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Exploration Proposal for the
Chollar-Potosi, Hale and Norcross,
and Savage Mines, Comstock Lode
(Virginia City) Mining District, Nevada

Willard D. Tompson

April, 1979

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SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

United Mining Corporation has options to purchase five patented lode mining claims in the Comstock mining district near Virginia City, in Storey County, Nevada. Three of the claims, the Hale and Norcross, Chollar-Potosi and Savage claims, extend along 2,571 feet of the Comstock Lode.

A total of 1,711,475 tons of bonanza ore were mined from these properties between 1863 and 1909 and about 600,000 tons of lower grade ore were mined from open pits between 1934 and 1938.

An evaluation of the economic potential of the properties was made to determine if sufficient ore reserves exist to support a mining venture. Some of the data used as a basis for this evaluation were the extensive underground assay maps prepared by the Comstock Merger Mines from which ore reserve estimates were made.

An estimate of reserves was made to the 580 level, which is about 580 feet below the surface. There are estimated to be about 3,367,877 tons which are classified as indicated reserves, containing values in gold and silver of \$46.39 per ton. These values were computed at \$250.000 per troy ounce for gold and \$7.50 per troy ounce for silver. In addition, geologic reserves are estimated to be about 3,356,000 tons.

Mineralization is known to extend for at least 3,500 feet down the dip of the lode below the 580-foot level; however, no ore reserve estimates have been made for that section.

This writer concurs with the proposal of Castagne (1978), which requires driving a 1,240-foot decline to intersect the ore body on the 465 level. From there, drifts and crosscuts will be driven to confirm and develop the ore reserves. Estimated cost of this work is \$1,480,000.

Exploration Proposal for the
Chollar-Potosi, Hale and Norcross,
and Savage Mines, Comstock Lode
(Virginia City) Mining District, Nevada

INTRODUCTION

This analysis of the central Comstock mines was undertaken in order to assess the economic potential of the mines with respect to current prices of gold and silver.

In 1968, the writer coauthored a similar report on these mines with Irving B. Gray, Ph.D., now deceased. Data and maps from that report are used liberally, and in part verbatim, in this report (Gray and Tompson, 1968).

PROPERTY

United Mining Corporation has options to purchase the Chollar-Potosi, Hale and Norcross, and Savage patented mining claims; they extend for 2,571 feet along the central portion of the Comstock Lode in the Comstock (Virginia City) mining district in Storey County, Nevada. United Mining also has options to purchase Gould and Curry and Best and Belcher mines, but they are not discussed further here.

Virginia City is in west-central Nevada, 22 miles southeast of Reno. State Highway 17 connects Virginia City with U.S. Highway 395. Electric power and water are available, and weather conditions are favorable for mining operation through most of the year (Figures 1, 2, 3 and 4).

LOCATION

The Comstock (Virginia City) mining district is in Storey County, Nevada. The mining claims, which are under option by United Mining Corporation, are in Sections 29 and 32, T. 17 N., R. 21 E., Mt. Diablo Base and Meridian.

The western part of the district is in the Virginia Range, a high, dissected plateau with an average elevation of about 6,200 feet. The Flowery Range is in the eastern part of the district. Virginia City and the Comstock Lode are on a small, softened bench between the Virginia and Flowery Ranges.

The claims are between elevations 6,160 feet and 6,475 feet, and lie along the east base of Mt. Davidson which rises to 7,856 feet elevation. The claims are 2,571 feet long, and are 1,080 feet wide at the south end and 1,125 feet wide at the north end.

HISTORY

The Comstock Lode has produced more than two billion dollars (calculated at current metal prices) in gold and silver. The greatest production from the lode was from 1862 to 1875. The Hale and Norcross, Chollar-Potosi, and Savage mines produced about \$60,000,000.00 from bonanza ores.

Comstock Merger Mines optioned the Hale and Norcross, Chollar-Potosi, and Savage claims in about 1921. They drove tens of thousands of feet of drifts and crosscuts on the upper levels of the mines and made excellent, detailed assay maps (Joralemon, 1934). These maps are the only reliable record of most of the lode.

