(7)
ITEM 12

Geologic Report
on the
CENTURION PROSPECT
Fairview Mining District
Churchill County, Nevada

by
Anthony Payne
April, 1985

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ILLUSTRATIONS

ILLUSTRATIONS (cont'd.)

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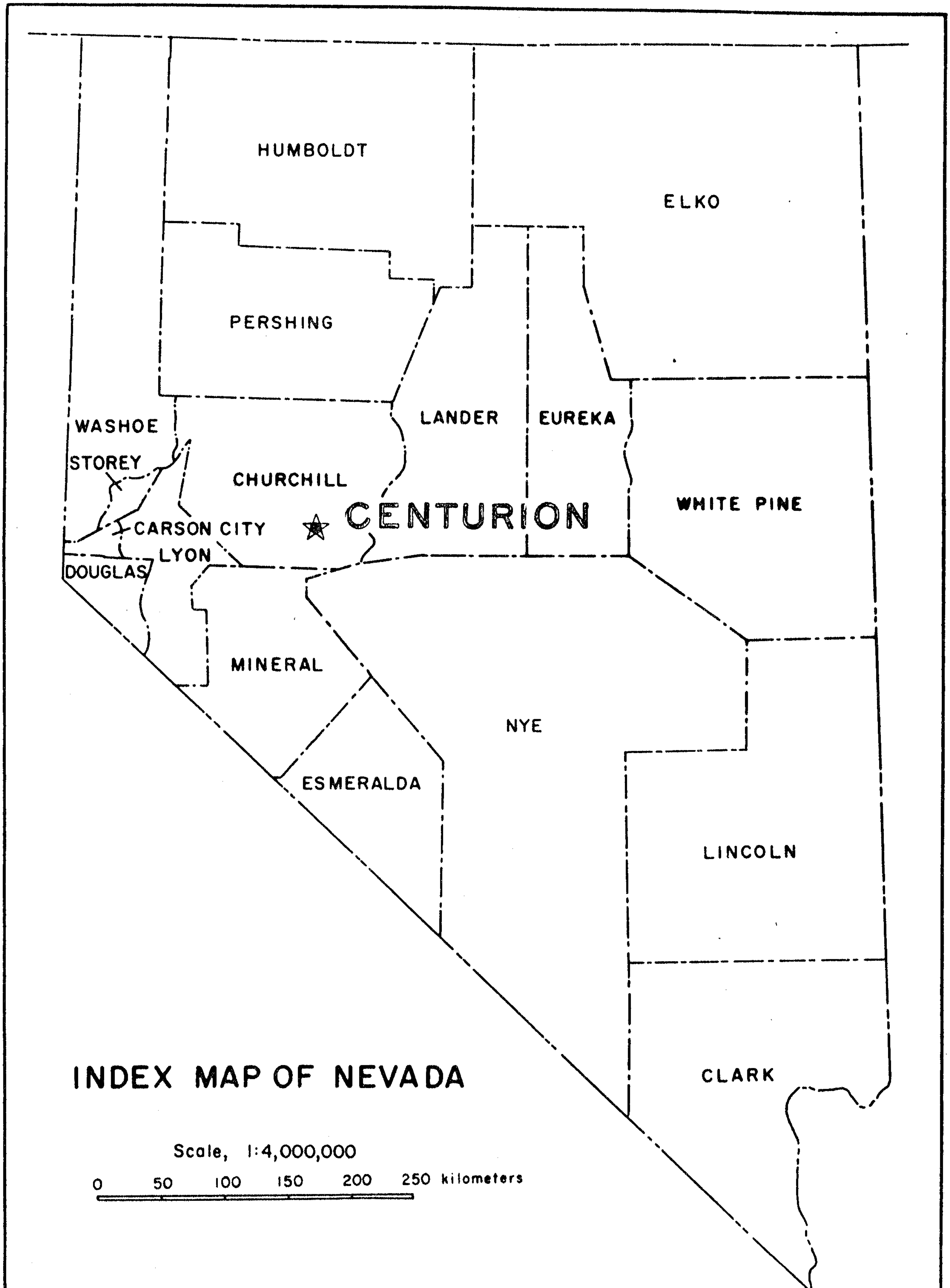
INTRODUCTION

The Centurion silver-gold prospect was found by the writer in March, 1984, during a program of prospecting for precious metal ore deposits in Tertiary volcanic rocks in western Nevada. This work started in January, 1984, and emphasizes ground reconnaissance of areas having potential for Tonopah-type epithermal silver-gold ores (Payne, 1985). The object of this program is the discovery of one or more high-grade ore shoots similar to those mined underground in the early days in many Nevada mining districts. This ore type is attractive today because of moderate size, short start-up time, simple mining and metallurgy, and relatively low capital investment requirements.

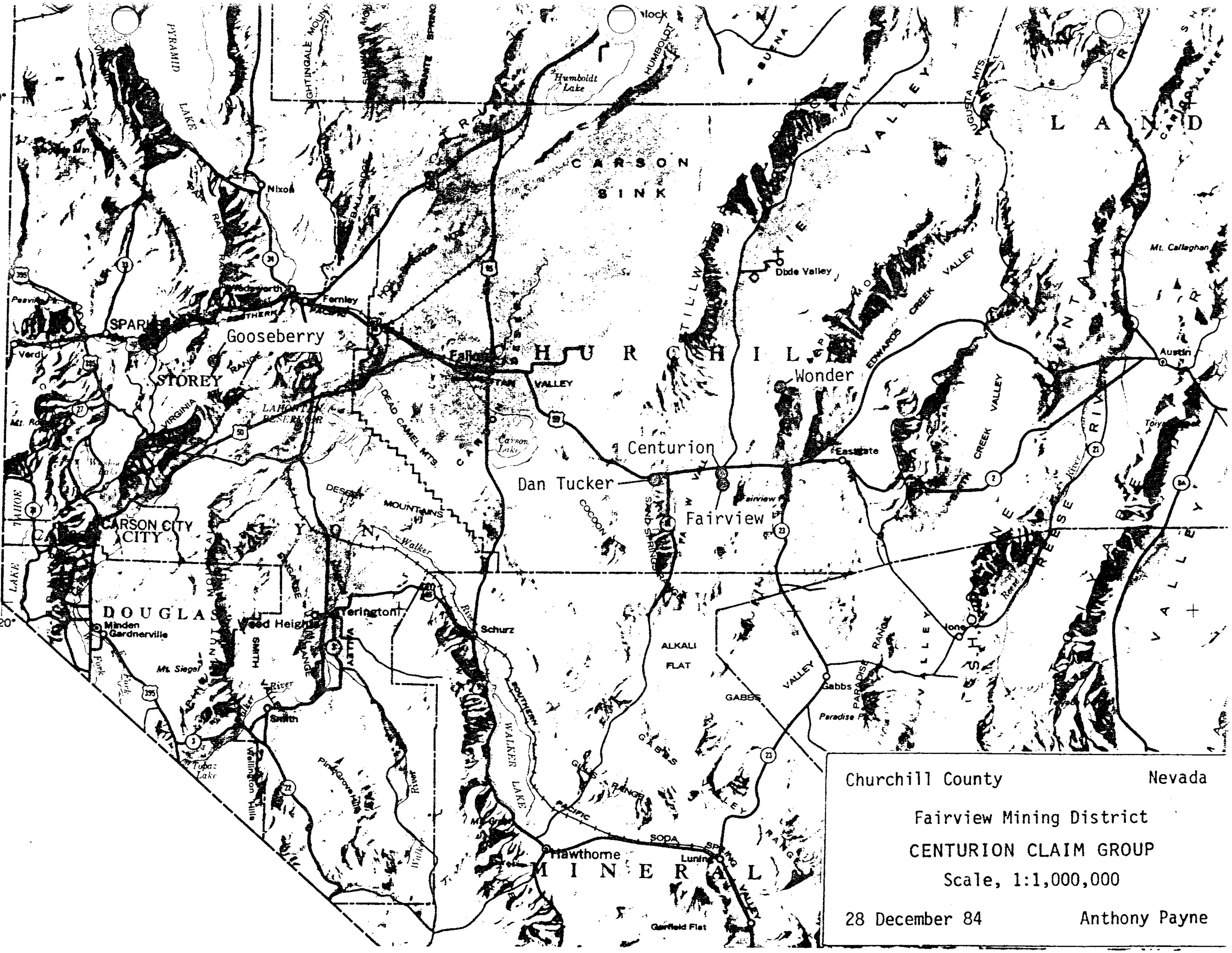
Metric units are used in this report. For convenience, conversion tables are appended.

LOCATION

The Centurion prospect lies at the extreme north end of the Fairview Mining District in Churchill County, Nevada. The claims are in the north part of T. 16 N., R. 34 E. (unsurveyed), Mount Diablo Meridian (see index maps on the following pages).


HUMBOLDT
ELKO
PERSHING
WASHOE
LANDER
EUREKA
STOREY
CHURCHILL
WHITE PINE
CARSON CITY
CENTURION
LYON
DOUGLAS
MINERAL
NYE
ESMERALDA
LINCOLN
CLARK
INDEX MAP OF NEVADA
Scale, 1:4,000,000
0 50 100 150 200 250 kilometers

Map 1



Churchill County — Nevada

Fairview Mining District

CENTURION CLAIM GROUP

Scale, 1:1,000,000

28 December 84 — Anthony Payne

Map 2

The Centurion prospect lies 140 km east of Reno, and is reached by driving 50 km on Interstate 80 to Fernley, then on U.S. 50 through Fallon to the property. Fallon is 50 km west of Centurion. U.S. Highway 50 passes over the northwest corner of the claim block, making it readily accessible at all seasons of the year. Jeep trails lead off U.S. 50, crossing the claim block at several places. They could easily be graded for all-season use.

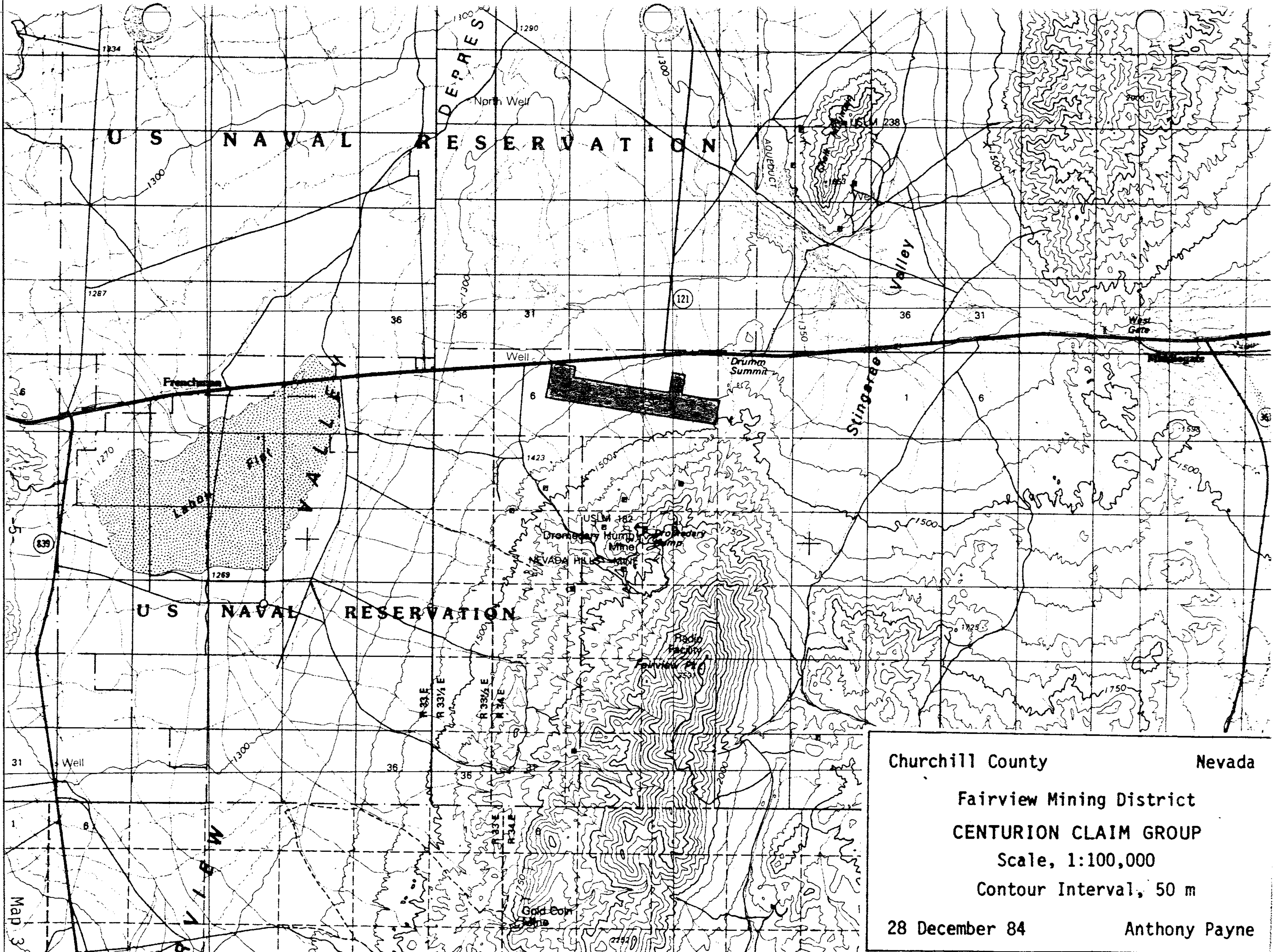
The claim block is in low terrain, on the pediment* at the north and west base of Fairview Peak. Labou Flat, a typical Great Basin playa, lies just west of the claims.

The climate is about the same as in the Reno area; the claims are at approximately the same elevation and latitude. All four seasons of the year are experienced, but the transition from one to the other is gradual, and extremes of heat or cold are brief and uncommon. Precipitation is mostly in the form of winter snow, with a few cloudbursts during the late summer season. Average annual precipitation is only a few centimeters.

Vegetation is the northern desert shrub association, dominated by desert shrubs, herbs, and grasses. It is a Little greasewood-shadscale association. It consists of low spiny shrubs that cover 5 to 10 percent of the ground. The shrubs are generally even-spaced and separated by bare ground. The following have been identified:

Squirreltail Grass *Sitanion hystrix*
Rice Grass *Oryzopsis hymenoides*
Shadscale *Atriplex confertolia*
Mormon Tea *Ephedra nevadensis*
Horsebrush *Tetradymia comosa*
Little Greasewood *Sarcobatus baileyi*
Bud Sagebrush *Artemesia spinescens*
Rabbitbrush *Chrysothamnus nauseosus var. consimilis and C. nauseosus var. holoeucos*

*Note: A pediment underlies the Centurion claim block. Comprehension of this fact is vital to full understanding of exploration possibilities. A pediment is a planar "rock shoulder", covered by a thin veneer of alluvium, often found at the foot of desert mountain ranges. Mabutt (1977, p. 82-85) discusses pediment genesis.


Churchill County
Nevada
Fairview Mining District
CENTURION CLAIM GROUP
Scale, 1:100,000
Contour Interval, 50 m
28 December 84
Anthony Payne
US NAVAL RESERVATION
US NAVAL RESERVATION
North Well
AQUEDUCT
USLM 238
Stingaree Valley
West Gate
Drumm Summit
Frenchman
Well
Labou Flat
USLM 182
Dromedary Hump Mine
Dromedary Hump
NEVADA HILLS MINE
Radio Facility
Fairview Pk
Gold Coin Mine
R 33 E
R 33½ E
R 34 E
121
839

Map 3

PROPERTY

The Centurion property consists of 25 lode mining claims and 6 mill sites. The claims were located in 1984 on Federal lands administered by the Lahontan District of the United States Bureau of Land Management in Carson City, Nevada. Churchill County and USBLM claim recordation data are tabulated on Figure 5 in the pocket of this report. The claims were located and are held by the writer.

The westernmost tier of claims, Centurion Nos. 22 through 25, were amended 01 January 1985. They overlap lands recently withdrawn by the U. S. Navy in connection with their proposed supersonic operational area for tactical training of new fighter aircraft. Sections 5 and 6 are irregular in size and shape, and the brass cap monuments marking their common boundary have not been set on the ground by the government. Until this is done, the boundary is merely a line on the map. To insure mineral title to the land open for location, the four claims were amended to place the location monuments as far to the east of the withdrawn land as possible, and off an association placer claim staked on Section 6.

The total area of lode mining claims is 177 hectares and of the mill sites 12 ha, for a total of 189 ha for the Centurion claim group.

Naval Reservation lies to the north, west, and southwest of the Centurion claims. An air to ground target area lies several kilometers to the southwest at the edge of Labou Flat (see Figure 3, p. 5). A civilian aviation corridor passes over the claims through the Navy's restricted air space (R-4804), one nautical mile wide, following U.S. Highway 50 2000 to 4000 feet above ground level. When the target range is active, Navy fighter/bombers often come in over the Centurion ground under 2000 feet, beneath the civilian corridor, resulting in considerable noise.

During the peak years at Fairview (1906-1917) five lode mining claims were developed and surveyed for patent in the general area of the Wyoming shaft; Hot Onion, Hot Onion No. 1, Hot Onion No. 2, Hot Onion Fraction, and Illinois Fraction. Patent was not issued. The mineral survey is shown in outline on the USBLM Master Title Plat for the township.

No specific restrictions are in force by Federal, State, or County agencies with respect to air quality, water, or surface environment. The USBLM classes mining as an appropriate use of the land.

HISTORY

Very little is known of previous activity in the northern part of the Fairview Mining District. The old main road from the town of Fairview to Wonder passes over the northwest end of the Centurion claim block, and can be used as a jeep trail (see Figures 4 and 6, in pocket).

What is known about the history of the Centurion area has been learned from; (1) the notes of E. A. Bylar, U.S. Mineral Surveyor who made Survey No. 3363, (2) pencilled notes on an old colored claim map of the Fairview Mining District in the files of the Nevada Bureau of Mines (Saunders, 1906), (3) a brief mention in the U. S. Bureau of Mines Mineral Yearbook for 1908, and (4) inspection of the ground.

The Wyoming shaft was sunk by the Wyoming Fairview Mining Company in 1906 and 1907. It was put down in the footwall of the vein, closely parallel to it at about 180^g inclination. The shaft can be seen to flatten slightly at about 20 m depth, then steepen again at about 40 m depth. A crosscut and short drift on the vein are mentioned in Bylar's notes. The Minerals Yearbook for 1908 (Naramore and Yale, 1908, p. 471) states:

> ".....*Development work on the Wyoming-Fairview mines included a 212-foot inclined shaft, with drifts and crosscuts*......"

Two separate pencilled notes on the Saunders map are at about the correct position for the Wyoming shaft:

> ".....*250' incline and 250'drift in bottom*................."
>
> ".....*Incl shaft 200' on Hot Onion. Good assays. (wasser)*..."

The size of the dump (see Photograph 3 and 4) indicates that little additional work could have been done since the survey for patent. It is unlikely that extensive horizontal development was done. If the water level was reached in the bottom of the shaft, the water table in 1907 stood 25-30 m higher than it does today. Nevada Highway Department wells along Highway 50, and a well on Stingaree flat 3 km to the east, penetrate standing water at about 100 m depth. It is probable that the vein is not significantly mineralized where exposed in the Wyoming shaft workings, otherwise patent would have been issued. The dump contains good gangue quartz, some of which contains base metal sulphides in small specks. The wall rock porphyry contains disseminated pyrite which is not oxidized. Inspection of the shaft would not be a major undertaking. It appears to be open and clear for the first 50 m, looking down it from the surface. There is no plan at present to do exploration from the shaft, so this rehabilitation and inspection has low priority. A barbed wire enclosure will be placed around the collar.

There was some interest in alluvial gold on the Centurion ground. Just west of the Nevada Highway Department borrow pits (12,700 N, 10,300 E) a cluster of prospects in the alluvium indicates presence of alluvial gold. It could be coming from the Centurion vein on the Centurion No. 20 claim, if the vein continues this far on northwest projection from Alpha Hill. The prospects were worked during the 1930's, judging from the tools and camping gear left laying abandoned on the ground. This ground shows on the old Saunders map as the "Bunch Grass" placer claim, which is no longer valid. In the area north of the Wyoming shaft, along the jeep trail leading out to Highway 50, several dozen small back hoe pits were cut into the alluvium about 25-30 years ago, probably by the Nevada Highway Department in search of highway metal. The area of this pitting lies between 12,400 N and 13,000 N, and 12,800 E to 13,400 E. These back hoe pits are not portrayed on the maps, for they are not thought to be relevant to mineral potential, and provide no insight into bedrock geology.

In the western part of the Centurion claim block, not far from the old Fairview-Wonder road (12,300 N, 10,950 E), a large hand trench was excavated at about right angles to the trend of the Centurion vein. This work was probably done during the main period of Fairview activity 75 years ago. The trench is about 1 km west of the westernmost bold exposures of the vein at Alpha Hill. The trench is about 100 m too far to the north, if the 310.5^g suspected trend is projected west-northwestward from Alpha. It is probable that the trench was dug by someone who had staked open ground well out on strike, and hoped to find the vein and sink on it, exploring for an ore shoot. The early miners knew that bedrock is at shallow depth here, as it can be seen exposed in arroyo bottoms nearby (see Photograph 8).

