at $20.67 per ounce) per ton. The stopes are filled with quartz sorted from broken ore and samples indicate a value of $5.00 per ton, and it is believed there are 10,000 tons of broken ore in fills." They had gained access to this ground through a 30-degree incline raise and up portions of an old shaft which made work impossible until these passageways were improved. Work was started on correcting this condition when that company closed down all operations early in 1918 as previously stated.

In the Philadelphia-Last Chance (southern portion) a drift on what is tenatively considered to be No. 3 Vein of the Juniata mine, extends along the vein for 400 feet at the shallow depth of 60 feet. The vein above this drift was stoped out in the early days of the camp except for a few small scattered pillars. These pillars sample Au 0.20 oz. and Ag 1 oz. per ton. Average width of this stoped vein perpendicular to the walls is 3.5 feet. The east face of the drift shows a width of 3.5 feet, sampling Au 0.38 oz. and Ag 1.4 oz. per ton, and the west face 4.2 feet with Au 0.48 oz. and Ag 1.2 oz. per ton. We tuned up our mill in November last on the old discarded and subsequently screened dumps of the early operators on this vein and they averaged Au 0.23 oz. per ton.

Adjacent on the east to this Last Chance ground, the Walker shaft has developed the dragged quartz blocks along the Humboldt fault zone to a vertical depth of 80 feet. These quartz blocks are neither persistent horizontally nor vertically as they are cut off in all directions by the numerous planes making up this fault zone which is some 60 feet in width. Our sampling of these dragged quartz blocks averaged 1.5 oz. in gold per ton. This small amount of development is on a fractional claim not held by us but there is no reason to consider that similar grade ground will not be developed in our surrounding ground adjacent to this fault zone.

Farther west the early-day operators mined these veins beyond the Prospectus fault and found them the highest grade and the most productive in the district. Their work was carried down to a fault underlying that area at a depth of 100 feet. Despite this shallow depth, this ground produced the dominent part of the $27,000,000 production of that period.

MINE AND MILL:

These are described in a separate memorandum by Mr. H. W. Evans.

ORE DRESSING TESTS:

In 1938 the American Cyanamid Company made ore dressing tests on a weighed composite of the one hundred and fifty channel samples cut from the veins of the Juniata mine workings by the writer's crew during his examination of the District for a client in 1936, with the following summarized results.

1. Fine Grinding and Cyanide Agitation. By grinding the ore(feed - Au 0.252 oz. and Ag 1.01 oz/ton)to 98% minus 150 mesh and cyaniding by agitation in an open bottle, 98.37% of the gold and 84.16% of the silver were extranced in 48 hours. The cyanidation tailings assayed 0.004 oz/ton Au and 0.16 oz./ton Ag. The consumption of cyanide was 2.98 lbs./ton of ore and the consumption of lime was 17.4 lbs./ton of ore.

2. Flotation, Desliming and Cyanide Leaching. With a 20-minute grind (98% minus 150 mesh) 88.84% of the gold and 72.0% of the silver were recovered in a rougher flotation concentrate assaying 3.05 oz./ton Au and 9.86 oz./ton AG; the flotation tailing assayed 0.030 oz./ton Au and 0.30 oz./ton Ag. Ratio of Concentration -- 13.8 to 1. These tailings were deslimed resulting in 69.2% sands carrying 0.042 oz./ton Au and 0.31 oz./ton Ag and 30.8% slimes carrying 0.015 oz./ton Au and 0.30 oz./ton Ag. The sands were leached without agitation by percolation for 72 hours and the additional percentages of gold and silver recovered were 7.36 and 9.0 respectively. The reagents consumed were 0.29 lb. of sodium cyanide and 1.75 lbs. of lime per ton of original ore. Thus the overall recoveries of gold and silver were respectively 96.2% and 81.0%, and the composite of the slimes and the cyanide residue, representing the overall tailings, contained 0.010 oz./ton Au and 0.20 oz./ton Ag.

The rougher concentrate was claned by flotation and the cleaner concentrate assayed 33.91 oz./ton Au and 102.6 oz./ton Ag with an overall concentration ratio of 163 to 1.

(In our mill tune-up 600 tons averaging 7 per ton [from cleaning out old workings and dumps] just before closing for the winter in November last, we obtained and shipped to the smelter a total of two cleaner concentrates as follows:

658.5 lbs. assaying 217.80 oz./ton Au and 871.75 oz./ton Ag
2795 lbs. assaying 20.15 oz./ton Au and 165.08 oz./ton Ag — $2180/T — $3800.
3453.5 " 57.84 " " 300. " "

The mill was not completed for desliming and cyzniding the flotation tails. The smelter paid us $34.43 and $33.90 respectively an ounce for the gold. It is probable a saving could be effected by putting such small quantities of high grade concentrate into bullion locally).

OPERATING CONDITIONS:

The climate is delightful in the spring, summer and fall. After Christmas for three or four months in some years there is sufficient snowfall to close for intervals the four or five miles at the Aurora end of the road to Hawthorne. A caterpillar tractor would be required to keep this open in a bad winter.

There is a sparse growth of small trees of the pine family, but suitable wood for mine timber is lacking. The mine requires a minimum of timber and the drifts stand without timberings. Wide open stopes of the early-day operators still stand without timbers.

The lower workings of the Juniata mine afford 50 gallons a minute of water. Springs located a quarter of a mile and one mile east of the campsite afford 15 gallons a minute of excellent spring water - the nearer could be piped by gravity to the campsite.

The high tension 33000-volt power line of the Mineral County Power System comes directly to the head of the mill, where it is transformed and metered without line loss to us. Their charges are as follows:

For the first	1,000	K.W.H.	at	$0.04
" " next	2,000	"	"	0.03
" " next	3,000	"	"	0.02½
" " next	4,000	"	"	0.02
" " next	10,000	"	"	0.01½
" all additional		"	"	0.01¼

There is a demand charge of $2.00 per month per K.W. of 15-minute maximum demand. A 20% discount of total monthly bill is made for prompt payment.

Labor has to be imported.

The veins break rather clean and the walls stand well suggesting that judicious mining should keep dilution down around 10%.

ESTIMATED OPERATING COSTS:

On a 100-ton a day basis, operating costs are estimated as follows:

Development	$ 0.75
Mining	2.60
Milling	1.50
Tailing loss	0.50
Royalty	0.56
Marketing, including metal price differential	0.50
Taxes and depreciation	0.54
Total	$ 6.95

Respectfully submitted,

A. W. STICKNEY

435 Hillcrest Road
San Mateo, California
April 20, 1940

JUNIATA MINE, MILL AND EQUIPMENT

By

H. W. EVANS

MINE:

The lower Adit level is our haulage level. From the portal to No. 1 Vein this is a crosscut a thousand feet long. This level is equipped with 16-lb. rails up to the face of No. 2 Vein, which is 1800 feet from the portal. A Worthington two-stage pump directly connected to a 10 H.P. motor is placed 140 feet down a winze from this level. This pump has a capacity of 75 gallons of water per minute and is connected by 1800 feet of 3-inch pipe with a storage tank on the surface above the portal. There is plenty of water.

The underground timbering has been all renewed and is in good shape.

On No. 3 Vein two steel ore chutes have been installed which take care of all the ore from the Middle Adit level. The ore is dtopped through a grizzly into an open stope which has a capacity of 800 tons. A timbered raise with air and water lines and ladders extends on No. 3 Vein from the lower Adit level to the Middle Adit level. The Middle Adit level has been opened up, retimbered, and track laid to the face on No. 3 Vein. From this level a raise on No. 3 Vein has been timbered and equipped with air and water lines up to the Upper Adit level.

From the Upper Adit level to the surface there are two old raises in good condition. An old vertical shaft extends from the surface down to within 15 feet of the present face of No. 3 Vein on this level. Water is pumped up to this level by an air pump of 10 gallons per minute capacity located on the Lower Adit level.