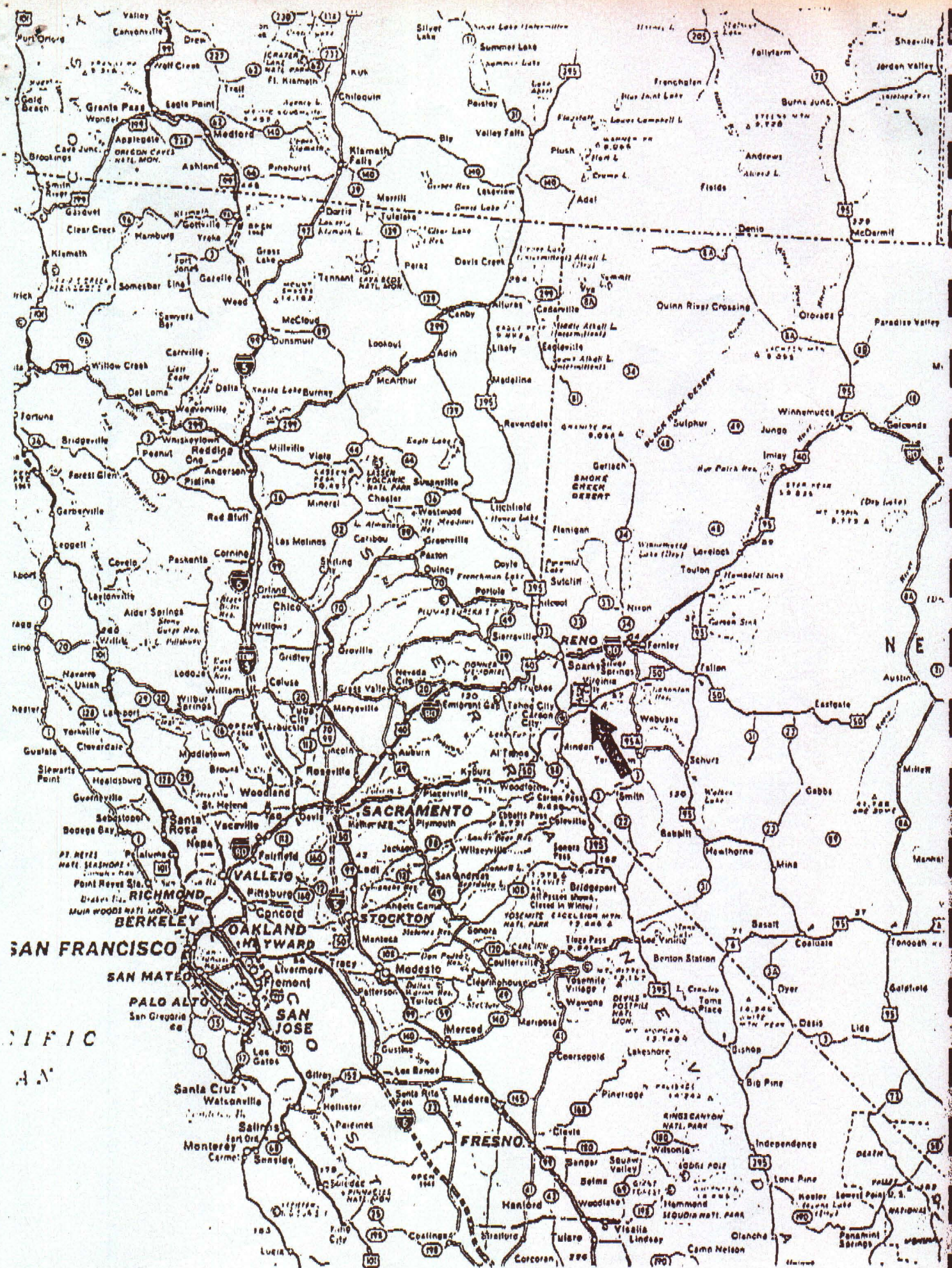


Figure 1. Comstock Lode Orientation Map

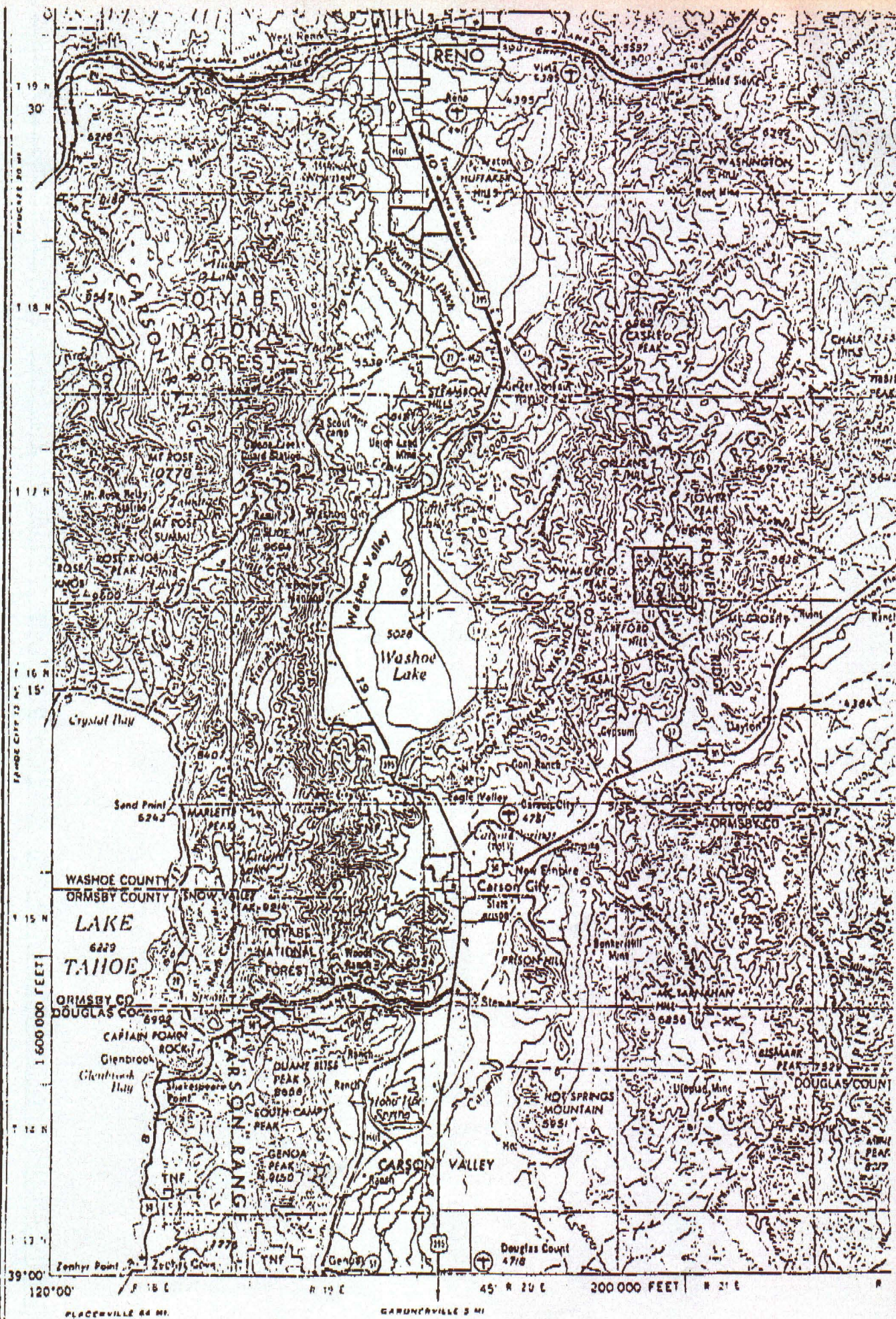


Figure 2. General Location Map



Figure 3. General Geography Map

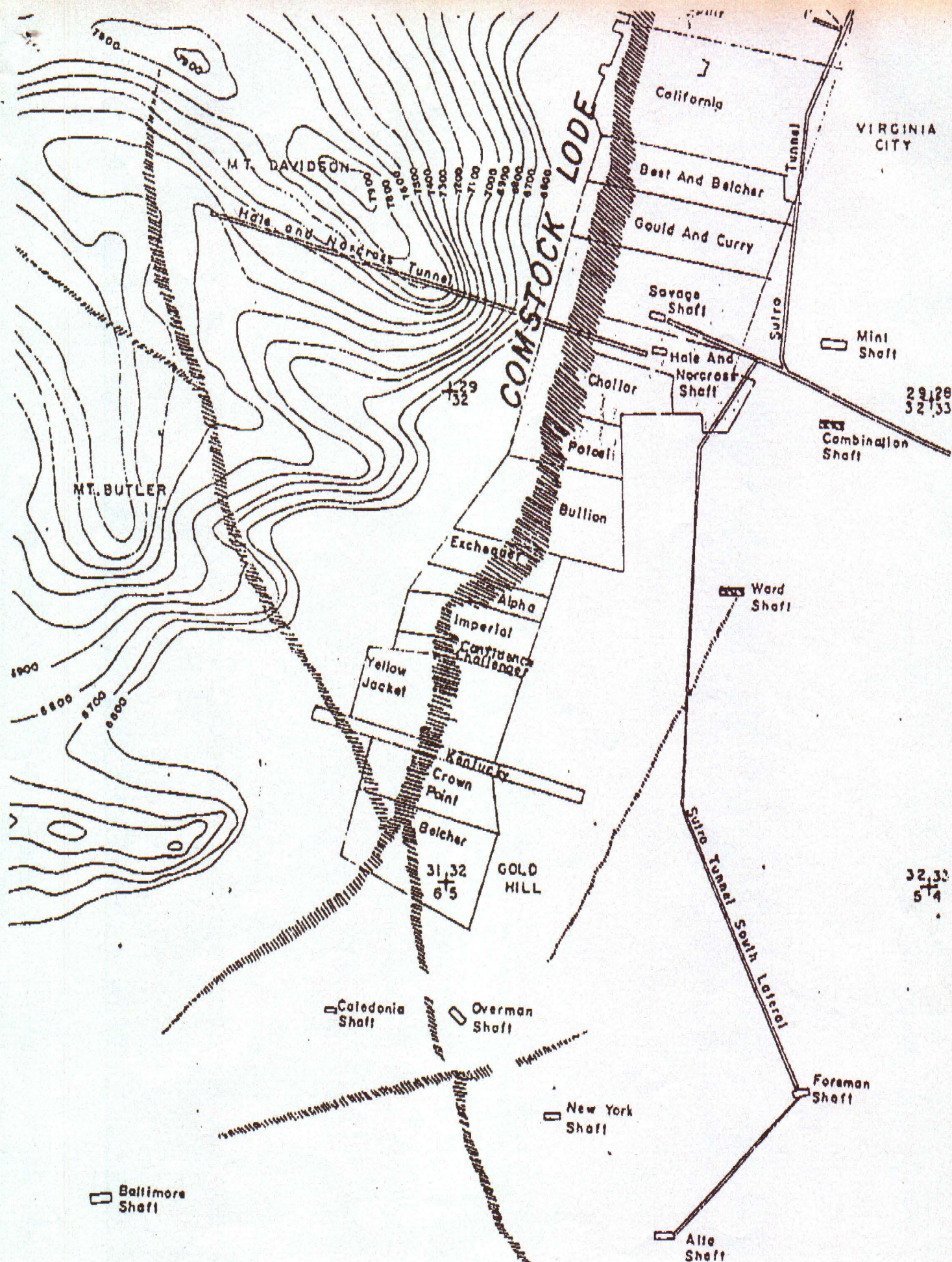


Figure 4. Map of the Comstock Lode

In 1931, the Comstock Merger Mills' holdings were acquired by Arizona Comstock Mining Company. About 600,000 tons of ore averaging \$5.00 per ton (about \$40.00 per ton at current metal prices) were mined and milled by Arizona Comstock during 1934 to 1938.

There are many reports on the Comstock, and a suggested reference list is included in this report. The reports by Joralemon (1934), Calkins (1944), Gianella (1936), and Reid (1905) are noteworthy. The excellent report by Mahoney, Crowell and Prince (1941) are chronological listings of mining news of the Chollar and Potosi, Hale and Norcross, and Savage mines gleaned from the Comstock newspapers from the 1860s through the 1910s.

RECORD OF PRODUCTION

The Hale and Norcross, Chollar-Potosi and Savage mines were active producers from the earliest history of the Comstock Lode. Total production of these mines, as listed by Mahoney, Crowell and Prince (1941) was as follows:

<u>Mine</u>	<u>Production Years Recorded</u>	<u>Tons</u>	<u>Value</u>	<u>Value/Ton</u>
Chollar-Potosi	1866-1904	648,883	\$13,882,756	\$21.39
Hale and Norcross	1875-1936	453,598	10,146,435	22.37
Savage	1863-1909	608,994	18,356,034	30.14

Total: 1,711,475 tons averaging \$24.76 per ton.

The values shown above are based upon metal prices which existed during the indicated periods of production. At that time, the price of gold was \$20.67 per troy ounce, and silver was \$1.29 per troy ounce.

GEOLOGY

General Geology

The Comstock Lode lies within the Comstock Fault. The Comstock Fault is a complex system of fractures which strikes north-northeasterly through Virginia City and dips easterly about 45 degrees.

In general, elevations are higher to the west of the Comstock Fault, and older rocks crop out to the west of the fault. These conditions are related: subsidence to the east of the Comstock Fault has preserved many of the younger rock units, and the uplift of the rock mass on the west of the fault resulted in the removal by erosion of younger rocks and the exposure of older rocks within the uplifted mass.

The oldest known rocks within the Comstock mining district are Mesozoic in age and are of an unknown thickness. According to Gianella (1936), they are metamorphosed sedimentary and volcanic rocks of Triassic age which were intruded by Jurassic age quartz monzonite.

The early Tertiary rock sequence consists of rhyolites which underlie numerous volcanic layers of andesite porphyry and pyroclastic rocks. This sequence is intruded by the Davidson diorite which is Miocene in age. Another sequence of Tertiary andesites was followed by basalt flows of Pleistocene age.

The reader is referred to Table No. 1 in this report, to Calkins' preliminary geologic map of the Comstock Lode district, Nevada (Calkins, 1945) and to the reports by Gianella (1936), Calkins (1944) and Reid (1905) for geologic details.

SUMMARY OF ROCK FORMATIONS IN THE VIRGIN CITY DISTRICT

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Quaternary	Alluvium and gypsite	Gravels, sand, silt, and alluvial fan material. Some gypsite in alluvium.
	American Flat basalt and alluvium	Flow of olivine basalt 25 feet thick. Underlain by alluvium.
Late Pliocene	Unconformity	
	Knickerbocker andesite	Pyroxene andesite. Thickness, 200 feet.
Early Pliocene (?)	Unconformity	
	Kate Peak andesites	Pyroxene andesites, glassy lavas, tuffs, breccias, and agglomerates. 1,200 ft.
Miocene	Unconformity	
	Intrusives	Hornblende and pyroxene andesites, tuffs, and breccias, including water-laid Suro tuff member, about 300 feet thick. Intrusions of various andesites and the Davidson diorite, followed by vein formation. Thickness = 3,600' +.
	Alta andesites	
	Erosion interval	
Eocene	Hartford Hill rhyolite	Biotite rhyolite with some quartz latite. Occasional underlying lenses of dacite. Thickness to 450 feet.
	Erosion interval	
	American Ravine andesite	Light gray, felsitic, hornblende andesite. Lies upon fanglomerate, monzonite, or the metamorphic rocks. Thickness, 500 feet.
Late Jurassic	Unconformity	
	Quartz monzonite	Biotite-hornblende quartz monzonite and associated dikes.
Triassic (?)	Intrusive contact	
	Meta-volcanics	Andesite and basalt lavas, tuffs, and breccias. 1,000 + feet.
	Unconformity	
	Sedimentary rocks	Limestone, shale, and schists. Thickness over 2,000 feet.

