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Unpublished Report on the
Carson Sink Area, Nevada

By
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Broken Hills District (3)
Broken Hills District

Location

The Broken Hills district lies between the Fairview and Paradise Ranges. It is 52 miles direct and 63 by road southeast of Fallon and 16 miles southeast of the Lincoln Highway at West Gate, with which it is connected by a good-weather automobile road (fig. 3). It is 22 miles east of Rawhide, and 2 miles west of Quartz Mountain (fig. 47). (Quartz Mountain map). It is mostly in Churchill County just north of the Nye County line and on the southeast corner of the Carson Sink quadrangle of the U. S. Geological Survey, fig. 3.

It consists mainly of a northwest-southeast area about a mile long by half a mile wide.

1/ This report is based mainly on a 2-day's examination made of the camp in June 1920.

History and production

Mineral at Broken Hills was first discovered in 1905 by James M. Stratford. He found it by panning the float gravel, or wash, especially heavily iron-stained material in the wash in which he found oxidized ore mineral, silver chloride and lead carbonate near the present site of the Silver Trailer mine nearly a mile below the site of the Broken Hills mine. By tracing the mineral up streamwards he also found the outcrop of what is now the Red Belmont vein near the Broken Hills mine, and he named the place Broken Hills (fig. 48).

At desert conditions, remoteness of location and lack of transportation prevented development at that time.
Eight years later, in 1913, Stratford and his partner, Joseph H. Arthur, on returning to the scene together soon, on April 6, found commercial silver ore in the Broken Hills vein which thereafter produced almost continuously until 1920. The ore shipped by 1920 was about $70,000 worth of silver-lead ore, of which more than 400 tons sorted ran 130 oz. silver, and some of it 250 oz. to the ton. There was also said to be blocked out in the mine 6800 tons of ore, and as only high-grade ore could be profitably shipped there had accumulated on the dumps and in storage stopes in the mine 3,500 tons of 15 ore rating its silver content at $1 per oz. and lead at 5 cents per pound, giving for the total ore in sight at the mine a value of about $100,000. Until this time the mine was worked and the production made by the owners Stratford and Arthur mostly single handed and alone. They sunk to the depth of 150 feet and worked the vein about 100 feet both to the north and to the south of the shaft on each the 50-, 100-, and 150-foot levels, aggregating more than 600 feet of drifting, fig. 49.

According to Stratford, the lower 42 feet of ground excavated from the shaft above the 150-foot level yielded $1,100 worth of shipping ore, and as a result of later work, the Broken Hills Silver Corporation reported that the vein on the 150-foot level at 120 feet north of the shaft contained 9 feet of $20 ore.

The ore was hauled to Fallon and Hazen at a freightage cost of $20 per ton. By 1920 more than $9,000 had been paid for ore haulage. During and subsequent to this period there was also some activity and small production in neighboring claims as the Silver Trailer, but on the whole the history of the Broken Hills mine is the history of the camp.
Early in 1920 the Broken Hills mine, the property then consisting of 7 claims, was sold to a new company, the Broken Hills Silver Corporation of Reno for $125,000. Following this transaction the most of the surrounding country within a radius of 5 or 6 miles, then known as the Broken Hills district, suffered a prospecting "boom" during which a tytn of several hundred people sprang up at Broken Hills, fig. 48, and later in the same year with the discovery of ore at Quartz Mountain a similar settlement sprang up there as noted later. The water supply for the camps was hauled from Lodi tanks 15 miles to the southeast.

The new company began work at the Broken Hills mine early in June and continued about a year until 1921, when, owing to financial difficulties, a reorganization was effected. During much of the time it worked a force of about 20 men. It sunk the Broken Hills main shaft from the 150- to the 350-foot level, explored and partially mined the Belmont, Broken Hills No. 2, and other veins by extensive trenching and sinking, in some instances to depths of 150 feet, and it is said mined about $150,000 worth of ore, the most of which was later treated in the Bruner mill at Phonolite, 15 miles to the east. This raised the production figure of the mine to about $220,000.

Since then there has been no production or development in the Broken Hills camp except that done by a few lessees working in the Broken Hills mine, by two of whom, Baxter and Browder, a shipment of lead-silver ore running $80 to the ton was made in May 1923.
Included in the new company's production was its first shipment made Oct. 18, 1920, to the Western Ore Purchasing Co. at Hazen, of 35 tons of sorted ore that ran $216.34 to the ton and contained 188.8 oz. silver to the ton and 19.6% of lead. This ore, it is said, came from the Belmont Cross vein near the bottom of the Belmont incline at the depth of about 90 feet.

Besides the afore noted production which was mostly shipping ore there had accumulated on the dumps and in the mine a large quantity of mill grade ore. That accumulated on the dumps alone by 1920 was 3,500 tons averaging, it was said, $15 to the ton.

**Geology**

The area consists of open gently rolling or low hilly desert country whose topography is fairly well expressed on the southeast corner of the Carson Sink quadrangle, fig. 3, on which the camp is mostly situated at an elevation of about 5,300 feet. It slopes and is drained southward into Gabbs Valley. The surface for the most part approximates a sagebrush flat sloping gently southeastward for several miles. It, in general, is covered with more or less finely comminuted shaley rock debris and its finer products of decay - loose earthy or volcanic ash-like material in places several inches deep. It is mostly dull earthy colored, more so than the summer-time sagebrush which clothes it, but portions depending upon the local mineral constituents of the weathered rocks are ash-gray, brown, purplish, orange, yellowish or brilliant red. The country rock consists of undifferentiated volcanics. The rocks exposed at or near the Broken Hills mine and vicinity beginning at the hill tops consist in descending order of
Basalt or andesite flows, about 40 feet

Unconformity

Whitish volcanic ash, 40 feet

Unconformity

Andesite breccia and tuff, 40 feet

The last-named formation, the andesite tuff breccia, is the country rock. It is mostly light-gray breccia and tuff of which specimens collected are too greatly altered for satisfactory determination. It is at least 350 feet in thickness, as shown in the Broken Hills mine. But its additional thickness is believed to not exceed a few hundred feet, judging from the occurrence of older underlying granite near by. The tuff portion of the formation is in part stratified. The rock has been intruded by younger andesite and dikes of black basalt as exposed on the Cracker Jack claim and considerably altered hydrothermally by solutions that accompanied or closely followed the intrusion of the andesite. It is believed to rest unconformably on granite which outcrops at several places about 1/4 mile to the north of Broken Hills mine. And it is unconformably overlain by whitish volcanic ash and tuff 40 feet or more in thickness, which, in places, seems to be waterlaid and to probably belong to the Siebert Lake beds - Esmeralda. Overlying the volcanic ash and tuff and capping some of the surrounding low hills or buttes as just west of Broken Hills mine is dark iron-gray basalt 30 to 40 feet in thickness. It is composed chiefly of calcic plagioclase, augite and olivine and contains much magnetite and ilmenite in flow structure arrangement. It weathers brownish and greenish due to its iron, olivine, and augite content, the augite and olivine altering mostly to chlorite and serpentine. Elsewhere, as in the Pin Peak Butte 3/4 of a mile to the north of Broken Hills mine, the capping is whitish andesite, which is porphyritic with small phenocrysts of whitish andesine - andradite and dark biotite. It consists mostly of a microlitic glassy base with dominant flow structure and includes
The granite believed to underlie the ore-bearing tuff-breccia formation is exposed mainly in a north-south reef or ledge about 1/4 of a mile northeast of Broken Hills mine and just beyond that point on the New Hope claim. It is a light-brownish gray medium-grained very siliceous rock which originally seems to have been composed chiefly of orthoclase and quartz but now is highly altered by weathering with the orthoclase and microcline changed to kaolin and sericite, some of the feldspar material and quartz recrystallized into micro-perthite and the biotite altered to meta-chlorite and hematite. The rock is provisionally referred to the Mesozoic age. It is probably the same age as the granodiorite at Quartz Mountain, 2 miles to the east, which is the nearest known occurrence of any rock approaching the granite in classification.

If the granite underlies the volcanic rocks as it is supposed to, it probably delimits the extension in depth of the veins and ore bodies occurring in those rocks near by, including those in the Broken Hills mine.

**Deposits**

The deposits of Broken Hills are silver-lead deposits, the value of their metallic content being principally silver and the value ratio about $3 in silver to $1 in lead, evaluating silver at $1 per oz. and lead at 5 cents per pound. They are contained in or associated with six or more veins found in the andesite tuff breccia. In general, the veins are not large. They range up to about 2,000 feet in length, 9 feet in width, and extend to the depth of at least 350 feet. They, in general, have well-defined walls, but are accompanied by little or no gouge, nor prominent reefs or cappings of silicified wall rock.
They are known as the

- Broken Hills vein
- Broken Hills No. 2 vein
- Belmont vein
- Belmont Cross vein
- Fidelity vein
- Silver Trailer vein
- Crown Point vein
- Olympia vein
- Black Dog vein

Their general distribution is indicated on the map, fig. 48. The veins, in general, do not outcrop but were discovered by cross trenching, though the position of some of them is indicated by bands of prominently mineral-stained rock debris, weathered even with the adjacent surface.

The principal zone of mineralization is about 400 feet wide and includes the Broken Hills vein on the west and the Belmont vein on the east and the intervening Broken Hills No. 2 vein.

These three veins strike about N. 30° W. and dip steeply to the west, except Broken Hills No. 2 which dips steeply to the east. Other veins that strike nearly east and west are known as cross veins, while still others occupy intermediate positions.

Mineralization is similar in all the veins and is best illustrated in the Broken Hills vein which has been the most extensively opened.

The veins are composed chiefly of hydrothermally altered and kaolinized tuff and quartz. Quartz for the most part, however, is only
sparingly present, the ore minerals being found in the altered replaced rock. 

The minerals found in the veins are as follows:

Gangue minerals:

Altered andesite breccia and tuff
Quartz
Calcite, and other carbonates
Clay

Ore minerals:

Cerargyrite
Argentite
Proustite : Ruby silver
Pyrargyrite :
Silver (native wire)
Galena (argentiferous steel galena)
Cerussite ?
Anglesite
Lead oxide ? (red)
Jamesonite
Bindheimite
Plumbojarosite
Meneghinite ?

Associated minerals:

Sphalerite
Molybdenite
Cobalt ?
Pyrite
Chalcopyrite

Hematite

Bismuth ?

Gypsum

Zinc carbonate (smithsonite ?)

The oxide and carbonate mineral extend from the surface to the depth of about 150 feet. The sulphides begin to appear at the depth of 120 or 130 feet and increase downward as the oxides decrease. Also a little sulphide mineral galena may be scattered through the oxidized ore, even near the surface, as was illustrated in several small veins or stringers on the mont ground.

In the Broken Hills mine the dominant ore minerals in the oxidized zone to about the 150-foot level are cerargyrite or horn silver, and the carbonates cerussite and anglesite and zinc carbonate smithsonite ?, and about that depth in the so-called sulphide zone the dominant ore minerals are silver sulphides - argentite, argentiferous galena, stephanite and esonite, with which in places are associated pyrite, a little chalcopyrite, sphalerite and fine hair-like wire silver in vugs.

Though the top of the sulphide zone is regarded as standing at the depth about 150 feet, its position at that level is not due to the present ground-water level which stands about 750 feet deeper or 900 feet below the surface, to an earlier ground-water table which stood at a much higher level than present one.

Broken Hills vein

The Broken Hills vein is about 2,000 feet in length and normally about 6 feet in width, and 9 feet in maximum width. It varies, however, from 2 to 7 or 8 feet in width and locally has associated ore bodies or mineralization
The vein on the whole is massive. But in places it is slightly parallel lined or streaked, and locally on the 100-foot and 150-foot levels rich black sulphide ore is associated with the banding for short distances.

The better ground occurs to the north of the main shaft. Here the ore is more plentiful and richer on all levels and the richest ore in the mine was found. This condition is believed to be due in part to greater secondary enrichment by downward concentration of the ore minerals in this part of the mine.

In the north drift on the 150-foot level a width of 5 feet of the vein for a length of 40 feet ran $21.40 in silver to the ton, and toward the end of the drift a width of 9 feet of vein and wallrock ran $17/to the ton.

At two points to the south of the shaft the vein is faulted laterally.

The south drift-stope on the 100-foot level contained an ore body 53 feet by 10 feet wide, of which 3 feet averaged $21 in silver to the ton. In another part of the drift 3 feet of the vein for a length of 21 feet assayed $26.

The vein is said to be wider and richer in depth, for instance on the 200-foot level, than near the surface. According to the report of the Broken Hill Silver Corporation, the shaft from the 150-foot level to the 250-foot level is excavated all the way down in a 5-foot wide min body that ran $50 to the ton, and the vein is 9 feet wide. On the 150-foot level the company was in 1923 to have opened up an 8-foot ore shoot running about $50 to the ton.
The Broken Hills Silver Corporation is said to have sampled the mine mainly with reference to its milling ore rather than shipping ore, with the idea of reducing the ore at the mine and the examination at that time showed that the ton of mine ore, unsorted waste and wallrock included, would run $15 to the ton, it and that it found large and important lenses more than 100 feet in extent of mill-grade ore paralleling the vein nearby.

Ore

The ore is mostly replaced andesite breccia and tuff, which feature is best shown in the oxidized ore. The oxidized ore is mostly pronounced in color which varies from orange or reddish to ocher, yellowish-gray or light-., and contains the ore minerals cerargyrite, cerusite and anglesite. Most of the color is due to iron oxide but much is probably also due to lead and zinc carbonates and oxides. The sulphide ore is mostly black or dark.

From the surface down to about the 150-foot level the oxidized ore is said to contain a little ruby silver disseminated through it, and in the sulphide zone the same mineral was noticeable in the shaft at a little above the 350-foot level, and the sulphide ore contains steel galena which is believed to be argentiferous. At the depths of 150 to 350 feet, the ore contains also a little pyrite, chalcopyrite and sphalerite, and also molybdenite, salt and bismuth are reported.