The mine is in excellent shape to produce ore.

It is advisable to advance the faces on No. 3 Vein on both the Upper and Middle Adit levels and block out at least 300 feet of ore which would give six 100-foot stopes. Also a cross-cut should be driven a distance of 40 feet on the Middle Adit level from No. 3 Vein to No. 2 Vein. This latter vein has never been opened up above the Lower Adit level.

The face of No. 1 Vein on the Lower Adit level should be advanced and a raise put up with a level started at the topof this raise as the Middle Adit level does not extend into this ground.

The Lower Adit level is electrically lighted with 220 voltage and a connection has been made to the Middle Adit level. There are good roads to the portals of the three levels.

The mine is equipped with -

4 ball bearing ore cars, 3/4 to 1-ton capacity
3 Smaller ore cars on the upper levels
1 New Cohise drifting machine
1 Nearly new No. 30 Ingersoll Rand drifter
3 Ingersoll Rand jackhammers
6 Air hoses and 6 water hoses
3 Portable water tanks with connections for drilling

750 Detachable bits
4 Sets of 1-inch steel
3 Sets of 7/8 inch steel
5 Tons of 12-lb. rails.

I would say that we require two additional ore cars and two stopers, costing approximately $1500.

Miscellaneous equipment on hand consists of a 1½-ton G.M.C. pick-up truck, model 1939, bought new last year and in good condition; and a model 1935 Ford 1½ ton dump truck, bought second hand but in good condition. There is also a 15 H.P. e electric driven saw for cutting mine timbers.

MILLING:

All foundations are reinforced with steel and rails and over 800 bags of cement were used. The building is constructed with 8" x 8" timbers with 2" x 6" studding and covered with 28-gauge galvanized iron with plenty of windows and doors. All floors are cement with covered drain down the center. The mill building is 100 feet long by 33 feet wide. Under the same roof is a 250-ton ore bin 20' x 20' and 14' deep.

Two 16-lb. rail tracks lead from the Lower Adit tunnel over a 3000-lb. scale to a 6' grizzly set 1" at the head of the mill. The oversize is crushed in a No. 30 Straub fine-grinding crusher, capacity 6 tons per hour to 1/4 inch mesh. A 25 H.P. Westinghouse motor drives this crusher through a Tex-belt drive. This crusher sets on top of a 250-ton ore bin. The ore from the bin feeds through two ore chutes at the bottom onto a 20' x 14" conveyor belt driven by individual 2 H.P. motor at a speed of one foot per second. This belt feeds into a 5' x 4' Eimco ball mill with special new Super-Molychrome liners, which is driven by a 75 H.P. General Electric motor though seven Tex-rope drives at a speed of 27 R.P.M.

The oversize from revolving screen at end of ball mill goes to Sub A Denver cell, and reject to classifier. Oversize from screen goes direct to classifier which is 14' x 4' Duplex classifier driven by 3 H.P. General Electric motor. Oversize from classifier back to ball mill and less than 80-mesh to a 6' x 6' conditioning tank with a 3 H.P. motor agitator.

The roughers consist of 6 Pan-American flotation cells driven by three 5 H.P. motors. The overflow from the roughers goes to two Pan American cleaning cells. Tailings from the roughers to a Wilfley table. The overflow from the cleaning cells is pumped by a 2-inch Kimball-Krogh pump to thickeners. Tailings from the cleaning cells are pumped by 2-inch Kimball-Krough pump back to conditioning tank. The pumps are directly connected to 3 H.P. motors. The thickener is a Door, 11' x 11' whth mechanism and steel super structure driven by 3 H.P. motor. An American thre-disc filter driven by a 3 H.P. reduction motor. The vacuum pump and compressor are driven by a 25 H.P. motor.

The Wilfley table is driven by a 5 H.P. motor. Concentrates from this table were pumped back to the conditioning tank by a 2-inch Wilfly pump with a 3 H.P. motor.

The mill is completely electric lighted and the machinery is in first class condition. Each unit is individually driven by electric motors. Its capacity is approximately 60 tons per 24 hours and can be raised to 90 or 100 tons by addition of another ball mill on the opposite side of the classifier where ample room as been reserved.

The following improvements should be made to the mill:

A vibrating screen with 3/4-inch openings instead of the grizzly. The conveyor belt

should be slowed down to a speed of one-half foot per second. There should be a screw feed installed from the classifier to the ball mill, and also a new 36-inch drum feeder on the ball mill. Instead of the Denver Sub A cell, a jig should be installed. Then, if advisable, the two cleaning cells can be placed ahead of the rougher cells and the Sub A cell used as a cleaning cell. The Wilfley table is to be used only as a check on the tailings.

These improvements would not cost more than $1500, as the vibrating screen would not be necessary until the capacity of the mill was increased.

The Machine Shop is a 20' x 16' building with power-driven lathe, saw and drill press. There is a welding outfit and three sets of pipe dies from 1/8-inch to 3-inch - bolt threads from 1/8-inch to 1½-inch inclusive. On hand there is a good supply of sheet iron, bolts, nuts, etc.

Adjoining the machine shop is a Blacksmith Shop 16' x 15' with a large Ingersoll Rand bit grinder and all necessary equipment.

In the Compressor Room there is the Sullivan V-type 480 cu. ft. compressor driven by a 75 H.P. General Electric motor through Dayton cog belt drive. From the 12' x 6' air compressor a 4-inch pipe line extends into the mine 1000 feet; then 500 feet of 3-inch pipe line, followed by a 2-inch line.

The Assay Office has three rooms, which is equipped with power crusher, pulverizer, oil furnace, and complete assaying outfit.

The Office is a single-room 12' x 15' building.

There are fire hydrants and hoses in the mill and in front of each building.

I would say we have around $5,000 worth of supplies on hand, including five tons of 2½ to 5 inch balls for the ball mill, chemicals and oils for the mill, assaying supplies, etc.

H. W. EVANS

Atherton, California

April 20, 1940.

S. M. Hill

Bull. 594 Ouray Dist 141-150

142. Production at least $27M

143 Extrusives. Oldest - alt rocks, mainly bi-qtz-latites
Some andesites. 900'+. Veins host.
above - rhy. 1000
Basalt capping
all these rocks, including the basalt, dip NNW
Erosion between andes. & rhy eruptions, & rhy flows rests on erosion surface.