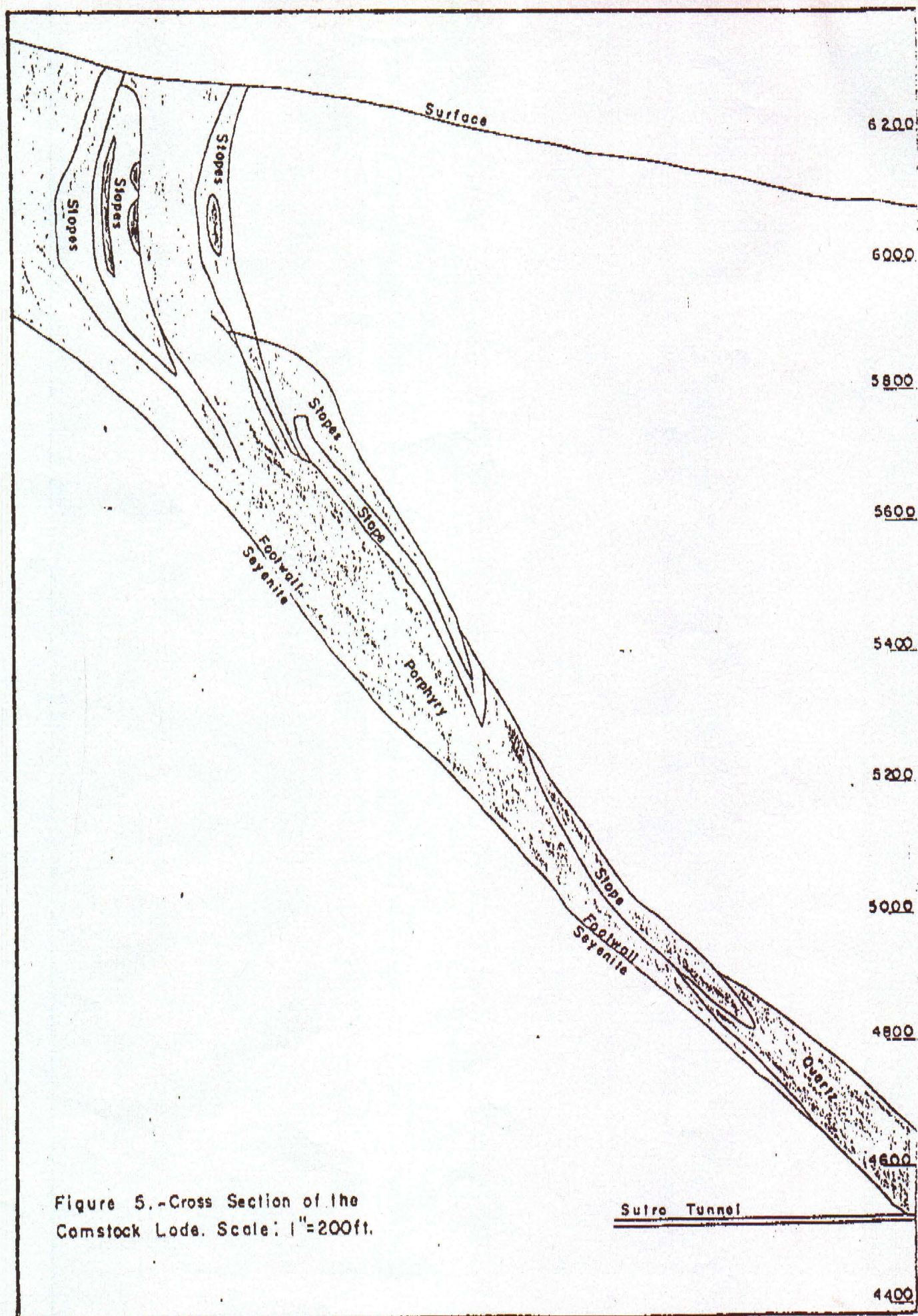
Table 1. Generalized Stratigraphic Column, adapted after Gianella (1936)

Structural Geology

The volcanic and sedimentary rocks of Mesozoic age were regionally metamorphosed, intruded by quartz monzonite, and were tilted and beveled prior to Cretaceous time. The early Tertiary volcanic rocks were deposited upon the Mesozoic-age erosion surface and were faulted at least twice during the Miocene Epoch. The Comstock ore-bearing veins were deposited within the earlier Miocene fault fractures, and then were crushed by later faulting. These faults are referred to as the Comstock pre-mineral, and Comstock post-mineral faults (Gianella, 1936). Basin and Range fault movement has further increased the displacement along the Comstock fault lines during post-Miocene time.

The fault pattern of the Comstock district, as displayed in Figure No. 4 and by Calkins (1945) probably can be resolved into three principal structural systems: the north-northeast-oriented Comstock fault, the north-northeast-oriented Brunswick fault and the north-northwest-oriented Silver City fault. Bonanza ore was produced around the intersections of these structural systems and also at places along the Comstock Fault northerly from Gold Hill where no major structural intersection is obvious.

The Miocene Comstock pre-mineral, and Comstock post-mineral faults, in addition to the post-Miocene Basin and Range type faults, generally dip about 45 degrees easterly; that is, they are normal faults, having hanging wall movement down dip with respect to the footwall. The vertical component of movement on the Comstock faults is estimated to be about 2,000 feet, and that of the Basin and Range faults to be about 1,500 feet (Gianella, 1936). In the



down thrown (easterly) block, the strata dip about 50 degrees westerly.

The Comstock Lode in the central Comstock area lies near the fault contact of the Davidson diorite with the Tertiary andesites. The upper portion of the lode is somewhat "V" shaped, but about 400 feet below the surface it assumes an easterly dip of about 45 degrees. Some of the bonanza shoots diverge from the lode and project upward into the hanging wall rocks.

Intrusive Rocks

In addition to the Mesozoic quartz monzonite, which is exposed to the west of the Comstock Fault, there are Tertiary masses of rhyolite, mica andesite porphyry, augite-hornblende andesite porphyry, augite andesite, diorite and basalt which intrude the Tertiary sequence of the Comstock district. The Davidson diorite is by far the largest of the known Tertiary intrusions; it crops out as a stock on Mt. Davidson and is common within the Comstock Fault as dikes and apophyses. A basalt dike referred to by the miners as the "Black Dike" lies with the Comstock Fault and is Pleistocene in age.

METALLIC MINERALIZATION

Metallization in the Comstock district extends about eight miles along the principal Comstock and Silver City structures, and to a known vertical depth of at least 3,200 feet below the highest vein outcrops. The type of metallization varies along the mineralized trend; for example, the Silver City portion has a high silver to gold ratio, Gold Hill near the center of the district has a high gold to silver ratio, and the section trending northerly

from Gold Hill contains significant amounts of copper, lead and zinc in addition to precious metals. At the 237-foot level on the Chollar-Potosi claim on the Central Comstock, 243 samples showed a silver to gold ratio by weight of 21.49 to 1.

Metal values are associated with quartz veins, but not all quartz veins contain sufficient values to be mined profitably. Some of the vein quartz was deposited as fissure fillings, and these veins frequently contain high-grade ore. In other cases, weakly mineralized quartz replaces wall rocks across broad zones.

The trend of the Comstock Lode at the central Comstock is sinuous in plan and complicated in detail (see Plates III, IV, V and VI. The lode here consists of three more or less interwoven quartz-vein strands referred to as the "West Vein", "Middle Vein" and "East Vein". These veins join, bend and bifurcate in unpredictable manners, and in places the intervening wall rock is so replaced by quartz that it resembles vein material. This complexity is displayed in vertical section, as well as in plan.

Vein development and metallization shows some correlation with fault structures, but not to rock types. It has been noted that bonanza shoots frequently are located where quartz veins join. No large bonanza shoots were discovered below the Sutro tunnel level, but broad veins of weaker mineralization laced with high-grade stringers were reported. It is not known, due to lack of exploration, whether the absence of large bonanza shoots on the lower levels is due to weakening mineralization with depth or to an absence of favorable structure.

Most of the ore mined from the middle Comstock claims came from the so-called Middle Vein, or at intersections of Middle Vein strands with the West or East Veins. Bonanza ore shoots were found on the Potosi, Chollar, Hale and Norcross and Savage claims; those on the Hale and Norcross and Savage claims extended to some 1,500 feet beneath the surface, which is about 200 feet above the level of the Sutro tunnel (see Plate II).

Although mining was restricted to bonanza grade shoots, much highly mineralized vein material remained untouched, and most of the stopes were backfilled with waste which is now considered to be commercial grade ore. Large segments of veins had no mining development, and other segments with developments have no assay data.

Most of the old workings which were opened and sampled by the Comstock Merger Mines contain large amounts of ore-grade rock, but only a small fraction of the potential ore-producing ground has been tested.

This analysis is concerned only with the evaluation of potential ore above the 580 level, but assays on the deeper levels show no decrease in values with depth. There remains, without question, a very large tonnage of possible ore between the 580 level and the Sutro tunnel, some 1,400 feet down the dip of the Comstock structure. Explorations to a vertical depth of some 1,700 feet below the Sutro tunnel level (3,200 feet lower than the surface outcrops) encountered strong mineralization (Mahoney, Crowell, and Prince, 1941).

ECONOMIC APPRAISAL

Reason for New Appraisal

The economic potential of the mines of the central Comstock property has increased recently due to an increase in the price of silver and gold.

An estimate of ore reserves was made by the writer using assay sample maps which were prepared by Comstock Merger Mines from 1922 to 1926, and from data prepared by Gray and Thompson (1968). It is difficult to make an accurate estimate of reserves, because records of stoped areas are incomplete.

A tonnage factor of 12 cubic feet per ton was used in the calculations.

Metal prices for this estimate were based on gold at \$250.00 per troy ounce and silver at \$7.50 per troy ounce.

Estimate of Reserves

Two categories of ore are identified in the ore reserve estimate, "indicated ore" and "geological ore".

The estimated reserves include 3,367,877 tons in the "indicated ore" category and 3,359,872 tons in the "geological ore" category. The average grade for indicated ore reserves has a value of \$46.39 per ton in gold and silver. No estimate of grade for geological reserves is attempted.

Several thousand assays were used in the determination of ore in the "indicated" category. The assays are from rock samples which were cut at 5-foot intervals in drifts and crosscuts. This sampling was done by Comstock Merger Mines during 1920 to 1923.

The weighted average of assays on any given level established length and width to the ore zone on that level. Area assays were projected between 15 and 60 feet above and below mine levels in order to establish ore blocks. Tonnages were calculated from these measurements.