Flumbojarosite and jraosite are present and gypsum is common in places. In several specimens tested in the present work, jarosite and plumbojarosite al law are more or less characteristically present in the yellowish-gray or lightish distilled brecciated ore, with the jarosite occurring mostly in the coarse breccia masses and plumbojarosite in the more crushed or finer grained phases, while pyraunonite and another related crystalline mineral are important constituents of the dark sulphide ore.
Although the ore in the Broken Hills vein averaged about $15 to the ton on the surface down to the 150-foot level, it, on the whole, became lower grade in depth, notably on the 250-foot and 350-foot levels. The shaft is sunk at what seems to be the intersection of several branches or feeders of the vein, with the result that the ore was fairly good in the shaft and vicinity down to the 350-foot or bottom level. But upon drilling short distances 40 to 50 feet from the shaft on the 250- and 350-foot levels the ore content of the vein rapidly decreased or played out, with the vein splitting up into several or more branches to such an extent that there seems to be no hope of finding commercial ore at this or greater depth in the mine.

This condition also emphasizes the fact that considerable secondary enrichment of the ore must have taken place in the upper levels through leaching downward concentration of the ore minerals by meteoric waters.

Following discovery of the ore conditions in depth most of the ore locked out and accumulated on the upper levels, stopes, and dumps, was hauled to the Bruner mill at Phonolite, 15 miles distant. But as the ore ran only about $15 to the ton and could not be thus handled profitably, mining operations by the company soon ceased.

If present in large quantity, ore of much lower grade than $15 to the ton could be profitably mined and milled at the mine, but the extensive development done seems to indicate that there is not nearly sufficient present in the camp to warrant the building of a mill there.

At present, the best solution seems to be expansion in exploration and discovery of more ore deposits in the surrounding country, as in the Broken Hills camp, with the view that the deposits collectively suffice for a mill to be built, as at Broken Hills, Quartz Mountain, or near by, and the ore profitably mined and treated therein.
Fidelity vein

The Fidelity vein, which is probably only a branch of or feeder to the Broken Hills vein which it joins near the Broken Hills shaft on the 150-foot level, was found in a west crosscut from the Broken Hills drift at 20 feet south of the shaft. It is said to have carried 3 feet of $14 ore.

Broken Hills No. 2 vein

The Broken Hills No. 2 vein or East vein is said to be about 100 feet to the east of the Broken Hills vein, was discovered in 1920. It nearly parallels the Broken Hills vein in strike but dips opposingly 60° to the east. It is only 15 inches in width but is said to carry rich ore from the surface.

Belmont vein

The Belmont vein, situated about 400 feet to the east of the Broken Hills vein, is said to have been opened by a 150-foot deep shaft and to contain silver-lead sulphide ore at that depth.

Belmont Cross vein

Of the several so-called cross veins occurring on the property, and which have an east-westerly strike, the Belmont Cross vein seems to be the most important. It lies mainly to the south of the Broken Hills mine shaft and is credited with a length of 900 feet. Though narrow at the surface, it is to widen to a width of 10 feet on the 150-foot level and to dip gently toward, its low dip giving it a stoping depth of 250 feet measured on the above the 150-foot level. It is opened by a 90-foot incline shaft and 150-foot vertical shaft and in depth notably on the 250-foot was worked in through the Broken Hills shaft. On the 350-foot level it intersects
Broken Hills vein at 20 feet south of the main shaft. It carried 20 feet of high-grade ore on the 90-foot level and is said to carry good ore to the east of the Broken Hills vein on both the 250- and 350-foot levels.

The Crown Point vein is opened to the depth of 90 feet and has been followed on at that depth with encouraging results.

Other Prospects

Silver Trailer
Of the other than the Broken Hills mine one of the more important is the Silver Trailer or "Baxter" mine located in the southern part of the camp nearly 3/4 of a mile southeast of the Broken Hills mine, fig. 48. It was discovered in 1913 by V. S. Baxter. It is owned by the Silver Trailer Mining Co. The company took out a little ore from time to time which it sold to the Broken Hills people and in 1920 the property was said to have just been sold for $100,000. The ore, which is oxidized, resembles that of the Broken Hills mine, but much of it besides silver and lead carries also about 1% in gold to the ton, which is an exception to the Broken Hills ore being non-sulphiferous. The property contains several small veins mostly on the northern end of the claim, some of which are opened to the depth of 150 feet with fairly good showings. The veins mostly have a northerly strike and a dip of 50° to 60° dip.

Other properties or claims presenting fairly good prospects are, the "Belmont" Extension, and New Hope.

Origin of the deposits

The Broken Hills deposits seem to owe their origin to hot magmatic injections that circulated through the rock fissures and fractures following
eruption or intrusion of some member or members of the volcanic
into the ore-bearing formation. This is inferred from the fact that
unaltered country rock is less silicified and more porous at
more from the vein or fissure than nearer to it, and, in
as, as on the 250-foot level the wallrock tuff breccia is highly altered
silicified and drusy and contains many vugs lined with white kaolin-like
material.

The intrusive rock was probably andesite or at least andesitic in
character. It is not definitely known, however, to appear at the surface
in the mines. The Broken Hills Silver Corporation reports that during
a campaign of development work in the camp it met with numerous instances
which the deposits frequently rich were associated with intrusive pipe-like
neck-like bodies and dikes of andesite? which it regarded as having
requestively produced on a small scale widespread mineralization or enrichment
the surrounding tuffaceous country rock. In every instance it is said the
lying
or stringer together with its fissure or fracture/lining in the
breccia formation extends up to or very nearly to the intrusive where
fracture loses its regularity, becomes wavy and indefinite with marked
rise in ore content and finally feathers out at the boundary of
intrusive, or extends but slightly into the intrusive if at all, and that
instance was the intrusive found to contain any ore or mineralization.

From the foregoing description the intrusive in these instances seems
older than the veins, but its failure to contain any veins, fissures
are all of which feather out as they approach it, leads to the belief
it is not the source of the ore deposits and that the source probably
was later and perhaps still buried intrusive.
Outlying Prospectz

Mines and prospects besides Quartz Mountain neighboring to Broken Hills

Donophon mine
Highway group
Illinois mine
Lodi mine
Platinum prospect
Red Hills prospect
Scheelite prospect
Stratford prospect

Donophon mine

The old Donophon mine is 7 miles south of the Lodi tanks on the west side of Elsworth Range in limestone and intrusive porphyry. It was worked early days.

Highway group

The Highway group of claims at 2-1/2 miles northwest of Broken Hills, owned by F. R. Ross, is said to present good showings of mineral in limestone porphyry, which rocks are probably Mesozoic of about the same age as similar rocks at Quartz Mountain and in the Lodi Hills.

Illinois mine

The old Illinois mine, 12 miles east-southeast of Broken Hills and mining from 1870, has produced $100,000 worth of ore. The ore is silver-gold ore averaging about 20% in lead, and $18 in gold, and silver
The old Lodi mine, 3 miles northwest of the Illinois mine, in lime porphyry, has considerable ore, but it is too low grade to pay. A silver-lead ore, was shipped about 1916.

Red Hills prospect

The Red Hills prospect being opened by W. W. Woodruff and Campbell, a heavily iron-stained porphyry, 5 miles northwest of Broken Hills, is to have good showings for silver-lead ore.

Stratford prospect

The Stratford prospect is at the old Stratford camp, 8 miles east of on Hills near the old Illinois mine. The deposits are gold-bearing of watery appearing quartz in hard Birdseye porphyry. They carry only where the porphyry is heavily iron stained. About 1900 they were cored for several years by J. M. Stratford, who does not regard them to commercial value. Limestone outcrops through the porphyry, but it is known to be connected with the deposits.
BELL MOUNTAIN DISTRICT, NEVADA

By F. C. Schrader

Bell Mountain Shop

Description

The Bell Mountain district is part of the Gold Butte district on the
edge of the Bell Mountains, in the east-central part of the

BELL MOUNTAIN DISTRICT, (FAIRVIEW)

The Bell Mountain, Fairview, or Schrader mine, is six miles direct

NEVADA

by road southeast of Fairview and a mile southeast of the Nevada

mines. It is north of Bell Flat, on the northeast side of the

Mountains, in a more elevated detached group of low hills, at

a direction of about 330° from (Fig. 2). It is usually reached from

Fairview on the west, by way of the old Basqueville road through Crown

Canyon. The fault trends southward through Bell Butte, and thence

southward through Crown Canyon into Fairview Valley.

History

The Bell Mountain deposit was located in March 1914 by W. N. (“Billy”)
McDowell, thecrest, was seen near the 60-foot adit shaft and found fair
ore, nearly all of the way down, a considerable part of the material
estimated in about 50 to the ton. The discovery was made on the west
end of the vein, and the Schrader No. 2 claim was located on the site of cut
(Stop 42), through mineralized material thrown out by a second
back depth of 3 feet.
BELL MOUNTAIN DISTRICT, NEVADA

By F. C. Schrader

Bell Mountain Mine

Location

The Bell Mountain district joins the Gold Basin district on the south and centers about the Bell Mountain mine.

The Bell Mountain, Homestake, or Stockton mine, is 6 miles direct (18 by road) southeast of Fairview and 5 miles southeast of the Nevada Hills mine. It is north of Bell Flat, on the southeast side of the Fairview Mountains, in a more or less detached group of foot hills, at an elevation of about 8,200 feet (fig. 3). It is usually reached from Fallon, on the west, by way of the old Downieville road through Crown Canyon. The area drains southward through Bell Flat, and thence northeastward through Crown Canyon into Fairview Valley.

History

The Bell Mountain deposit was located in March 1914 by W. W. ("Billy") Stockton, the owner, who soon sunk the 60-foot incline shaft and found fair values nearly all the way down, a considerable part of the material excavated running about $8 to the ton. The discovery was made on the west part of the vein, and Homestake No. 6 claim was located on the site of cut A (fig. 45), through mineralized material thrown out by a badger, which had dug to a depth of 9 feet.
The Nevada Wonder Mining Co. took an option on the property in

A/ Nevada Wonder Mining Company, Thirteenth Annual Report, for the
time ending December 31, 1919, page 9.

October 1916 and soon did, by hand, several thousand dollars worth of
development work, which included the driving of a 580-foot adit tunnel,
crosscutting, and the sinking of a 50-foot winze. In the fall of 1919
the company renewed its option, installed machinery, sunk the winze 200 feet
deeper and drifted and crosscut at the bottom until its engine broke down.
This was done in the hope that the deposits would improve with depth,
and the company would have purchased the property, it is said, had it been
able to find ore that averaged as well as $9 to the ton. The ore that
they found, however, averaged much lower, and ore was running low in the
face of the deep drift at the time of the break-down. The company is said
to have estimated that the equipment needed for working the mine efficiently
would cost half a million dollars; and, as the outlook did not seem to
justify any such expenditure, the work was abandoned and the option surren-
dered.

In 1919 a prominent mining company of San Francisco was said to have
A/ taken an option on the property.

A/ Nevada Mining Press, June 25, 1925.

The nearest adequate source of water supply for mining and milling
is Westgate, 8 miles distant. Although ample firewood of medium quality
is obtainable nearby in the Fairview Mountains, the most dependable source
of power would probably be gasoline or oil, which would have to be hauled
from Fallon.
At the time of visit there was stationed in place and well housed in the mine a 25-horse power Fairbanks engine for running the compressor air pump, and also 3 smaller engines.

Country rock

The country rocks consist of siliceous light-colored Tertiary volcanics. In texture they are all fragmental, consisting of tuffs of flow breccias. Their composition probably ranges from that of rhyolite to that of dacite or quartz latite, but they have been so thoroughly altered that nothing remains of their primary constituents except a few phenocrysts of quartz and feldspar. The original groundmass, which constituted almost the whole of the rock, seems in all specimens to have been glassy, but it is completely devitrified and turbidly silicified. The feldspar phenocrysts that remain are predominantly plagioclase, a fact which apart from other considerations suggests that the rock may be a dacite; but this indication does not amount to an absolute proof, and the rocks will therefore be referred to as rhyolitic rocks, in accordance with local usage. The rock on the hanging-wall side of the vein in particular is locally regarded as rhyolite.

In many of the specimens unmistakable traces of the original flow structure still remain, but the glassy groundmass is entirely transformed, vitrified, and recrystallized into secondary quartz, albite, oligoclase, and other minerals. The rock in the deepest workings, at the crosscut in the bottom of the 250-foot winze, though relatively firm and fresh in texture, is found on microscopic examination to have been originally a...
may tuff, but it now consists almost wholly of secondary minerals.

May small vugs in these rocks are lined with quartz or with a mixture of quartz and adularia that corresponds closely to the quartz-adularia found in the vein; vugs of this character occur even at considerable distances from the vein.

The rocks are cut by a dominant sheeting that strikes N. 75° E. and 15° N., and by another sheeting that strikes N. 25° W. and dips 70°.

Deposits

The deposits are contained in the Bell Mountain vein or lode, shown in Figure 45. The vein, which has a known extent of more than 5,000 feet, is in the rhyolitic rocks just described and is associated with a fault. It strikes about N. 70° E. and dips about 50° S. Its width varies from less than 10 feet to more than 50 feet. It has a known vertical range, to deepest underground exposures, of 650 feet, and its highest and lowest ends differ in altitude by 500 feet. It does not outcrop prominently; instead, it is general stand high above the surrounding surface, though in places it may be well silicified. In places the wall rock, especially the hanging wall, contains quartz stringers 2½ inches in maximum width, parallel to the vein. The vein in part is rudely and coarsely banded. Much of it has been crushed or brecciated and re-cemented with silica, which is fine-grained. The walls of the vein are mostly without well-defined stages, the crushed vein material itself being directly in contact with the wall rock. The walls are partly smooth, but in places they are rough and deeply into the vein. The shattered condition of the vein has
The vein consists mainly of greenish-gray quartz, calcite, and partially-replaced fragments of country rock, and its wider parts include lenses or horses of the country rock, as on Homestake No. 1 claim. On the eastern end of this claim, as shown at cut 6 -- a long crosscut trench -- the vein or lode, here 160 feet in width, consists mainly of alternating bands of vein material and of country rock each about 3 to 5 feet wide. On the south or hanging-wall side there is 4 feet of vein quartz, apparently replacing country rock. This quartz is said to pan $5 to the ton. Oxidation extends below the deepest workings in the mine, which are 350 feet deep. There are indications that the workings have approached the sulphide zone, the top of which probably lies at a depth of about 600 feet.