The early miners were confused by vein fragments in the alluvial veneer mantling the pediment. They could see the bedrock exposed from place to place, and must have suspected it to lie at shallow depth over much of the area. The pediment veneer consists mostly of debris swept from the montane area adjoining to the south. In this case, the alluvium is coming from the north slope of Dromedary Ridge, where several veins crop out. The vein fragments are more resistant to mechanical break-down and chemical decomposition than the wall rock, and boulders of vein are swept out far from the range, across the breadth of the pediment out to Highway 50 and beyond. It must have been discouraging to prospect this vein "float" only to find barren alluvium or unmineralized bedrock at depth. Several dozen such pits in the alluvial veneer are shown on Figures 4 and 6.

There is no record of silver or gold production from the area of the Centurion claims. There is no mention of the vein in the various reports on the district, other than the Minerals Yearbook item for 1908 already cited. The recent report on the geology and ore deposits of Churchill County (Willden and Speed, 1974) makes no mention of these mineral showings. Their geologic map shows only gravel and alluvium in this area.

SIMILAR DISTRICTS NEARBY

Several old nearby mining districts are quite similar to the Centurion vein in terms of geologic controls of mineralization, wall rock, mineralogy, and probable mining and metallurgical characteristics. Later in this report, comparisons will be made in evaluating Centurion exploration and mining possibilities, and in laying out exploration work. A brief account of the four camps follows: Wonder, Fairview, Sand Springs, and Gooseberry. The production of these four silver-gold camps is summarized in Table 1, p. 10.

Table 1. GOLD AND SILVER PRODUCTION FROM NEARBY DISTRICTS.

District	Period	Production: Gold, kg	Silver, kg
Fairview	1906-1917	1,600	160,000
Wonder	1911-1919	2,300	214,000
Sand Springs	1940-1951	600	39,000
Gooseberry*	1978-present	6,500	280,000
	Average,	2,750	175,000

Note: estimated production plus reserves.

At current metal prices ($10 per gram gold, 20¢ per gram silver), average gross production from the four districts is over $60,000,000. Statewide, 17 silver-gold mining districts of this (Tonopah) type (excluding the Comstock Lode, including the four districts in Table 1) produced an average 5 metric tons of gold and 400 metric tons of silver, worth well over $100,000,000 at current prices. In general terms, it can be said that this Nevada ore type produces in the range $50 to $100 million at $10 gold and 20¢ silver. Mining in all of these old districts was done from relatively small ore bodies underground.

Table 2. GOLD AND SILVER ORES FROM NEARBY DISTRICTS.

District	Metric tons	Average Grade: Gold, g/t	Silver, g/t	Au:Ag ratio
Fairview	261,206	6.0	585	98
Wonder	381,043	6.0	561	93
Sand Springs	92,000	7.1	427	60
Gooseberry*	1,000,000	6.5	283	44
Average,	433,500	6.4	464	74

Note: estimated production plus reserves.

At $10 per gram gold and 20¢ per gram silver, the average gross production from these four mines is $68,000,000 in recovered metal. $157 of gold and silver was recovered from each ton of ore mined, after mine losses, dilution, and cyanidation.

Fairview Mining District

The Fairview Mining District centers on the principal producer, the Nevada Hills mine, 3.5 km south of the Centurion claims (see Figures 2 and 3). Although the first claims at Fairview were located in 1906, and Perly Langdell located the Boulder claims on what would later become the Nevada Hills mine, it was not until later that J. T. Hodson and W. H. Weber came into the district, optioned the properties, and thoroughly prospected the ground. They found the ore shoot that started serious development at Fairview (Zalinski, 1907, p. 701):

> ".....*Ore was found in a fairly prominent andesite outcrop, to the west of a small north-south gulch caused by a fault. A quartz vein about 18 inches wide was exposed on this ledge, and on close examination was seen to contain fine black grains of silver sulphide disseminated through the quartz. After seeing this discovery it is not easy to understand why this property had not been located before, although crossed many times by prospectors and others*....."

A typical Nevada mining boom followed, and by mid-1907 over 1000 people lived at the town of Fairview, located 1 km southwest of the Centurion No. 25 claim (see Figure 4, in pocket). The town had two hotels, several bars and gambling halls, bank, etc. All that remains today is the concrete encasement of the bank vault.

Until 1911, only the richer ores were shipped to outside smelters for reduction. In 1910, the Nevada Hills Mining Company acquired the properties and constructed a 175 tpd mill employing gravity methods (tables and amalgamation) and cyanidation. The main period of production was from 1912 to 1917, when reserves were depleted and deep exploration failed to develop additional ore. The ore shoots were found to extend to a depth of approximately 200 m beneath outcrop. Thorough exploration was taken to twice this depth but the lower portion of the vein system was found to be relatively barren. The last six months of operation was in mining low-grade secondary silver ore found in the fractured walls of the Nevada Hills vein at the surface. This mining became possible when silver prices rose sharply toward the end of World War I.

Several attempts to revive the mines have failed. Various leasers have not contributed significantly to total district output. Just before his death, Howard Hughes purchased the patented ground. Summa Corporation subsequently sold the properties to Houston Oil and Minerals (predecessor to Tenneco Corporation). Various deals have been made on the property, none of which resulted in significant development.

The veins at Fairview are mostly in an intrusive called "lode andesite" by the miners. Willden and Speed call the rock dacite.

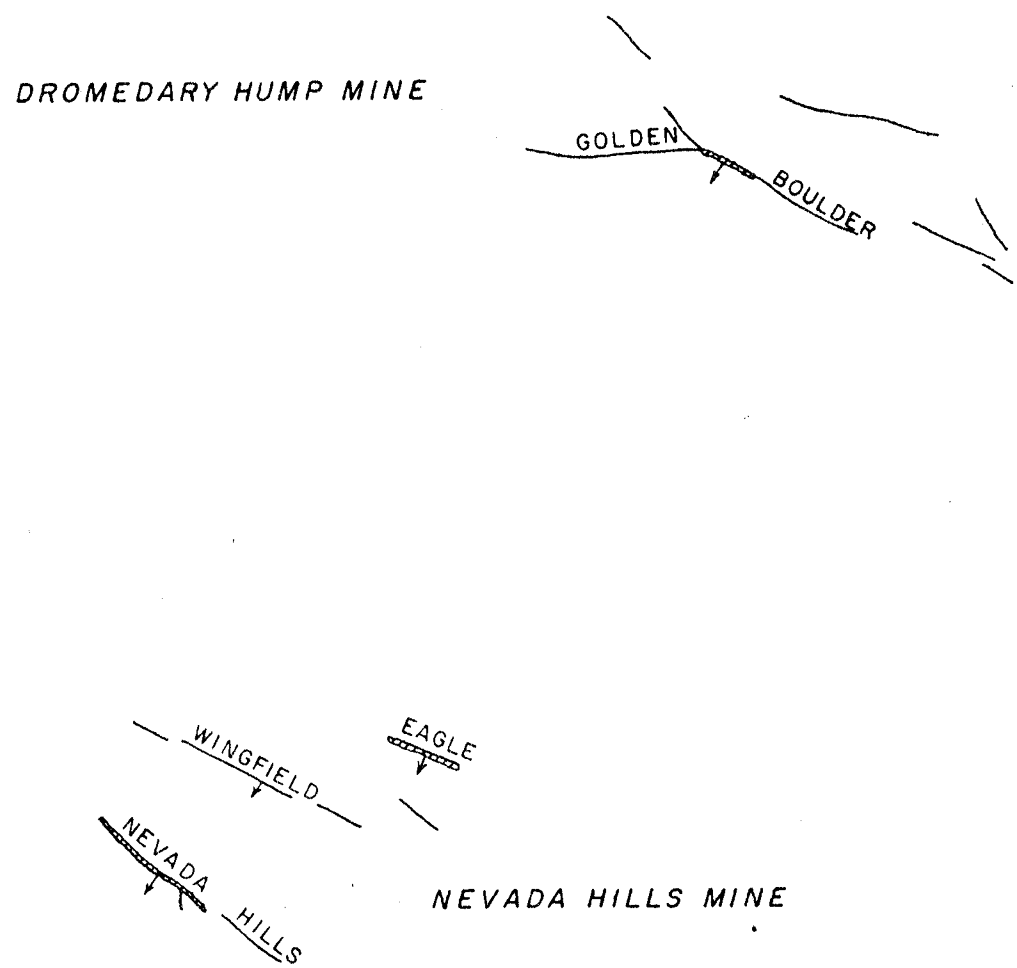
The principal ore minerals are acanthite, chlorargyrite, bromargyrite, embolite, electrum, gold, polybasite, pyrargyrite, pyrite, silver, chalcopyrite, sphalerite, galena, stephanite, and tetrahedrite. Other minerals locally occur in small amounts. The productive veins lie in or near the borders of the intrusives. Mineable ore generally lies within 150 m of the surface. The veins are parallel, strike northwest, and dip steeply to the southwest. The two most productive veins, the Nevada Hills and the Eagle, range in thickness from a few centimeters to 5 m. Figure 7 on the following page portrays the vein system.

Wonder Mining District

Soon after Fairview was discovered, T. J. Stroud located a claim on the Jackpot vein near what quickly became Wonder, 25 km northeast of Centurion (see Figure 2, p. 3). Shortly afterward, Murray Scott and William Mays located the Nevada Wonder vein, 2 km south-southeast of the Jackpot. The Nevada Wonder is the principal producer in the district. In 1910 eastern interests who had been successful at Tonopah put the properties together and in 1913 constructed a 200 tpd agitation cyanide plant at the Nevada Wonder mine. The main period of production was from 1913 to 1919. Subsequent leasing activity has not contributed substantially to district output. Most of the patented ground is now owned by Mr. Frank Lewis of Reno.

The Nevada Wonder vein follows the contact of a dacite intrusive into Miocene rhyolite/dacite wall rock. The vein strikes northwesterly and dips steeply to the northeast. Schrader (1947, p. 40-41) describes the mineralization:

> *".....the vein ranges from less than a foot up to 40 feet or more in width, and is usually separated from the wall rock by a tabular sheet of gouge less than an inch to several feet in width. Locally the gouge is well banded and mineralized and constitutes good ore, some of which ran up to $60 per ton. ......The vein filling in general is soft and is crushed by faulting and pressure, with the result that it is easily mined and milled. The principal gangue mineral is quartz, with which there is frequently associated considerable adularia or vein orthoclase, white potash feldspar, and more or less brecciated and crushed wall-rock material. The values occur mostly in the hanging-wall side of the vein. The silver occurs chiefly as argentite, cerargyrite, and as halogen salts................."*



(21% of vein outcrop is ore)

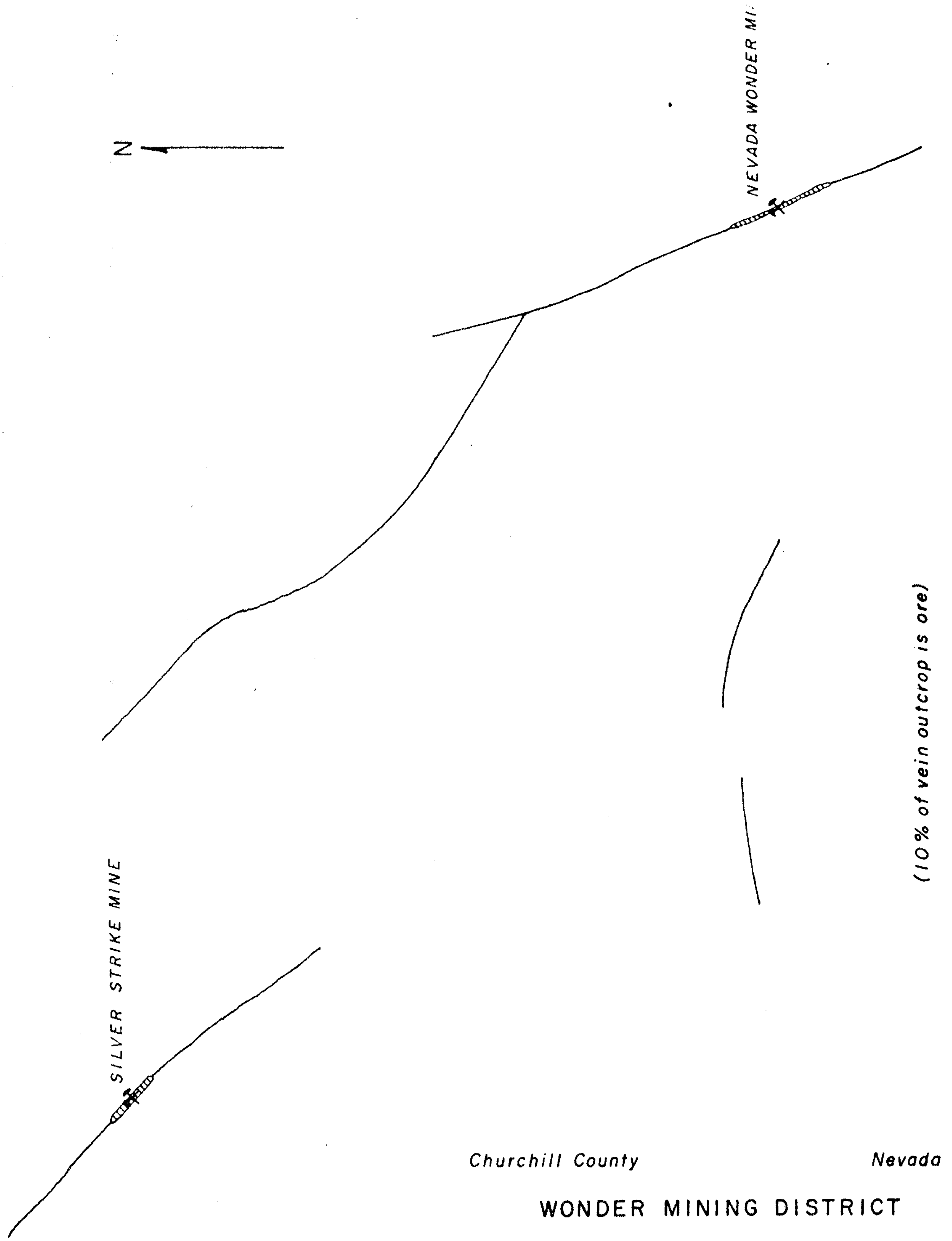
Churchill County *Nevada*

FAIRVIEW MINING DISTRICT

NEVADA HILLS VEIN

Scale, 1:10,000

28 December 1984 *Anthony Payne*
Map 7



Churchill County *Nevada*

WONDER MINING DISTRICT

NEVADA WONDER VEIN

Scale, 1:10,000

28 December 1984 *Anthony Payne*

Map 8

Much of the mining was done in open stopes or by shrink stoping.

Oxidation of the Nevada Wonder vein extends to 300 m, where it gives way abruptly to hypogene sulphide ore, presumably at an old water table. The primary ore, unprofitable to mine, continues at depth.

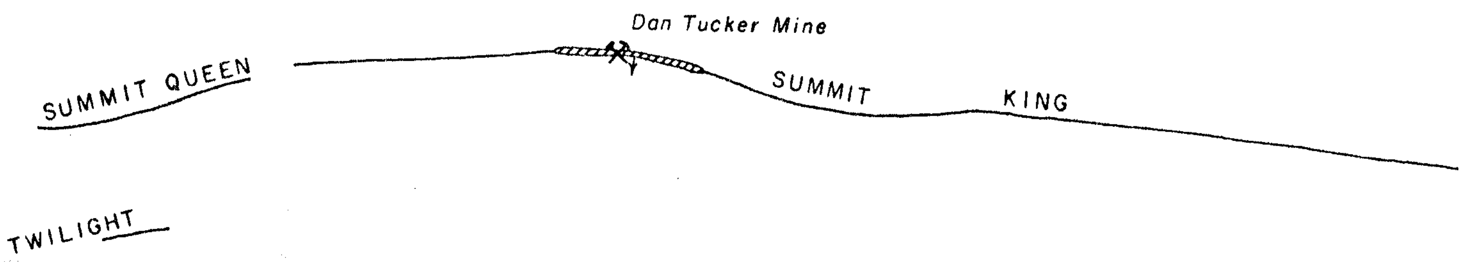
In 1982, Belmont Resources Ltd., of Vancouver, B. C., leased patented claims from Mr. Lewis near Porphyry Peak, 2 km northwest of the Nevada Wonder mine, on the same or a parallel vein. Belmont attempted to operate a small open pit mine here called the Silver Center. They blended new crude ore (containing 125 grams of silver per ton) with old tailings from the Nevada Wonder cyanide operation (containing 50 grams of silver per ton), agglomerating and heap leaching the mix. The steady decline in silver prices during late 1984 and 1985 resulted in closure of the project before it had a chance to produce significantly.

The Nevada Wonder vein system is shown on the map on the preceding page.

Sand Springs Mining District

The veining at Sand Springs, 15 km west of Centurion, was first prospected by C. W. Kenney in 1905. Over the next few years, a few ore shipments were made to the Selby smelter. In 1927 a small amalgamation plant was built on the property and a few thousand tons of ore put through it. Major development came in 1940, as a result of geologist Ira B. Joralemon's recommendation of the property to Bralorne Mining Company of Vancouver, B. C. Bralorne built a 50 ton per day agitation cyanide plant at the Dan Tucker mine, on an ore shoot on the main vein. Exploration failed to develop additional ore at depth. No significant production has come from the district since the Dan Tucker was shut down in 1951. The vein system at Sand Springs is shown on the map on the following page.

Complex faulting complicates the over-all picture, and the compact central portion of the district has not been mapped in good detail. Metamorphic and instrusive rocks of the Paleozoic-Mesozoic bedrock complex crop out within the central mine area. Tertiary andesite and rhyolite, hosts to the vein, rest upon the complex. Younger basalt flows are found to the north of the district. Andesite and rhyolite host rock



(10% of vein outcrop is ore)

Churchill County Nevada

SAND SPRINGS MINING DISTRICT

DAN TUCKER VEIN

Scale, 1:10,000

28 December 1984 Anthony Payne

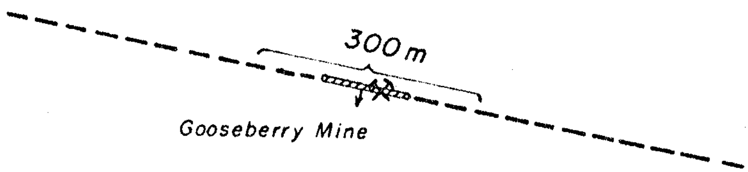
Map 9

is intruded by rhyolite dikes which occupy the same structures as ore. The veins strike west-northwesterly, are a few centimeters to a few meters in thickness, and dip steeply to the south. They contain fine-grained to vuggy quartz, breccia, and locally abundant calcite and pyrite. Values are in gold, chlorargyrite, and acanthite. At the surface and in the upper levels of the mine the vein is highly oxidized and crumbles readily. Extensive underground development reaches depths of 150 m beneath outcrop, where the vein is barren of precious metal.

Gooseberry Mine

The Gooseberry mine, just north of the Comstock Lode, 110 km west of Centurion, has been known for many years. It was probably discovered in the 1860's. Little was done for many years, because silver is leached from outcrop along the sparse exposures of the vein. J.D. Martin, Sr. bought the claims in 1928, and he and his two sons methodically developed the vein at depth during the period 1930-1974. The fully-developed ore deposit was taken over by APCO Minerals of Houston in 1974 and has been operated by a succession of Canadian owners. The mine is presently operated by Asamera Minerals of Vancouver, B.C., who mine 350 tpd through a single shaft underground, treating the ore in a combination selective flotation and cyanide plant.

The Gooseberry vein system consists of more than one vein at depth. The Martins somehow got off the main vein at about the 700 level, and were developing a relatively poor parallel structure when APCO took over. In the late 1970's it was found the mineralization continued downward on the main structure. The ore shoot is 1.5 m to 2 m in width, 300 m along strike, and extends approximately 250 m vertically beneath outcrop. A particularly high-grade shoot within this main zone is 1.5 m in width, 60 m long, and extends 70 m along the dip of the vein. This shoot contains 10 to 12 g/t of gold and 500 g/t of silver. The over-all grade of ore mined to date is 6.5 g/t gold and 283 g/t silver. The ore minerals are electrum and argentite in a quartz-carbonate gangue. Host rock is the Miocene Kate Peak andesite, which is intensely propylitized in the immediate walls of the vein. The vein system is portrayed on the map on page 18.