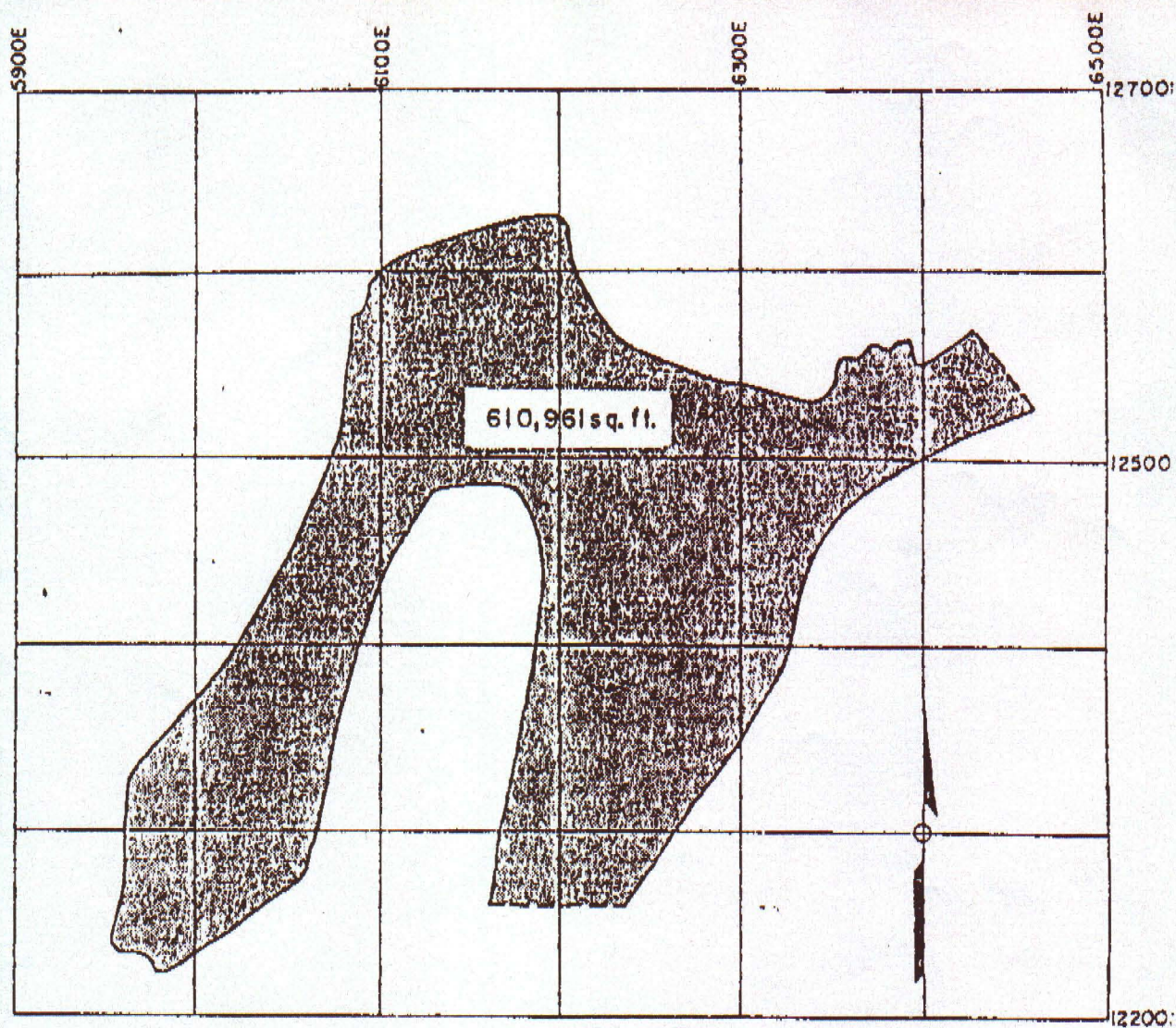
Blocks of ore in the category "geologic ore" were determined by projecting from blocks of "indicated ore" on strike, and up and down dip. Projection is based upon geologic evidence from detailed geologic maps.

Figures 6 to 18 are area assay plan maps of the mine levels from which tonnages were calculated. Plates IX to XII are geologic maps of four levels in the mine; these provide geologic evidence which supports a "geologic ore" category.

DATA USED IN EVALUATION

The economic evaluation in this report is based entirely upon assay data which was acquired by Comstock Merger Mines during the years 1920 to 1923. Some Comstock Merger maps were redrawn by Arizona Comstock Mining Company between 1931 and 1938. Assay plans of the 580, 732, and 882 levels were redrawn from old blueprints by Gray and Thompson (1968).

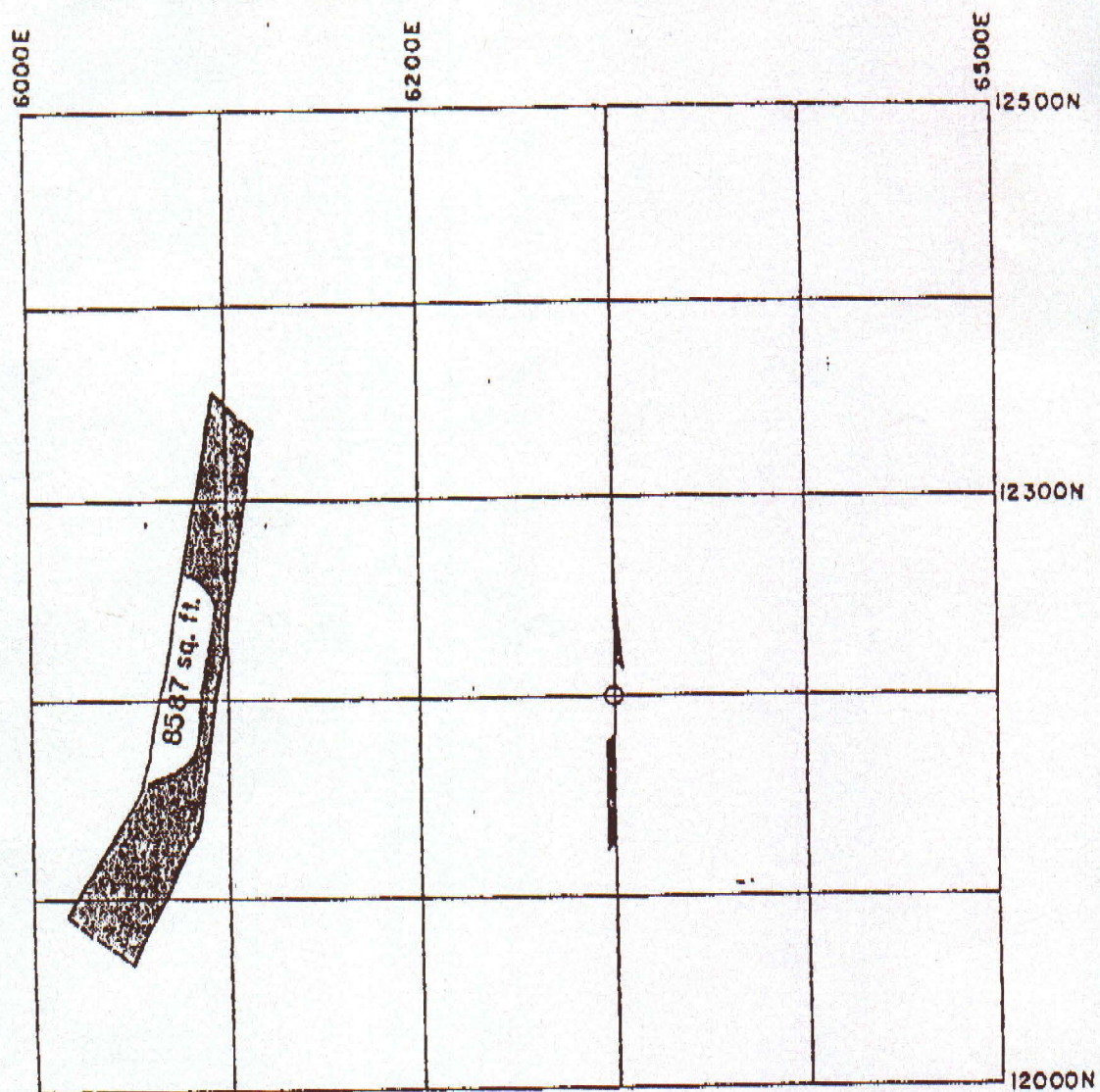
Geologic maps of the underground workings, which were prepared by Comstock Merger Mines, are in the library of the Mackay School of Mines, University of Nevada. These maps are at scale: 1 inch equals 20 feet. They are in very poor condition and tracings were made from the originals by Gray and Thompson (1968) and reduced to scale 1 inch equals 100 feet for use in this report (Figure VII). The original geological work is of excellent quality.