Much of the vein and ore is stained darkish with oxides of manganese and iron, and the good ore is commonly associated with manganese stains. The best values are in or toward the footwall or north side of the vein, which side generally carries also 1 to 2 feet of tough greenish-gray sparry quartz. This quartz, apparently formed for the most part by replacement of the wall rock, contains only about $1.25 to the ton.

Most of the ore contains much calcite, some of which has been replaced by quartz. Much of the quartz has an apple-green tinge. The gangue of the ore is usually quartz and calcite, the best ore being generally associated
It is almost pure quartz, especially of the greenish variety. It nearly always contains considerable silver sulphide as well as gold, and on weathering it turns bluish owing to oxidation of its silver sulphide content. The vein, especially the more siliceous one, is drusy and contains small quartz ore, especially the more siliceous ore, is drusy and contains small

In the most of the 140-foot drift to south, as shown by occasional exposures of wall rock on one side or the other, the vein seems to be only about 4 feet wide. Toward the face of the drift, however, it seems to widen a little and to improve in quality. The face shows 30 inches of good-looking banded hard quartz and 2 feet of mud and bouldery quartz. At the bottom of the winze, as shown in a cross section, this mixture of hard mud and bouldery quartz is 20 to 25 feet wide.

The vein has been explored to the depth of 360 feet by about 2,000 feet of work, mainly on the adit-tunnel or 110-foot level and on the north of 300 feet of work, mainly on the adit-tunnel or 110-foot level and on the "foot of the winze may be rather local and that farther east or at a deeper depth the ore may improve and become normal.

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The ore in general runs about $4 in gold and silver to the ton, the values being about half gold and half silver at the surface and about two-thirds silver and one-third gold at depth. In many places, however, the vein carries $6 to $12 or $14, in some places as much as $20, and in very few places as much as $40 to the ton; and some small residual masses of primary (?) quartz ore found along the foot wall are said to have assayed as high as an ounce in gold and 45 ounces in silver to the ton. Most of the high values found in the mine are probably due to concentration or enrichment by leaching and redeposition. Crushed ore when panned usually yields a long head or string of fine free-gold particles, together with considerable argentite and cerargyrite, much of which resembles lead. All the ore that weathers bluish pans well in argentite as well as in free gold, the bluish color being apparently due to the presence of argentite. The gold is light colored and is probably electrum, containing perhaps 40 percent of silver by weight.

Origin of deposits

The deposits are of hypogene origin. They were formed by ascending hot magmatic solutions that circulated through the rocks following one or more volcanic eruptions, and they belong to the group of deposits found in the Tertiary volcanic rocks, of which there are so many examples in Nevada. They were probably formed by the same solutions that so extensively altered the country rock in the surrounding region.
Outlook

Judging from the nature of the deposits and the development work done on them, the vein seems to contain considerable ore, but because of its low grade and irregular distribution, the ore could not be mined and milled at a profit unless all operations were conducted in a very economical manner. Before installing an expensive camp and machinery, at least two kinds of exploration should be made. First, although it seems doubtful whether there has been much secondary enrichment of the deposits at the top of the sulphide zone, the vein should be prospected, by drilling or otherwise, down to the primary sulphides. Second, the eastern part of the vein, which has hitherto been prospected only by shallow trenches, should be explored in depth. An engineer experienced in this class of deposits in this part of the country believes that with proper management the ore can be mined and milled for about $2.50 per ton and that ore of $5 grade will yield a net profit of $1.50 to the ton.
CARSON SINK AREA, NEVADA

By

F. C. Schrader

RAWHIDE DISTRICT (4)

Acknowledgments

The writer is indebted to Mr. W. Lindgren who
worked during the early days, and to R. H. Turner who did a
large amount of work in 1899, making a geologic survey
for the Constance Mining Co., upon whom
he continued the work by R. C. Templeton who had
no idea of the writer by the Nevada New Mines Co., who also
had access to the corresponding Turner Collection of about 60
mineral specimens in charge of Professor A. P. Rogers at Stanford
University.

Widely and courteously were generously extended by the various
firms and individuals, especially by Mr. E. W. King, President of
the Nevada New Mines Co., who placed at the writer's disposal a valuable
acquire.

Mineral deposits of the Rawhide District

Location

The Rawhide district is at Rawhide and vicinity in the northern part
of Nevada, near the Churchill County line, 40 miles south-southeast
of Ely, and 6 miles east of Shara, the nearest railroad station and
also on the Southern Pacific Railroad. It is on the southern
end of the U. S. Geological Survey Carson Sink topographic map in
which at an elevation of about 5,150 feet, and is near the border
between Nevada and the south, fig. 5. It is on the old
(reverse City stage route which here forms the main and principal
...
Rawhide District

Acknowledgments

For valuable suggestions the writer is indebted to Mr. W. Lindgren who visited Rawhide during the early boom days, and to H. W. Turner who did a few weeks' field work in 1910, ending August 20, in making a geologic survey of the Rawhide Coalition property for the Constance Herzig Co., whereupon the survey was continued for a couple of months by E. C. Templeton who had been assisting Mr. Turner. Subsequently the field notes of this work were made at the disposal of the writer by the Nevada New Mines Co., who also kindly given access to the corresponding Turner Collection of about 60 rocks and ore specimens in charge of Professor A. F. Rogers at Stanford University.

At Rawhide aid and courtesy were generously extended by the various mining companies and miners, especially by Mr. E. W. King, President of the Nevada New Mines Co., who placed at the writer's disposal a valuable collection of rocks and ore specimens from the various mines.

Mineral deposits of the Rawhide District

Located near the Carson Sink topographic map in west central Nevada County near the Churchill County line, 40 miles south-southeast of Carson City stage route which here forms the main and principal

Location

The Rawhide district is at Rawhide and vicinity in the northern part of the county near the Churchill County line, 40 miles south-southeast of Shurz, the nearest railroad station and nearby points on the Southern Pacific Railroad. It is on the southern border of the U. S. Geological Survey Carson Sink topographic map in a country at an elevation of about 5,150 feet, and is near the border of the adjoining Hawthorne map on the south, fig. 3. It is on the old Carson City stage route which here forms the main and principal
street of the town. Though the district is variously regarded as
having a large and indefinite area, the ore deposits which placed it on
map, namely its deposits occurring in the volcanic rocks are about all
confined in an east-west belt about 5 miles long by 3 miles wide with the
name of Rawhide and the principal mines situated in its eastern part, about
from in the southern half of fig. 52.

Less extensive prospecting by J. M. Schadler and the first
History and Production

Rawhide is famous for its precious metal deposits in Tertiary volcanic
rocks. In February 1906, promising silver-gold-bearing veins were found in
the vicinity of the Black Eagle mine and vicinity in what was then
as the Regent District, 2 miles northwest of Rawhide. This discovery

1/ Consequently the Regent-Rawhide region became and still is officially
Regent district, although it together with the Camp or town is almost
commonly known as Rawhide. The mining claims are all recorded in the Regent
District. The camp was formed in September, and several lots which at first sold for

and considerable excitement which resulted in much surrounding ground
interest was secured to under the leading parties in which a short
was staked. The first location was made by J. M. Schadler and associate
in May. Late in June ground below Regent in what is now Rawhide was discovered
and staked, proved successful on the first location being made, and soon, with 357 leases operating, disclosed
large gold-bearing. Here the first location was made December 25, 1906 by
2/

Stuart, E. E., State Inspector of Mines: Nevada's Mineral Resources,
I, p. 63.

Wynn, Gorrill and Stockton, who panned free gold and horn silver from
nuggets of "porphyry" and founded the camp of Reward, later known as West
Chas. McLeod and C. A. Bovard located on Hooligan Hill and Z. T.


Also called McLeod Hill.

Rawhide in February 1896 (1907) located on Bluff Hill and Balloon Hill.

In April extensive prospecting by J. H. Barrett of the Rawhide Queen disclosed the first remarkable values which attracted mining men generally and believed that the district would prove as permanent as Goldfield or Virginia, whose ores the deep sulphides of Rawhide resembled, especially those of the Mint lease on the 500-foot level. The discovery was made on the Davis mining ground, which with other claims was later incorporated as the Rawhide Cons. Mining Co. property, the first company organized in the district.

In its first three months the camp acquired 1,000 inhabitants. The Rawhide Consolidated Co. was formed in September, and town lots, which at first sold for 10 cents, soon sold as high as $1,500.

The district was opened up under the leasing system in which a block of ground 300 feet square constituted a lease. The system proved successful, and soon with 330 leases operating, disclosed the presence of ore or mineralization extending intermittently over an area of only 5 miles square. Under this system George Graham Rice promoted the Rawhide Queen Mining Co., the Rawhide Consolidated Mining Co., and the Black Eagle Mining and Milling Co., whose mines later proved to be the most important in the district. In most cases, however, the size of the lease was too small for the ground to be developed to the best advantage.
At first the usual term for leasing was 18 months, the royalty being 10 per cent. Soon, however, most leases were let for a period of 3 or more years, the royalty of 20 per cent. In 1908, 50,000 feet of work was done at a cost of $1,000,000, and nearly a hundred men were working in the mines. Ninety-five headframes stood in an area having a radius of only half a mile at which 50 gasoline hoists were in operation (Fig. 53). Only better than $30 ore could be shipped. In March and April 350 sets of lessees were working.

Most of the discoveries were made in areas of relief as in Balloon Hill and Hooligan Hill. (Figs. 53 and 54.) At first Rawhide had been heralded as a high-grade free-gold district. At the close of 1908, however, it was becoming recognized that the deposits consisted mainly of secondary silver veins containing milling grade ore rather than rich ore, though, many of the deposits contained streaks and pockets of very rich ore. On the Grutt lease on the Wild West claim $15,000 was shipped from a body about the "size of a burro." Considerable of the early-ore ran about $500 to the ton. Gooding Company, J. E. King and Anyone.

From the Kearns No. 1 lease purchased for $35,000 and later incorporated as the original Rawhide Mining Company property there was shipped to Goldfield and Cripple Creek lots of ore of which 93 tons ran $117.00 to the ton. Similar shipments were made to the Western Ore Purchasing Company at Hazen, some from the Steinheimer and some in West Rawhide. Twelve properties made ore shipments to the record, and a Weiss mill was in operation.
The log of the well drilled by the Rawhide Northern Water Company in the
western part of the town reported a large gold-bearing ledge at the depth
of 380 feet, assays of several dollars in gold to the ton at the depth of 30
feet and some of $100 at the depth of 156 feet. Mining claims were the

The population, which reached its peak in this year, was more than

Main Street, 2 miles long, was built up solidly on both sides (fig. 53).

There were 3 banks, 2 daily and 3 weekly newspapers, 2 telegraph lines, a long
distance telephone, and daily auto-stage and mail service from Shurz, Fallon,

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There were 3 banks, 2 daily and 3 weekly newspapers, 2 telegraph lines, a long
distance telephone, and daily auto-stage and mail service from Shurz, Fallon,
By 1909 the (R. Coalition) Company had expended $500,000 in operating leases, one of which, the Miller lease, from about 300 feet of development yielded shipments of rich ore ranging up to $900 to the ton and much $20 milling ore. Among nearly a score of similarly promising claims were the Hooligan, Wild Horse, Silver King, Kearns No. 2, Queen and Northern.

On the Happy Hooligan a 40-foot lode was opened up for the extent of 130 feet, from which several shipments had been made and 6,000 tons of $6.50 ore had accumulated on the dump. On another lease the Rawhide Victor Mining Company had opened on the 350-foot level a 4-foot vein with 1 foot of high-grade ore, and the Proskys Rawhide No. 1 lease had opened up a 2-foot vein containing high-grade ore from which the company shipped about $10,000 worth. On the Silver King and Silver King No. 1 claims considerable ore was produced, some from depths of about 400 feet, and a large quantity of ore running from $9 to $10 to the ton was disclosed. Also 2 small mills were in operation, a Watt mill and that of the Rawhide Quartz Milling and Mining Company. The Watt mill used a new crushing device called the Tadmor mill, having a gyratory muller.

The company mill used 4 Knight cannonball mills to treat the product coming from the Blake crusher. Failure of the early-day mills to satisfactorily extract the gold is ascribed to the fact that they did not use cyanide.

By August 1910, 75,000 feet of underground work had been done. More than 100 mines had been opened to depths of 150 to 500 feet, the deepest being the Riot with 4 levels. It had produced about $35,000 worth of ore from a comparatively small tonnage. The Coalition and the Queen, had produced about 100,000 tons. The company's mill was treating 40 tons of ore a day, with a recovery of about 95 percent.

There were at this time 3 additional mills, the National, Klinker, and
etc. The National Mill, having a capacity of 75 tons a day and located
just below town, was built at a cost of $100,000, but owing to poor design
not successful. It burned down in 1912. Its tailings dump of 10,000
was said to contain nearly $5 to the ton in precious metal. The Klinker
and Queen mills were located 5 miles below town on the border of Alkali Flat,
were water is reached at the depth of 150 feet. The Klinker was a ten-foot
mill, and obtained only a low extraction. The Queen was a modern 10-stamp
smelting and concentrating mill with a tube-mill, 35-ton cyanide plant,
returns etc., and it yielded the best results (fig. 55).