100 m outcrop of 300m ore shoot along 1000 m vein

(100% of vein outcrop is ore)

Storey County *Nevada*

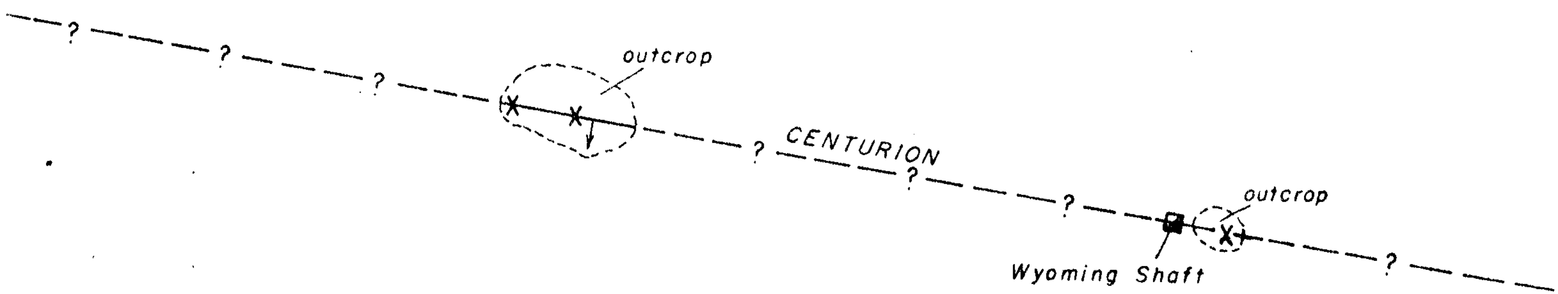
GOOSEBERRY MINING DISTRICT

GOOSEBERRY VEIN

Scale, 1:10,000

28 December 1984 *Anthony Payne*

Map 10



250 m of outcrop of vein along possible strike length of +2500 m. No known ore.

Churchill County Nevada

FAIRVIEW MINING DISTRICT

CENTURION VEIN

Scale, 1:10,000

28 December 1984 Anthony Payne

Map 11

MAPPING

Control

Base control for the topographic mapping on Figure 6 (in pocket) was surveyed using Wild T1 Micrometer Theodolite. Base line Alpha-Bravo was measured from both ends with Wild 2 m Invar Subtense Bar, using the auxiliary base method. Elevation was carried by level from USC&GS Bench Mark 1390.0 just north of Highway 50. The meridian was established with the Wild T1, using Roelof's prism, Radio Shack Timekube, and Micronta LCD quartz chronograph, making several horizontal angle observations on the sun from Alpha and from Bravo. Four temporary points were put in at the corners of the map area. Horizontal distances to the temporary points were measured directly with the subtense bar. Elevations were carried through the control system with the T1, using the "two-wire" system, taking several vertical angles from each end of each shot, and at several different tripod heights.

Aerial Photography

Alpha, Bravo, and the four corner temporary points were paneled on the ground with 2 m white crosses with 25 cm arms, laid over black PVC sheeting. A stereo pair of vertical black and white photographs was flown over the control on 29 May 1984, at a contact scale of 1:18,000 by Great Basin Aerial Surveys, using Wild RC-10 22.5 cm x 22.5 cm camera mounted in Cessna 206 aircraft. Mylar diapositives were prepared for photogrammetric work. A simple black and white enlargement was made of a portion of the south photo of the pair, on a scale of 1:5,000, for use as geologic mapping base in the field.

Photogrammetry

A topographic map was prepared in June, 1984, with additions in January, 1985, by Great Basin Aerial Surveys using Wild BS-8 Aviograph photogrammetric equipment. The topographic map was made on 1:5,000 scale, contour interval 2 m, and is shown on Figure 6, in pocket of report. The topographic map will be used in exploration planning.

Geologic Mapping

Geologic mapping was done during March and April of 1985 by the writer, using the 1:5,000 topographic map and aerial photograph enlargement as mapping base. The extensive but thin veneer of alluvium mantling the pediment made it necessary to traverse the ground carefully. Some of the outcrops are small areas of the bedrock pediment plane exposed in the bottoms of the numerous arroyos crossing the claims. These croppings have no topographic expression, are typically only a few square meters in extent, and cannot be discerned on the aerial photographs. Enough of them were found to put together a rough picture of the bedrock geology under the Centurion claim block.

GEOLOGY

General

The Fairview Mining District lies just east of the Carson Sink, a broad low area where older rocks are poorly exposed. Late Tertiary and Quaternary basalts and sediments cover approximately 90% of the Carson Sink. East of Fairview is the high desert of central Nevada, where exposure of pre-Quaternary rocks is far better than in the Carson Sink, but Miocene and Oligocene volcanics conceal most of the underlying Paleozoic-Mesozoic bedrock complex. It is therefore necessary to make broad correlations with known exposures of the older rocks to the north and south, generally within 100 km of the Centurion Prospect. This general area of approximately 10,000 km^2 will be called "west-central Nevada" in this report.

Pre-rifting continental crust never existed in west-central Nevada, the region is what until recently has been called "eugeosynclinal". The post-rifting, pre-orogenic rocks were all deposited on oceanic crust. The pre-orogenic rocks were deposited in and around island arcs, in back-arc basins, on the ocean floor, or as clastic wedges along the continental margin. The pre-orogenic rocks were accreted at the continental margin by obduction. These rocks are characteristically dark-colored, siliceous, and of volcanic origin-- giving rise to the term "siliceous western assemblage". Rocks deposited on or over the continental margin are spoken of as "transitional", that is laid down in an environment between the active volcanism of the ocean to the west and the inactive continental plate to the east. Rocks deposited on the edge of the continental plate are fairly pure carbonates, laid down in what was formerly thought of as a "miogeosynclinal" environment. The eastern, continental rocks are called "eastern assemblage" and the environment now referred to as mioclinal. The transition zone is a NNE-SSW-trending belt, approximately 100 km wide, lying immediately east of Fairview.

Paleozoic Rocks

No pre-rifting continental crust existed in what is now western Nevada. The nearest exposures of lower Paleozoic mioclinal rocks lie 85 km northeast of Fairview in the Shoshone Range and 85 km to the east in the Toiyabe Range, where quartzites correlative with the Cambrian Osgood Mountains and Prospect Mountain formations are seen at the western edge of the North American Continental plate.

Several sequences of lower Paleozoic rocks are found in west-central Nevada, all suggestive of island arc volcanism some distance offshore to the west of the continent. The Antler and Havallah sequences of Pennsylvanian-Permian age may have been accumulated in such an environment. In northern California there is evidence for several such sequences in the Paleozoic. The Koipato sequence of northwestern Nevada is probably an old island arc system, accreted to western North America early in Triassic time, then covered by marine carbonates and terrigenous clastics. The Koipato sequence is a classic progression of basic to intermediate and finally acid volcanism-- the "Steinmann Trinity" of early European eugeosynclinal theory. The Limerick basalt gives way upward to andesite (keratophyre) and finally rhyolite at the culmination of this island arc sequence. Some of the rhyolites are themselves intruded by rhyolite and by plutonic trondheimite deep in the throats of the rhyolitic volcanoes.

These island arc assemblages, back arc basin deposits, and the carbonates and clastics covering them, were obducted or thrust upon the continental margin in faults that can be traced through the entire region. The Roberts thrust ("Antler orogeny") occured in late Devonian to early Mississippian time. The Golconda thrust ("Sonoma orogeny") occured in late Permian to early Triassic time. This large-scale imbrication along the western continental margin represents collisions of North America, as it moved northwestward over the Pacific ocean floor, with island arcs orginally developed hundreds of kilometers to the west. The pre-batholithic rocks of western Nevada constitute a collage of tectono-stratigraphic terranes that were accreted along an actively deformed continental margin. As rifting progressed, the pattern of accretion may have become simpler. As the continent collided with each progressively younger terrane, the subduction zone jumped westward so the accreted rocks were themselves protected from destruction at depth along the plate juncture. However, the accreted zones along the new continental margin were uplifted and deeply eroded, much of the material re-deposited as volcaniclastic sediments over and adjacent to the continental margin.

The Paleozoic rocks nearest to Fairview outcrop at the north end of the Paradise Range, 20 km to the southeast, and at the north end of the Stillwater Range, 25 km to the north, where Permian greenstone and clastic sequences are found, probably correlating with the Limerick formation near Unionville and the Pablo formation near Ione. It is likely that similar rocks lie at depth at Fairview.

Mesozoic Rocks

Stratified units of Middle Triassic to Middle Jurassic age are the most abundant pre-orogenic rocks of west-central Nevada. They are often much deformed and metamorphosed near orogenic plutons. A fairly complete geologic record is found to the north, the so-called "Winnemucca sequence". To the south, in Mineral County, corresponding rocks are called the "Luning sequence". Comparing the two, a fairly clear picture is gained of the depositional conditions at this time at and near the continental margin. The sequences have been faulted eastward onto the continental margin. Because of isolated outcrops, complicated structure, and thermal metamorphism near later igneous intrusions, field geologists have not attempted to map individual formations or correlate broadly from one area to another. The carbonates overlying the Koipato and Pablo sequences (Prida, Natchez Pass, Luning, Grantsville, etc.) thicken westward and pinch out to the east, at the inferred shoreline at the edge of the continental plate, less than 100 km east of Fairview. The clastic Grass Valley and Gabbs-Sunrise rocks were deposited over the carbonates at the mouths of major streams draining the continent from the east; the Colorado Plateau area of Wyoming, Utah, and Arizona, building huge deltas along the transitional zone of central Nevada. A small portion of this clastic material may have been derived from local highs in eastern Nevada and western Utah. The upper, western part of the clastic sequence shows an increase in volcanic debris, suggesting island arcs to the west, or precursor volcanism over the site of the Sierra plutonism developing on a major Benioff zone in late Triassic to mid-Jurassic time. Subduction continued along this zone to late Cretaceous time, in five major episodes of plutonism collectively referred to as the Sierra batholith, and thought of as the main orogeny along the western margin of North America. The batholith is actually composed of thousands of coalescing plutons of granite, quartz-monzonite, granodiorite, and quartz-diorite, emplaced from 200+ to 72 m.y.a. As geologic study of this plutonism progresses, the eastern boundary of the batholith has moved eastward to embrace many smaller granitic siliceous intrusives in west-central Nevada. The eastern margin of the batholith is now drawn as a NNE-trending line passing through west-central Nevada at about Fairview. The relatively small, isolated exposures of pre-orogenenic rocks in west-central Nevada are interpreted as pendants, septa, or huge xenoliths within the plutonic mass.

As plutonism waned, uplift of the entire continental margin continued, elevating the terrane more than 10 km. Uplift continued into Cretaceous time, cutting deeply into the plutons and enclosed pre-orogenic rocks. One of the largest molasse sequences found anywhere in the world was shed eastward onto the continent, extending into the Rocky Mountain region to eastern Colorado and west Texas. Wedges of clastics were also shed westward from the Sierra into the area now occupied by the Great Valley and Coast Ranges of California. Uplift and erosion involved the entire region. Stratified rocks of Cretaceous and early Tertiary age are unknown in west-central Nevada.

The nearest sequences of Mesozoic pre-orogenic rocks are immediately to the southwest, just south of the Fairview town site, where Triassic-Jurassic volcaniclastics crop out, and are probably correlative with the Grass Valley and Gabbs-Sunrise sequences. To the northeast 2 km, at Chalk Mountain, granitic rocks and carbonates crop out, the latter probably correlative with the Gabbs-Sunrise (Thorstensen, 1968, p. 17).

On the Saunders map (1906) a crude pencilled notation on the Defiance Nos. 3 and 4 lode mining claims (no longer valid) is found:

"....Granite on Defiance 3 and 4. Put on map......"

This area (10,800 N, 11,100 E) was searched very carefully in the field. No outcrop of granitic rock was found, but a bed of very coarse andesitic flow breccia is exposed in an arroyo bottom, and contains sub-angular cobbles and boulders of decomposed granodiorite. No such inclusions were found elsewhere in the many breccias, agglomerates, and conglomerates observed. The base of the Miocene volcanic sequence was not found anywhere in the areas shown on Figures 4 and 6.

Cenozoic Rocks

As post-orogenic erosion of the region progressed, and the Sierra was worn down, slow-moving streams finally developed in a mature drainage system. The streams drained westward from the low, broad crest of the Sierra, and lowlands in western Nevada were drained into the Pacific through low canyons cutting across the range from east to west. The crest of the Sierra was a broad highland, perhaps 1,000 m above sea level. Much of western Nevada was a lowland 600 to 700 m above the sea. The Pacific shoreline was approximately at present day Sacramento.

This deeply eroded, mature surface of erosion remained fairly stable into mid-Tertiary time. Any stratified rocks deposited during the interval mid-Jurassic to mid-Tertiary were eroded not long after deposition, for there is no record of such rocks in west-central Nevada. Today, over the entire region, the bedrock complex is overlain in profound unconformity by mid-Tertiary volcanic rocks. The lowermost Tertiary volcanics are dated at about 27 million years, or late Oligocene. These radiometric dates correspond well with the paleontological conclusions previously reached. The base of the post-orogenic sequence is sometimes separated from the underlying bedrock by gravel-filled channels carved into the older rocks. The gravels usually contain clasts of rhyolite and the basal units themselves are most often rhyolitic. In a few places, these old Tertiary stream channels contain alluvial gold. They correspond perfectly in age and mode of origin with the Tertiary gold channels of the west slope of the Sierra, which have been important gold producers. Although a few Oligocene dates have been obtained from the lowermost pre-orogenic rocks in west-central Nevada, this unconformity is usually overlain by Miocene rhyolites and rhyodacites. The erosional hiatus between orogenic plutonism and post-orogenic volcanism is a minimum of 40 million years in most places, and may have been half again this long at some localities. The last Sierra plutonism was about 70 m.y.a. and the oldest Tertiary cover in west-central Nevada is about 30 million years old, or mid-Oligocene.

No post-orogenic rocks of Oligocene or older age have been recognized in the Fairview Mining District. The nearest exposures of Oligocene volcanics are 30 km to the southwest in the Gabbs Valley Range, where various rhyolitic tuffs are found overlying granitic rocks and Triassic carbonates.

The mid-Tertiary rocks of west-central Nevada conform precisely to Hans Stille's concept of "subsequent volcanism"; extrusives erupted over the deeply eroded batholith, overlapping slightly on the mioclinal rocks deposited on the continental margin. In the typical orogenic belt, Stille observed that subsequent volcanism consists of a sequence rhyolite-andesite-basalt, in reverse order of the Steinmann Trinity in the pre-orogenic eugeosyncline. Hans Schneiderhöhn, in his classic analysis of ore deposits, noted that an important belt of circum-Pacific epithermal precious metal deposits was hosted in "subsequent" volcanic sequences, as is the case in western Nevada. The ores are found in rhyolite or andesite, rarely in basalt. The deposits in andesite are generally larger and of better grade than ores hosted in rhyolite.

After subsequent volcanism, there is usually an episode of block faulting and basaltic eruption which is termed "final volcanism". Final volcanism is never host to important epithermal precious metal mineralization in the circum-Pacific belt.

The basal post-orogenic volcanic rocks of west-central Nevada are rhyolitic in character and widespread in occurrence. This un-named sequence includes flows, welded tuffs, and local small hyabyssal porphyry intrusives. Thin sedimentary units are interlayered with the flows and tuffs. The sediments are often volcaniclastic and were laid down in fluviolacustrine and lacustrine environments. Fossils in the sediments are invariably Miocene. Rhyolite or dacite intrusive bodies are present in some areas of precious metal mineralization, but a genetic connection is not absolutely certain. The ore shoots are in veins that are enclosed within the intrusives, or lie along the contacts of the intrusives with the intruded country rock.

The rhyolite is mostly sub-aerial welded tuff, containing lithic fragments of volcanic and various pre-orogenic rock types. Such pyroclastics are particularly common at Fairview Peak, possibly indicating a nearby resurgent caldera source. No direct evidence has been found for a caldera.

To the west at Carson Sink, a Miocene flow named Eagle's House rhyolite may correlate with rocks of this age at Fairview, but the two rock types are visually dissimilar. The Truckee Formation exposed in the Carson Sink area is tuffaceous mudstone, siltstone, sandstone, and diatomite similar to those interlayered with the volcanic units at Fairview.

In the eastern part of west-central Nevada, a thick sequence of welded tuffs with some interlayered air-fall tuff and flows, mainly of rhyodacitic composition, has been mapped separately in the Desatoya and Clan Alpine Ranges. Elsewhere, the flows of this type are thinner and are mapped with the rhyolites. This sequence is mostly reddish-brown densely welded tuff containing abundant plagioclase and lesser quartz and biotite, with some sanadine.

To the east of Fairview, near Middlegate and in Buffalo Canyon, Miocene sedimentary deposits rest on or interfinger with tuffs of the rhyolite sequence. Siliceous tuffs are sometimes interbedded with the sediments, and become more dominant westward. The most common rock type is pebbly mudstone that often weathers to produce badland topography. The pebbles are of various types of siliceous volcanic rock, including pumice, and the fine-grained matrix is largely tuffaceous. Interlayered with the mudstone are diatomite, diatomaceous shale, and fairly well-sorted sandstone and pebble conglomerate. These sediments were deformed and beveled by erosion before the younger rocks were deposited upon them. At places, dense opaline silica is found in diatomaceous sediments immediately beneath later ash-flow tuffs. The maximum measured thickness of sedimentary rock is 300 m, at a locality where the base is not exposed. These sediments are thought to be equivalent to similar rocks found at Finger Rock Wash, 50 km south of Fairview.

Overlying the rocks just described are rhyodacite flows and tuffs. They generally rest unconformably upon the rocks of the rhyolite sequence, and are dominantly flows and flow breccia; with lesser amounts of tuff and welded tuff. Flow banding is often seen. Plagioclase is of oligoclase to andesine composition and biotite and/or hornblende occurs in a glassy or cyptocrystalline matrix. The rhyodacite unit attains a thickness of 300 m, but is often only 100 m in thickness. Absolute age dating indicates a late Miocene or early Pliocene age.

The crest of the Desatoya Range is a sequence of quartz latite welded tuffs exceeding 600 m in thickness. It rests conformably on the rhyodacite. Quartz latite tuffs mapped with the rhyolite unit may be a non-welded air-fall equivalent of the Desatoya sequence. Quartz in the quartz latite is often smokey.

The youngest Cenozoic rocks in the region are a sequence of basalt and andesite flows with interlayered tuffs and sediments. The flows and tuffs rest unconformably on all of the older rocks at one place or another in west-central Nevada, suggesting considerable local erosion and topographic relief. These younger flows and tuffs sometimes fill broad channels cut in the older rocks, and well-rounded boulders and cobbles are often found in them, under basalt and andesite, as at the Grayback Hills east of Fairview. In some places the sediments are sandstone, conglomerate, diatomite, shale, marl, and lacustrine tuff. This unit was named the Bunejug formation at exposures 35 km west of Fairview. As much as 700 m of the sequence has been measured near Fallon.

Olivine basalt is the most common rock type. The andesite is commonly a hornblende-bearing variety. Pyroxene andesites also occur and appear to grade into pyroxene basalts. Radiometric data indicate the basalt-andesite sequence to be only slightly younger than the underlying dacite. However, in spite of extensive exposures of the Bunejug formation in west-central Nevada, no propylitic alteration or precious metal mineralization is found in it, and it is presumed to be post-ore with respect to Tonopah-type epithermal silver-gold mineralization.

A reasonable estimate of the age of mineralization at Wonder and Fairview, at just over 12 million years, can be made assuming that the mineralization is younger than the dacite intrusives, which cut the quartz latite sequence within the rhyolite. The quartz latite is only slightly older than the barren Junebug basalt-andesite, which has been dated at about 12 million years.

Shortly after the eruption of the Bunejug basalt-andesite sequence, major block-fauling established the basin-and-range topographic character of the region. This correspends well with other regional lines of evidence suggesting that the first fault-controlled sedimentary basins were established no earlier than 11 to 13 m.y.a. (Hemphillian). These faults cut the Miocene and Pliocene volcanic and sedimentary sequences equally, every indication is that the onset of block-faulting came on rather abruptly shortly after the North American plate over-rode the East Pacific rise.

Elsewhere in west-central Nevada, particularly along the Walker Lane southwest of Fairview, strike-slip movement occurs along northwesterly-trending faults parallel to the major active zones in California. The north-south block faults and northwesterly strike-slip zones produce most of the topographic features seen in the region today.

Faulting continues. In historic time, earthquakes have occurred in west-central Nevada at about 30-year intervals; 1869, 1903, 1932, 1954, indicating that stress may once again have built up for a major earthquake at any time. The Fairview district lies in the midst of the last major earthquaking, on the so-called "118th Meridian zone". However, the new activity probably will occur in a historically less active segment of the zone, as for example at Gabbs Valley 25 km south of Fairview.

Table 3. RECENT EARTHQUAKE ACTIVITY NEAR FAIRVIEW (1954).

	Richter Magnitude	*Locality*	*Distance from Fairview*
1.	6.8 ± 0.2	*Rainbow Hills Fault*	*35 km west*
2.	6.8 ± 0.2	*Rainbow Hills Fault*	*35 km west*
3.	7.3 ± 0.2	*Fairview Peak Fault*	*2 km east*
4.	6.9 ± 0.2	*Dixie Valley Fault*	*5 to 45 km northwest*

In all four cases, prominent fault scarping occurred at the surface during the earthquakes.