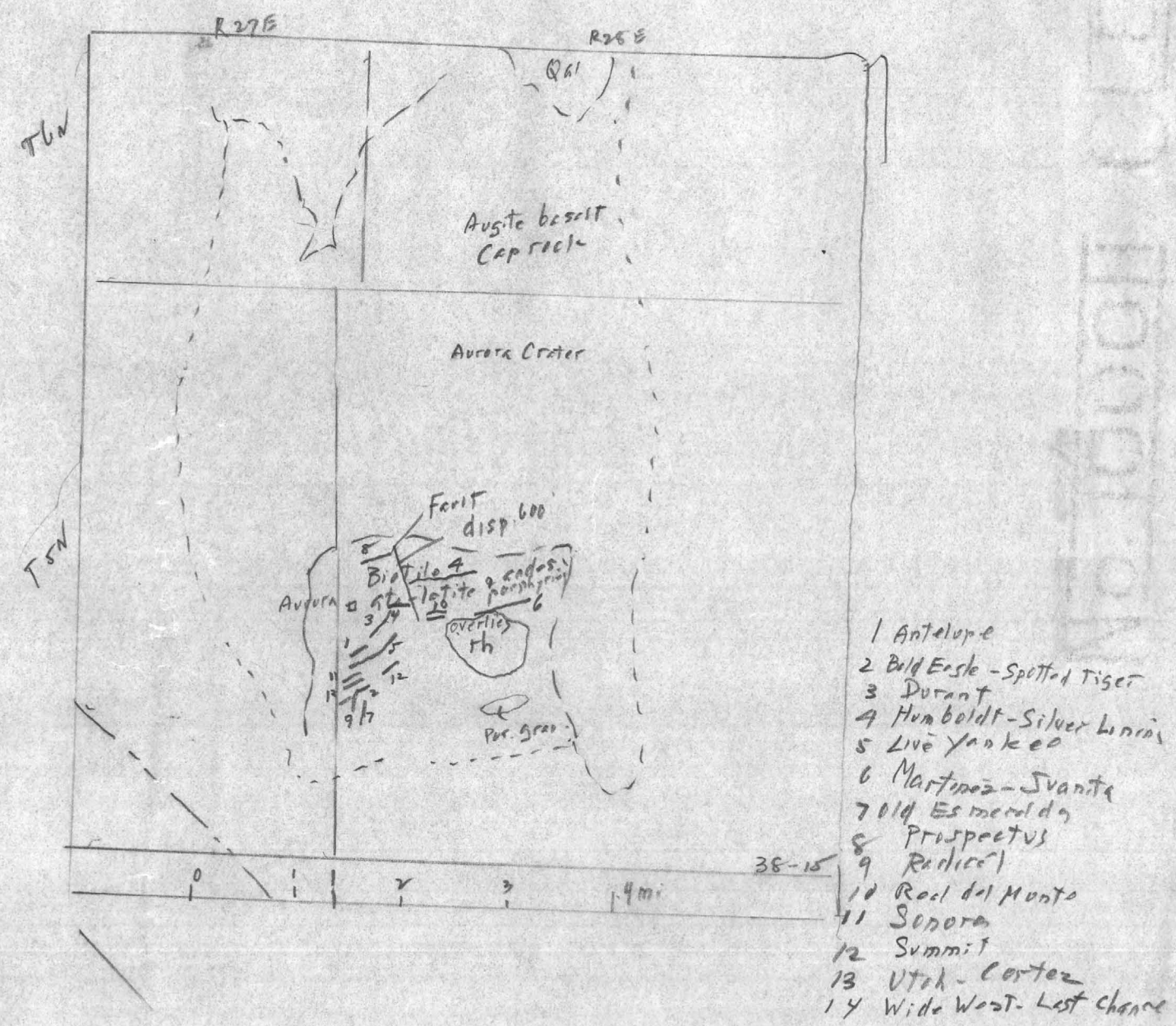
145. Bi-qtz latite - Phenos andesine, bi, pyroxene(?)
Matrix andesine & some FMS; qtz, orthoclase I G.
Alteration - andesine phenos to calcite, sericite,
Some qtz. Epidote -
FMS to chlorite, some mag.
GM to aggregate of sericite, chlorite, qtz.
Alt. much more intense near the veins than 150' away. In the highly alt. zones, silicif. & stringers of qtz & cal. Sericite, epidote more abundant near the veins, chlorite farther away.
141 Rhy - thin flows, glassy.
147 all veins dip SE - largest & strongest - Eureka, Antelope & Lady Jane dip 45-60 SE. Some smaller veins dip SE more flatly. Old Esmalda & Radical veins N10E 90°
These have wide outcrops - U.E. 60', & 20-30' max.
Humboldt & Prospectus dip 80N; other E-W veins dip S (WSW?) 65-75.

147. Veins from fraction of inch to 70-80' wide; as a rule between 1.5' & 4'. Not simple, clean cut veins — Send off narrow interlacing branches into the walls esp in HW. (Photo shows qtz-carb. breccia as well)
Some veins have thin selvage in HW.

V.M. mainly f.-granular, white, banded-looking qtz.
S.T. so fg that it is milky-white, porcelain-like.
Banded by constriction - the different bands being due to difference in size of the qtz-grains. Small chimes lined with tiny clear qtz xx. Rich ore marked by irregular wavy streaks of what looks like dark qtz cutting the white low grade qtz. These streaks = qtz, adularia, argent. - Tetrah, pyr, copy. + a soft blsh-gray (mineral - possibly Av, + As?) Selenide.

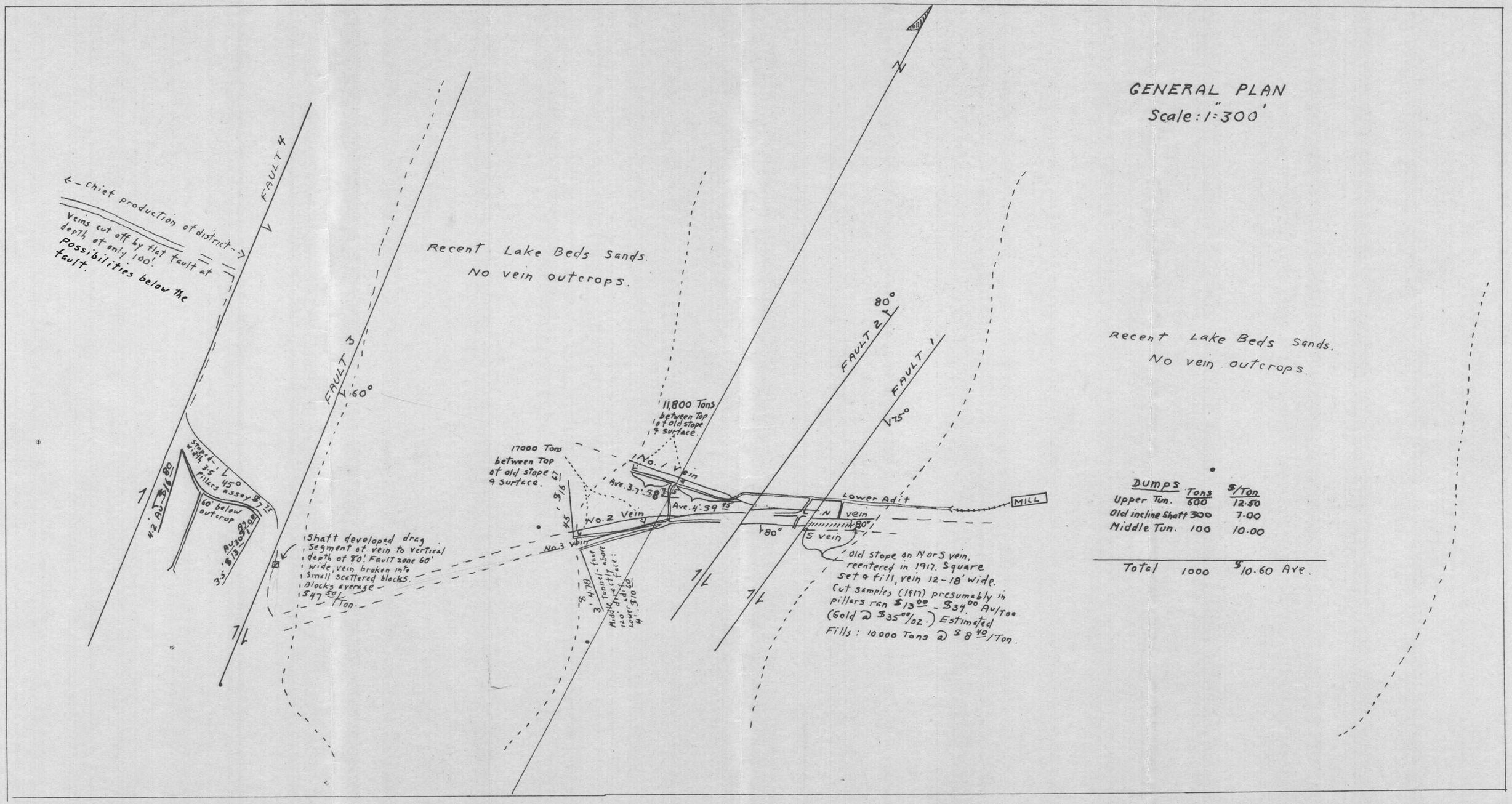
Adularia goes with very rich ore.
Some <u>56</u> in rich ore.