About this time with the prospect of procuring electric power from the
line of the California Mono Lake Power Company then being built nearby
to Wonder, the outlook seemed bright for Rawhide's being able to mine
ore of $10 grade and possibly lower grade. From 1911 to 1920 most
the mills were supplied with electric power from the above line at 2-1/4
kilowatt hours.

In 1912 the Nevada New Mines Company was incorporated and took over the
interests of the Rawhide Queen Mining Company, the Rawhide Coalition Mining
Company, and the Black Eagle Mining and Milling Company, comprising 16 patented
mines, the most important mines in the district, practically all of which
were idle since the mild boom of 1908. This Company operated mainly
high leases. Ten-dollar ore was regarded as of commercial grade,
of less than $40-grade could not be shipped.

In 1913 the vein which earlier had been worked to the depth of 225 feet
in Phoenix shaft was found to be 5-feet wide on the 500-foot level and
promising. The property at this time contained nearly 7 miles of under-
workings. The Company's mill was treating 40 tons of ore a day, with
traction of about 96 percent.
By January 1914 about 150 mining claims had been patented in the district. The most of 1914-15 the Nevada New Mines Company was daily milling about 2 tons of $20.00 ore, mostly from the Black Eagle mine, and considerable care was taken to maintain the ore in the mill and was sending considerable ore, the leased in order to maintain their operations to the oxidized mill to the Selby smelter.

Also, a third mill was operated at intervals on ore from the old Mint and theore of the railroad on the Jumbo and mining leases. The Mint-Lease was mining good ore at the depth of 400 feet. About half a dozen leases were being profitably operated. Also development was commenced at the Nevada New Mines Company had been taken over by the company, and had good to be leased to the exceedingly for about $15,000 worth of mostly $25 ore.

In 1916 the Company resumed operations on its own account and in September 1917 returned to the leasing system, leased all its holdings and received royalties on all ore shipped. Their holdings in recent years until 1920 they

In 1916 only the Black Eagle mill, just then taken over by the Nevada Mines Company, was operated. It was a modern mill, having a capacity of 100 tons a day. As the ore milled easily, the stamps were only about half time. The power used in the mill and most of the mines electric.

In its Coalitonal mine, on the 650-foot level, the company was mining a ton was chiefly silver but carried about $1 in gold to the ounce. Much Black Eagle bullion, however, it was said carried about $7 in gold to ounce of silver.
From 1917 to 1920 activity continued on a moderate scale. Lessees shipped a small tonnage of ore in 1918. In 1920 the population was only 50, but lessees were working in most of the leading mines.

Owing to the high cost of having test assays made for guidance in the sulphide ores, the lessees largely confined their operations to the oxidized ores whose values they themselves quickly determined without cost by panning. Some ore was hauled to the railway at Nolan, 25 miles southwest of Rawhide.

In general, the high-grade ore as shipped carried about 60 oz. in silver to the ton. The current miner's wage was $6.00 a day.

By 1920 important changes in ownership had taken place in the last few years. The properties of the Nevada New Mines Company had been taken over by the Scheeline estate of Reno, and had come to be known as the Scheeline mines. They included those of the Rawhide Queen Company, Rawhide Coalition Company, and the Black Eagle Mining and Milling Company. The Grutt Brothers of Davenport, Washington, who from their early advent into the camp in 1907 had constantly been heavy investors and soon purchased some of the best claims, had further increased their holdings in recent dull years until in 1920 they consisted of 17 claims incorporated in four companies of which the latest, the Nevada Victor Company, was organized in 1919. These two interests, the Scheeline interest and the Grutt Brothers interest, comprising about 30 staked claims, now covered the townsite and nearly all the adjacent more valuable mineral ground.

In 1920 to 1923 lessees were active. In 1922 the Scheeline mines were developed by 3 shafts, the deepest being 750 feet. The production was 8,000. April 1, 1923, the indicated ore reserves in these mines were said to be $200,000 of milling ore.
The production of the Rawhide district to date is claimed to be more...

The production figures here given are not complete on account of some
records being lost in the Rawhide fire and others were not obtainable.

$2,000,000, which figure is probably nearly correct. Some estimate it to
$6,000,000.

In March 1908 $120,000 worth of ore was hauled out of the district, and
in 1908 to 1920, as given by the United States Mineral Resources reports, the
production was 68,933 tons of ore containing $993,888 in gold, 696,673 oz. of
silver, 24,895 lbs. of copper and 1,472 lbs. of lead, in all valued at $1,418,680.

The lead seems to have come mostly from the Lappatt lead mine and the copper from
a Copper Mountain mine which is now included in the Rand district.

Production in 1911-1917 was 1-1/4 million dollars, approximately.

The production of the Rawhide Queen Mines Co. on 24 leases from the
beginning of its operations in 1908 to October 31, 1909, was approximately
14,000 from 4,508 tons of ore that ran about $47.50 to the ton.

From 1917-1930 the production was $200,000, mostly by lessees, and it
continued on a small scale in 1931.

Scheeline, Henry, Oral communication September 3, 1930, and Nevada
Mining Press, Jan. 2, 1931.

Further detail on production appears on pages (4) - 46-48.

Climate

The climate at Rawhide corresponds fairly well with that described for
the valley portion of the Carson Sink region. It is suitable for
operations throughout the year. In general, it is characterized by
Extreme dryness, warm to hot days and cool to cold nights. April and May are about the most pleasant months of the year and the most comfortable for outdoor work. Hot weather begins early in June and continues till about October, during which period cloudbursts of great magnitude sometimes occur. Excepting a scanty growth of scattered sagebrush confined mostly to the valleys, the surface is almost barren of vegetation, fig. 54. It is of importance in showing that the ore-bearing volcanic rocks are a thickness six at least equal to the depth of the boring.

Water supply

The nearest source of water supply for Rawhide is the large lowland playa, or Alkali flat, also called "dry lake", situated 6 miles southeast of Rawhide and at 1,044 feet lower than Rawhide, fig. 3. This explains why several mills were located here during the more active days of the camp.

Here the groundwater table stands at the depth of only 150 feet and at a horse well 35 feet below the surface or at a level about 1,200 feet below the surface at Rawhide which latter figure represents approximately the depth which a boring would have to extend to reach water at Rawhide. As the playa is nearly 100 square miles in area, contains a great thickness of valley fill as storage reservoir, and is the bottom or lowest part of Gabbs Valley from which it receives the drainage of a large watershed the water supply is almost inexhaustible. Formerly, as early as 1909, water was pumped from Murphy's well here through a 5-mile pipe line to the National mill and to be raised enroute 1,390 feet. Also excellent water for domestic use is gained from Hot Springs at the eastern end of the playa 14 miles distant to Rawhide. Hot Springs at the surface discharge an abundance of clear hot water and during the active days of Rawhide was patronized as a bathing and resort.
At Rawhide a little moist ground was found in some of the mines at depths of about 600 feet, but this moisture seems without doubt, to have been of surface origin. The Keystone drill boring made to the depth of 833 feet by the Rawhide Water Co. in search of water in the northern part of the town on the Brogan Fraction of the Northern Mining Co. ground did not find any water. The boring is in dacite and rhyolite and bottoms in the volcanic mud formation, fig. 52. It is of importance in showing that the ore-bearing volcanic rocks have a thickness at least equal to the depth of the boring.

**Topography**

Rawhide lies at an elevation of 5,150 feet on the upper northwest rim of Gabbs Valley near the summit of a broad open divide which separates the slope running into Gabbs Valley on the south from that draining northwestward toward Carson Lake and Fallon, and also separates the south end of the Sand Spring Mountains or their westward continuation, from an irregular group of unnamed mountains about 6 miles wide on the west, which latter for convenience may be referred to as the Cone Mountains from Pilot Cone, a prominent peak and well-known landmark in which they culminate near the center at an elevation of 902 feet, fig. 3 and fig. 54. The word pilot is here omitted from the name to avoid confusion with the Pilot Mountains to the south on the Tonopah quadrangle.

The topography of the mountains is of the type produced by erosion in tilted and folded Tertiary volcanic rocks. It is hilly and mountainous, in rugged but not rugged, nearly all parts of the area being easily accessible. Average relief is about 800 feet. The trend of the mountains and drainage is, which, however, is not pronounced, is north-northwestward and southeastward.
is also the trend of the principal veins and geologic features. The

drainage is mostly southward into Alkali Flat, the bottom of Gabbs Valley

which is 6 miles distant from Rawhide and lies at an elevation of 4,103 feet.

From Rawhide to Alkali Flat the surface delines at the rate of 175 feet

per mile or with a grade of 3.3 percent, and along the Rawhide wash the

drainage line and road the grade is fairly uniform throughout the entire
distance.

The mountains on the east culminate in Big Kasok Mountain at an elevation

of 7,110 feet at a point 4 miles east-northeast of the town, fig. 3, but the
mesas and prospects are nearly all confined to the low western foothills mostly
in a nearly north-south belt extending only about a mile east of town.

In the mountains on the west it is the commanding position of Pilot Cone

of its nearly perfect conical form, fig. 54, rather than height above its
mower peaks or surrounding summits that makes it a very outstanding and dis-

tinctive landmark visible over a wide area of country from nearly all directions,
some it is said for the distance of more than 100 miles. The peak is said
have been an invaluable guide to the pioneer, traveller and prospector before
the country was marked out by roads or trails. It is also locally known
as Sugar Loaf Mountain", and simply "Sugar Loaf", and as "Brown Knob".

The elevation which the Survey of the Rawhide Western railroad is said
have assigned to Rawhide is 5,012 feet or 140 feet lower than that of 5,
2 feet given by the U.S.G.S. (bench mark) at the Rawhide Hospital.

Geology

General statement

Excepting certain areas of surficial alluvium or wash the Rawhide District
underlain chiefly by Tertiary volcanic rocks, which as shown in the surrounding
orders of the district rest unconformably on the eroded surface of a much older series of rocks consisting of limestone, shale, and slate here referred to the Mesozoic age. and elsewhere it is intruded and capped by dark-grayish sandstone.

Sedimentary rocks

Mesozoic rocks

Sedimentary rocks regarded as Mesozoic are prominent at the eastern border of the district at about 2 miles east of town, fig. 52, where they form the southeast continuation of the sedimentary belt of rocks described on page (6) - 8 chiefly constituting the Sand Springs range. The rocks consist of limestone, shale, and slate. They have been considerably upturned, folded, faulted, and otherwise deformed and cut by granular intrusive notably quartz monzonite and granite, fig. 52. They consist in general of gray to bluish or dark-gray limestone alternating with shale and slate, and include rhyolite, dacite, and andesite. They are exposed on the east side of a broad alluvial fan extending for 1/2 mile east of the prominent rhyolite hill on the south side of the road eastward for 1-1/2 miles consist chiefly of limestone.

The limestone is medium- to heavy bedded and occurs mainly in dark-grayish marl, beds alternating with those of whitish altered crystalline limestone or marble, all in general dipping westerly. The rocks, however, have been much disturbed and exhibit various deformational structures. Just east of a large rhyolite hill the limestone is in anticline form. At other points
is on edge and at some possibly overturned. In places it is intruded by diabase, granitic, and monzonite and by rhyolite and is capped by dark basalt or basalt, and elsewhere it is intruded and capped by dark-greenish diabase. All that it usually pass a considerable thickness and in turn has been

At about 2 miles northeast of Rawhide the limestone having a dip of about 30° to the west extends westward beneath the Tertiary volcanics. At 4-1/2 miles north of Rawhide at the Yankee Girl property and vicinity the rocks in an area three-fourths of a mile square expose on the south a northeast-southwest belt of black shale and slate about 500 feet wide which in its southern part stands

edge or is vertical, becomes more shaly toward its northwest border where it is succeeded conformably by limestone along a contact which dips 80° east-northeast. The limestone belt is about 1,000 feet or more in width, but includes also the slate-shale belt, some intrusive rocks, rhyolite, dacite, andesite, and diabase. It is mostly heavy bedded, dark blue or gray and partly crystalline, in places silicated but does not show pronounced metamorphism.

It has also been reached in the deep workings of the Black Eagle mine 6 miles west of Rawhide.

Exposures of these older rocks occur also 6 to 7 miles southwest of Rawhide in the west and southwest base of the Cone Mountains.

Tertiary rocks

Upper Miocene (Esmeralda)

As described on page (6) - 5 from fossil wood similar to that of the Esmeralda formation at Cedar Mountain having been found in abundance at several localities near Rawhide, for instance at about 2 miles north-northwest of Rawhide a mile northeast of Regent; 3-1/2 miles northwest of Rawhide or 1 mile west of Regent; at the northern base of the Cone Mountains; and thirdly at about is
miles east of Rawhide, it is inferred that the fossil wood is probably derived from the same Esmeralda formation which may occur in this vicinity and has since been more or less buried by Quaternary alluvium or wash. In low places like Alkali Flat it probably has a considerable thickness and in turn has been fully buried by Quaternary alluvium.

The fossil wood at the first-named locality includes well opalized or alconized specimens.

Quaternary

Alluvium or wash

Covering the consolidated rocks on the lower slopes of the mountains and hills is a thin mantle of alluvium or so-called wash which increases in thickness more than 100 feet in the valleys and low places. The deposits consist of a heterogeneous mixture of gravel and finer material derived from the various surrounding hills and range from fine sand or silt up to boulders a foot or more in diameter. They are mostly igneous detritus. The gravels in general are subangular rather than rounded or water worn owing to the fact that they have not been transported far nor much subjected to stream action.

The deposits vary in thickness from almost nil at the foot of the hills to 100 feet or more in the low places, as shown by placer shafts sunk in them in the Rawhide wash and vicinity near the National Mill Hill and about 2 to 4 miles from the town of Rawhide. They in general are crudely and discordantly stratified and were deposited mostly precipitously during short and often widely spaced intervals by torrential waters resulting from cloudbursts.