Quaternary

A variety of unconsolidated sediments have been deposited in west-central Nevada, particularly in the Carson Sink area. Pleistocene basalt flows were erupted from local vents; the "final volcanism" of Hans Stille.

Older Gravels

Older gravels, as much as 30 m in thickness, have been mapped along the west side of Fairview Peak and elsewhere in the region. These older gravels stand at a higher elevation that the alluvial fans and pediments, and are deeply dissected by erosion. They are composed of pebbles and cobbles of rocks exposed at the edges of the range. They might be mapped separately as fanglomerate. Pluvial lake terraces have been cut in these older gravels, making them Pleistocene or perhaps even late Pliocene in age. They were probably deposited in response to unusual conditions of mass-wasting, when block-faulting first raised the ranges, before well-defined drainages had a chance to develop.

Pediment Veneer

During Pleistocene time extensive pediment surfaces were developed around the base of many of the ranges of west-central Nevada. For example, pediments can be found in the Trinity and Truckee ranges, at the western and northern base of Fairview Peak, and all around the northern part of Gabbs Valley. The pediments are covered by a thin layer, or veneer, of transported alluvium. Some of these unconsolidated deposits were re-worked by wave action along the shores of the pluvial lakes, indicating them to be much older than casual inspection would suggest. The pediments are not forming under present climatic conditions. At many localities, recurrent basin-and-range faulting produces fault scarps on the pediments, as for example at the Fairview town site and northward across the west end of the Centurion claim block. Some of these faults are only a few thousand years old. When a pediment is faulted in this fashion, the alluvial veneer is rapidly stripped from the up-thrown (usually the up-slope) block, exposing the bedrock pediment surface. A spectacular example of this kind of pediment exposure is seen at the western base of Fairview Peak 7 km south of the Fairview town site.

There is a genetic connection between alluvial fans and pedimentation. The planar rock surface is created by sub-alluvial notching around the base of rock protruding (inselberg) through the alluvium. Pedimentation is more of a process of chemical decomposition rather than of mechanical abrasion. The moist soil deposited against the inselbergs gradually planates the bedrock surface laterally by notching into the base of the rock mass, causing the overhanging material to slump into the alluvium where it is more easily decomposed. Some rocks, such as granodiorite and graywacke, are very susceptible to pedimentation because they are cemented by minerals that break down readily in the sub-soil environment. Other rocks, such as limestone and basalt, resist the process because they are not easily weathered in the alluvium. Over the thousands of years involved in the construction of a pediment, alluvium is periodically swept from the ranges out over the bajada. Low spots are filled and water-saturated, arresting the pedimentation process. High spots (inselbergs) are surrounded by moist alluvium and planated laterally by chemcial decomposition of the rock in the sub-soil. A mature pediment surface faithfully mimics the topographic surface, rising under the alluvial fans at the mouths of arroyos, forming a "rock fan" beneath the veneer. The pediment veneer is often only a few meters in thickness, and may actually be completely removed from time to time as floods move across the bajada. The water table beneath pediments was quite shallow at the time the surface was formed, and the rocks are typically not oxidized to great depths. The alluvial veneer is not derived residually from the underlying bedrock. It is transported material swept in great distance from the upslope bedrock terrain during flash flooding. These factors considered, it is evident that electrical methods of geophysical prospecting, soil sample geochemistry, etc. might be expected to produce extraneous results.

The fanglomerates at the foot of the range and alluvial veneer on the pediment give way outward to finer clastics and clay deposited in the playa lake environment of the nearby basins. Modern erosion re-works some of the older alluvium during floods, and again the finer clastics and clays are carried out into the playas. The basins are gradually filled by fine-grained lacustrine sediments ranging from Pliocene to Recent age.

Basalt

At various places in west-central Nevada, young basalt flows, cinders, and tuffs are erupted from local vents. No such vent is presently active in west-central Nevada, but some of them are quite young and Indian lore suggests that some may have occurred in the past few thousand years. Future eruptions will doubtless occur. Some took place during the high water stages of Lake Lahonton just to the west, producing truly phenomenal cratering phenomena, as for example at Soda Lake just west of Fallon. The nearest basalt volcano of this kind is Rattlesnake Hill; northeast of Fallon.

Young Alluvium

Much of the younger alluvium of west-central Nevada is the fine-grained lacustrine clay and silt washed into the playa lakes. Young alluvium is found in the modern arroyo channels incising older alluvium. In large part, young alluvium is re-worked older alluvium. Wind blown sand deposits are often found leeward of the playa lakes, particularly where bed rock cradles the dunes, preventing the wind from blowing the sand over into the next bolson, as at Sand Mountain 25 km west of Fairview.

Centurion Area

The rocks exposed at the north end of the Fairview District are shown on the geologic maps accompanying this report (Figures 4 and 6, in pocket). They correlate fairly well with the late Tertiary and Quaternary rocks just described in the surrounding region.

Coxey Porphyry

The oldest rock exposed in the Centurion area is a lithic rhyolitic tuff. It is named for an adit in it just off the south edge of Figure 4 (10,500 N, 12,800 E). It is mildly welded and contains chunks of rhyolite, andesite, dacite, and quartz latite in a siliceous matrix. It crops out southeast of the claim block on the lower slopes of Fairview Peak. It weathers light gray with minor iron oxide staining on fracture surfaces. It is moderately altered, the plagioclase clouded with sericite or illite. Some of the plagioclase in xenoliths is replaced by orthoclase. Where the matrix is glassy it is sericitized.

The Coxey porphyry is probably Miocene in age, a part of the rhyolite sequence described on p. 27. The thickness of this unit cannot be measured in the area mapped.

Wyoming Andesite

Overlying the Coxey porphyry is a thick, complex sequence of andesite flows, flow breccias, agglomerates, lacustrine sediments, and air-fall tuffs. The main unit is andesite flow consisting chiefly of plagioclase, hornblende, biotite, and sparse round eyes of Beta quartz in a matrix of plagioclase and microlite. The flows are generally propylitized, developing calcite, pyrite, and epidote at the expense of phenocrysts and matrix. The matrix is altered to calcite and fine scaly sericite. Hornblende is replaced by calcite, pennine, and hematite. The unit is named for the Wyoming shaft, near which it outcrops. There is no opportunity to measure total thickness of the unit within the mapped area.

The andesite is dark, almost basaltic in appearance where fresh. Where propylitized it weathers a uniform drab olive gray. It appears to grade from porphyry through flow breccia to a pebbly agglomerate that resembles a sedimentary rock. It is possible that some of the porphyry is in small hypabyssal intrusives, although all of it is portrayed as flow on the geologic maps and sections. Some specimens resemble the "ore andesite" at the Nevada Hills mine just to the south at Fairview (see page 28). This intrusive was mapped recently by the U.S.G.S. as dacite. The rock would probably analyze chemically as dacite. However, the free quartz in the matrix is likely of deuteric origin, and the rock "looks like" an andesite in hand specimen and in thin section under the microscope, and will be called by this name in this report. The Wyoming andesite is probably part of the rhyodacite sequence described on page 28.

Several distinct rock types are interlayered within the Wyoming andesite, some of them probably at more than one horizon within the unit.

Laminated lacustrine tuff.--Several distinctive fine-grained tuff units have been mapped. They are generally dacitic in composition, show some evidence of re-working, and were probably deposited in shallow lacustrine environment. They weather gray with a pink to lavender tint. Weathering enhances the banding within the rock, giving it a pronounced laminated appearance in outcrop. One variant, not mapped separately, resembles nothing more than a varved sediment, except that it is extremely hard and of tuffaceous character. The bands or lamina are often distorted by soft-sediment deformation. The mapped units range from 5 m to more than 30 m in thickness.

Tuffaceous Sediments.--At several places, diatomite, mudstone, sandstone, and pebbly sandstone appear to conformably overly laminated tuff. These sediments appear to grade laterally into andesitic agglomerate of the main body of Wyoming Andesite. Visually these lacustrine sediments closely resemble the Truckee formation of the Carson Sink, described on page 27. One lacustrine unit is almost 80 m in thickness, and outcrop relationships suggest that some of the sediment may actually be thicker than this. At several localities, the tuffaceous sediments appear to be carbonaceous, as for example the cropping shown in Photograph 10, page 57.

Agglomerate.--In the southwest part of the mapped area, a distinctive agglomerate or lahar unit crops out. It is about 20 m in thickness and weathers to a smokey gray with a distinct purple tint (see Photograph 11). It appears to mark the depositional transition vertically from lacustrine environment to sub-aerial volcanic flow.

Several such agglomerate units were observed within the main body of Wyoming Andesite, but were too small and discontinuous to map separately. At one locality, cobbles and boulders of granodiorite from the underlying bedrock complex are thickly distributed within a coarse agglomerate.

Highway Quartz Latite

In the northeast mapped area, a fairly fresh quartz latite welded tuff appears to rest conformably on the Wyoming Andesite. It is particularly well exposed in the old highway cut at Drumm Summit-- hence the name it has been given. The matrix is banded glass. Large plagioclase and biotite phenocrysts are abundant and tend to lie with long dimension parallel to banding. There are lesser amounts of Beta quartz and hornblende. The rock weathers to an ash gray, and is probably at least 60 m in thickness. The general intensity of alteration and minerlization is far less than in the Wyoming Andesite. A specimen of Highway Quartz Latite is shown in Photograph 13, page 59.

The Highway Quartz Latite is probably Pliocene in age, and appears to be identical with the unit mapped in the higher part of the Desatoya Range, 15 km to the east.

Summit Formation

The new highway cut at Drumm Summit, in the northeast part of the mapped area shown on Figure 4 (in pocket), exposes about 25 m of soft, friable tuffaceous sandstone and pebbly conglomerate. The unit appears to rest unconformably on the Highway Quartz Latite. The lowermost 3 m of Summit formation is iron-stained along fractures and is a lacustrine diatomaceous mudstone. Some of the tuffaceous material in the upper part of the unit is pumiceous and is not worked or stratified, suggesting a sub-aerial environment of deposition. The impression gained from these outcrops is of a lake shore thermal spring environment in volcanic terrane. The Summit Formation is similar to sedimentary units interlayered with the Pliocene Bunejug formation 20 km to the west in the Carson Sink.

Stingaree Andesite

Fresh flows of augite andesite overly the Summit Formation, but the exact nature of the contact cannot be told for it is everywhere covered by soil and slope wash. The single exposure of this unit within the mapped area shown of Figure 4 is at the isolated hill at the northeast corner of the map, at the west edge of Stingaree Flat. It contains small phenocrysts of plagioclase, augite, hypersthene, and small amounts of brown hornblende. The rock has not been altered. It is probably Pliocene in age, and likely correlates with the Bunejug formation of the Carson Sink (see p. 29).

Pliocene Sediments

Just north of the northwest corner of the mapped area, low outcrops of unconsolidated Pliocene sediments are seen in a horst formed by the recent faults trending northward from Fairview town site. This gravel represents some of the first debris swept into the basin after it was block-faulted into existence in the Pliocene. This unit is not described in the geologic literature of the surrounding region, and might best be considered as the lowermost of the older gravels for the purposes of this report.

Older Gravel

The old fanglomerate described on pages 30 and 31 is not well developed along the foot of Fairview Peak across the south part of Figure 4. It has been mapped here with the pediment veneer. From a point just upslope from the Fairview town site, southward along the western base of the range, the fanglomerate is well developed and could easily be mapped as a separate unit.

Pediment Veneer

The pediment extending over most of Figure 4 and virtually all of Figure 6 is mantled by alluvial veneer that conforms in every respect to deposits of this kind found elsewhere in the region (see pages 31-32). The transported character of the veneer is particularly evident on the Centurion prospect, for fragments of vein material from Dromedary Hump are swept down the hill slope onto the pediment, out across the claim group to the highway and beyond. The early miners thought these vein fragments were float and spent a great deal of fruitless effort probing the alluvium beneath them in search of veins. This may account to some extent for lack of aggression in exploring the bed rock mineral showings on the Centurion ground.

Young Alluvium

The younger alluvium mapped on Figures 4 and 6 is identical in every respect to deposits of this kind described on page 33, found in the surrounding region. The younger alluvium at the western edge of the mapped area grades rapidly into playa lake sediments on Labou Flat.

Structure

The pre-orogenic and orogenic structure of the Fairview region has already been discussed on pages 22-25 in connection with Paleozoic and Mesozoic rocks of west-central Nevada. The lack of geologic record between mid-Jurassic and mid-Tertiary was discussed on pages 26 and 27.

About 25-30 million years ago, after the ancestral Sierra Nevada had been worn down thousands of meters by erosion, eruption of "subsequent" volcanism began. Miocene rhyolite tuff was deposited over a lowland carved on the deeply eroded metamorphic and plutonic rocks. This tuff unit is the Coxey porphyry mapped on Figures 4 and 6. The character of the bed rock beneath the Coxey on the Centurion prospect is not known. Granitic rocks crop out 7 km to the northeast. Mesozoic carbonates are found at the surface 6 km to the northeast. Mesozoic metavolcanics crop out 6 km to the northeast, 7 km to the east, and 3 km to the southwest. There is no clue to the character of the Paleozoic rocks beneath these Mesozoics. Present theory of epithermal mineralization envisages large hydrothermal convective cells as the mechanism of ore emplacement. The concept proposes metal-rich rocks at depth beneath the vein system as the source of silver and gold. The most favored rocks are basic volcanics such as the Permian Limerick (or Pablo) greenstones, which are known to be metal rich. It is not possible to determine if such rocks lie at depth beneath the Centurion prospect, although there is no evidence that they do not.

After the eruption of the Coxey tuff, the Wyoming andesite was deposited. Andesite flows, breccia, agglomerate, lahar, lacustrine tuff, and sediment accumulated in a lowland terrain. A similar pattern of volcanism and volcaniclastic sedimentation in adjoining lakes characterized western Nevada late in the Miocene. Flows near the vents grade away to agglomerate, lahar, conglomerate, sandstone, mudstone, and diatomite in the lake basins. Integrated drainage to the Pacific was probably blocked from place to place, and considerable water was locally ponded in shallow lakes during this volcanic episode. Tonopah-type epithermal mineralization took place as volcanism waned, probably in a sub-volcanic environment, possibly in close genetic relationship to hypabyssal intrusive equivalents of the later andesite flows. There is a pronounced tendency for the epithermal veins to strike west-northwesterly. The positioning of the ore shoots along the main veins is vague and ill-defined except at Fairview, where cross-faulting is suspected as an important ore control. The ore shoots of the Nevada Hills, Eagle, and Dromedary Hump veins are thought to be controlled by north-northeasterly cross faults which themselves are not mineralized. The ore shoots lie along the veins, between the high-angle cross faults. The projection of the cross faulting takes it into structures of this type mapped just east of the Centurion claim block. There may be considerable faulting of this trend and character on the Centurion claims-- bed rock is not well enough exposed to make the determination.

The Centurion Vein appears to extend from Bravo to Alpha Hill, a kilometer, more or less, in a straight line. If this projection proves valid, it would suggest that cross-faulting may not be as important as thought at Fairview. A characteristic of many Tonopah-type silver-gold districts in western North America is that cross-faulting is often pre-ore or intra-mineral, and in some camps the cross faults themselves contain good ore.

There is no sinter or other indication of surface mineralization along the outcrop of the Centurion Vein. This could be taken to indicate that erosion has removed the upper portion of the vein system. Any ore shoots within the vein may have been exposed by erosion, and are now concealed only by the thin pediment veneer. The oxidation effects in the sub-outcrop of the vein may be intense (discussion follows). Regional analysis of Tonopah-type ores suggests that the tops of ore shoots terminate about 100 m beneath the surface at the time of mineralization. Little is known concerning the character of this (perhaps relatively barren) segment of vein over ore. Most districts have been eroded deeply enough to have exposed at least one ore shoot for discovery by prospectors. This late Miocene to early Pliocene erosion took place under relatively stable crustal conditions and may have resulted in thorough oxidation under climatic conditions more warm and moist than have existed since Hemphillian (inception of Basin and Range faulting). It is possible that erosion and oxidation of the Centurion Vein preceded deposition of the Highway Quartz Latite. It is probable that erosion and oxidation of the Centurion Vein preceded deposition of the Summit Formation and Stingaree Andesite. It is not known whether the Centurion prospect is domed, as is often the case in Tonopah-type mining districts. Geologic conditions can be interpreted as permissive, but there is no clear proof that doming has occurred.

After eruption of the Stingaree Andesite, block-faulting began, raising Fairview Peak (actually an elongated north-south range segment) as a horst, bounded on the west by Dixie Valley (Labou Flat) and on the east by Stingaree Flat. The Fairview horst is 4 to 5 km in width and has actively undergone erosion for over 10 million years as uplift continues. At the time the Fairview horst and other basin ranges in west-central Nevada were developed, renewed uplift began on the site of the long-dormant ancestral Sierra Nevada, raising a huge ramp-like range which has placed the Great Basin in a classic rain-shadow situation with respect to the prevailing winds coming from the Pacific Ocean to the west. The climate has been relatively dry and cold since then, inhibiting oxidation. The Fairview horst is still rising, as evidenced by prehistoric faulting (downthrown on the west) passing through the Fairview town site, and the dramatic 1954 movement along the Fairview Fault (downthrown on the east), which cuts Highway 50 about 2½ km east of the Dixie Valley turn-off (State Highway 121).

MINERALIZATION

Regional

Wonder, Fairview, and Sand Springs are the important metal mining districts in nearby Churchill County. These three camps are Tonopah-type silver-gold veins. However, there are various other pre-orogenic, orogenic, and post-orogenic ore types in west-central Nevada.

Pre-orogenic ores

Sea-floor copper has been found in vesiculated Jurassic lavas, as at the Boyer and Bradshaw mines. Volcanigenic copper ores have been mined at Big Mike and Ludwig. Volcanigenic silver ores are known at Unionville, Rye Patch, Sheba, Grantsville, and Candelaria. Island arc plutonic rocks contain disseminated copper mineralization, as at Yerington and Lights Creek, which are not typical southwest U.S. porphyry coppers. Magnetite veins related to gabbro intrusives have been mined at Buena Vista, Gabbs, and other localities in the region. Low-grade titanium ore is found associated with albitic dikes at Corral Canyon. Pre-orogenic epithermal cinnabar and antimony ores are found in the Antelope district, at the Red Bird, and at Bernice. Sea-floor manganese has been prospected at many localities in Paleozoic volcanic sequences.

Orogenic Ores

Ores related to orogenic plutonism are found at a number of localities in west-central Nevada. Skarn tungsten ores are found in a belt along the eastern margin of the Sierra batholith, as developed at Scheelite, Sand Springs, Shady Run, Alpine, and elsewhere. A disseminated molybdenum prospect is in granitic rocks at Big Kassock Mountain near Rawhide. Minor manto silver-lead mineralization is found in the aureole of a granitic intrusion at Chalk Hills, and showings of this ore type occur at Westgate.

Post-orogenic Ores

Post-orogenic ore types in west-central Nevada are predominately epithermal veins in Tertiary volcanic host rock. Fluorspar has been mined at the Baxter mine. Epithermal mercury is found at Holy Cross, Cinnabar Hill, and in many smaller prospects. Silver-gold veins have produced significantly at Wonder, Fairview, and Sand Springs. These silver-gold veins belong to an ore type that is common in western Nevada; historically the most important kind of ore mined in the region. A conceptual model for these (Tonopah-type) ores was synthesized by the writer in a private report in 1985, emphasizing the 10 principal geologic and mineralogic characteristics that distinguish it from other precious metal ores. The silver-gold veins at Wonder, Fairview, and Sand Springs conform in every important respect to this Tonopah ore type, although as mentioned on page 10, these three districts are not quite as large as the average of 17 Nevada mining districts where significant quantities of this kind of ore have been mined.

Wonder departs from the conceptual model only in minor respects. The hypogene ore shoots extend through more than the typical vertical range, and the oxidized ores may have been enriched somewhat. Residual enrichment of gold near the surface is less than average. Oxidation extends to greater depths than usual. Silver, released from the primary minerals during oxidation, remains fixed *in situ* as stable secondary halogen salts. There is a clear-cut genetic connection between hypabyssal porphyry intrusives and the veins.

The ores at Fairview conform in every respect to the genetic model. There is a suspected connection between hypabyssal porphyry intrusives and the veins.

The ores at SandSprings fit the conceptual model perfectly. There appears to have been slightly more near-surface residual enrichment of gold, and possibly more leaching of hypogene silver than usual. This may be because of the relatively competent wall rocks, resulting in more shearing and brecciation along the vein prior to and during oxidation.

What is presently known of the Centurion Vein strongly suggests it to be Tonopah-type mineralization, and initial exploration will be based on the assumption that it is.