150 The rich ore occurred in relatively small shoots in the large barren veins. 5 such shoots, exceptionally long, in the Wide West vein.
Rich ore streaks, to 6" wide, near walls, esp. HW. Not continuous for any great dist.
Veins wider in richer parts, esp. with Wide West vein — Some stopes 60' wide. Lean parts between stopes 6-10'.
Ave value of ore 56-8". Av : As = 1:2 or 1:5
One small vein qtz-adularia calcite pseudomorphs Cal. earlier than qtz.



Geol. Sketch Map of Vicinity of Aurora
Mineral Co. 1910

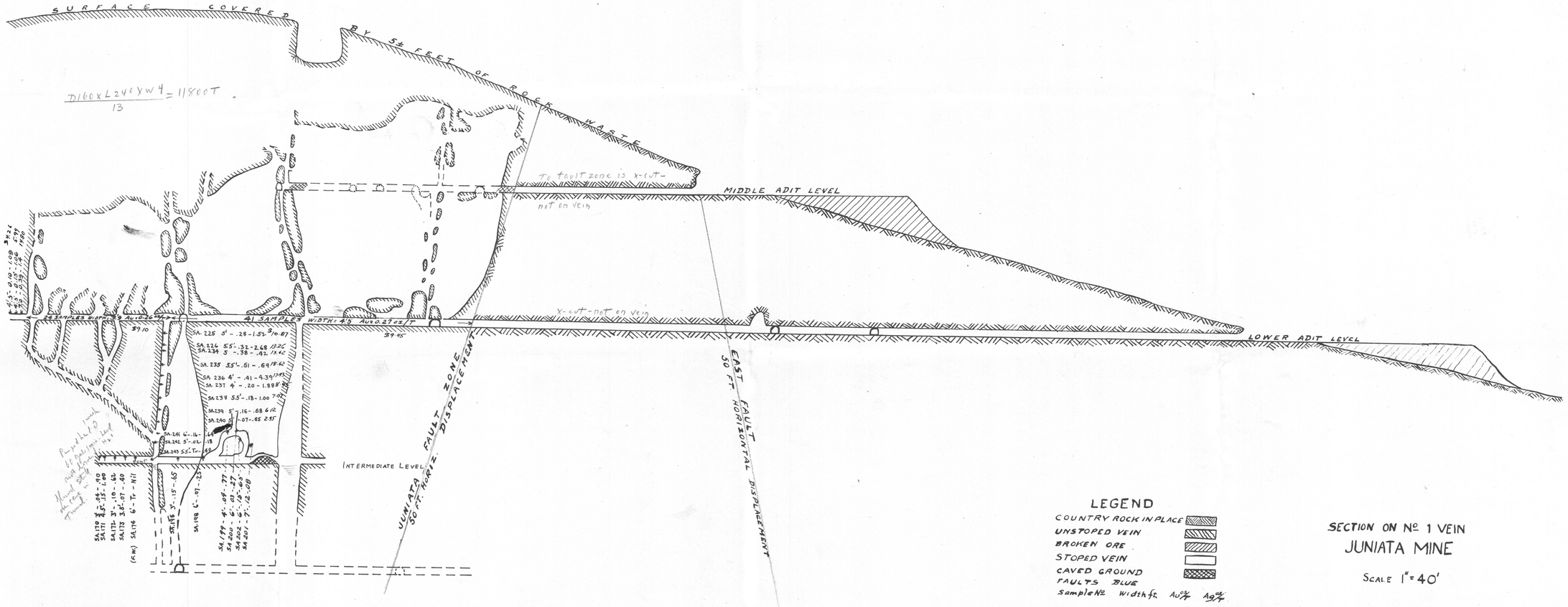
Bull. 594 Pl. 14

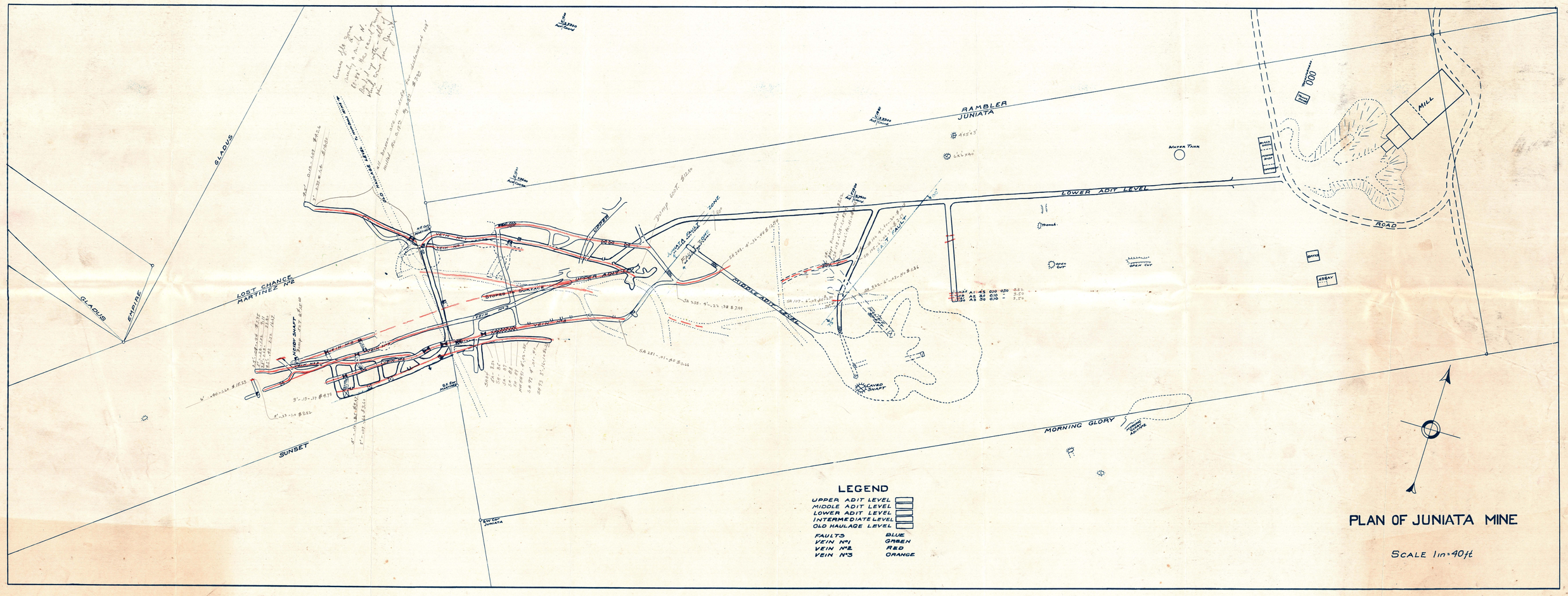


Dumps	Tons	$/Ton
Upper Tun.	600	12.50
Old incline Shaft	300	7.00
Middle Tun.	100	10.00
Total	1000	$10.60 Ave.