In places where the deposits are of considerable thickness in the basal part of the section, though not lithified, they are semi-consolidated or cemented with a matrix of clay and iron and lime carbonates to the extent that blasting is
employed in placer mining them. They have extending eastward to make a point about

Igneous rocks

Mesozoic (late Jurassic or early Cretaceous)

Granular intrusives

Granite

The Mesozoic sedimentary rocks afore described are cut by several types of granular intrusives, of which the more important are a granitite and a monzonite porphyry, with both of which ore deposits are associated. Aplite is present in the southwest slope of Big Kasock Mountain, fig. 56, photo 21.

The granitite occupies a couple areas each about a mile in diameter, one at Gold Hill, about 3 miles east of Rawhide at the lower south base of Big Kasock Mountain, and another at the Sunnyside camp a mile farther to the southeast where it forms a prominent knob-like hill 300 feet high and is known as the Sunnyside granite. The granite occupies a couple areas each about a mile in diameter, one at the lower south base of Big Kasock Mountain, and another at the Sunnyside camp a mile farther to the southeast where it forms a prominent knob-like hill 300 feet high and is known as the Sunnyside granite. The granite is a massive slightly pressed sub-medium grained gray speckled rock resembling a salt and pepper mixture. In places, however, the texture is black biotite ranging up to 1/10 of an inch in diameter. The rock weathers to brown due to its iron content held in the biotite. It is a soda-lime olivine porphyry. It is composed chiefly of

Monzonite

The monzonite rock occurs chiefly at about 5 miles east of Rawhide, where it occupies an east-west

East End to

Black biotite is present, and the rocks were uplifted and considerably faulted, with a long almost east-west line of fractures and cracks in parallel southerly lines and zones, and as

Monzonite—southerly lines and zones, and an

about a mile wide and 4 miles long extending eastward to a point about a mile east of Eagleville. It is an iron-gray fine- to medium-grained sparsely to often dimly porphyritic rock with dull feldspar phenocrysts, and in the specimens examined microscopically the minerals are too altered for precise determination.

The rocks in places are stained reddish brown and yellowish with hematite flakes, but in general there is a pervasiveness of iron stain which seems to be caused by parging flows. The rocks are stained reddish brown and yellowish with hematite flakes, but in general there is a pervasiveness of iron stain which seems to be caused by parging flows.

**Diabase**

The Mesozoic sedimentary rocks are cut also by dikes of dark diabase in instances resembling greenstone.

**Tertiary Volcanic rocks**

The Tertiary volcanic rocks underlie nearly all of the Rawhide district, they are by far the most important rocks as they contain nearly all the deposits, fig. 52. They consist chiefly of a series of superimposed lava flows and associated ejecta forming ten of a dozen formations. They are probably 100 feet or more in thickness. They have a known thickness of at least 833 feet, as shown by the well boring made in search of water in the northern part of the town and which did not reach their lower limit.

As shown at the borders of the district where they thin out and give way the older Mesozoic sedimentary rocks afore described they rest unconformably on the eroded surface of these older and more deformed rocks in which they only occupy a pre-Tertiary basin or synclinal valley whose floor slopes eastward toward Alkali Flat about the same as does the present surface.

Following their deposition, the rocks were uplifted and considerably faulted, create and crushed in persistent north-southerly lines and zones, and as noted it is along these zones and lines that much of the mineralization has taken place. The earlier members of the series have been also cut, intruded and capped by dikes and flows derived from the later members.
The rocks have been variously called quartz porphyry, granite porphyry, rhyolite, breccia, and silicified rhyolite. In natural columnar order they are about as follows. But the succession here given in several instances is not regarded as conclusive owing to lack of adequate exposures due to surface weathering and disturbed and altered conditions of the rocks underground.

The rocks in places are stained reddish brown and yellowish with hematite or limonite, but in general there is a meagerness of iron stain which seems to denote a leached condition of the base metals, which is reflected by the light color of the rocks as shown in figs. 53 and 54. This absence of iron stain has been given as excuse for the district not being prospected earlier.

Tertiary volcanic rocks

In reverse age order, beginning with the youngest at top

- Basalt, dikes, and flow-caps, as at Regent - (Quaternary?)
- Pilot Cone andesite
- Black buttes basaltic andesite
- Younger rhyolite and dacite
  - (a) East ridge (Iron Hill) rhyolite and so forth, intrusive in Balloon Hill mines
  - (b) Cone Mountains rhyolite
  - (c) Younger dacite
- Quartz latite tuff
- Portland rhyolite

Balloon Hill rhyolite (V.-P. 17)

- (a) Ore bearing
- (b) Mud "formation" Ascending order
- (c) Flow banded

Hooligan Hill dacite (Mint shaft, 400-foot level)
A brief description of the rocks in consecutive order, beginning with the oldest, follows:

Seemingly the oldest of the volcanic rocks is a dacitic rock known as the Hooligan Hill dacite from its prominent occurrence in Hooligan Hill, which it probably underlies. The dacite is closely associated with some of the oldest rocks in the area, as shown in the Marian tunnel, much of the rock is closely sheeted or cut into slices from 2 to 15 inches in thickness, and locally it is cleaned crushed to small bits. Here it is intruded by the Portland rhyolite, with

Hooligan Hill dacite

It is also present in Last Chance Hill, Grutt Hill, Roseberry Hill, and elsewhere, including the Cone Mountains to the southwest of town. The dacite crop out at several points in the gulch diagonally across the street (Nevada ave.) to the northwest of the old Hotel Rawhide, indicating that the Last Chance dacite belt probably connects beneath the wash with that of Hooligan Hill, the southeast slope of Burns Hill. The Prince shaft, 200 feet deep, in the lower part of Hooligan Hill has its lower half or more in dacite and the upper half in the Portland rhyolite.

The dacite is in contact with the Balloon Hill rhyolite on the east in the vicinity of Balloon Hill and Grutt Hill and is associated with the dacite south of the/ND and west. At Hooligan Hill it has a thickness of at least several hundred feet. It is believed to rest on the underlying Mesozoic sediments, with which, however, its actual relations have not been observed.
which it alternates in bands or zones, but the formational contact of the two
rocks is not usually well defined. A typical specimen, (No. 234) of the dacite
collected from the Marian tunnel in the north side of Hooligan Hill, is a
greenish-gray to grayish-green medium-grained massive rock, profusely speckled
with small dull whitish phenocrystic feldspars and a few dark quartzes, about
1/10th of an inch in maximum diameter. The microscope shows it to consist of
about 75 percent of pale greenish cryptocrystalline to glassy base with flowage
structure arrangement in which rest the larger feldspars, quartzes, biotite, and,
sparingly, hornblende, all in approximately parallel orientation. The rock has
been highly altered hydrothermally. The feldspar was about all plagioclase,
singly in relatively stout forms, but it has been too completely sericitized,
specific
b talznized, and epidotized for determination, and the biotite and horn-
blende are changed to chiefly chlorite and iron. The quartz is present only
in moderate quantity. It tends to occur in elongated sinuous blebs. In other
specimens examined the rock stands near quartz latite.

Balloon Hill rhyolite

Following the deposition and erosion of the Hooligan Hill dacite there
was deposited at the site of Balloon Hill, Grutt Hill, and vicinity a rhyolitic
flow which has come to be known as the Balloon Hill rhyolite from the strength
of occurrence there. From an economic standpoint it is the most important
rock formation in the district, as it contains nearly all the principal ore deposits.
The Balloon Hill rhyolite, fig. 56a, consists of three varieties or members
as follows named in ascending and age order:

(a) Principal ore-bearing rhyolite
(b) Mud "formation"
(c) Flow banded rhyolite
Ore-bearing rhyolite

The principal ore-bearing rhyolite is supposed to rest in depth unconformably on the Hooligan Hill dacite, but its contact with that rock was not observed in the present work, nor can much that is definite be said of its thickness and extent. It is found chiefly in the deep part of the mines. It is typically a gray to whitish medium-grained massive and in part, at least, tuffaceous rock, and in places discloses the characteristics of flow brecciation in old form. It is at least several hundred feet in thickness. It seems to have been formerly, for the most part, a normal rhyolite, but has since become so altered hydrothermally and otherwise by devitrification, kaolization, crystallization, silicification, and the development of secondary minerals that satisfactory determination could no longer be made in the numerous specimens examined microscopically in the present work. The rock has been greatly faulted and crushed and commonly contains or is traversed by veinlets of sec quartz and adularia, alunite, jarosite, and wide zones of silicification. A representative specimen, 399, from the 500-foot level of the Phoenix mine, is a light lead-gray, fine-grained lithoidal or nearly aphanitic hard siliceous, slightly tuffaceous rock containing a few small phenocrystal forms of whitish orthoclase and glassy quartz and streaks and veinlets of secondary quartz. It is also pyritic, with some cubes and grains of pyrite uniformly disseminated throughout the rock, except that the pyrite is in places concentrated along the walls of the veinlets and zones of silicification and is apparently of late-vein or post-vein origin.

The microscope indicates the rock to have consisted mainly of a microcrystalline to glassy base with minute forms of orthoclase and quartz and with band structure, but now it is altered, devitrified, and silicified with secondary quartz and adularia or valencianite occurring as veinlets and in zones.
Also adularia in irregular bodies and disseminated forms has replaced much of the rock, as shown in fig. 56b (specimen 387), which is from the Balloon Hill unded rhyolite on Balloon Hill at the site of W.S.L. 216. Here the rock is whitish or semi-chalky in appearance and hardness.

The microscope shows the rock to be a microcrystalline to glassy flow-unded rhyolite with pegmatite to pale brownish base. It is now highly altered, devitrified, silicified, and contains much adularia, kaolin, sericite, and some alunite and jarosite. Silicification, perhaps the most important feature, follows the banding in slender discontinuous bands of streaks, while chloritization is more widespread and extends almost throughout the rock with much of the adularia occurring in nearly perfect rhombic forms. But little if any primary mineral other than quartz remains. The jarosite favors the sider feldspar bands and areas rather than the more siliceous ones.

The scarcity of jarosite and alunite down in or near the sulphide zone is regarded as significant of its being an alteration product. From the center of the alunite aggregate replacement quartz and adularia, extend in an irregular manner laterally into the rock.

In the neighboring Victor mine on the 750-foot level the footwall rock, (specimen 683) is likewise lithoidal, similar to that just described from the 600-foot level of the Phoenix mine, but lighter in color, and with only a very little pyrite disseminated in the rock itself. But it contains inclusions of a darker and more pyritic rock with biotite ? changed to chlorite and is slightly tuffaceous. It too has a microcrystalline glassy base. Separated from the footwall pyrite just described by a 4-foot vein which stands about vertical, with dip to the south, is a darker, coarser, and much more tuffaceous and pyritic rhyolite sill, (specimen 687) forming the hanging wall. It is a greenish-gray dimly illit medium-grained rock and contains fragments ranging up to two-tenths of an
inch in diameter. It is a devitrified and altered glassy tuff, but still contains small phenocrysts and smaller forms of sanadin, orthoclase, quartz, biotite, a little biotite altered to chlorite, and considerable pyrite, characteristic of a rock from the sulphide zone. It is the most tuffaceous phase of the ore rhyolite observed in the present work. Some of the orthoclase altered to chiefly sericite, to underlying tuff. On the 200-foot level Pseudomorphic quartz also occurs in the New York mine.

Mud "formation"

Intervening in places with irregular contacts between the ore-bearing rhyolite and the flow-banded rhyolite next described is a whitish light-gray to light-brown to earth-colored rock resembling dry mud, from which it is known as the "Mud formation", fig. 56a. It is the darker rock composing the upper ends of Balloon Hill, while the lighter rock forming the intervening central part and most of the crest of the hill connecting the two ends is the flow-banded rhyolite which normally overlies the main ore-bearing rhyolite, as shown on the surface in figure 53, (photos 1678-1680). It varies locally from soft and talcy to hard and gritty and resembles rotten remains of the flow rhyolite and contains what seem to be fragments of this formation. Its contact with the overlying flow rhyolite in general dips steeply to the southeast. In a belt of considerable width it trends north southerly through Balloon and Cut Hills, than which, however, it may have a wider extent. It varies from soft and friable to semi-hard and from a few feet to several hundred feet in thickness, as shown by the mine workings in Balloon Hill and vicinity. It apparently is a decomposed altered portion of the flow-banded rhyolite, judging from the fact that the walls of the workings in many places, as in the Gray Eagle
channel, are coated with or composed of this mud formation, while exposures nearby
are composed of the harder banded rock. The alteration of the rock was brought
about probably by hydrothermal solutions having just the strength and alkaline
composition adequate to completely decompose the rock. In the St. Ives shaft
the mud formation extends to a depth of 270 feet below the collar of the shaft,
which point it gives way to underlying tuff. On the 200-foot level
接触与 the overlying flow rhyolite dips 75° toward the south-southeast.

**Flow-banded rhyolite**

Succeeding and overlying the ore rhyolite and the mud "formation" is the
layer known as the flow-banded rhyolite which, as noted, forms the upper middle
part of Balloon Hill, where it seems to fill a dish-like depression in the ore
rhyolite and has a thickness of at least several hundred feet extending from
the top of Balloon Hill to below the 200-foot level in the mines. It is a dense
phaneritic rock and as exposed at the surface in Balloon Hill it is in the
horizontally banded and is composed predominantly of light-grey bands
ranging from mere lines up to 4/10th of an inch in width and alternating with
narrowly narrow bands having a light creamy color, (specimen 342) and fig. 57.

The bands in general are well defined, the sharper contacts being those of the
outer edge of the dark bands naturally with the upper edge of the lighter ones.