Average Assay

Gold: 0.092 ounces per ton
Silver: 2.55 ounces per ton

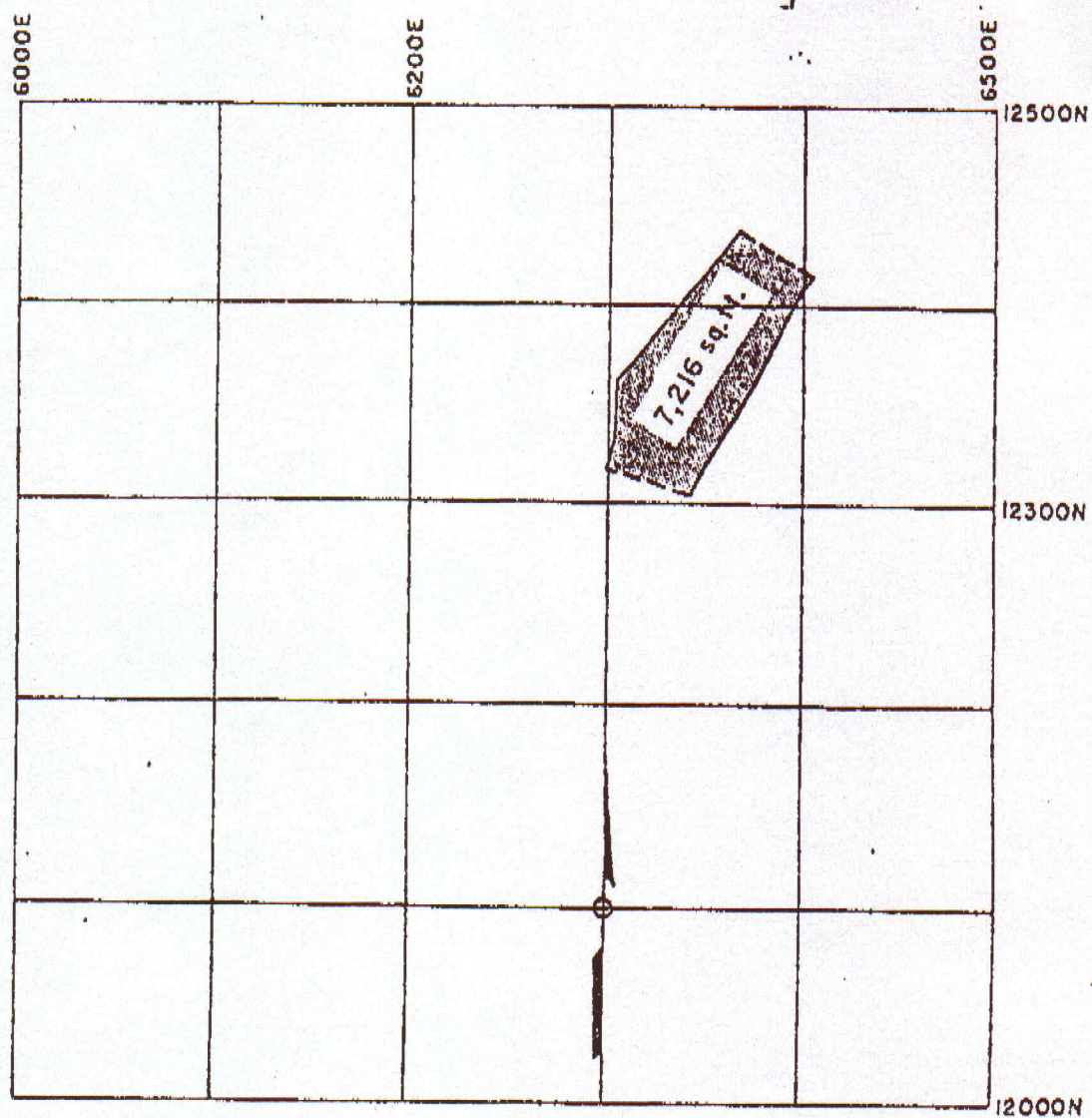
Figure 6
Glory Hole



Average Assay

Gold: 0.035 ounces per ton
Silver: 1.58 ounces per ton

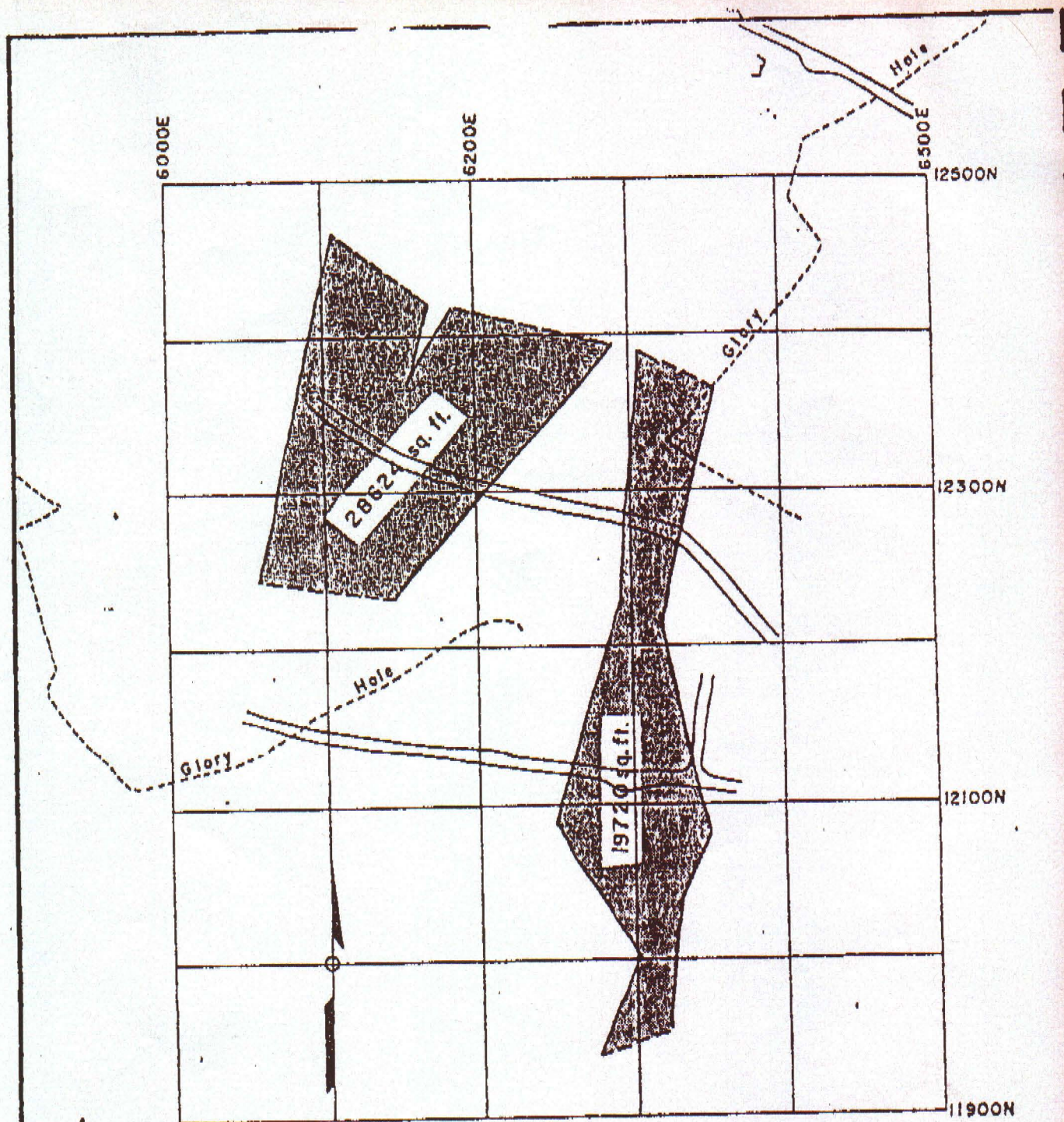
Figure 7
107 foot level



Average Assay

Gold: 0.056 ounces per ton
Silver: 2.47 ounces per ton

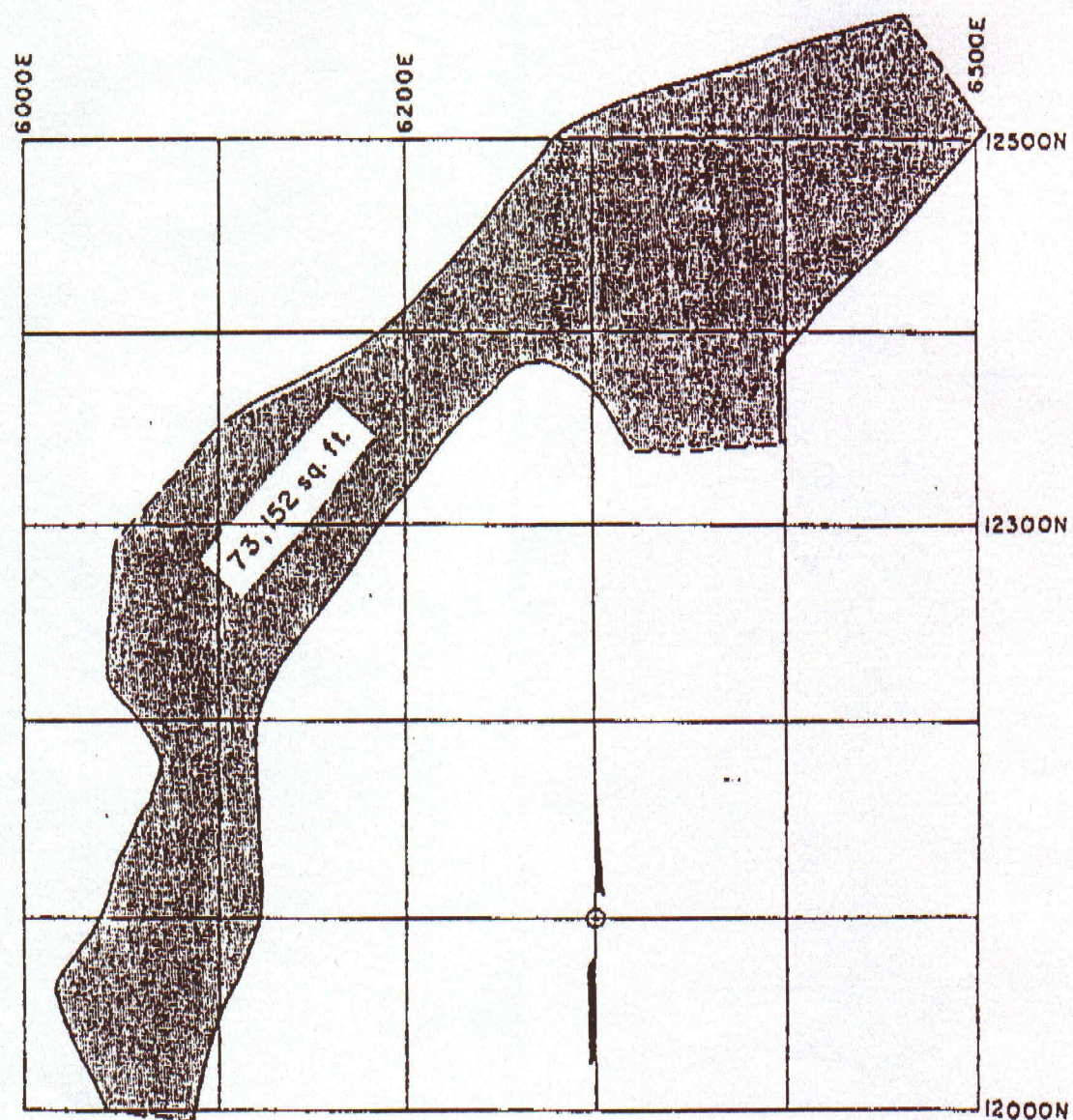
Figure 8
120 foot level



Average Assay

Gold; 0.118 ounces per ton
 Silver; 1.82 ounces per ton

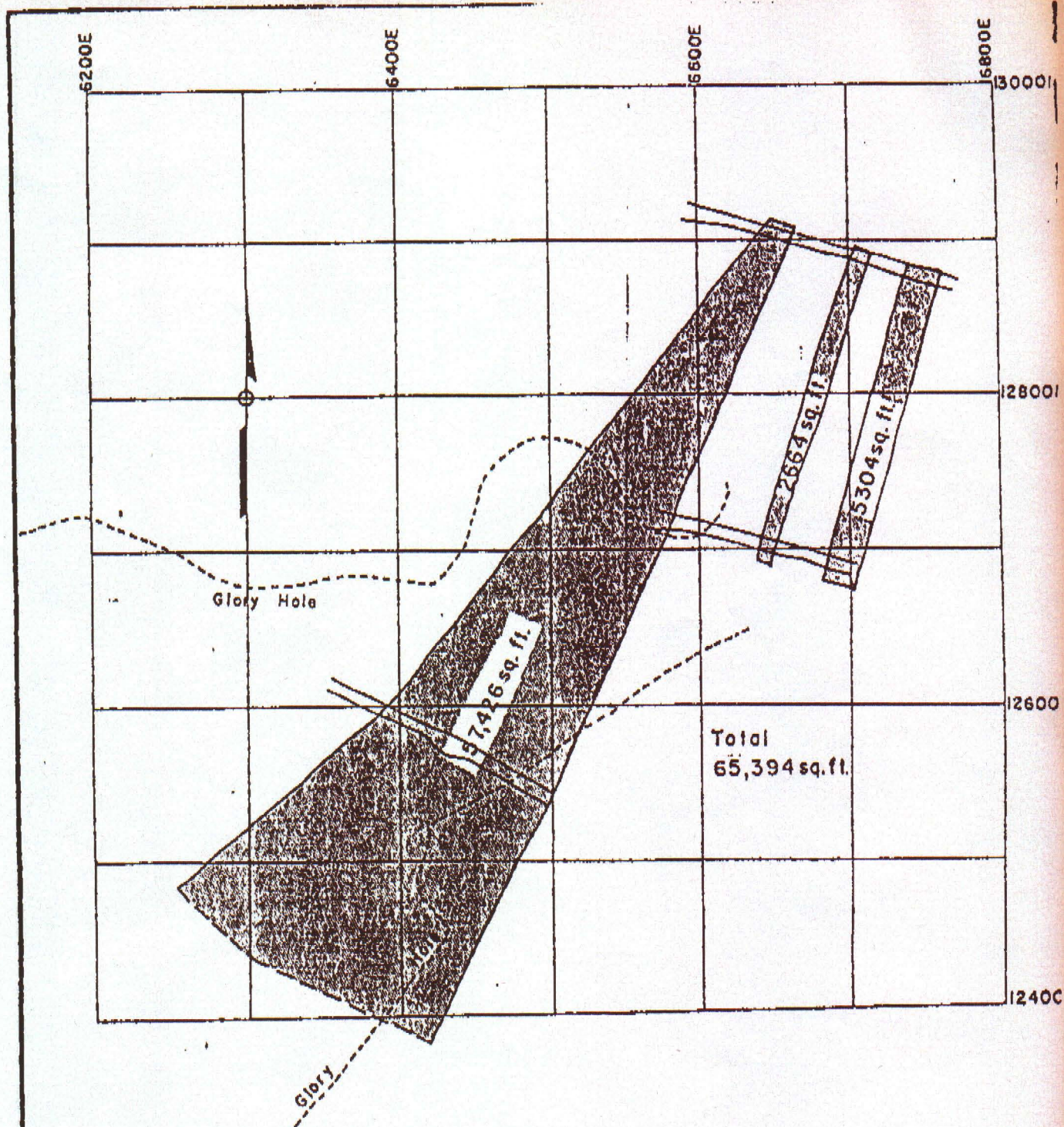
Figure 9
 137 foot level



Average Assay

Gold: 0.071 ounces per ton
Silver: 2.39 ounces per ton

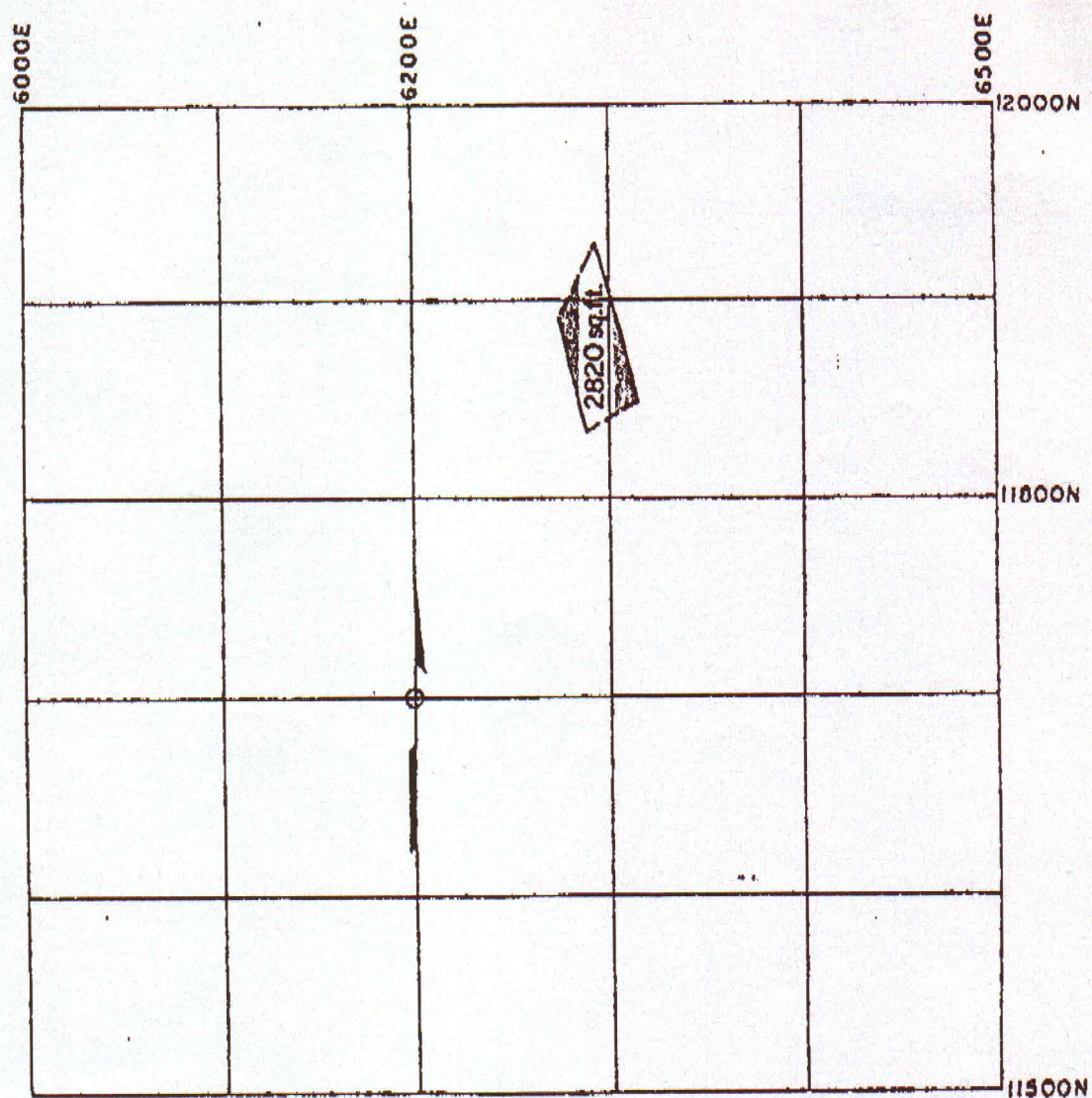
Figure 10
155 foot level



Average Assay

Gold; 0.101 ounces per ton
 Silver; 2.37 ounces per ton

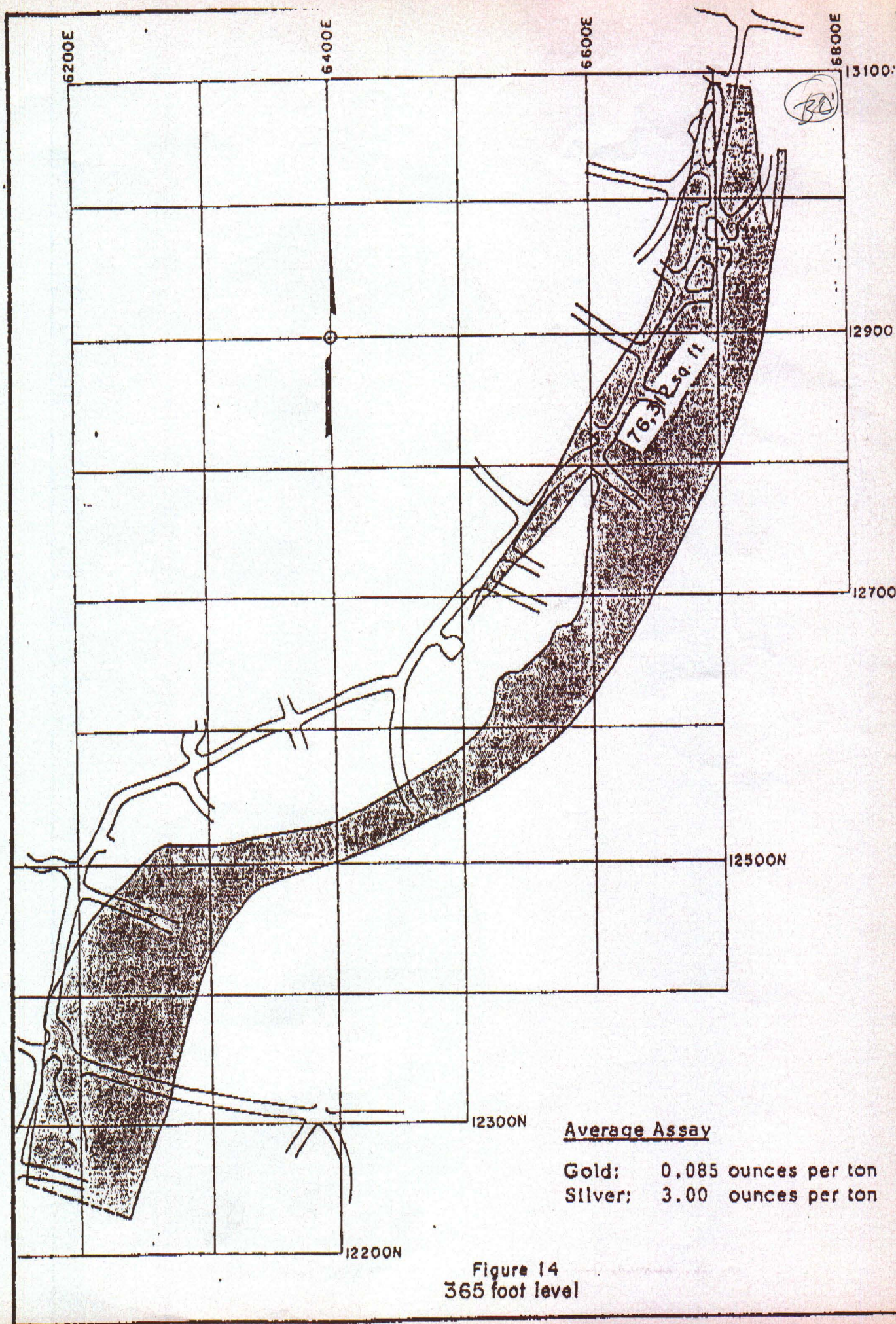
Figure 11
 173 foot level

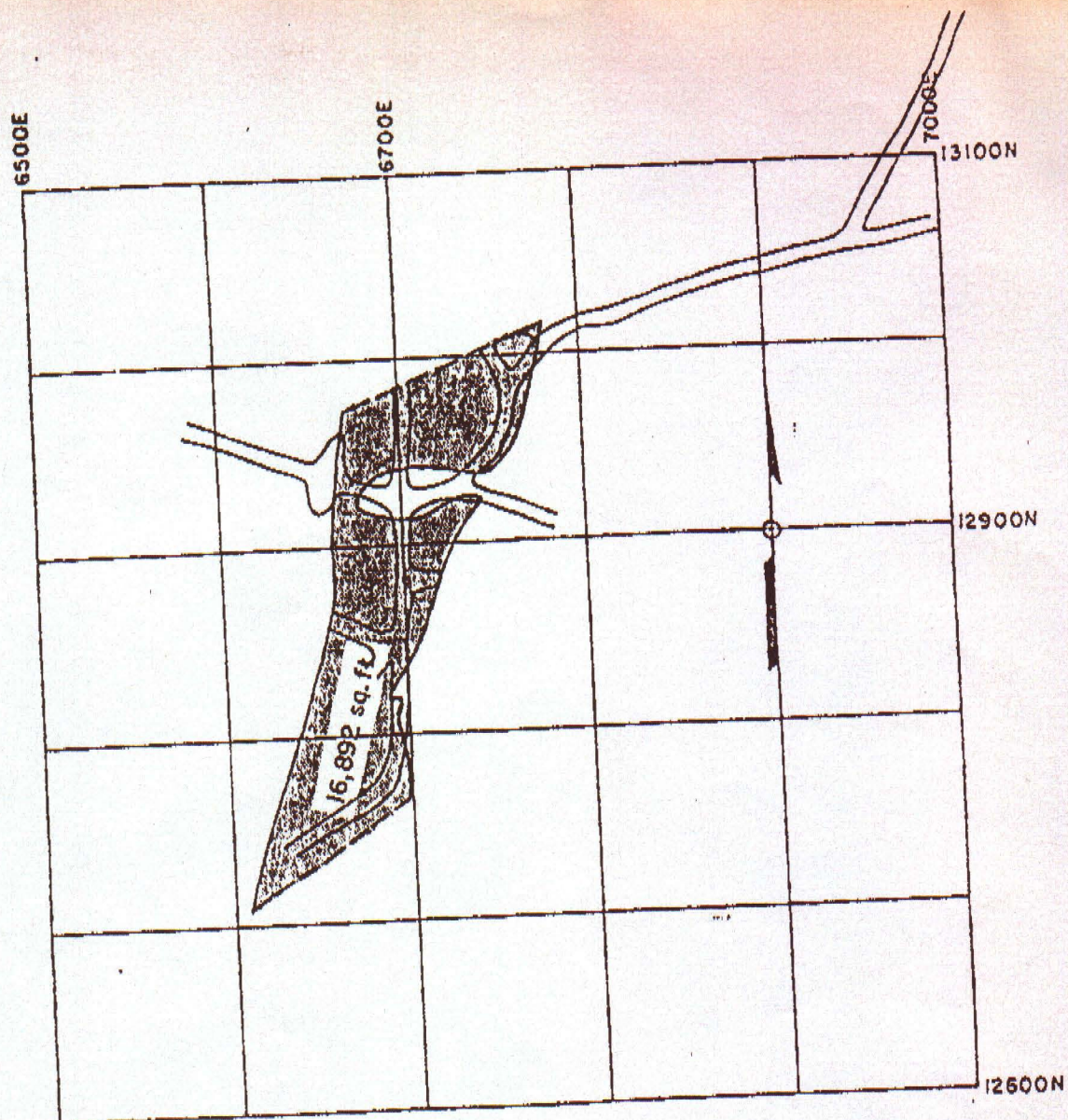


Average Assay

Gold: 0.353 ounces per ton
 Silver: 14.04 ounces per ton

Figure 12
 220 foot level

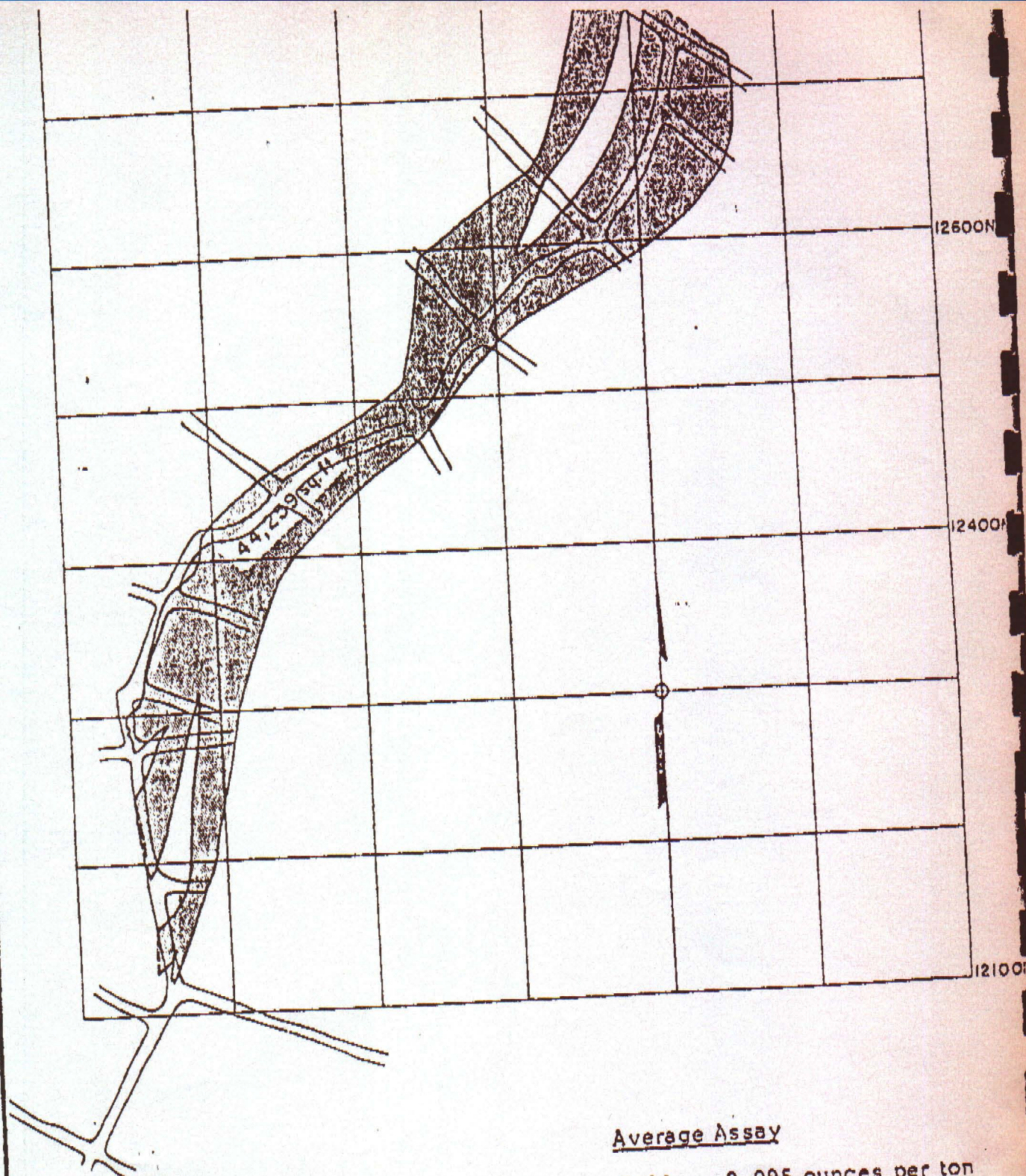




Average Assay

Gold; 0.086 ounces per ton
 Silver; 2.77 ounces per ton

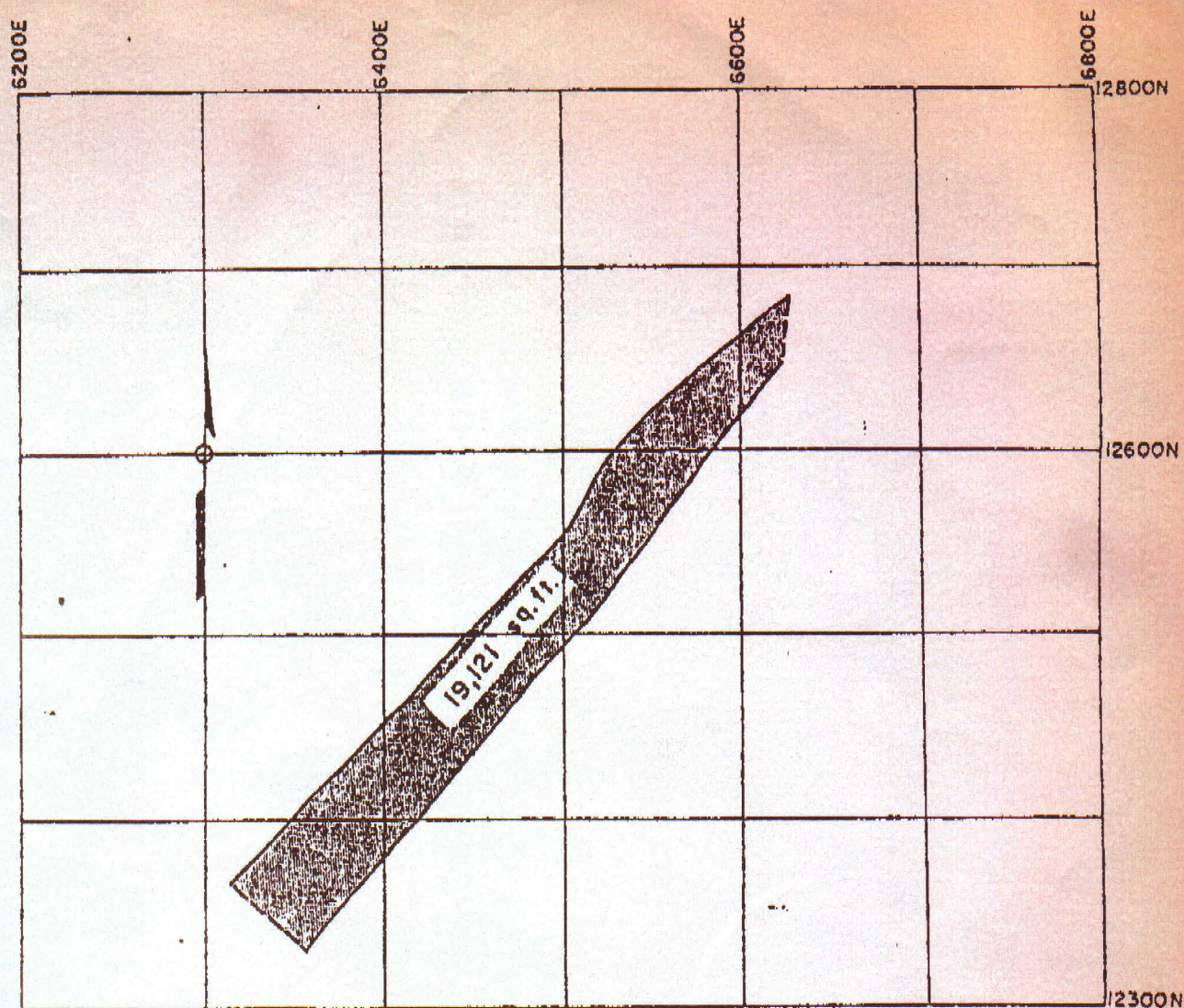
Figure 15
 426 foot level