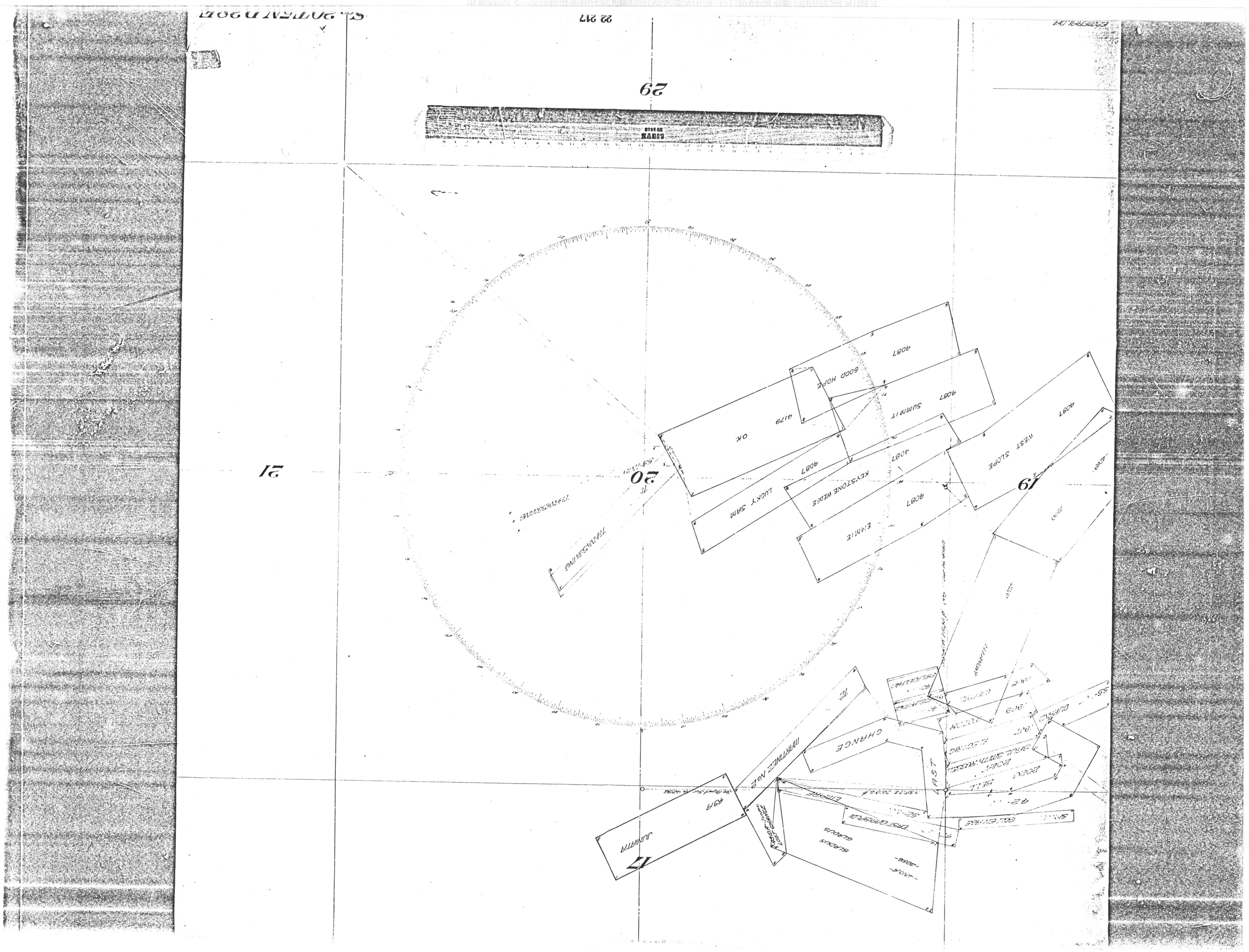
For Lyall Lichty
Nevada

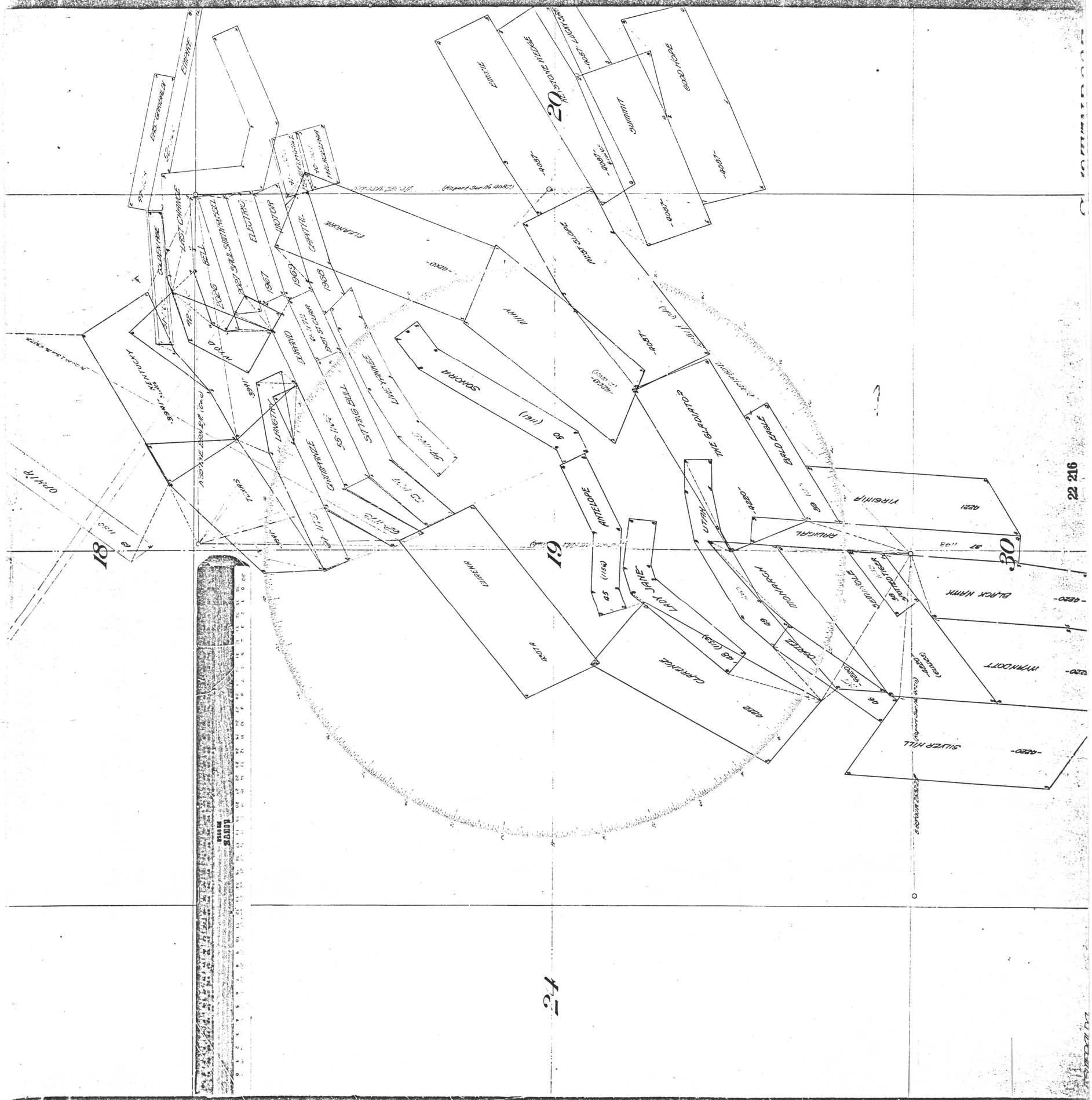
Esmeralda Mng Dist
Mineral County, Nevada


SURFACE COVERED BY 55 FEET OF ROCK WASTE
D160 x L240 x W4 / 13 = 11800T
MIDDLE ADIT LEVEL
To fault zone is x-cut - not on vein
X-cut - not on vein
LOWER ADIT LEVEL
41 SAMPLES WIDTH: 4.2 AU 0.27 oz/T
INTERMEDIATE LEVEL
JUNIATA FAULT ZONE 30 FT. HORIZ. DISPLACEMENT
EAST FAULT 50 FT. HORIZONTAL DISPLACEMENT
LEGEND
COUNTRY ROCK IN PLACE
UNSTOPED VEIN
BROKEN ORE
STOPED VEIN
CAVED GROUND
FAULTS BLUE
Sample No. Width ft. Au oz/T Ag oz/T
SECTION ON No. 1 VEIN
JUNIATA MINE
SCALE 1" = 40'