The rock has been considerably cross faulted vertically on a small scale
disseminated along the fault planes by veinlets of bluish chalcedonic and
blue lustered silica or crystalline comb quartz and by veinlets of whitish
jasper-like opaque, practically pure alunite, fig. 58, as shown by examination
of the powdered material. The microscope shows the rock to be a very fine-grained
By fresh rhyolite, consisting mainly of cryptocrystalline to finely crystalline orthoclase, quartz, secondary quartz, and adularia in delicate structure arrangement. There is no longer much glass, the former quantity has been reduced by devitrification. The light bands contain more and coarser crystalline material than the dark bands. Secondary quartz and adularia are present in the ratio of one to two. They are generally oriented and in some cases form small aggregates or phenocrystal bodies long, perfect rhombohedral forms of adularia projecting into the quartz and feldspar. Wherefore the Balloon Hill rocks also seem to be more or less altered with adularia like those of Grutt Hill. Beryl is sparingly present as accessory is common in crystals and grains in the base and adularia in association with the adularia and quartz, where it sometimes in aggregates. In some instances the adularia lined vugs which later filled with quartz, but in general the reverse order prevailed.

Burns Hill in the western edge of the town occur tabular bodies of orphic-laminated quartz and adularia up to 20 feet or more in diameter, (specimen 247), of which some slabs several feet in diameter are frozen walls of fissures or fault planes. Some of the laminae or plates orphic after calcite or some other spar are about 3 inches in diameter.

On the Silver King No. 3 claim at a depth of about 50 feet, perfect barite crystals, some being entirely replaced by silica, were found.

In the various volcanic rocks of different veins, specimens have been which show partial replacement of feldspars by the precious metal-bearing solutions, showing the method of ore forming. The mineral-bearing solutions dotted along the smallest rock cracks and cleavage planes of the minerals.

All gradations of replacement appear. There were several periods of dilution following respective periods of eruption.
Portland rhyolite

Following the eruption of the Balloon Hill rhyolite, or perhaps contemporaneous with it, there was erupted or intruded the Portland rhyolite, so
and from its prominent occurrence in the Portland lease, where it is the
principal rock in the mine. It forms nearly half of Hooligan Hill where it
intrusive into the Hooligan Hill dacite and is the main rock in the eastern
north-central and south-central parts. The yellowstone tunnel, 300 feet long,
the eastern end of the Hill, is all in this rock.

The rock is a light-gray to whitish rhyolite in part tuffaceous and
others rust brown from its pyritic or iron content. It is submedium-grained
compact, aphanitic or lithoidal and porphyritic, or nearly so, with small
microcrysts of whitish feldspar and glassy quartz. In places it contains
uniformly disseminated minute crystals and grains of pyrite. In its
more compact form it shows a near hackley fracture.

Microscopic examination (of specimens 235, 239, 242 and 340) shows the
rock to consist of about 80 percent cryptocrystalline glassy base with a
yellowish tinge and flow structure arrangement. In the base or groundmass
are small phenocysts and smaller forms and fragments of orthoclase, quartz,
plagioclase, biotite, apatite as an accessory mineral, and pyrite in minute
amounts. The quartz in some instances contains inclusions of
olivine. In places, with the oligoclase and orthoclase present in about
amount, the rock stands near quartz latite. In all the several specimens
examined, however, the rock has been highly altered hydrothermally and by
alteration, the feldspar being changed to chiefly sericite and the biotite to
green or bleached chlorite and iron. There has been also considerable
silification and in some instances silification with development of secondary
port, in some cases forming stringer-like veinlets traversing the rock mass.

This rock is important, as all the deposits in Hooligan Hill and vicinity are
related with it.

Quartz latite tuff

The next succeeding of the volcanic rocks is a tuff formation, here called
latite tuff, but it varies in character from place to place to that of an
oolite tuff. It is of wide distribution and is heavy bedded or massive, and
only 200 feet in maximum thickness. It dips gently toward the south and
is to be related to the Hooligan Hill dacite. It forms the lower slopes of
hills and ridges where in places it weathers and erodes into badland forms
lower down the slopes it passes beneath the detrital wash of the valleys.

Examined in a specimen (255), collected from the north base of the first
north of Pilot Cone, it is ash gray and is composed mostly of buff and
ash pumiceous fine- to medium-grained matrix containing dark brown and
as-colored dense volcanic rock fragments ranging up to 3/10th of an inch
in diameter. The microscope shows the groundmass to be composed almost entirely
greenish to greenish-brown isotropic material or devitrified glass with
regular flow structure, and containing besides fragmentary rock inclusions
jecta, a few small crystals or fragments of crystals of oligoclase-andesine,
oligoclase, quartz, and biotite. Elsewhere, as in Reward Wash, three-quarters
mile north of Pilot Cone, as shown by specimen 259, the rock is slightly
witer or creamy colored, the isotropic groundmass shows a trachytic radial or
politic and irregular flow structure with marginal devitrification or
silification along flow lines and fractures.
The tuff is widely distributed in the southern half of the Cone Mountains, in the southern part, it is overlain by the Pilot Cone andesite and in northerly part by rhyolite. The deeper portions of the valleys and drainage lines are entrenched in the tuff, while the upper sides and the tops of the bounding hills and ridges are composed of the rhyolite and andesite.

Younger rhyolite and dacite

The term younger rhyolite as here used comprises several occurrences of rhyolite in different parts of the district as follows, whose rocks are evidently younger, but may not be entirely contemporary. Following the position of the quartz latite tuff there was erupted and deposited as flowage structure in which rest phenocrystic forms of orthoclase, oligoclase and, sparingly, biotite, ranging up to a maximum of nearly 1 inch in diameter.

Cone Mountains rhyolite

The Cone Mountains rhyolite, as shown in figure 52, is widely distributed west of Rawhide, where in part, at least, it overlies the quartz latite tuff, as seen at the Black Eagle Mine (specimen 547). It is a light ash-gray massive submedium-grained rock, sparingly speckled with a few thin foils of black biotite. Microscopically it is a nearly typical rhyolite, consisting mostly of a pale-brown glassy isotropic base in which rest sub-phenocrysts of sanadin, orthoclase, quartz, acidic oligoclase, and biotite.

Situated about two miles west of Rawhide, in the U. S. location Monument Ridge, Reward Gulch and Shurz Gulch to the west, the rhyolite, which forms the northerly part of the ridge, is a slightly reddish-gray, fresh, hard, fine-grained rock, and consists of 90 percent cryptocrystalline to glassy groundmass with a flowage structure in which rest phenocrystic forms of orthoclase, oligoclase and, sparingly, biotite, ranging up to a maximum of nearly 1 inch in diameter.
Younger dacite

In the western part of the district both the latite-tuff and the overlying younger rhyolite are cut by a younger fresh dacite (specimen 261) which forms a series of knob-like hills that extend from the Rawhide metals mine south-south-esterly toward and probably to Reward wash, a distance of 3/4 of a mile, and to represent croppings of a large dike.

It is an attractive medium-grained reddish-gray massive porphyritic rock, yielded with small microphenocrysts of lightish plagioclase feldspars and quartz black biotite and hornblende, and in the hand specimen has the appearance of having been slightly pressed. Exceptional hornblende prisms are as much as 10 of an inch long. Some quartz crystals or grains are 1/10 of an inch in diameter but quartz is not abundant. The microscope shows about four-fifths of the rock to consist of a greenish-brownish flow structured microcrystalline glassy base in which rest the phenocrysts and intermediate forms.

East Ridge or Iron Hill rhyolite

The East Ridge or Iron Hill rhyolite is best exposed in the prominent northeast-southwest ridge of this name situated about three-quarters of a mile northeast of Rawhide and locally known as Iron Hill from the brownish red iron-rich character of the rocks. The rhyolite practically composes the ridge, which is a mile or more long, and may be regarded as a semi-detached foothill of the Sand Springs Range on the east. It is well shown in the left middle ground in figure 53, through the gap between Grutt and Balloon Hills. The rhyolite, (specimen 295), from the southwest end of the ridge, is a medium-grained, massive, fresh looking rock. It contains lighter colored streaks and blotches of tuffaceous material and is moderately porphyritic, with principally phenocrysts of glassy lustered orthoclase and sanadin and pale
colored quartz ranging up to one-tenth of an inch in diameter. By reason
of its iron content, the rock weathers a pronounced brownish-red or near terra
Cotta color. By aid of the microscope the rock is seen to be fresh and consists
mainly of about 70 percent pale brownish microcrystalline to glassy rhyolitic groundmass
which is formed into a pronounced flow structure, in which rest abundant phenocrysts of quartz
and stocky orthoclase in the ratio of about two to one, foils of brown biotite,
altered to chlorite and iron, and very little hornblende and magnetite
in accessory mineral in anhedral forms and grains. The quartz phenocrysts
contain inclusions and embayments of the groundmass and some of the orthoclase
is altered to sericite and kaolin. The pale wine-color of the quartz is due to
hematite dust and allied fine-grained ferritic material contained in
structures in the quartz and in its inclusions of the groundmass. It is
recently this class of material that gives to the groundmass its pale brownish
color.

As shown in the south end of Balloon Hill, the East Ridge rhyolite is
as tongues or dikes and sheets intrudes the latite tuff and the ore rhyolite,
don not appear to be genetically connected with the ore deposits. In
exposure in the shaft on the Grutt Mountain lease, the East Ridge rhyolite
is seen to be the black band (58), and here they was collected from a
rhyolite or six sheets or bands ranging up to 2 feet wide intrudes the country
side basalt and is changed to bluish drab finely banded, dense, hard, hornstone
of a mile north-northeast of Rawhide.

Black Buttes andesite

The next succeeding formation in columnar order is the Black Buttes The
site, which roughly forms a range of low dark hills that are deployed in the
and
of a horseshoe about 2 miles wide/nearly encircle Rawhide on the northeast
end (fig. 52 and 54). It seems to be mostly intrusive, composed of mainly
by glassy base crowded with slender laths of oligoclase-andesine to
Beginning at about a half mile northwest of Hooligan Hill and west of the well-boring and main road, the range extends 1½ miles southwestward into Cone Mountains, forming the Black Buttes Range, which here consists of a series of 10 or more low rounded dark hills. It occupies a crescentic belt about 1/5th mile wide opened toward the southeast. Figure 52 and 54. Last Hill, though isolated in the north end of the town, is in part an eastward extension of this same rock. This view is supported by the fact that shafts peer to bottom in this rock and that the rock is exposed in the nearby railroad cut just northeast of the road.

To the east of the main road the range and rock are represented by Black Butte Mountain, the largest single body of the rock (fig. 54), and on the south its continuation in the form of a ridge about a mile long to the southeast. Balloon Hill. Also, greenish altered basaltic-looking dikes appearing in several of the mines as specimen 417 on the 200-foot level of the Grutt Mining Co., and in the 148-foot level of the Mint lease, seem to belong to this wall, but do not appear to be connected with the ore deposits.

Microscopically the rock resembles a common basalt which, in general, is taken to be. The specimen (302), here described, was collected from Black Butte Mountain one-third mile southeast of Black Butte Monument and three-quarters of a mile north-northeast of Rawhide.

In fresh specimen the rock is a greenish dark-slate colored to blackish, fine-grained or aphanitic rock, except that it is slightly speckled with small greenish-gray feldspar phenocrysts, lighter than the mass of the rock. The rock is slightly pressed and is slightly calcareous from the presence of secondary calcite. It weathers pale greenish-gray. Microscopically it is found in a calcic basic augite andesite standing near basalt and composed of mainly olivine to glassy base crowded with slender laths of oligoclase-andesine to
magnesio-labradorite and contains small phenocrystal forms of these feldspars and of altered augite and a little hornblende. Quite uniformly distributed throughout the rock is considerable magnetite in the form of minute microscopical octahedral crystals grains and skeleton crystals. The phenocrysts are partly altered to sericite, calcite, and other carbonates.

At what is known as the "brick yard" between the southwest base of Iron Hill and the northeast base of Balloon Hill, occurs an adobe deposit of dull remish-dark mudstone or earthy loam or clay apparently derived from this green andesite rock by weathering, a dike of which extends southerly from the Monument Black Cone. The material has been utilized to some extent locally in buildings.

**Pilot Cone andesite**

The next succeeding of the volcanic rocks is the Pilot Cone andesite, so-called here from an important locus, perhaps the main locus of its eruption, being the Pilot Cone, which is a large plug of this rock, fig. 54. It is a bluish-grey, fine-grained compact massive rock and is sparingly porphyritic, with small phenocrysts of elongated hornblende and equidimensional biotite. Parallelism in orientation of the longer hornblendes indicates flow structure. The weathering of the andesite to reddish-brown and blackish, with coatings of iron and manganese, makes it to be readily mistaken for basalt, by which name it is locally known.

Microscopic examination shows the rock to be a hornblende andesite. It consists of about 90 percent of a pale-greenish microlitic plagioclase-glassy matrix, with flow structure and pilotaxitic texture, in which rest many small phenocrysts and smaller forms of green or brown hornblende and a lesser number of green or brown biotite, green being predominant in the fresher specimens of the rock. Scattered throughout the rock is also considerable accessory sericite in crystals and particles, and some apatite. In some instances the
Brenblande is in part or wholly altered and surrounded by a dark border of
magnetite or almost wholly replaced by this mineral. As shown in figure 52,
the rock is widely distributed as a lens through nearly all of the Pilot Cone
Mountains except their northeastern part. Outlying remnants of it occur also
in the southeast of Rawhide east of the main mass and wash. As flows it probably
there exceeds a couple hundred feet in thickness. In the southern part of the
Mountains it rests mainly on the eroded surface of the quartz latite and
 elsewhere in other formations, including the younger rhyolite. It, in general,
shews little chemical and physical change. It is in general rock that of the
caprock or upper part of the ridges and hills between which the valleys
and drainage lines are incised in the older underlying rocks, not in most cases
much different from what is shown on the map. The area accorded to it on the
map in the northwest part of the mountains, which could be given only a very
preliminary examination, probably includes in places also other rocks.