In recent years, several large, low-grade precious metal ore deposits have been discovered in more or less the same geological environment that hosts Tonopah-type veins. Borealis (Houston Oil and Minerals), Paradise (FMC Corporation), and Sleeper (AMAX) are all developed or being developed as open pit-cyanidation operations, and are spoken of as "stockwork" or "thermal spring" deposits. Such mines, of course, are a far more attractive investment opportunity today than ore shoots of the type mined underground at Fairview and other nearby Tonopah-type districts. Still another large disseminated precious metal ore type has been found elsewhere in the circum-Pacific belt of subsequent volcanism; gold-silver ores in Tertiary sediments. At Wenatchee, and at Republic, Washington several major mines have been developed in this little-known geologic environment. At Republic, the Tonopah-type epithermal veins were largely mined out in the period 1896-1914. When gold was re-priced in the early 1930's, a 500 tpd cyanide plant was built to treat low-grade ore, and over a million tons of ore containing 4 grams of gold and 30 grams of silver was mined from two open pits, the Mud Lake and Mountain Lion mines, during the period 1936-1942. The ore is disseminated along and just above an angular disconformity separating the Eocene San Poil volcanics (andesite, rhyodacite, quartz latite) from the overlying Klondike Mountain Formation. The basal Klondike, the Tom Thumb member, is carbonaceous and tuffaceous fluvio-lacustrine and lacustrine sediment. The disseminated ores occur in a rubbly accumulation at the base of the Tom Thumb member, through a stratigraphic range of about 15 to 20 m, and along the strike of the formation over 300 m. The dissemination is along the strike projection of the Republic-Knob Hill vein. The vein structure did not extend upward into the overlying lake beds; mineralizing solutions penetrated only into the porous basal rubble zone, where the blanket-like deposit was formed. The stratigraphic sequence at Republic is quite similar to the rocks mapped southeast of the Wyoming Shaft on the Centurion ground. Here, the projection of the vein passes into an area of poor outcrop but obvious structural complexity, where tuffaceous (and carbonaceous?) sediments transition laterally and vertically within the Wyoming Andesite, in an area of mineralization and strong alteration. There is a chance that disseminated precious metal mineralization might be found in agglomeratic zones within the sediments. Inasmuch as little is known of the geology in this area, northeast, east, and southeast of triangulation point Bravo, exploration will await the work done specifically on the Centurion Vein itself, which will provide some sub-surface information and permit more intelligent planning.

Centurion Prospect

On Alpha Hill the Centurion Vein strikes 310^g and dips 180^g to the south. It has been explored in 2 prospect pits and two shallow (3-4 m) vertical shafts. Neither wall of the vein is well exposed, either in outcrop or in the prospect workings. Where seen, the vein walls are indistinct and are not marked by shearing or gouge. The vein may project along strike to the west-northwest some distance, under thin pediment alluvial veneer (see Photograph 7, p. 56). The projection of the vein to the southeast, toward Bravo Hill, directly aligns with the exposures at the Wyoming shaft and on Bravo Hill, more than 800 m from Alpha Hill.

At Bravo Hill, a prospect shaft 3 m deep and adjoining hand trench expose the vein walls. The hanging wall appears to be marked by a sheared zone, although slumping of the cuts makes relationships uncertain. The outcrop of the vein on Bravo Hill does not expose the walls of the vein, quartz barely protruding through the thin soil (see Photograph 6, p. 55).

The Wyoming Shaft was collared in the immediate footwall of the Centurion Vein. It appears to have been sunk at too shallow an angle, passing into the footwall of the vein at shallow depth, then steepened to correct the situation. The Wyoming dump consists of thoroughly propylitized Wyoming Andesite with considerable admixed vein material. The vein quartz is porcelaneous and contains pyrite, chalcopyrite, arsenopyrite, and other unidentified sulphides. The wall rock is not oxidized. Bright disseminated pyrite can be seen in most specimens, and the dump has the characteristic greenish-yellow cast caused by intermediate oxidation products of the iron minerals, formed since the material was broken and placed on the dump. The Centurion Vein may project directly on strike a hundred meters or more to the southeast, where faulting and poor exposures obscure relationships. It is in this area that exploration will done with particular attention to dissemination of precious metals out along sedimentary horizons.

To the east of the Centurion claim block, in the low hills at the north end of Fairview Peak, several short vein segments trend WNW and dip steeply to the south. None of them aligns with the Centurion vein at the Wyoming Shaft. None is as impressive as the mineralization on the Centurion ground in terms of intensity of veining, development of gangue minerals, texture, etc.

It is probable that the Centurion vein is continuous from Alpha Hill to Bravo Hill (see Photograph 5, page 55), and it may extend some distance further in both directions, perhaps 2½ km or more in total strike length. A point by point comparison of the Centurion vein with the conceptual model of a Tonopah-type vein will guide initial exploration and lay the groundwork for interpretation of results.

The Centurion Vein is about 2 m in width in the scant exposures available for inspection. If an ore shoot 200 m long and 100 m along dip were to be found, it would contain about 100,000 tons of ore-- within the lower size limit of the Tonopah ore type. It is likely that an ore shoot would widen to two or three times this vein width, increasing the tonnage to two or three hundred thousand tons, well within the typical size range of Tonopah-type ore deposits.

Aside from the base metal sulphides just mentioned, no primary ore minerals have been observed as yet in the Centurion Vein. An ore shoot, if present should contain any or all of the following: electrum, argentite, silver sulpho salts, and selenides (naumannite). Minor pyrite, arsenopyrite, galena, chalcopyrite, and sphalerite are often present. Wolframite or molybdenite may be found. These minerals may be expected to be partially or completely oxidized to auriferous electrum, acanthite, halogen salts of silver (particularly chlorargyrite), native silver (particularly wire), scorodite, cerussite, malachite, azurite, and wulfenite.

Gangue minerals in Tonopah-type ores are quartz, calcite, and adularia. These have been observed in the Centurion vein, although calcite is not as common as usual. In most Tonopah-type districts, large amounts of calcite in the gangue are taken as a sure sign of lower-grade mineralization, particularly in terms of gold content. Other gangue minerals to be expected are dolomite, ankerite, manganiferous calcite, rhodochrosite, and rhodonite. Sometimes barite and amythest are found, fluorite is rarely present. Alunite is generally absent. The Centurion outcrops are heavily stained by manganese oxides, indicating the presence of one or more of the primary manganese minerals.

The alluvial gold toward the northwest might have been derived from a northwesterly projection of the Centurion vein, which may lie at very shallow depth just up-slope from the dry placer diggings.

Some of the white quartz in the Centurion vein on Alpha and Bravo hills gives the impression of secondary origin, the "billy" of the west Australian prospector. This type of quartz is formed at the surface in response to accelerated weathering and oxidation of the vein, and fades rapidly in depth. "Billy" in some districts is best developed when the weathered outcrop of a quartz vein is buried beneath younger lava flows which rapidly devitrify, the silica-rich solutions passing out the base of the cooling unit into the underlying rocks. Billy often makes relatively low-grade portions of veins stand out boldly in outcrop, where they attract the attention of prospectors. The portions of the vein that contain good ore, or the ore shoots, often do not stand out as well topographically. These segments of the vein are often less siliceous, are more likely to consist of soft, easily decomposed minerals, and often are more sheared by post ore dynamic forces or internal adjustments accompanying intense oxidation of the vein minerals. The ore zones are less likely to stand out than the barren portions of the veins. Where the vein is sheared, silver is likely to be leached from the uppermost portion of the vein, making it difficult for early prospectors to detect.There may or not be an accompanying residual enrichment of gold near surface. Where such shearing and leaching involves calcarous gangue, it may be thoroughly leached as well, so that the vein walls collapse against a crushed zone of quartz fragments, much thinner than the primary vein structure, and often marked at the surface by a topographic depression.

Trace metal associations in primary Tonopah-type mineralization are arsenic, mercury, antimony, selenium, and tungsten. Tellurium is usually absent. As yet, no trace metal geochemistry has been done on the Centurion prospect. Outcrops are not sufficient to collect enough samples to be meaningful. Also, not enough is known of the stability of these metals in the surface weathering environment.

Several textures are characteristic of epithermal mineralization. Lamellar quartz is particularly distinctive, where fine-grained quartz and adularia replace early-form calcite along cleavage planes. Cockading, combing, and rhythmic banding are common, although they may be obliterated by crushing and repeated brecciation during later shearing of the vein. All of these textures have been observed in the Centurion vein.

Large envelopes of propylitic alteration enclose Tonopah-type veins, particularly where the wall rock is andesite. These alteration haloes are too general and irregular to be of any help in localizing ore targets. The immediate vein walls are adularized, sericitized, and silicified. All of these alteration effects have been observed in the Wyoming Andesite adjacent to the Centurion Vein.

Tonopah-type ores are best developed in andesite. Ore shoots in rhyolitic host rocks are smaller and not as rich. Regional analysis of the ore type suggests that the ideal wall rock condition is where Miocene andesite lies in the hangingwall of the vein and the footwall is a harder, more competent rock such as diorite or quartzite. The geology of the Centurion claim block indicates that andesite probably lies along both walls of the vein at any given point. However, relationships are complex and poorly exposed, and a rock other than andesite might occur on one wall of the vein somewhere along the 2½ km to be explored.

Ore shoots are deposited in Tonopah-type veins in a range 250 to 100 m beneath the surface at the time of mineralization, through a vertical range of about 150 m. In a few districts this vertical range of ore deposition is exceeded. Little is known of the character of the vein in the barren vein segment between the upper limit of the ore shoot and the old topographic surface-- this zone has been removed by erosion in the districts discovered thus far and therefore available for study.

Ore shoots in Tonopah-type veins occur in one of three general environments: (1) as ore shoots along one wall or the other (the hangingwall is preferred) of quartz-calcite veins that crop out boldly and extend for kilometers horizontally and for hundreds of meters along dip, (2) as ore shoots along minor cross veins that often do not crop out boldly, particularly within 150 m horizontally of where they intersect the main veins of the district, and (3) as ill-defined stockworks in the hangingwall of the main vein at flattenings in dip, at vein intersections and bifurcations along strike or dip, or in porous, reactive, and reductive sedimentary horizons.

The topographic expression of Tonopah-type ores is pronouncedly negative, whatever the scale of observation. The largest districts are found in topographic depressions or in low, hilly terrain. The veins that are most intensely mineralized within a district are often found late in the history of a mining camp, because of poor outcrop, position in the bottom of arroyos, etc. The ore shoots within veins usually do not stand out topographically. Where an ore shoot lies along one wall of a vein, the relatively barren portion often crops out boldly, shedding debris over the adjacent ore shoot, which itself may be covered by soil.

An analysis of ore shoots at Fairview, Wonder, Sand Springs, and Gooseberry (Figures 7 thru 10) gives an idea of the frequence of ore shoots in Tonopah-type veins. The length of the ore shoots in these four districts, expressed as a percentage of the total strike length exposed, is as follows:

District	*Ore Shoots, as a percentage of strike-length of outcrop*
Fairview	*21%*
Wonder	*10*
Sand Springs	*10*
Gooseberry	*100*
	Average, 35%

An average of 35% of the strike-length of Tonopah-type veins is underlain by ore shoot.

On the Comstock Lode (the premier Tonopah-type silver-gold mining camp), a little more than 450 m of the 4300 m total strike length of vein outcrop, or about 11%, represents ore shoots coming through to to the surface in outcrop. The ore shoots are marked at the surface by subdued topography and are concealed by talus, soil, and vegetation, which delayed discovery of the district for several decades. On the Comstock, about 10% of the plane of the vein, above the Sutro Tunnel level (an average 600 m beneath average elevation of the vein's outcrop), is occupied by ore shoots.

If this approach to estimating risk is valid, it can be seen that the chance of an ore shoot being present along a well-developed Tonopah-type epithermal silver-gold veins is better than 1 in 10. More than 2,500 m of the Centurion vein (see Figure 11, p. 19) may lie at very shallow depth under soil and pediment veneer, and the chance of 250 m of it being ore shoot is a good exploration bet.

In west-central Nevada, Tonopah-type mineralization is Late Miocene to early Pliocene in age (Barstovian-Clarendonian, 12-14 m.y.a.). The best estimate of the age of the Centurion Vein is slightly older than 12 million years, although this is based on a series of assumptions.

In most Tonopah-type districts, mineralization cannot be related with certainty to hypabyssal intrusives, or "ore-bringers". There is often a suspicion that a particular porphyry may be intrusive in character, but the relationship cannot be proven for certain. It should be remembered that orthodoxy of the theory of ore genesis during the first sixty years of the century required such an "ore bringer". Where such ore porphyries are known or strongly suspected, as at Fairview, Wonder, and Sand Springs, they are fine-grained rocks of andesitic to rhyolitic composition. There is a possibility of such a hypabyssal andesite on the Centurion ground (see p. 34). In a few districts, underground development reveals thin, scoriaceous, red-stained basalt dikes and small plugs in close spatial relationship to ore.

CONCLUSIONS

The Centurion Vein is a Tonopah-type epithermal structure. It may extend for 2½ km or more along the trend of the Centurion claim block. Only two short segments of this strike length expose the vein at the surface on Alpha and Bravo Hills. If ore shoots are present in or along the vein, they are likely to be in the zones covered by shallow pediment alluvial veneer. Pediments do not carve deeply into the soft zones, cutting beneath the plane of the pediment surface. Instead, the transported alluvium fills and covers low areas, effectively protecting them from erosion and chemical decomposition.

It is likely that the uppermost portions of any ore shoots present are partially or wholly leached of silver, perhaps to the extent that the first few meters might notbe profitable to mine by underground methods.

There is ample space for one or more ore shoots containing several hundred thousand tons of ore, lying at less than 150 m depth. The ore can be expected to contain more than 6 grams per ton of gold and more than 450 grams per ton of silver. At today's prices, about $150 would be recovered from each ton of ore. The total recovered value of silver gold could be in the range $100,000,000. The ore would cyanide readily. Mining by underground methods would present no particular difficulties, and high selectivity and relatively low costs can be anticipated. Use of rubber-tired loading and hauling equipment would permit ramping downward in a "race-track" scheme of development in the footwall of the vein, eliminating the need for tramming, ore pockets, hoist, pumps, ore bins, etc.

Two principal unknowns might negatively affect exploration of the Centurion Vein:

(a) The Centurion vein may have no ore shoots in or along it.

(b) The prospect may have been so deeply eroded that any ore shoot(s) originally present may have been stripped away, leaving barren roots of the vein cropping out at the present topographic surface.

There is a slim chance that a low-grade "stockwork" or disseminated ore deposit may lie somewhere along the mineral trend. The chances are so slim, and so little indication is evident in the outcrops, that an exploration program could not be justified with this sole objective in mind. However, as exploration continues on the vein mineralization, the potential for low-grade will be constantly kept in mind, and an exploration target of this nature may develop as the work progresses, and additional understanding of this mineralization is gained.

RECOMMENDATIONS

No rock chip sampling has been done on the Centurion prospect. Outcrops are too scant to result in meaningful patterns. The mineralized showings have not been sampled, for they are obviously not competely exposed-- the more resistant portions standing out in outcrop are probably not well mineralized, otherwise they would be more thoroughly explored. It is probable that gold and silver will both be impoverished at the immediate surface in this ore environment. The Centurion prospect is a geological proposition-- the major exploration possibilities lie at shallow depth under a very thin veneer of soil and alluvium. No soil sampling over the vein projections along strike is recommended because of the transported character of the alluvium. No soil vapor sampling is recommended because of the relatively high cost and the sophistication of such work. No geophysics is recommended. The pyritized wall rock was apparently not deeply oxidized and has recently been faulted, fractured, and raised above the water table. The vein itself may have been deeply oxidized during an epoch of late Miocene or early Pliocene weathering. There is a good chance that these recent un-mineralized structures in the wall rock would give rise to anomalies, while the vein itself give no detectable clue as to its presence.

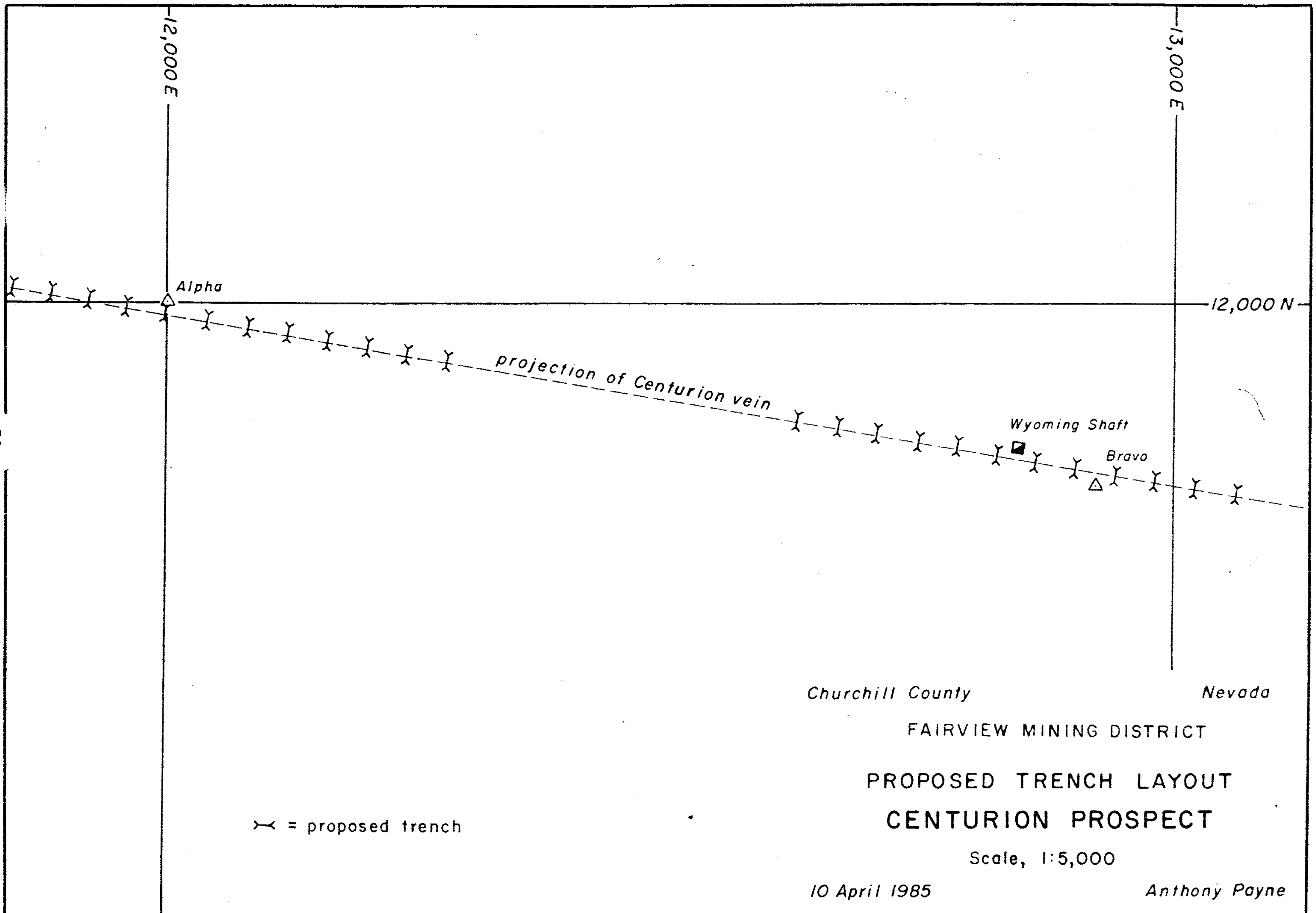

12,000 E
13,000 E
12,000 N
Alpha
Bravo
Wyoming Shaft
projection of Centurion vein
= proposed trench
Churchill County
Nevada
FAIRVIEW MINING DISTRICT
PROPOSED TRENCH LAYOUT
CENTURION PROSPECT
Scale, 1:5,000
10 April 1985
Anthony Payne

Figure 12

Shallow refraction seismic surveys could be used to establish the contour of the pediment bed rock surface, but back-hoe cuts would do this work better and at less expense, and provide the opportunity for bedrock sampling to assist in working out the geological picture. Gravity and magnetic methods are obviously inapplicable. Electrical methods might result in extraneous anomalies, as described in the previous paragraph.

The major exploration potential of the Centurion prospect, as it is now understood, is simple and straightforward. A series of bulldozer trenches should be cut at right angles across the vein at close intervals. The work should begin on the inselbergs at Alpha and Bravo, for the vein is not fully exposed here and should be sampled across the full width of the structure and into the walls. Working in either direction from the inselbergs, along strike projection of the vein, the trenches should be cut in sequence, watching for changes in strike, branching, en echelon structure, stockworking, dissemination of mineral into the vein walls, etc. The trenches can be cut cleanly, exposing the vein and immediate walls for inspection and sampling without disturbing the surface badly.