RAMBLER
JUNIATA
GLADUS
EMPIRE
LOST CHANCE
MARTINEZ No2
SUNSET
MORNING GLORY
LOWER ADIT LEVEL
UPPER ADIT LEVEL
MIDDLE ADIT LEVEL
STOPES TO SURFACE
VEIN No1
VEIN No2
VEIN No3
WEIR SHAFT
WATER TANK
MILL
ROAD
CAVED SHAFT
LEGEND
UPPER ADIT LEVEL
MIDDLE ADIT LEVEL
LOWER ADIT LEVEL
INTERMEDIATE LEVEL
OLD HAULAGE LEVEL
FAULTS BLUE
VEIN No1 GREEN
VEIN No2 RED
VEIN No3 ORANGE
PLAN OF JUNIATA MINE
SCALE 1in=40ft

4219 B
EASTERN
MILL SITE
4507 B - EUREKA
MILL SITE
4219 B - SOUTHERN MILL SITE
4219 A
LIBERTY BELL
PROVO
WESTERN
EASTERN
BELLE WEATHER
NORTHERN BELLE
SOUTHERN
PROSPECTUS
HUMBOLDT WEST
HUMBOLDT EAST
IDA
VICTOR
ROSE & DENNIS FRACTION
SOUTH REPUBLIC
REVENUE
GLADYS
RAMBLER
JUNIATA EXTENSION
JUNIATA
MARIPOSA No. 2
BANNER FLEECE
CHANGE
GOLDEN AGE
BELL
SALT SMITH RUSSEL
ELECTRIC
MOTOR
CAPITAL
PHILADELPHIA
DURAND
18
17
16
20
22 214
Esmeralda Mng. Dist
Mineral County
Nevada
T 5 N R 38 E


17
JUNIATA
ASA
INTERTINEE NO 2
CHANCE
ELIMBARE
EAST CAMBRIAN
GLADIS
GLADIS
GOLDENCE
DELL
DUPRAD
12
20
THANKSGIVING
LUCKY SAM
KEYSTONE MINE