Average Assay

Gold: 0.095 ounces per ton
Silver: 2.30 ounces per ton

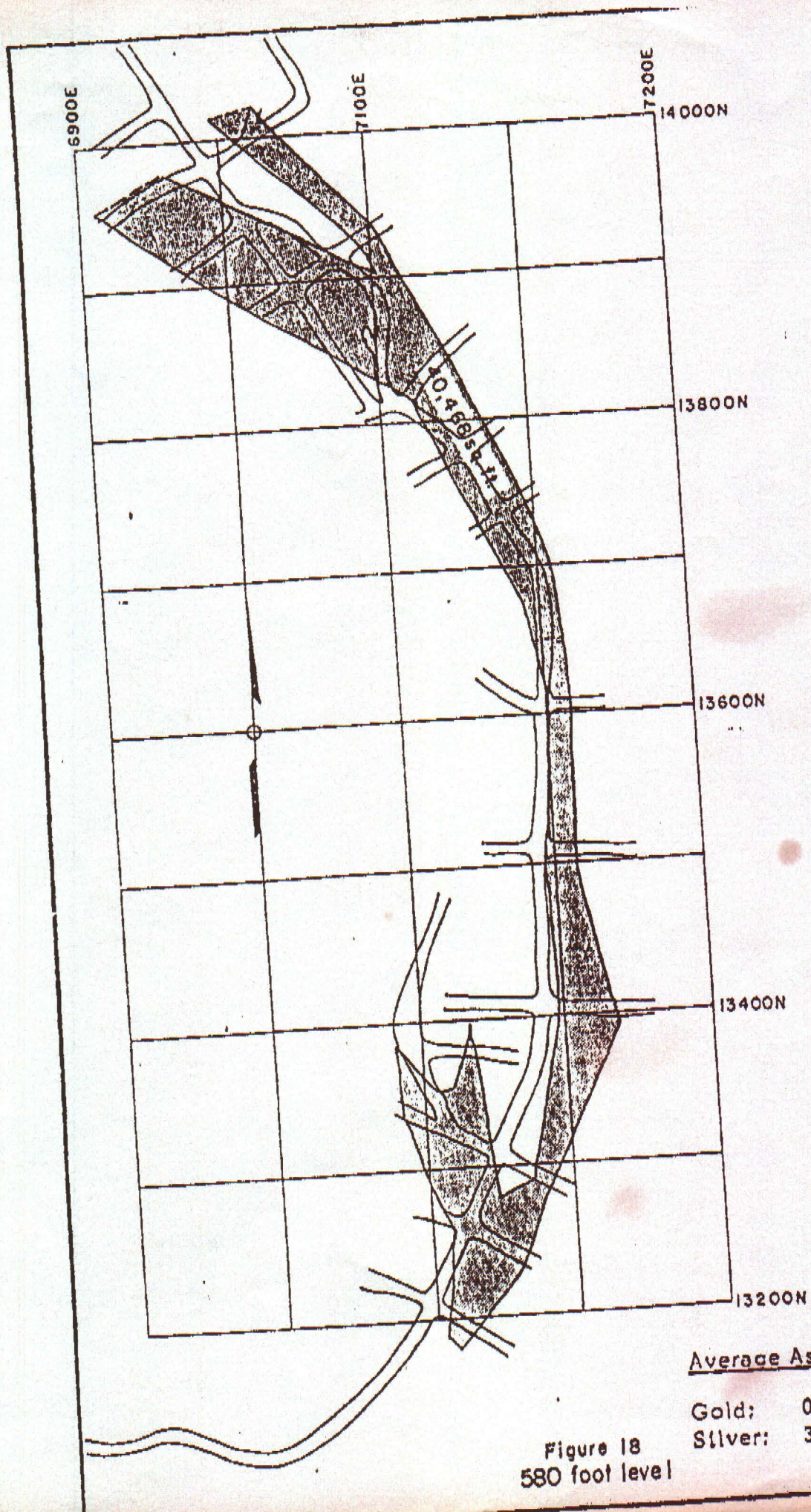
Figure 16
465 foot level



Average Assay

Gold; 0.189 ounces per ton
Silver; 2.16 ounces per ton

Figure 17
505 foot level



Average Assay

Gold: 0.107 ounces per ton
 Silver: 3.17 ounces per ton

Figure 18
 580 foot level

Table 2.

Ore Reserve Estimate in Savage, Hale and Norcross and
Chollar-Potosi Mine

<u>Mine Level</u>	<u>Tons Indicated Ore</u>	<u>Oz. Gold Per Ton</u>	<u>Oz. Silver Per Ton</u>	<u>Value Per Ton</u>	<u>Geologic Ore Tons</u>
Glory Hole	278,656	0.092	2.55	\$ 42.20	340,000
107 and 120	50,042	0.045	1.99	25.75	190,000
137	72,516	0.118	1.82	49.47	108,000
155	121,921	0.071	2.39	35.76	168,000
173	245,227	0.101	2.37	43.15	117,000
220	10,575	0.353	14.04	193.70	Incl. in 237 level
237	1,288,640	0.110	2.56	46.98	672,000
365	604,133	0.085	3.00	42.88	771,000
426	70,299	0.086	2.77	42.44	430,000
465	148,426	0.095	2.30	41.38	340,000
505	151,373	0.189	2.16	63.57	Incl. in 580 level
580	326,069	0.107	3.17	53.38	220,000

Recap of totals:

Indicated ore reserves: 3,367,877 @ \$46.39 per ton

Geological ore reserves: 3,356,000