It would be desireable to cut a minimum of 24 trenches, on 40-meter spacing, as shown on Figure 12, p. 51. If the pediment veneer is thicker than anticipated, the trenching should be stopped. If the pediment is about as thick as anticipated, and bedrock reached within two meters of the surface, a second phase of trenching should be laid out. If results are straightforward, a preliminary inspection of vein walls and channel sampling of the vein and walls will guide further work. It might be advisable to cut one or two intermediate trenches on 20-meter spacing if two adjoining trenches cut visually impressive mineralization. If two adjoining trenches on the initial 40-meter spacing expose vein that can be mined, the results will immediately be analyzed in terms of:

(1) possible small open pit and heap leach operation of low grade to determine if grade increases at depth.

(2) possible small open pit, shipping intermediate grade to Sunshine's Silver Peak cyanide plant, to determine if grade and tonnage increases at depth.

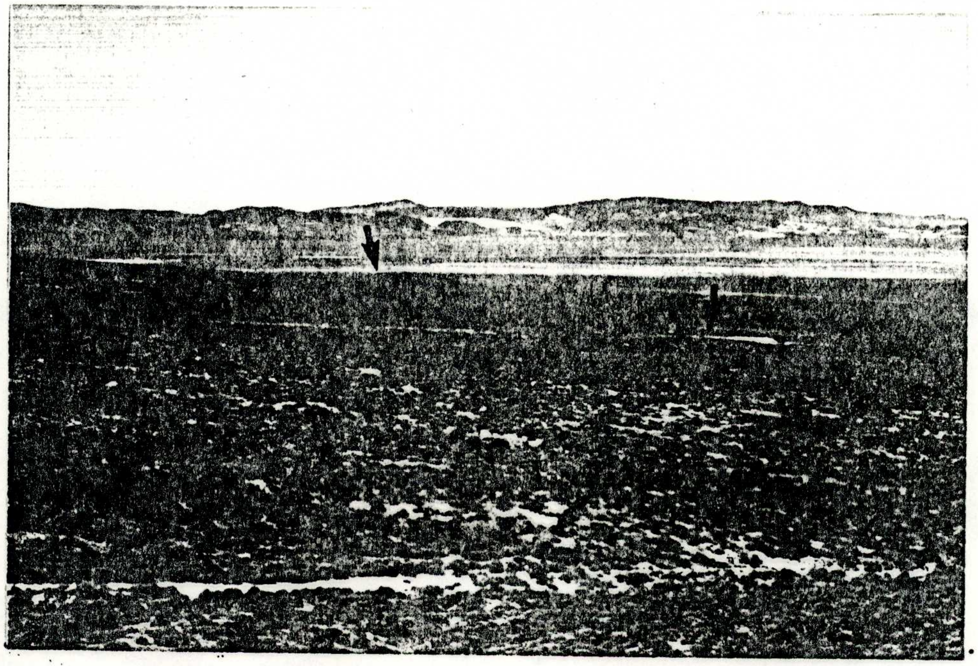
(3) decline from the surface to crosscut the vein at intervals to determine grade and tonnage.

Only in a very closely controlled situation would any drilling from the surface be considered as a test of ore shoots at depth. If a small, track-mounted reverse circulation down-the-hole hammer rig could be contracted, with experienced driller, shallow angle-holes might be drilled under showings in the trenches. The work would have to be directly and continuously supervised by an experienced geologist. The combination of such drilling equipment, operator, and supervisor can rarely be put in place on small exploration projects of this kind today.

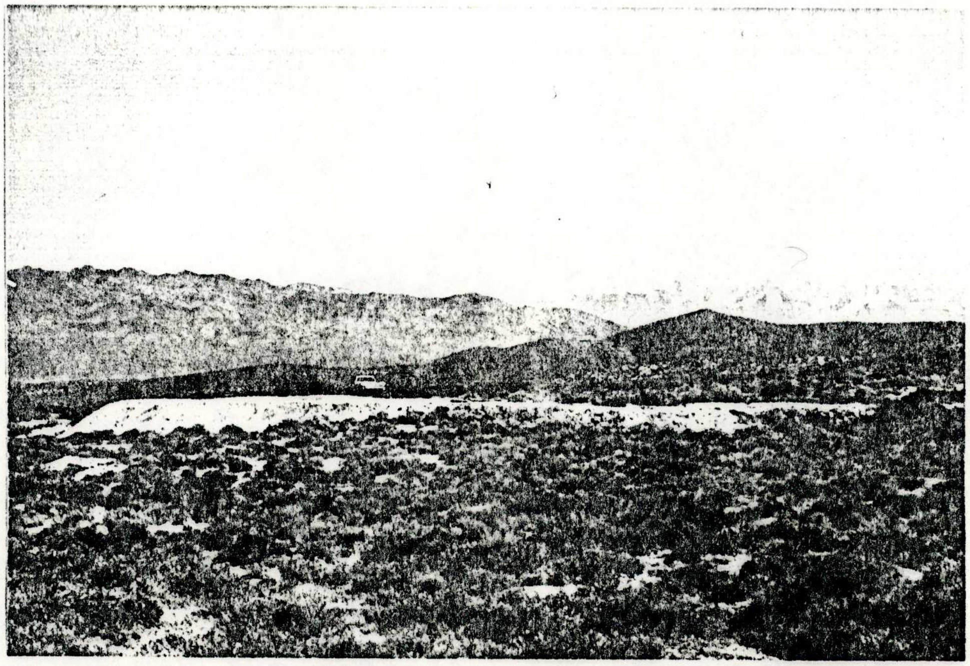
Once the results of the initial trenching are in hand, additional exploration or possible initial mine development can be planned.

Anthony Payne
Mining Geologist

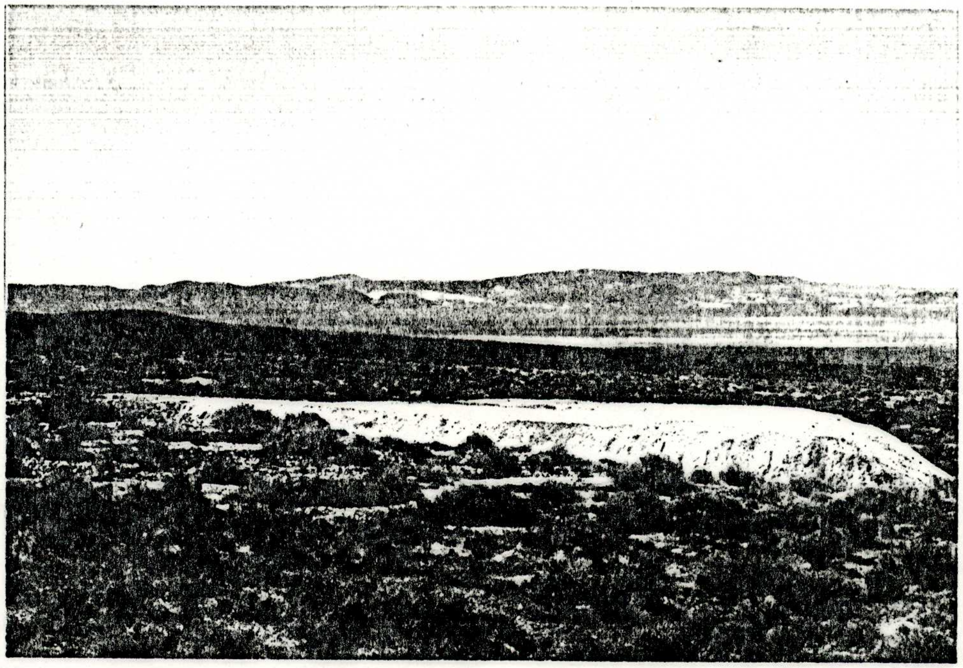
Reno, Nevada
20 April 1985



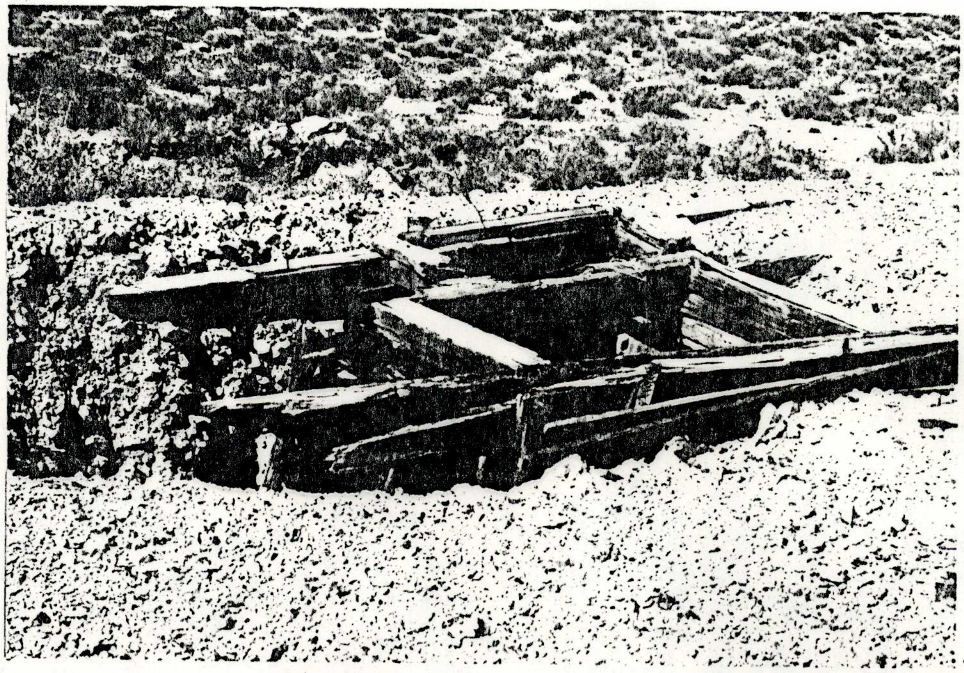
PHOTOGRAPH 1. Centurion Prospect. General view looking northwest from southeast part of claim block. Wyoming shaft in right middleground, Alpha Hill in left middleground. Stillwater Range in background.



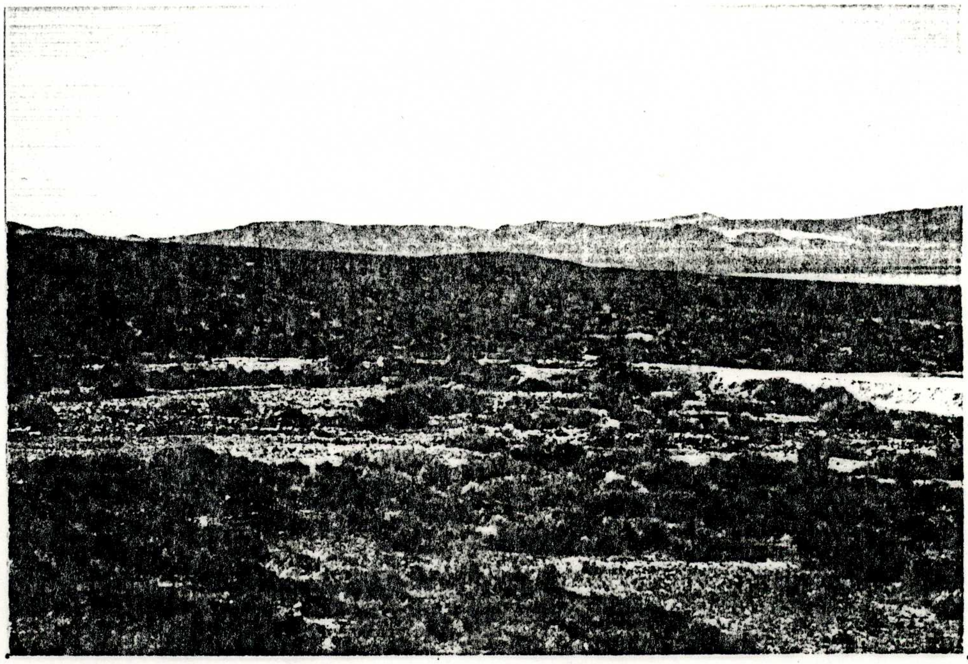
PHOTOGRAPH 2. Wyoming Shaft. Closer view looking east. Clan Alpine Range in left background. Desatoya Range in right background with snow.



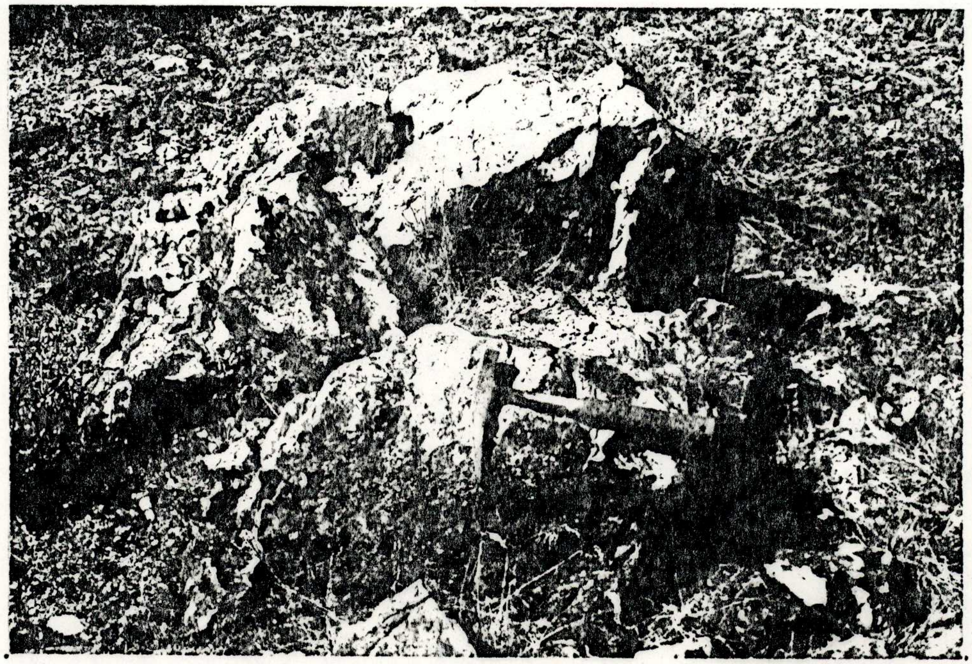
PHOTOGRAPH 3. Wyoming Shaft. Close view looking northwest. Alpha Hill in left middleground. Stillwater Range in background beyond Dixie Valley.



PHOTOGRAPH 4. Wyoming Shaft. Close view looking northwest. Outcrop of Centurion vein just over wooden collar. Shaft inclined to left (southwest).

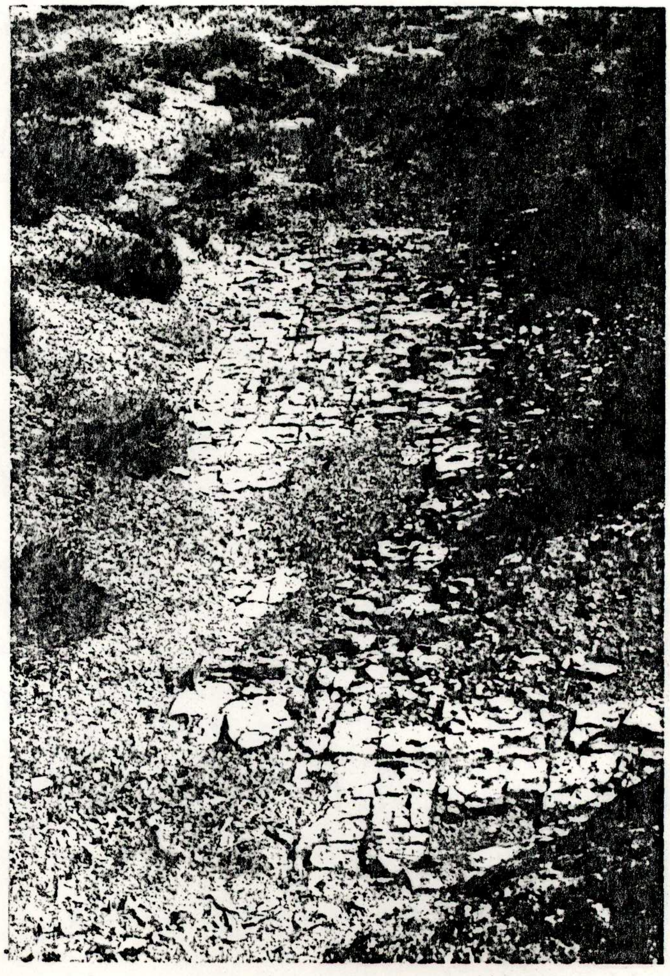


PHOTOGRAPH 5. Wyoming Shaft. Close view looking northwest. Alpha Hill in center middleground. Stillwater Range in background beyond Dixie Valley.



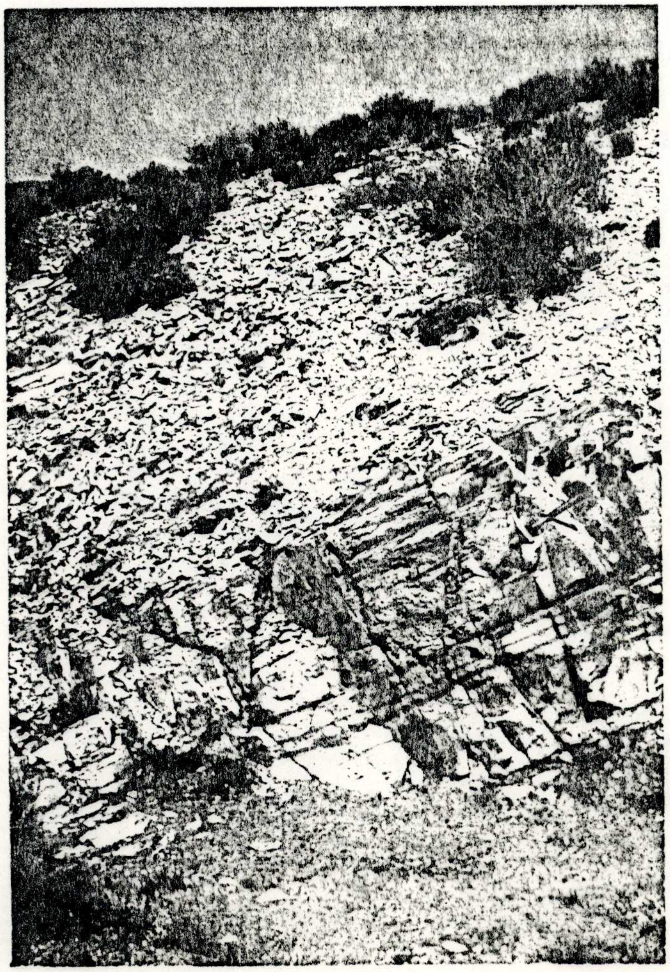
PHOTOGRAPH 6. Centurion Vein. Outcrop just west of Wyoming shaft. Walls of vein are not exposed.

PHOTOGRAPH 7. Centurion Vein. South of triangulation station Alpha. Looking west-northwesterly along trend of vein. Pediment in middleground. Labou Flat to left. Dixie Valley and Stillwater Range in background. Walls of vein not exposed.

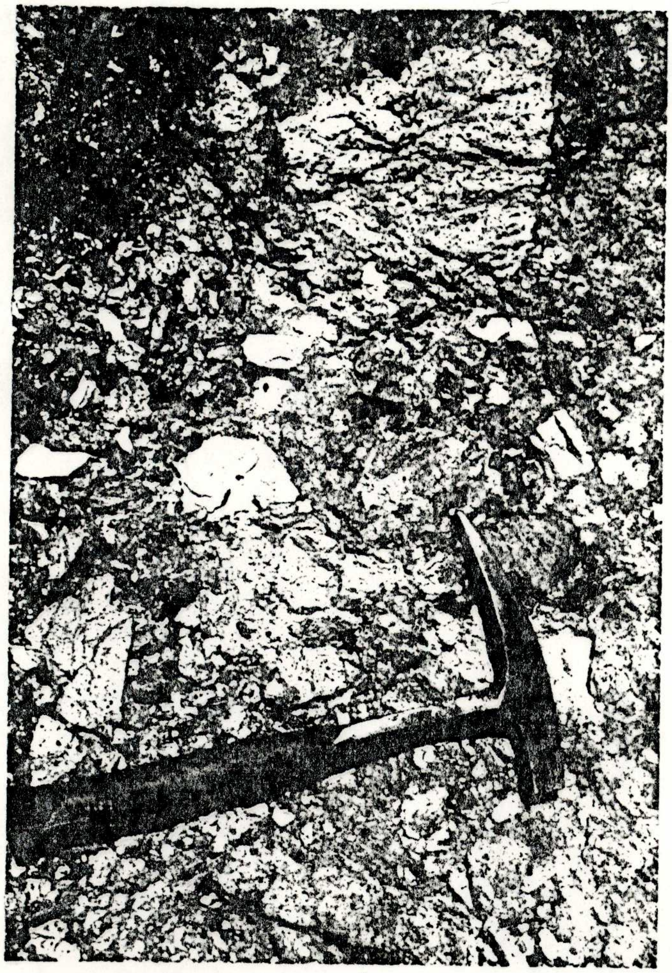


PHOTOGRAPH 8. Wyoming Andesite. Exposure on pediment in arroyo bottom west of hand trench at 12,300 N, 10,950 E. Looking southeast.