At Pilot Cone the rock forms a fairly symmetrical conical plug having a
height of 1,100 feet, figure 54, and a basal diameter of about 1/2 mile and
extends much more. In the surrounding hills the rock in the form of flows
occurs on the latite tuff at elevations of about 5,800 feet, above which level
is exposed all the way up to the top of the cone, especially on the north
west slopes, which culminates at 6,206 feet in elevation, and it
apparently exclusively composes this part of the cone. It also, in the form
of large dikes radiating from the plug, cut the tuff. On the northwest slope
of the cone from about the 6,000-foot contour to that of 6,100 feet, the rock
is highly disturbed and shows a well-developed platy flow-structure, which in
general dips about 80° to the northwest away from the axis of the cone,

Also at Pilot Cone there are extensive dyke-like intrusions of the latite,
and granites. The rock in general is considerably altered, with much
Columnar structure in the andesite begins to appear at about 200 feet above the summit of the cone, and from a little above this contour on up to the top, the rock is all columnar and consists of a huge pile of columns. The columns are from 1 to 3 or 4 feet in diameter and individually range up to 40 feet in length or height. In general, the columns decline outward at angles of about 40 degrees, as if on subsidence of volcanic activity and settling of the cone, the tops had been tilted inward toward the center of a perhaps still active orifice or vent.

From the present and attitude of the columns it is inferred that at the time of eruption the land surface approximately coincided in elevation with the top of the cone. For which reason it is noted occur as silver-gold deposits in tertiary volcanic rocks, chiefly in the rhyolites. They occur mainly in Basalt.

The next succeeding and youngest of the volcanic rocks is basalt, which protrudes at several places as dike and flow remnants cutting and capping older rocks. Examples of its occurrence are found along the west approach to the lake Girl Camp in the northeast part of the district (specimen 233x2 294) and ranch of Regent, ½ miles northwest of Rawhide (specimen 271). It, in general, is dark iron-gray to blackish fine-grained to compact. Some of it has a brownish tinge due to the presence of olivine, and some is slightly porphyritic, containing small phenocrystal forms of lightish feldspar and greenish olivine.

Microscopic examination shows the rock to consist of 60 to 80 percent pale brownish glassy to microcrystalline base with slender laths of andesine-labradorite plagioclase flowage structure and much magnetite in minute grains and small needles. In the groundmass are small phenocrysts and smaller forms of oligoclase-clino-andesine to andesine-labradorite and pale brownish augite in large and small needles and grains. The rock in general is considerably altered, with much
the feldspar kaolinized and sericitized and the augite changed to chlorite, epidote, calcite, and iron-ore products. Augite and magnetite are especially plentiful in the Regent rock. In the Yankee Girl rock most of the augite crystals, now about completely altered, are represented by corresponding areas of the secondary minerals—epidote, chlorite, and calcite—with dark borders of secondary iron ore products.

Ore deposits

Lodes

General description

The ore deposits for which Rawhide is noted occur as silver-gold deposits in the Tertiary volcanic rocks, chiefly in the rhyolite. They occur mainly in the north-southerly zones of mineralization, the Balloon Hill or East Zone, the Royal-Regent or West Zone, and the Hooligan Hill or Middle Zone.

The Balloon Hill or East Zone lies in the eastern part of the camp and by the eastern edge of the town in open country. It has a length of about a mile and a width of about a mile. It extends from the LXL, Poor Boy and Diana properties on the north south-southeastward to Murray Hill inclusive, includes near its center Grutt Hill and Balloon Hill with their numerous known properties. The Royal Regent or West Zone lies about 2 miles west of the town of Rawhide. It extends from the Rawhide Regent Camp 2 miles southwestward to the Ruby Queen group.

The Hooligan Hill or middle zone, practically adjoins the Balloon Hill on the east and contains important properties in Hooligan Hill, Roseberry to the south, and in Burns Hill and Silver King Hill, in the western part of the town to the north of Hooligan Hill.
In the Balloon Hill or east zone, bodies of good-grade milling ore from 30 feet wide had been developed in 1908 on the Poor Boy, Bethania, Grutt, Kearns No. 1 and No. 2, Murray and other leases. Likewise in the Royal-
ent or west zone bodies of milling ore had been uncovered on the Regent, 

The deposits occur as quartz veins up to 5 feet in width and much wider 

tes of kaolinized rhyolite in the rhyolite and related rocks. They occur 

gely as replacement veins and irregular bodies along zones of sheeting, 

ure, and faulting. In many respects they are similar to the deposits 

scribed in the Gold Circle District.


They have been mined to the maximum depth of nearly 800 feet. As the 

mid-water table stands at about 1,000 feet below the surface the mines are 

, but the sulphide zone is regarded as beginning at about the 500-foot level, 

perhaps marks the level of an earlier water table. In the deep well 

made by Tex Ricard with a Keystone drill in the northern edge of the 

the sulphide zone is said to have been found at the depth of about 420 

and the top of the mud-rock rhyolite formation in which the rest of the 

extends, and finally bottoms at the depth of 833 feet below the surface, 

uch iron sulphides present in the last 400 feet but no valuable metal.
Ore deposition was attended by profound hydrothermal alteration of the rock and mineralization including devitrification, silicification, chloritization and alunition. Also sporadic ore bodies are associated with brecciation of the rock.

In the Balloon Hill zone of mineralization, particularly in Grutt Hill and Murray Hill, many of the veins trend N. to N-NE. diagonally across the end of the zone.

All of the veins containing native Hg. I vein in Balloon Hill and the four in Murray Hill dip west.

- Electrum
- Calena
- Gold (native)
- Carphynite
- Manganite
- Helvetite
- Hemitite
- Hisingerite—hydrous iron-iron silicate
- Júrosite
- Maslin
- Lacerite
- Linomítite
- Mangite
- Melanite
- Morassite
- Moicronicite
- Neomaticite
- Corl
- Lepidocrocite
- Pyroxine
- Pyromérite
- Pyrite
- Pyritohedrite
- Pyritephrophite
- Quartz
- Sulfur (native)
- Sphalerite
- Stibnite? (Gaar Hill)
- Taillurite
Following is a list of minerals occurring in the district:

List of minerals in Rawhide District

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adularia (valencianite)</td>
<td></td>
</tr>
<tr>
<td>Almagen</td>
<td></td>
</tr>
<tr>
<td>Alunite</td>
<td></td>
</tr>
<tr>
<td>Argentite</td>
<td></td>
</tr>
<tr>
<td>Azurite</td>
<td></td>
</tr>
<tr>
<td>Barite</td>
<td></td>
</tr>
<tr>
<td>Caledonite</td>
<td></td>
</tr>
<tr>
<td>Cerargyrite</td>
<td></td>
</tr>
<tr>
<td>Chalcedony</td>
<td></td>
</tr>
<tr>
<td>Chalcopyrite</td>
<td></td>
</tr>
<tr>
<td>Copper (native)</td>
<td></td>
</tr>
<tr>
<td>Covellite</td>
<td></td>
</tr>
<tr>
<td>Electrum</td>
<td></td>
</tr>
<tr>
<td>Galena</td>
<td></td>
</tr>
<tr>
<td>Gold (native)</td>
<td></td>
</tr>
<tr>
<td>Gypsum</td>
<td></td>
</tr>
<tr>
<td>Kaolinite</td>
<td></td>
</tr>
<tr>
<td>Halyylite</td>
<td></td>
</tr>
<tr>
<td>Humite</td>
<td></td>
</tr>
<tr>
<td>Hisingerite</td>
<td>hydrous ferric-iron silicate</td>
</tr>
<tr>
<td>Jarosite</td>
<td></td>
</tr>
<tr>
<td>Kaolin</td>
<td></td>
</tr>
<tr>
<td>Leverrierite</td>
<td></td>
</tr>
<tr>
<td>Limonite</td>
<td></td>
</tr>
<tr>
<td>Magnetite</td>
<td></td>
</tr>
<tr>
<td>Malachite</td>
<td></td>
</tr>
<tr>
<td>Marcasite</td>
<td></td>
</tr>
<tr>
<td>Molybdenite</td>
<td></td>
</tr>
<tr>
<td>Naumannite</td>
<td></td>
</tr>
<tr>
<td>Opal</td>
<td></td>
</tr>
<tr>
<td>Paligormsite</td>
<td></td>
</tr>
<tr>
<td>Proustite</td>
<td></td>
</tr>
<tr>
<td>Psilomelane</td>
<td></td>
</tr>
<tr>
<td>Pyrargyrite</td>
<td></td>
</tr>
<tr>
<td>Pyrite</td>
<td></td>
</tr>
<tr>
<td>Pyralsite</td>
<td></td>
</tr>
<tr>
<td>Pyrhotite</td>
<td></td>
</tr>
<tr>
<td>Quartz</td>
<td></td>
</tr>
<tr>
<td>Silver (native)</td>
<td></td>
</tr>
<tr>
<td>Sphalerite</td>
<td></td>
</tr>
<tr>
<td>Stibnite (Czar Hill)</td>
<td></td>
</tr>
<tr>
<td>Tellurium</td>
<td></td>
</tr>
</tbody>
</table>

The chief ore minerals in the oxidized zone are electrum, pyrite, and silver, native or in concretions. In the sulfide zone argentite, gold, pyrargyrite, and electrum are chiefly.

Some ores are high grade silver and silver-gold, and the silver and electrum were never smelted, but were treated as native silver. The principal silver was either fine and of light weight. Nearly all silver ores were previously oriented, and it is safe to have run in value about 3/4.

Nearly all silver ores were reduced to dust, and this could be determined by shaking. In 1912 the ore was regarded as of little value. At that time, the larger part of the ore contained silver values occurring in or close to isolated bodies. Although there were good grades to low grades, silver (native) evidenced the need of adequate milling.

Large values or bodies of the adjacent wall rock now consist of white or tawny gray-like material traversed by stringers and veinslets of
Tellurides have been reported particularly from Roseberry Hill, southwest of town.

The chief ore minerals in the oxidized zone are cerargyrite, pyrite, native silver, native gold, and electrum, and in the sulphide zone argentite, pyrrhotite, pyrargyrite, pyrite, gold, and electrum.

The new gangue minerals resulting from the hydrothermal replacement process are chiefly:

- Adularia
- Alunite
- Jarosite
- Kaolin
- Pyrite
- Pyrrhotite
- Quartz
- Calcite

The early day ore, which was primarily about all in the oxidized zone, was friable and free milling and is said to have run in value about 3/4 gold and 1/4 silver. Much of the gold was fine and of light weight. Nearly everywhere panning was resorted to during operations to determine whether the material hoisted should be shipped, milled or dumped as waste. In 1912 ore was regarded as of commercial value. At that time the larger part of ore values occurred in more or less isolated bodies. Although there were several stopes 150 to 250 feet in length 40 per cent of the ore they contained was too low grade to ship, which fact evidenced the need of adequate milling facilities.

Large volumes or lodes of the adjacent wall rock now consist of white silty or talcy gouge-like material traversed by stringers and veinlets of...
parts which examination shows to consist of about 80% of amorphous kaolin distributed throughout which and also traversing it as slender veinlets is a later sericite or sericitic mineral constituting about 20% of the whole. The pale kaolin contains also a little crystalline alunite and perhaps also some crystalline alunite, but, in general, it is not sulphate enough to contain much of this mineral.

In some instances, as in the Black Eagle mine, the gangue of the vein which here is from 5 to 20 feet wide is largely almost pure alunite, as shown in Fig. 60, (micro photo of Spec. 317).

The following chemical analysis of this specimen further shows it to be alunite of good grade with a potash content of 8.36% which is relatively high compared with the well-known Marysville, Utah, alunite which runs about 10%.

\[
\begin{align*}
\text{H}_2\text{O} & : 110^0 \text{ C.} \\
\text{Cu} & : \text{trace} \\
\text{Mg} & : 1.5 \\
\end{align*}
\]

As the alunite is of good grade and seems to occur in considerable quantity in the Black Eagle mine which is being worked for precious metals, it may prove to be of economic value for the potash content as a by-product.
Analysis of alunite (Spec. 317)

From the Black Eagle Mine, Rawhide District, Nevada.

Analyst, H. B. Hicks

$\text{SiO}_2$ 1.24
$\text{Al}_2\text{O}_3$ 36.90
$\text{SO}_3$ 36.50
$\text{Na}_2\text{O}$ 2.32
$\text{K}_2\text{O}$ 8.36
$\text{H}_2\text{O}$ 110° C. 0.20
$\text{H}_2\text{O}$ 110° C. 14.17
$\text{Cu}$ trace
$\text{Mg}$ trace
99.69

As the alunite is of good grade and seems to occur in considerable quantity in the Black Eagle mine which is being worked for precious metals, it may prove to be of economic value for its potash content as a by-product.
Elsewhere, as in Balloon Hill, fractures in the rhyolite are cemented by
inlets of alunite, Figs. 57 and 58 (spec. 342 and 342-A). In Fig. 58 the
unooth layer of quartz lining both walls of the veinlet with its long prisms
and comby structure projecting into the body of the veinlet which is mainly
alunite show that deposition of the quartz took place in open space and
that deposition of the alunite followed that of the quartz.

The microscope shows the alunite to be locally dimly banded, but not
sufficiently definite to prove that it was deposited and crystallized in
successive layers from the walls inward. More likely it was deposited by and
following crystallization from a solution which deposition of the quartz completely
filled the fissure. This view is favored by the fact that the alunite is
more perfectly crystallized in the middle of the veinlet than toward the
walls. Some of the alunite crystals have embayed borders as if corroded by
an acidic solution. In the alunite occur a few fragments and minute crystals
of quartz, grains of gold, and bits of wire silver.

In the mine and in the hand specimen the alunite, though nearly white,
as a slightly reddish tinge, is less greasy or talcose to the feel and is
harder and has a more hackly to sub-conchoidal fracture than the kaolin.