EMMIE
WEST SLOPE
GOOD HOPE
SUMMIT
OK
19
4087
4179


22 216
30
19
18
SILVER HILL
MINNIDOCA
BLACK HAWK
VIRGINIA
RANKIN
SEMINOLE
MONARCH
CONTEZ
LADY JANE
MINTEMORE
THE GUARDIANS
BLUE DRAKE
SONORA
CLARENCE
SPRING BELL
LINE-HAWKES
CHIMPANZEE
DUMAND
ELECTRIC
MOTOR
BELL
EDGE
HYD. O
FIRST CHANCE
GOLDEN FACE
ELIFANORE
ENTRANCE
FIRE GRENADA
MAY BLOOM
MILLY
FLINTIE
QUINNITT
ECHO NOSE
MR STONE HEDGE
OPAL
ALBERT
CHARLES
HENRY
JOHN
ROBERT SALSBURY
SOUTHERN PACIFIC
(Report Sur 16 4087)

7
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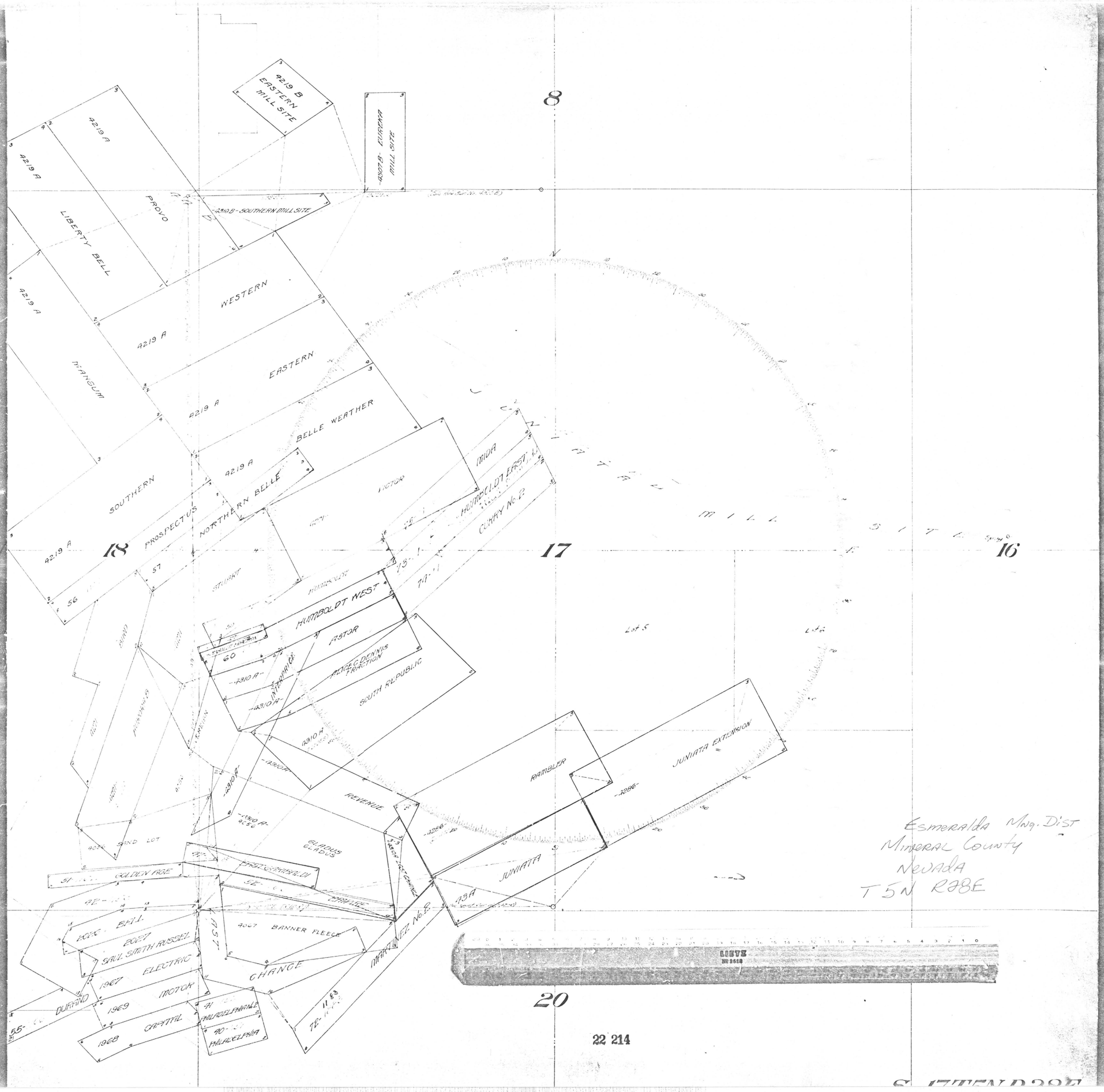
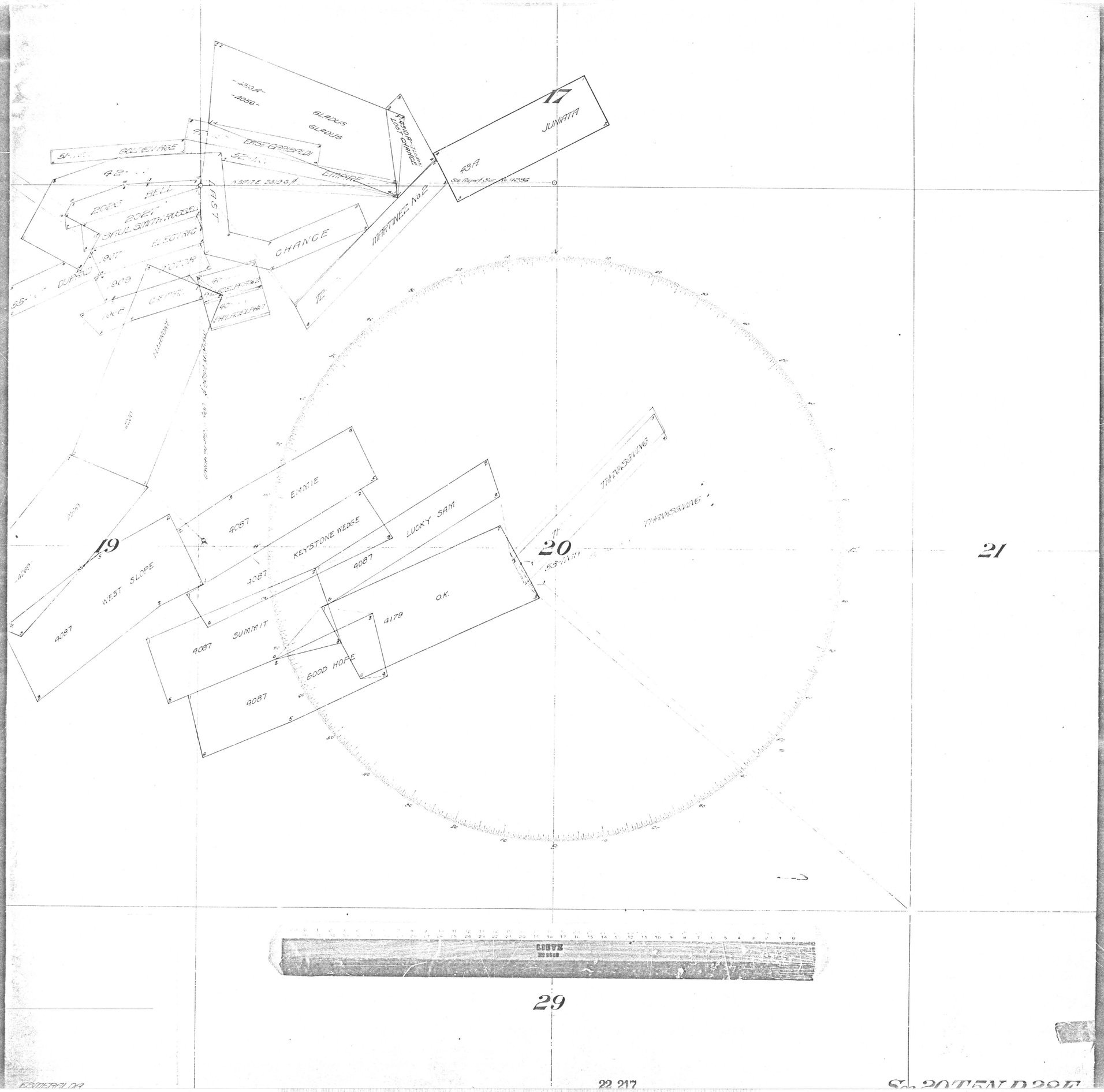
4219 B
EASTERN MILL SITE
4219 A
4218
PROP. OLINATA MILL SITE
LIBERTY BELL
4219 A
TITANIUM
4219 A
WESTERN
4219 A
EASTERN
4219 A
BELLE WEATHER
4219 A
SOUTHERN
PROSPECTUS
NORTHERN BELLE
VICTOR
EVA
BIRD
STUART
HUMBOLDT
HUMBOLDT WEST
ASTOR
ALGE GOLDING KINGSTON
SOUTH REPUBLIC
WAR EAGLE
OPHIR
AURORA B
SOVEREIGN
LITTLE
REVENUE
GLADUS
GLADUS
SAND LOT
KENTUCKY
TEXAS
2026 BELL
2027 SAIL SMITH RUSSEL
ESMERALDA
22 215