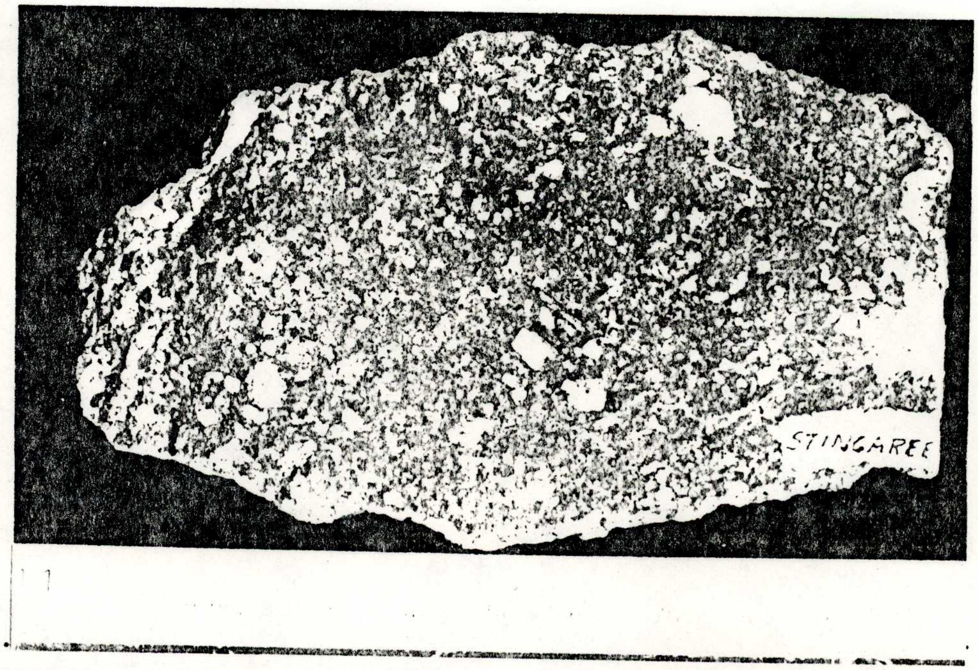
PHOTOGRAPH 9. Wyoming Andesite. Exposure on pediment in arroyo bottom just northeast of Wyoming shaft. Looking north. 11,900 N, 12,910 E.



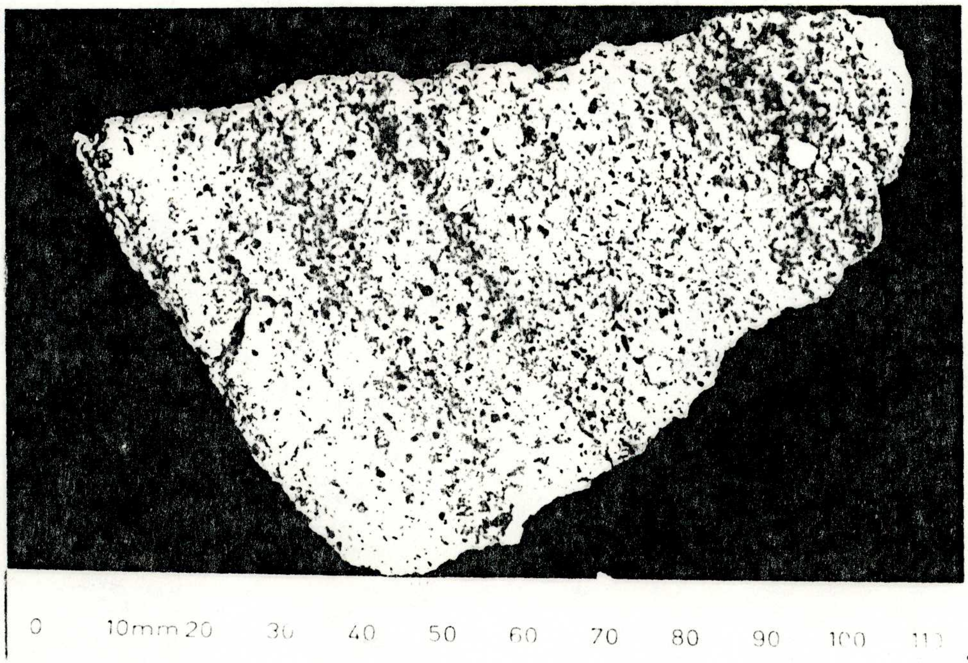
PHOTOGRAPH 10. Tuffaceous Sediments. Shale and sandstone interlayered with Wyoming andesite. Looking northeast. 10,800 N, 10,800 E.



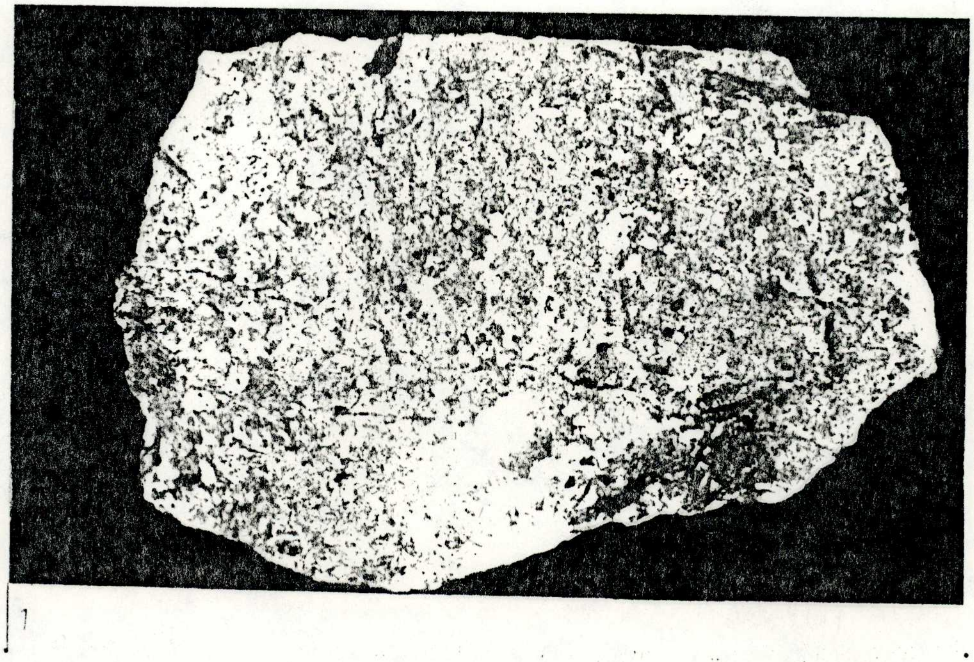
PHOTOGRAPH 11. Agglomerate. Interlayered in Wyoming andesite. Looking northeast. 10,850 N, 10,730 E



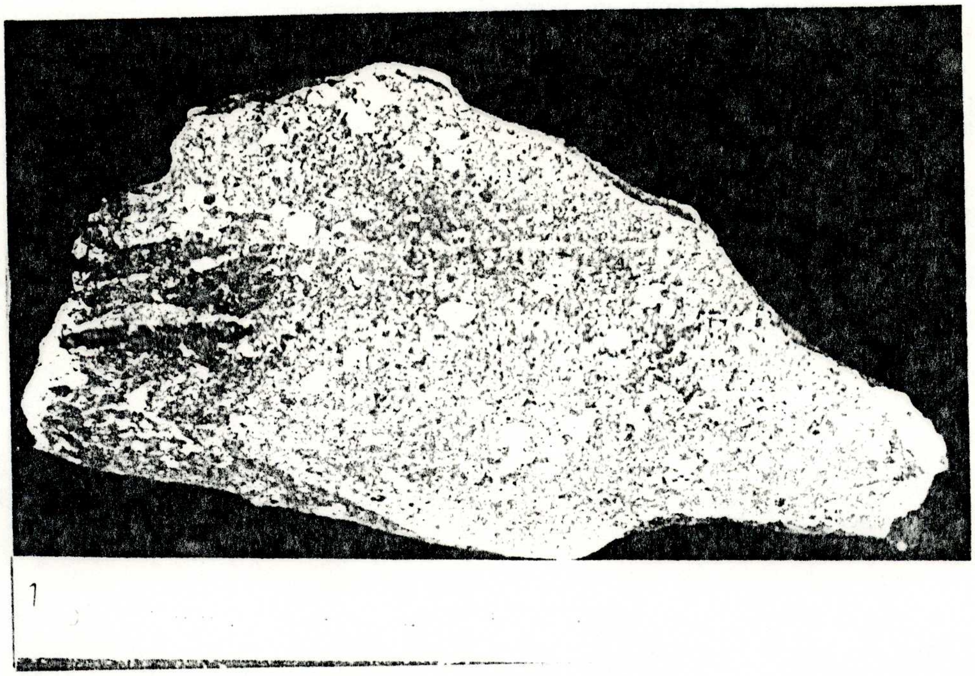
PHOTOGRAPH 12. Stingaree Andesite.



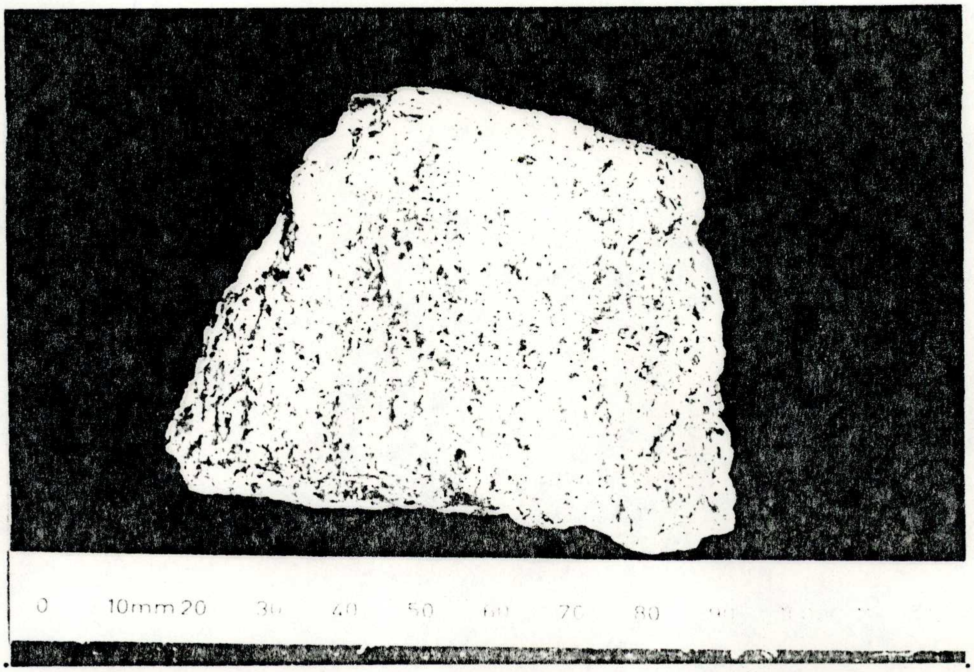
PHOTOGRAPH 13. Highway Quartz Latite.



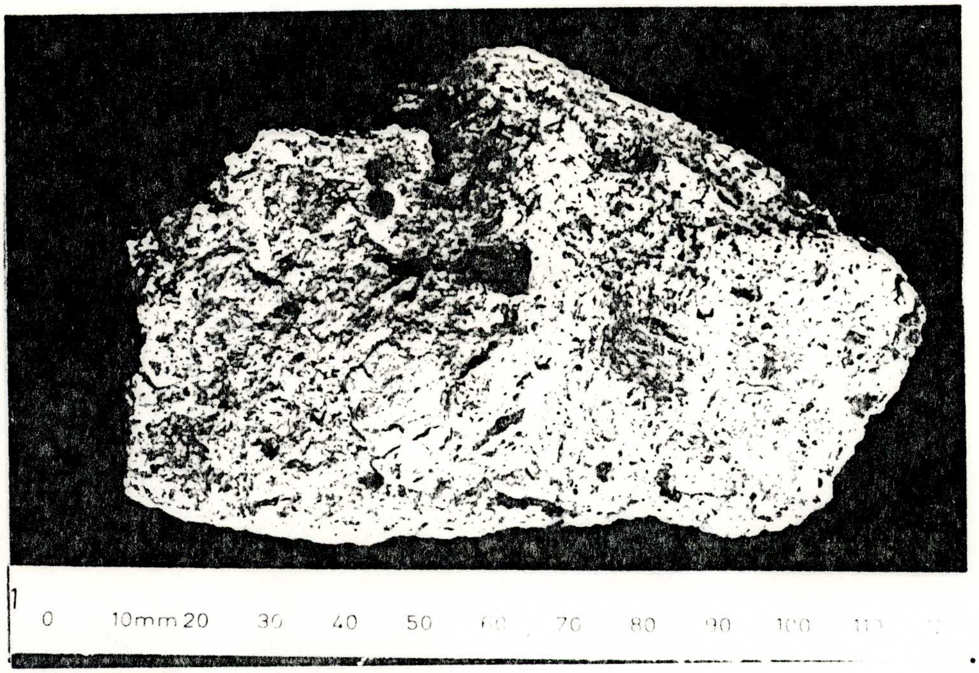
PHOTOGRAPH 14. Wyoming Andesite.



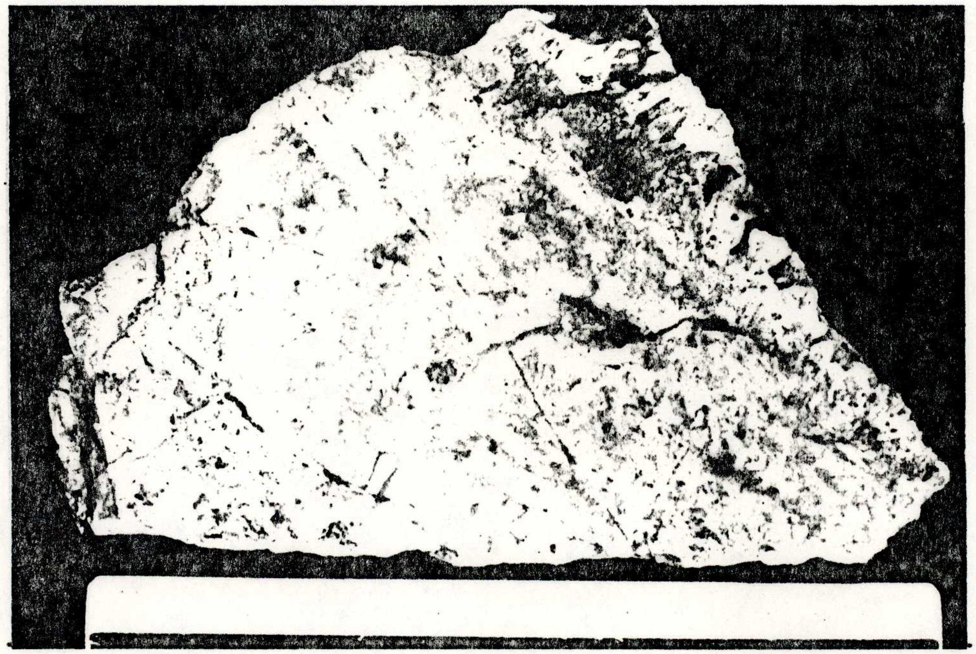
PHOTOGRAPH 15. Wyoming Andesite.



PHOTOGRAPH 16. Wyoming Andesite. Propylitized



PHOTOGRAPH 17. Agglomerate. In main body of Wyoming Andesite. Propylitized



PHOTOGRAPH 18. Centurion Vein. Porcelaneous quartz.

APPENDIX

Conversion of Gold and Silver Prices, Metric to Troy*

Gold

$9 per gram	=	$290 per Troy ounce
10	=	311
11	=	342
12	=	373
13	=	404
14	=	435
15	=	466
16	=	497
17	=	529
18	=	560
19	=	591
20	=	622

Silver

15¢	=	$4.67 per Troy ounce
20	=	6.22
25	=	7.78
30	=	9.33
35	=	10.89
40	=	12.44
45	=	14.00
50	=	15.55
55	=	17.11
60	=	18.66
65	=	20.22

*Note: one gram per metric ton = one part per million
one gram per metric ton = 0.0291667 Troy ounces per short ton
one gram = 0.032151 Troy ounces

one Troy ounce per short ton = 34.2857 grams per metric ton
one Troy ounce = 31.10348 grams

PROFESSIONAL QUALIFICATIONS OF ANTHONY PAYNE. Born 25 Dec 27

Education:

B.S. in Geology, University of Utah, 1949.
M.S. in Mineralogy, Geophysics, and Mining Engineering, U of U, 1950
Ph.D. in Economic Geology, Stanford University, 1959.

Experience:

1959-present, Independent Geologist. Exploration and development of silver and gold deposits in Nevada, California, Oregon, and Utah.

1959-present, Consulting Geologist. Consultant to mining and petroleum companies, individual investors, state and federal agencies, government and legislative committees, the National Academy of Science. Western US, Southeastern US, Alaska, Canada, Mexico, the Caribbean, and South America.

1959-1979, Professor of Mining, Professor of Economic Geology. Mackay School of Mines, Univ. of Nevada. Teaching and research in ore deposits, mineral exploration, evaluation of ore deposits, mining law. Chairman, Dept. of Mining Engineering, 1966-1973.

1955-1959, Mining Geologist. Shenon & Full, mining geologists, Salt Lake City. Exploration and evalutation of mineral deposits in Colorado, New Mexico, Arizona, and Utah.

1952-1954, Mining Geologist. Matahambre Copper Mine, Pinar del Rio, Cuba. Geologic mapping, exploration, evaluation, and engineering work at mine. Evaluation of mines and prospects in western Cuba.

1951-1952, Exploration Geologist. Regional exploration in southwestern U.S. for the American Smelting and Refining Company.

1950-1951, Resident Geologist, Quiruvilca copper-silver mine, Libertad province, Peru. Geological and engineering work at mine. Exploration of surrounding district. Northern Peru Mining and Smelting Company, a wholly-owned subsidiary of American Smelting.

1948-1949 (summers) Junior Geologist. Section of Mineral Deposits, United States Geological Survey. Evaluation of phosphate in Montana. Geological mapping of the area between the Climax, Leadville, and Gilman mining districts in central Colorado

1947 (summer) Geologic Field Assistant. Sampler. Section of Mineral Deposits, United States Geological Survey. Sampling and evaluation of phosphate deposits in Idaho.

Military Service:

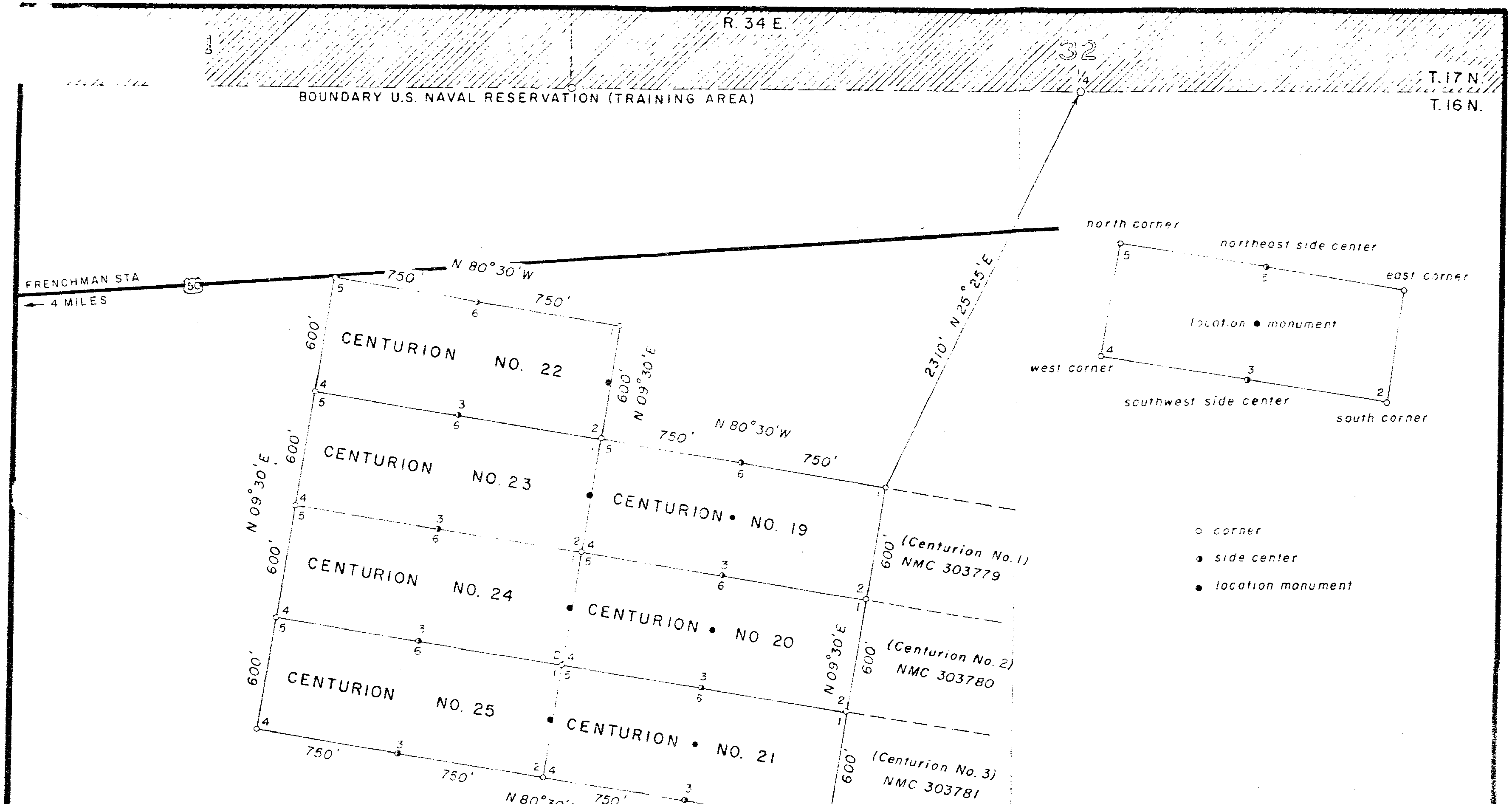
1945-1946, Navy V-5 Aviation Cadet. In flight training at close of World War II, Corpus Christi Naval Air Training Station, Texas. Commissioned Ensign, USNR. Veteran of World War II. Victory ribbon, American Theater ribbon.