Published and unpublished reports, maps, sections and other diagrams from the Siskon Corporation files and from the Mackay School of Mines were employed as required. A topographic map (Plate VII) with a 5-foot contour interval was prepared by Gray and Thompson (1968).

RECOMMENDATIONS

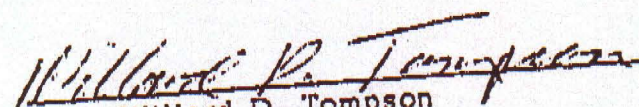
Previous workers (Joralemon, 1934, and Royer, 1922) state that veins of low-grade ore up to 150 feet wide occur in the footwall portion of the lode. Other mineralized zones occur in the hanging wall.

Many parts of these veins have had little exploration or development, and very little assay information is available from them. Systematic testing may show that they contain significant tonnages of ore.

Castagne (1978, p.8) has recommended a five-part initial phase for entering the mine and confirming and developing the reserves:

1. Drive a decline to the 465 level.
2. Drive drifts and crosscuts through probable ore zone in order to confirm the ore reserves.
3. Raise a ventilation hole.
4. Conduct a rock mechanics study.
5. Conduct development work. Estimated cost is \$1,480,000.

This writer concurs with the concepts of Castagne's proposal. A cross section showing the proposed decline is on page 37 (Figure 19).


Willard D. Thompson

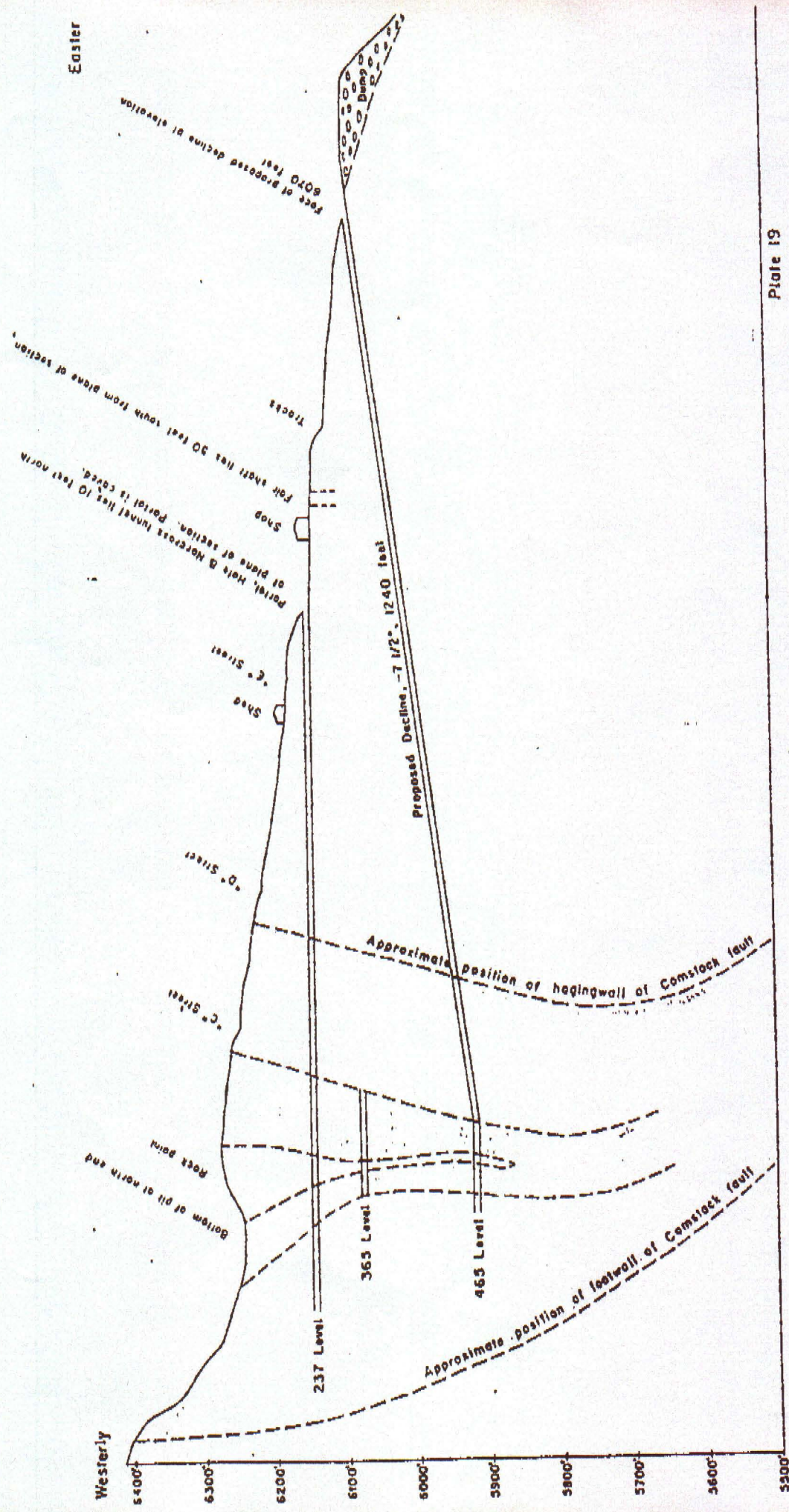


Plate 19

Section Looking N. 21° W.

Royahem Hall Contracting, Inc.
Comstock Gold Company
United Mining Corporation

Cross Section Through Comstock Lode
Showing

Proposed Location of Collins Decline to 465 Level
Wittard D. Thompson April 24, 1979

Explanation


 Area of early stoping and of indicated ore reserves

 Approximate configuration of Comstock Lode

CERTIFICATE

I, Willard D. Thompson, of Smithers, British Columbia, do hereby
certify:

1. That I am a consulting geologist, residing at Van Gaalen Road, Smithers, British Columbia;
2. That I hold a Master of Science degree from Montana State University;
3. That I have practiced my profession for twenty years;
4. That I have examined all the files, documents and maps which are available on the Savage, Hale and Norcross and Chollar-Potosi mines and have made several inspections of the surface of the properties.


Willard D. Thompson
Consulting Geologist

SUGGESTED REFERENCES

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