8
4219 B
EASTERN
MILL SITE
4307 B - EUREKA
MILL SITE
4219 A
LIBERTY BELL
PROVO
4219 B - SOUTHERN MILL SITE
WESTERN
EASTERN
MAGNUM
BELLE WEATHER
SOUTHERN
PROSPECTUS
NORTHERN BELLE
VICTOR
IDAHO
HUMBOLDT EAST
COMY No. 2
18
17
16
STUART
HUMBOLDT
HUMBOLDT WEST
PASTOR
ROGER DENNIS FRACTION
SOUTH REPUBLIC
INDIANOLA
REVENUE
RAMBLER
JUNIATA EXTENSION
JUNIATA
ELDORADO
ELDORADO
GOLDEN AGE
BANNER FLEECE
CHANGE
MARTINEZ No. 8
DURAND
CAPITAL
PHILADELPHIA
20
22 214
Esmeralda Mng. Dist
Mineral County
Nevada
T 5 N R 38 E


17
JUNIATA
GLADUS
GLADUS
EAST GARFIELD
GOLDEN AGE
BELL
ROBERT
ROBERT
SAUL SMITH HOUSE
CHANCE
MARTINEZ No 2
DUPAND
PHILADELPHIA
19
WEST SLOPE
4087
EMMIE
KEYSTONE WEDGE
LUCKY SAM
SUMMIT
GOOD HOPE
4179
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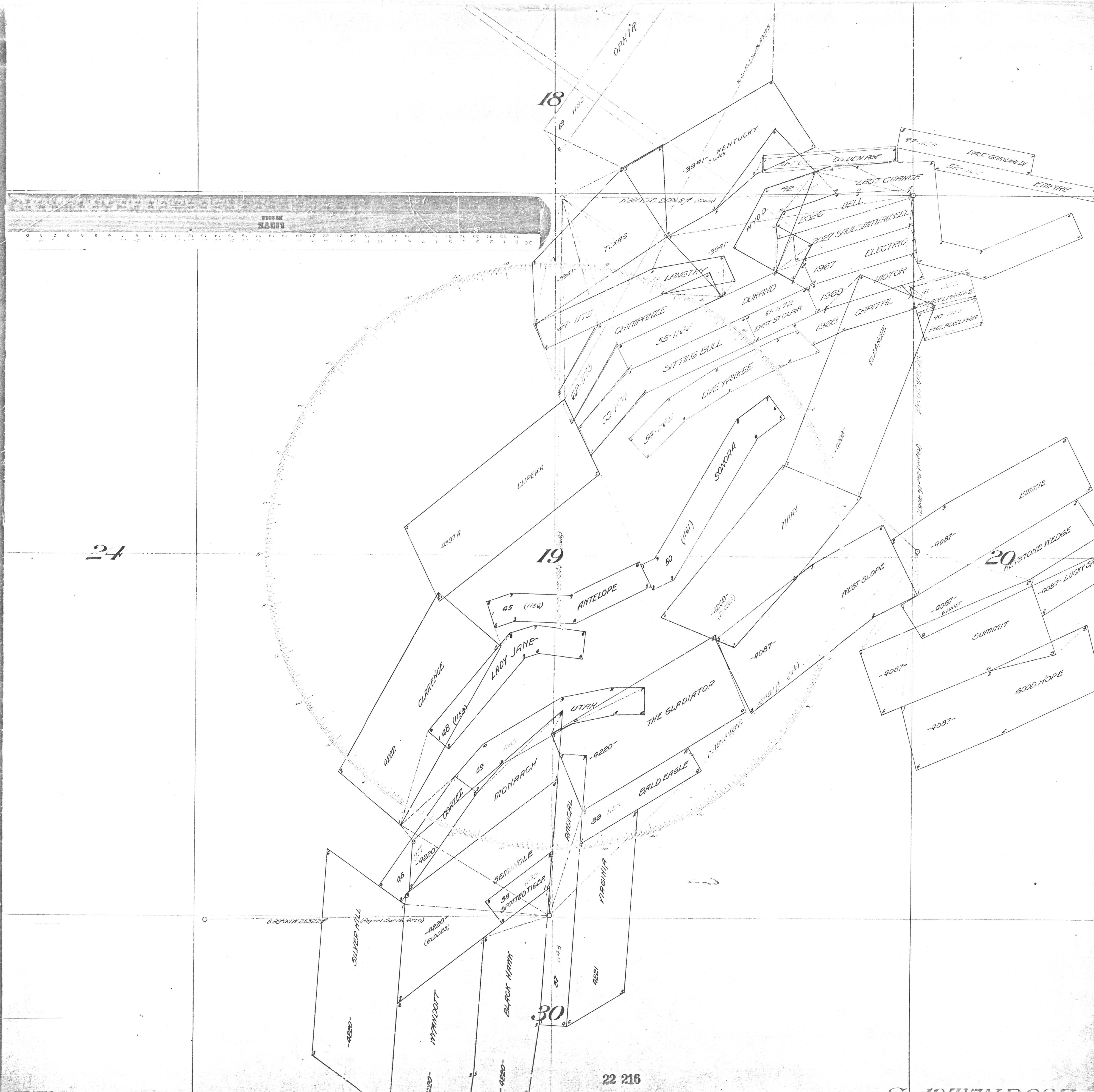
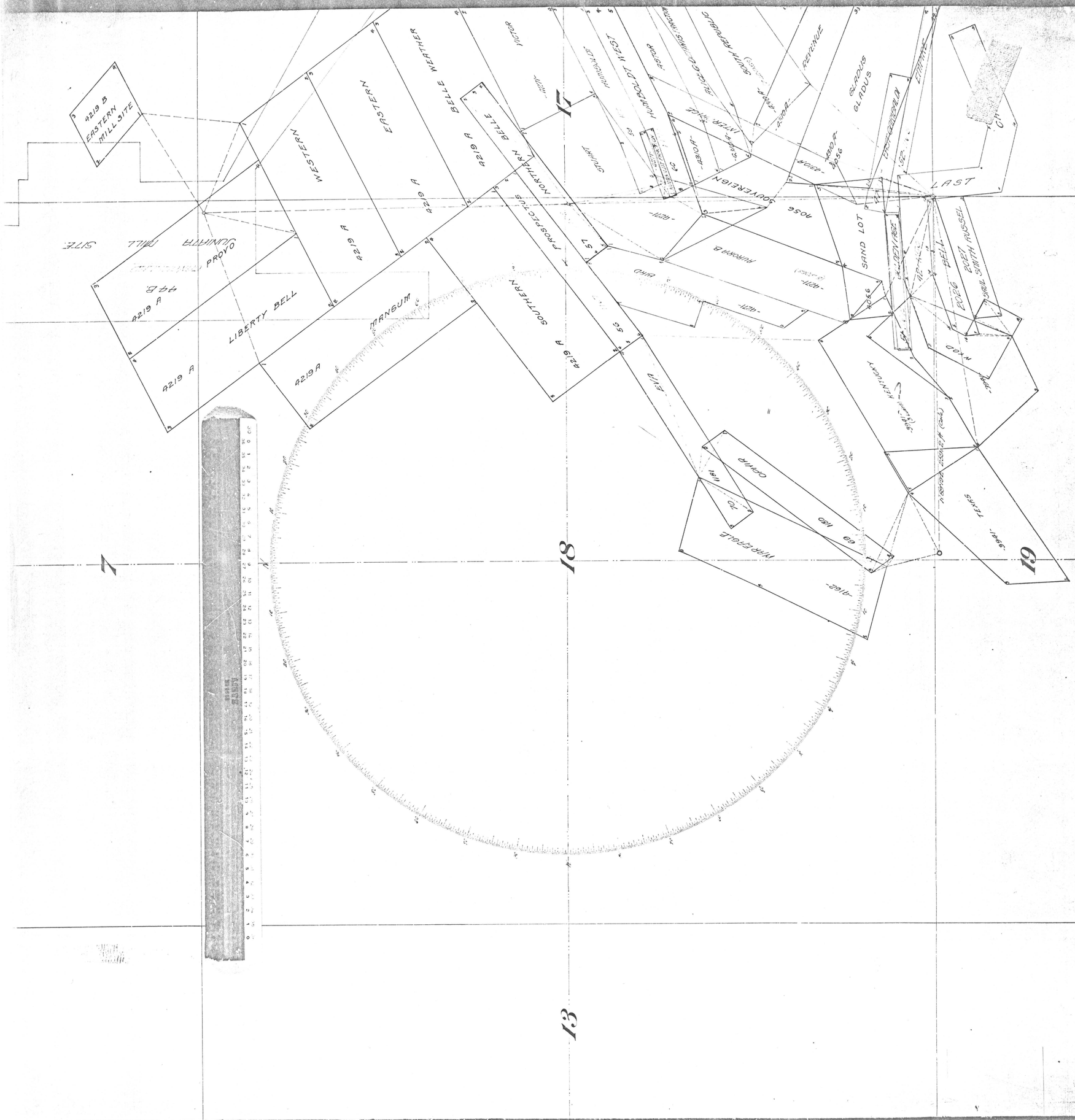
THANKSGIVING
21
29
ESMERALDA
22 217
Sec 20 T5N R28E


OPHIR
18
KENTUCKY
-3941-
3 LODES
TEXAS
LANGTRY
GOLDEN AGE
EAST GARIBALDI
EMPIRE
LAST CHANCE
BELL
W.Y.O.D.
2026
2027 SAUL SMITH RUSSEL
ELECTRIC
1967
MOTOR
1969
DURAND
CHIMPANZE
64-1175
55-1166
SITTING BULL
EAST ST. CLAIR
1968
CAPITAL
PHILADELPHIA No 2
PHILADELPHIA
62-1175
LIVE YANKEE
ELEANORE
EUREKA
4307 A
SONORA
50 (1161)
MARY
EMMIE
19
24
20
ANTELOPE
45 (1156)
-4087-
KEYSTONE WEDGE
-4087- LUCKY SAM
WEST SLOPE
-4269-
LADY JANE
48 (1159)
CLARENCE
4222
SUMMIT
GOOD HOPE
UTAH
THE GLADIATOR
-4220-
MONARCH
CORTEZ
49
BALD EAGLE
39
RADICAL
SEMINOLE
46
58
SPOTTED TIGER
VIRGINIA
S 89°00'W 2532.2 ft
(Report Sur. No. 4220)
-4220-
(6 LODES)
SILVER HILL
WYANDOTT
BLACK HAWK
37
4221
30


4219 B
EASTERN
MILL SITE
WESTERN
EASTERN
BELLE WEATHER
4219 B
4219 B
4219 B
NORTHERN BELLE
PROSPECTORS
SOUTHERN
LIBERTY BELL
MANGUM
4219 A
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4219 A
4219 A
4219 A
PROVO
SUMMA MILL SITE
44 B
SOVEREIGN
4056
SAND LOT
AURORA B
LAST
CHANCE
GLADUS
GLADUS
REVENUE
SOUTH REPUBLIC
BELLE OF MINES MAGNUM
HUMBOLDT WEST
MAGNUM
VICTOR
SUMMIT
ELVA
OPHIR
WHEREFORE
69
180
70
181
FENWICK
NYOD
BELL
BOZE
SMITH ROOSEL
TEXAS
19
18
17
13

22 215