Registered Professional Engineer, Nevada 1515.

Member: American Association of Petroleum Geologists, American Institute of Mining Engineers, Society of Economic Geologists.

Senior Editor and principal author of "Exploration for Mineral Deposits" in "Mineral Engineering Handbook" AIME, 2 vols. New York, 1973.

FAA Licensed Commercial Pilot, Instrument Flight Instructor, Instrument Ground Instructor.



CLAIM	LOCATED	COUNTY NO.	USBLM NO.
Centurion No. 19	27 Dec 84	210639	333540
Centurion No. 20	"	210640	333541
Centurion No. 21	"	210641	333542
Centurion No. 22	"	210859	333543 (as amended 01 Jan 85)
Centurion No. 23	"	210860	333544 " " "
Centurion No. 24	"	210861	333545 " " "
Centurion No. 25	"	210862	333546 " " "

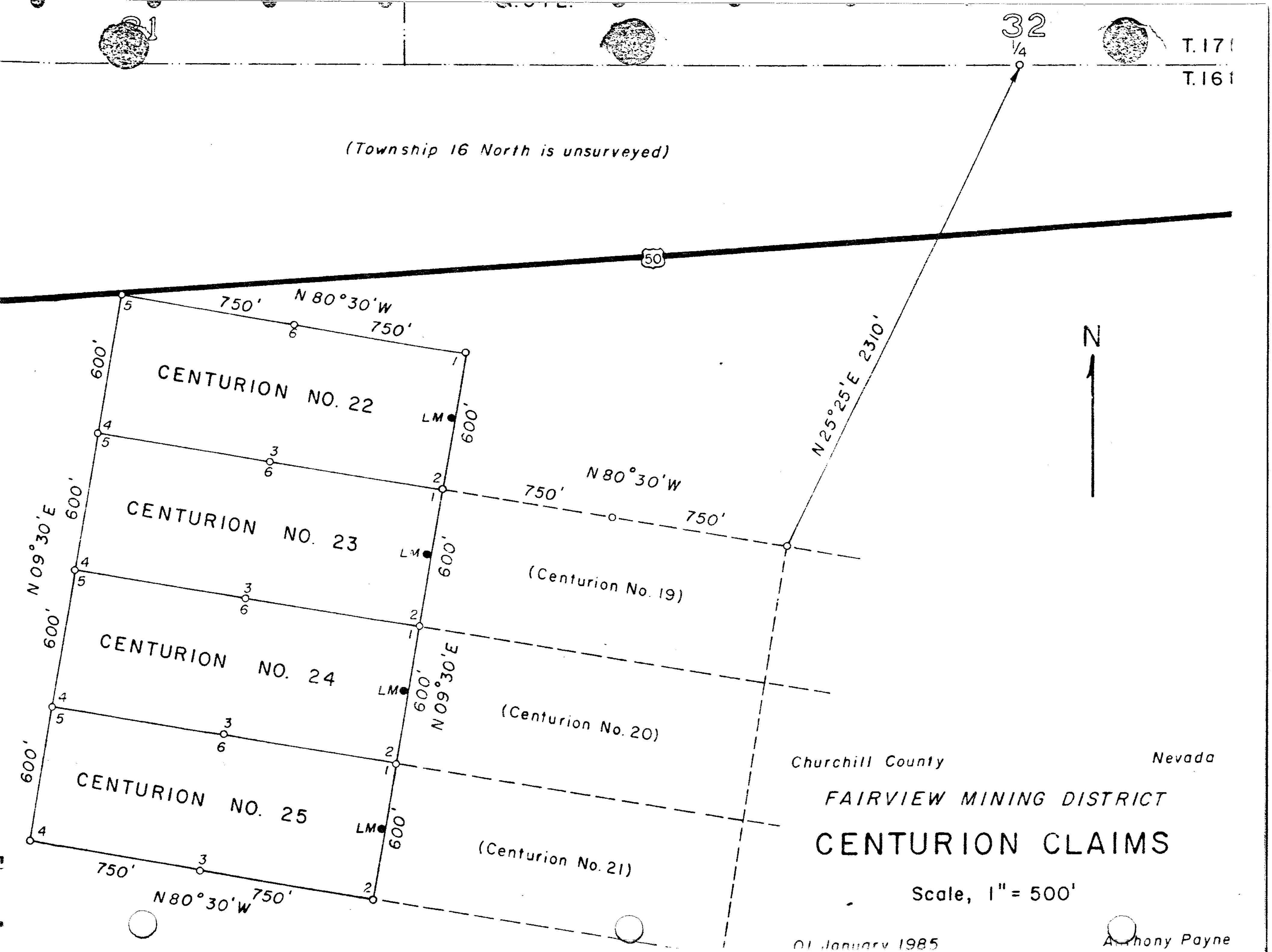
Churchill County Nevada

FAIRVIEW MINING DISTRICT

CENTURION CLAIM GROUP

Scale, 1" = 500'

28 December 84 Anthony Payne



Churchill County Nevada

FAIRVIEW MINING DISTRICT

CENTURION CLAIMS

Scale, 1" = 500'

01 January 1985

Anthony Payne

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APPENDIX

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one gram = 0.032151 Troy ounces

one Troy ounce per short ton = 34.2857 grams per metric ton
one Troy ounce = 31.10348 grams

TOPOGRAPHIC MAPS

1. Drumm Summit 7½' U.S.G.S. quadrangle. 1:24,000
2. Fallon 30' x 60' U.S.B.L.M. quadrangle. 1:100,000
3. Reno 1^{o} x 2^{o} Army Map Service quadrangle. 1:250,000

GEOLOGIC MAP

1. Geologic Map of Churchill County. Plate 1 in Willden and Speed, 1974. The only published geologic map of the area. 1:250,000.

AERIAL PHOTOGRAPHS

1. U.S.B.L.M. Project N-03A FY67, Flown 09 Jul 67. Contact scale, 1:17,300. Photos 7-242, 7-243, and 7-244.
2. U.S.G.S. Project VCSV, Flown 30 Apr 71. Contact scale, 1: 32,500. Photos 1-82, 1-83.

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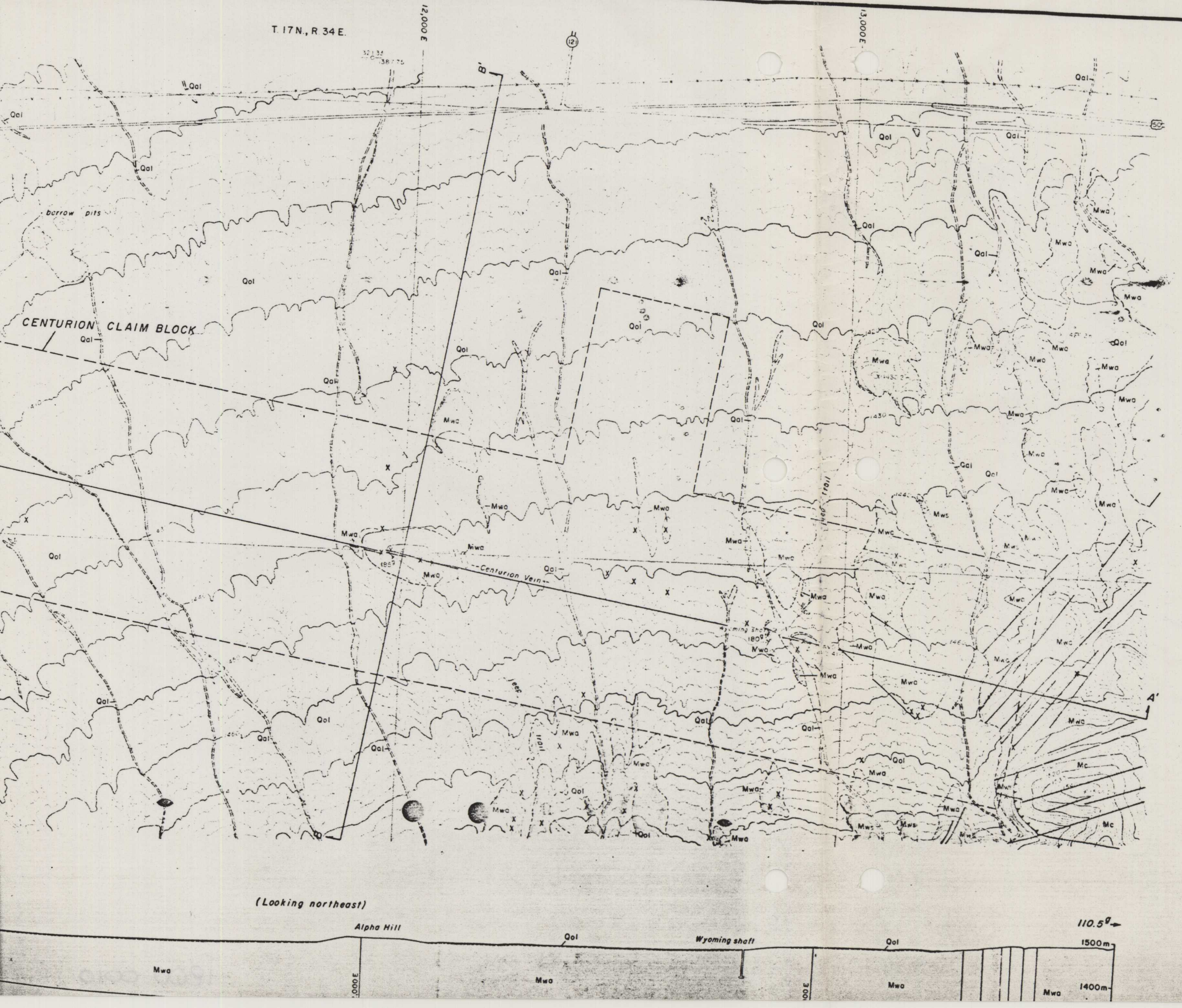


EXPLANATION

Qal	Alluvium
Qol	Older alluvium. Pediment veneer, fanglomer...
Pst	Stingaree andesite. Augite andesite flows
Psu	Summit formation. Tuffaceous sandstone. B... diatomaceous lacustrine ...

PLIOCENE

UNCONFORMITY

Mhl	Highway quartz latite. Spherulitic welded t...
Mwg, Mws, Mwt, Mwa	Wyoming andesite. Mwa, andesite flows, flow ... possible small intrusives. Mwg, purple aggl... Mws, tuffaceous sandstone, mudstone, diato... units. Mwt, laminated lacustrine tuff, wea... gray with pink to lavender tint.

MIOCENE

UNCONFORMITY

Mc	Coxey porphyry. Lithic tuff of mixed compos...

shaft

borrow pit

prospect pit

adit

hand trench

dug well

triangulation point

photogrammetric elevation

jeep trail

geologic contact

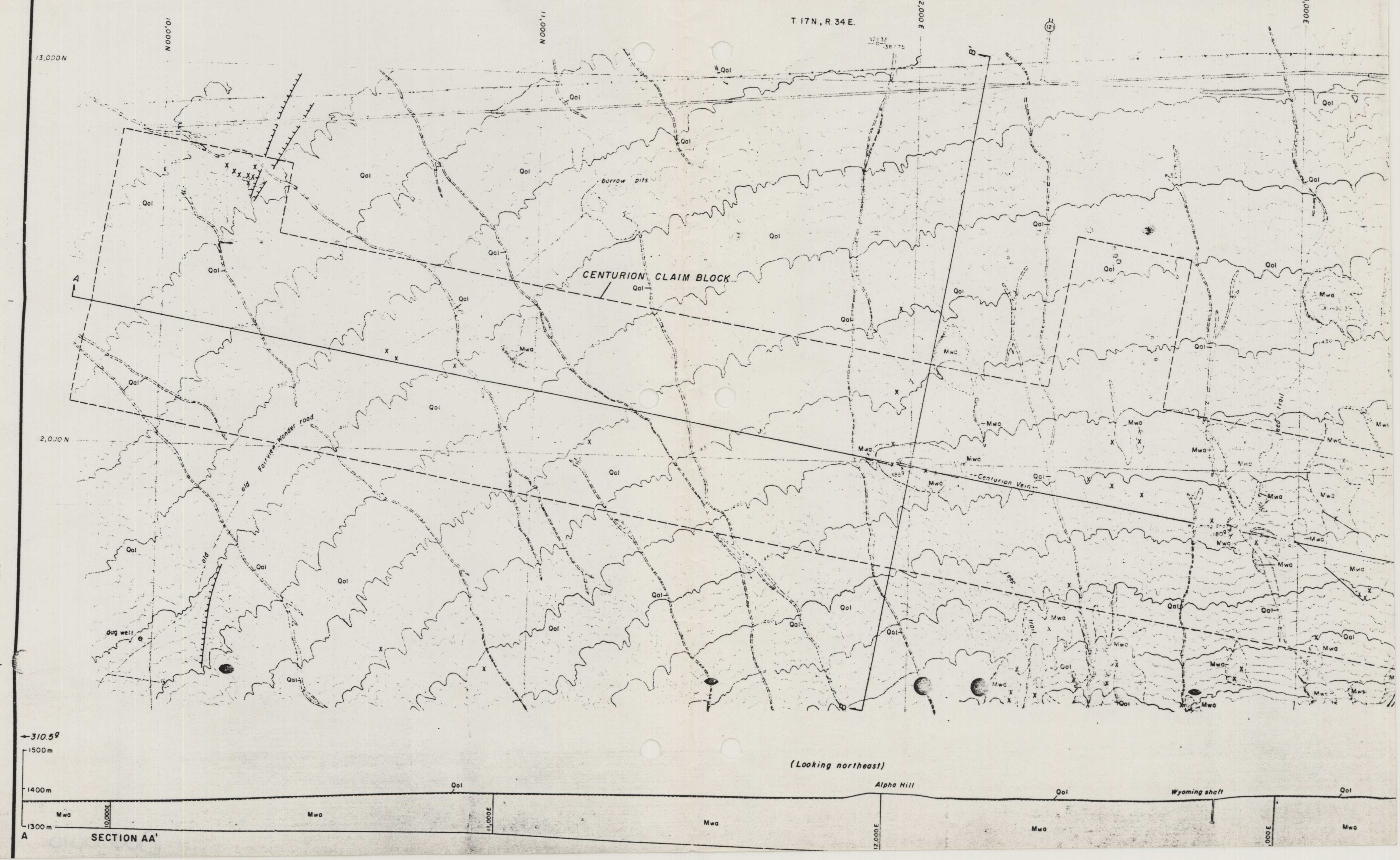
185g vein

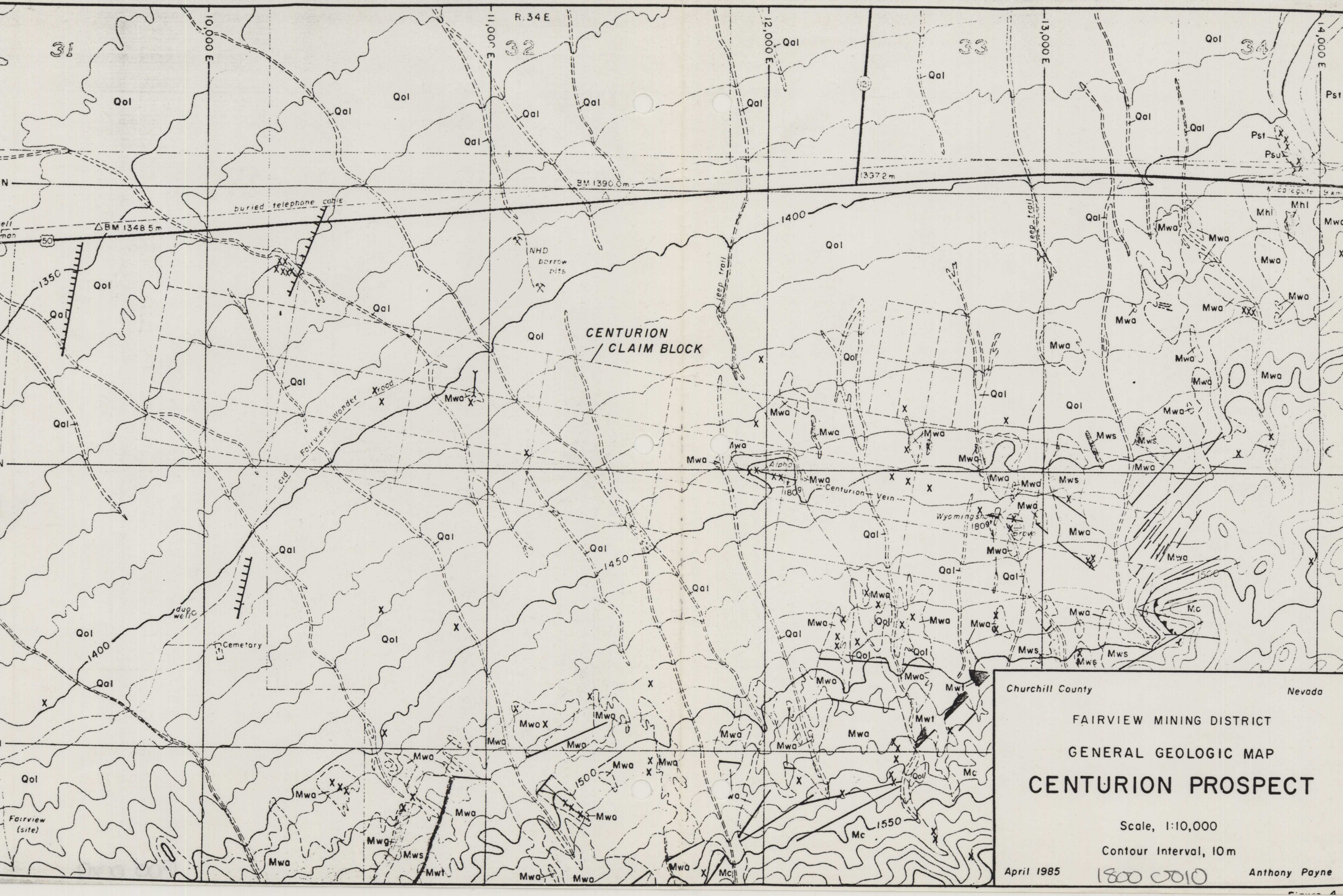
fault

recent fault (hachures on downthrown side)

thrust fault (barbs on upper plate)

1800OOTO


T 17N, R 34E.
13,000N
10,000N
11,000N
12,000E
13,000E
12,000N
B'
A
CENTURION CLAIM BLOCK
borrow pits
old Fairview-Wonder road
Centurion Vein
trail
dug well
Wyoming shaft
Qal
Qol
Mwa
(Looking northeast)
1500m
1400m
1300m
Alpha Hill
Wyoming shaft
10,000E
11,000E
12,000E
SECTION AA'


Churchill County
Nevada
FAIRVIEW MINING DISTRICT
GENERAL GEOLOGIC MAP
CENTURION PROSPECT
Scale, 1:10,000
Contour Interval, 10m
April 1985
1800 0010
Anthony Payne
R.34 E
31
32
33
34
10,000 E
11,000 E
12,000 E
13,000 E
14,000 E
CENTURION CLAIM BLOCK
buried telephone cable
BM 1348.5m
BM 1390.0m
1337.2m
NHD borrow pits
jeep trail
old Fairview Wonder road
Alpha
Centurion Vein
Wyoming shaft
Cemetery
Fairview (site)
1350
1400
1450
1500
1550
Qal
Qol
Mwa
Mws
Mwt
Mc
Mhl
Pst
Psu