Where the kaolin is drab or dark it is commonly called "blue mud". As
clearly report the best of the ore which as a little gray or brown and
which of the kaolin bodies in both the lodes and wall rock is good-grade ore
it is inferred that the ore metals and minerals were deposited by the same
solutions that caused the hydrothermal alteration of the rock.

Accompanying and closely following the hydrothermal alteration there
were also formed in the kaolin and rocks small veins and stringers of quartz
tongue side of which commonly occur streaks and sheets of ore, forming in some
instances a kind of stock-work, Fig. 61, (Photo 23-1677). Along and 250 feet
north its west side concave or amphithetical in outline. It is composed
Much of the ore in the several zones occurs also as replacement in reddish un-stained rhyolite or related rock and in quartz replacing the rock, as in fig. 62, (Spec. 408, from the Phoenix shaft), the ore minerals being argentite, margarite, electrum, and gold including free gold.

As the mines and prospects of the district numbering more than 200, Fig. 63, claim map, are too numerous to all be described here, the following description of a few of them is given in order to convey a general idea of the deposits and workings as a whole. The general distribution of the more important mines is shown on the large-scale claim map, Fig. 64. As much of the ground was worked in small blocks under the lease system and has several times changed ownership and name, effort will here be made to designate any given deposit or opening by the name under which it is most generally known.

East zone

The most important of the deposits occur in the East or Balloon Hill zone, - in Grutt, Balloon and Murray Hills and vicinity which has also made most of the production. The veins and lodes in general trend northeasterly diagonally across the trend of the zone which is a little west of north and the prevailing dip of the lodes is steeply southeast.

Balloon Hill

Nevada New Mines Company Mine

The most important of the deposits occur in Balloon Hill near the middle of the zone which, as shown in fig. 64, Claim map, and fig. 53 (panoramic photo), is an elongated hill nearly a half mile long and 250 feet high with its west side concave or amphitheatrical in outline. It is composed
mainly of the Balloon Hill rhyolite afore described. But the lower half of the east slope of the hill and also that of Grutt Hill is the greenish massive silicified dacite tuff.

The deposits and mines are nearly all owned by the Sheeline estate. They were last worked on any considerable scale by the Nevada New Mines Company and subsequently by lessees. Only partial figures of production are available, two of which follow.

Production

Production of the Nevada New Mines Company's mines, which constitutes the principal production of the Rawhide District, as supplied by the company:

| Mine Name                  | Gold Ounces | Silver Ounces | Production
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tourmaline</td>
<td>22,512</td>
<td>923,533</td>
<td>41,907,327</td>
</tr>
<tr>
<td>Old Mining Company</td>
<td>170,53</td>
<td>9,241,73</td>
<td>1,870,33</td>
</tr>
<tr>
<td>Good Diamond</td>
<td>470</td>
<td>17,822</td>
<td>283,340</td>
</tr>
<tr>
<td>Silver &amp; Merigold</td>
<td>1,562,65</td>
<td>28,756,92</td>
<td>4,794,00</td>
</tr>
<tr>
<td>Ruby Bear</td>
<td>1,062,23</td>
<td>29,126,16</td>
<td>3,000,00</td>
</tr>
<tr>
<td>Big Rawhide</td>
<td>2,551,36</td>
<td>37,675,65</td>
<td>6,000,00</td>
</tr>
<tr>
<td>Rawhide, Miller</td>
<td>1,191,67</td>
<td>24,657,45</td>
<td>4,000,00</td>
</tr>
<tr>
<td>Cassine</td>
<td>410</td>
<td>9,000</td>
<td>800,00</td>
</tr>
<tr>
<td>Mine</td>
<td>378,51</td>
<td>8,616,57</td>
<td>1,000,00</td>
</tr>
<tr>
<td>Ly and Naper</td>
<td>3,24</td>
<td>64,136</td>
<td>7,000</td>
</tr>
<tr>
<td>Total</td>
<td>16,369,43</td>
<td>$239,618,47</td>
<td>280,940,00</td>
</tr>
<tr>
<td></td>
<td>27,650,73</td>
<td>$421,825,55</td>
<td>103,433,25</td>
</tr>
</tbody>
</table>

Average recovery from all ore treated, $23.87 per ton.

Rush Hill Mine contained million over from $1.20 gold to $1.80 gold per
which silver ranged at 10 cents. The highest in gold came from Hooligan
ore from the mint was also high in gold.
### Rawhide Queen property

<table>
<thead>
<tr>
<th>Lease</th>
<th>Tons ore</th>
<th>Gross returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trutt Balloon</td>
<td>967.67</td>
<td>$53,184.93</td>
</tr>
<tr>
<td>Tronac</td>
<td>23.87</td>
<td>4,050.01</td>
</tr>
<tr>
<td>St. Ives</td>
<td>92.9</td>
<td>633.26</td>
</tr>
<tr>
<td>Gold Mines Co.</td>
<td>25.71</td>
<td>963.44</td>
</tr>
<tr>
<td>Phoenix</td>
<td>4,086.91</td>
<td>78,213.69</td>
</tr>
<tr>
<td>Farms No. 2</td>
<td>276.99</td>
<td>15,946.05</td>
</tr>
<tr>
<td>St. Ives Co. own work</td>
<td>169.88</td>
<td>11,989.97</td>
</tr>
<tr>
<td>Sills and Sisson</td>
<td>1.00</td>
<td>2,008.42</td>
</tr>
<tr>
<td>Victor Stanquist, K. 2</td>
<td>646.39</td>
<td></td>
</tr>
<tr>
<td>Drags from leases</td>
<td>192.39</td>
<td></td>
</tr>
<tr>
<td>Cyanide product from filings and ore bought</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6,473.23</td>
<td><strong>$239,476.07</strong></td>
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</table>

### Rawhide Coalition property

<table>
<thead>
<tr>
<th>Lease</th>
<th>Tons ore</th>
<th>Gross returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trutt Hill Coalition</td>
<td>152.47</td>
<td>5,118.60</td>
</tr>
<tr>
<td>Trutt Hill Mint</td>
<td>1,036.02</td>
<td>36,094.67</td>
</tr>
<tr>
<td>Dayton Toledo</td>
<td>22.55</td>
<td>151.80</td>
</tr>
<tr>
<td>Trutt Mining Co.</td>
<td>179.80</td>
<td>9,321.75</td>
</tr>
<tr>
<td>Billand Rickard</td>
<td>.70</td>
<td>151.81</td>
</tr>
<tr>
<td>Alabama &amp; Marigold</td>
<td>1,562.43</td>
<td>38,710.39</td>
</tr>
<tr>
<td>Agent</td>
<td>17.25</td>
<td>187.35</td>
</tr>
<tr>
<td>Zion</td>
<td>102.00</td>
<td>316.98</td>
</tr>
<tr>
<td>Trockey Rawhide</td>
<td>1,052.99</td>
<td>20,425.16</td>
</tr>
<tr>
<td>Trrett Rawhide</td>
<td>3,952.28</td>
<td>33,876.15</td>
</tr>
<tr>
<td>Trutt Hill Truitt</td>
<td>86.65</td>
<td>5,267.84</td>
</tr>
<tr>
<td>Victor</td>
<td>4,862.67</td>
<td>55,803.93</td>
</tr>
<tr>
<td>Nevada Rawhide, Miller</td>
<td>1,525.67</td>
<td>28,999.65</td>
</tr>
<tr>
<td>Yellowstone</td>
<td>.10</td>
<td>130.00</td>
</tr>
<tr>
<td>Iron Chance</td>
<td>6.00</td>
<td>83.59</td>
</tr>
<tr>
<td>Portland</td>
<td>378.51</td>
<td>4,877.51</td>
</tr>
<tr>
<td>Sills and Monger</td>
<td>2.26</td>
<td>378.36</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6,472.60</td>
<td><strong>$239,885.47</strong></td>
</tr>
<tr>
<td></td>
<td>27,884.26</td>
<td><strong>$239,885.47</strong></td>
</tr>
</tbody>
</table>

Average recovery from all ore treated, $20.57 per ton.

Nevada New Mines Company's bullion runs from $1.20 gold to $11.50 gold per ounce with silver priced at 59 cents. The highest in gold came from Hooligan Hill. Some from the mint was also high in gold.
In June 1913 the Nevada New Mines Company had an authorized capitalization of $1,200,000 and owned nearly 200 acres of lode mining claims from which it had produced from surface or shallow workings about a half million dollars. Also much additional property of which the surface equipment amounted to $70,000 included a 10-stamp mill fully equipped and which was making extraction of 94%, etc. The property contained more than 37,000 feet of workings. The total production by that date was 27,884 tons of ore that yielded a gross return of $573,749. The average recovery of all ore treated at $20.57 to the ton.

In the vein map, Fig. 65, the veins in general trend north-south with moderate curvatures or concavities to the northwest and are paralleled by several neighboring veins. They lie almost entirely in the Balocek Hill Block, but on the southeast as shown in the extension of the Grant-Balocek vein. On the 200-foot level at about 30 feet beyond the Phoenix vein, the Balocek Hill pyrite is succeeded by a reddish iron-stained dacite tuff.

In June 1913, the Nevada New Mines Company had an authorized capitalization of $1,200,000 and owned nearly 200 acres of lode mining claims from which it had produced from surface or shallow workings about a half million dollars. Also much additional property of which the surface equipment amounted to $70,000 included a 10-stamp mill fully equipped and which was making extraction of 94%, etc. The property contained more than 37,000 feet of workings. The total production by that date was 27,884 tons of ore that yielded a gross return of $573,749. The average recovery of all ore treated at $20.57 to the ton.

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Veins

The chief veins are the Phoenix, Proskey, Victor, Grutt-Balloon, Kearns, and New veins.

The two principal veins are the Phoenix and Victor veins. They rank among the early-day producers. Their combined production to August 1, 1913 was 16,473 tons of ore having a gross value of $257,875. They lie mostly just southwest of the central point of Balloon Hill and vicinity.

The Phoenix lease and vein lie mainly on the Rawhide Queen property and the Victor on the Rawhide Coalition property. They are nearly parallel, the Phoenix vein, which is the most southerly one, being the stronger and more important. They are opened through a horizontal extent of 1,000 feet and to the maximum depth of 760 feet mainly by the Grutt-Balloon, New, Old Kearns, Phoenix, Proskey, and Victor shafts, named in order beginning on the northeast. They are mostly southwest of the central part of Balloon Hill.

As shown by the level map, Fig. 65, the veins in general trend northeast with moderate curvature or concavity to the northwest and are paralleled by several neighboring veins. They lie almost entirely in the Balloon Hill rhyolite, but on the southeast as shown in the extension of the Grutt-Balloon Hill crosscut on the 500-foot level at about 30 feet beyond the Phoenix vein, the Balloon Hill rhyolite is succeeded by a reddish iron-stained dacite tuff (Spec. 54.0).
In this part of the mine the foot wall rock of the Phoenix vein is locally marked by flow bedding or joint planes, or probably both, dipping about 30° northerly. These structures appear also on the same side of the Victor vein and fissure but are not apparent on the northerly side of either vein. The structures are even more pronounced on and below the 600 level as shown in No. 4 winze on the southerly side of the Phoenix veins. They are probably due to northwest-southeast stresses having been greater on the southeast side than on the northwest side of the veins.

On the northeast at the surface the two veins are about 100 feet apart, the apex of the Phoenix vein being at the Old Kearns shaft and that of the Victor vein near the New Shaft 100° NW. However, as the veins converge toward the southwest and the Phoenix vein dips 80° NW while the Victor stands about vertical or in places dips steeply southeast the veins in depth to the east of the Proskey shaft on the 500-600-foot levels and vicinity become urged for the horizontal distance of about 50 feet, the mergency being more directly due to local curvature in strike than convergence in dip. The ore from this joined stretch of the two veins was mostly sulphide and is said to have been of more than average richness.

The veins in general average about 3 feet in width and are composed mainly of quartz and altered and in large part replaced and mineralized rock. For instance, the Phoenix vein in the eastern part of the mine is about 5 feet wide and consists of more or less crushed and in part silicified pyolite and quartz with parallel stringers of quartz. Here as shown in Fig. 66 (Stope diagram), the vein for the horizontal distance of 250 feet standing eastward from near the Phoenix shaft has been mined from the surface to the 650-foot level, and was mostly ore which averaged $15 to the ton. The
At Kearns shaft and vicinity, 150 feet east of the Phoenix shaft, the Phoenix vein, for the horizontal extent of 120 feet and from above the 150-foot level to below the 275-foot level, was about 3 feet wide and nearly all $20 rated. This section of the mine from the surface down to the 325-foot level produced $80,000. However, for 180 feet to the southwest of this section, vein especially on the 275-foot level and vicinity, the metal and ore occurred very irregularly in sections and pockets and beyond the Proskewy shaft occurs much faulting and gouge. Middie part of its course between the Phoenix shaft and the Balloon shaft, fig. 65, which is one of the main working shafts, has a com extent of 680 feet (of which 500 feet is to the south and 180 feet to the north of the crosscut). It is continuous with ore still in both ends, and good grade mill ore the greater portion of the entire distance.

In the Phoenix vein on the 500-foot level occurred a rich ore shoot of unusual mineralogical interest from standpoint of open space bilateral disposition. It varied from 6 to 15 inches in width and had an extent of more than 20 feet. Extending through its middle part was a parallel open crevice, fissure, or so-called water course whose walls on either side are lined with very quartz and solid masses of argentite and ruby silver (proustite) which carries considerable gold. Some samples are said to have assayed as high as $1,000 in gold to the ton.
On the 600-foot level the ore in the Phoenix vein was about all sulphide and averaged about $25 to the ton. Considerable ore was stope southwesterly from Station 511 between the Ruhlahmmx Proskey and the Phoenix shafts.

In the Phoenix vein on the 600-foot level occurred 1½ inch shoot or stringer of very rich ore which contained much argentite thoroughly impregnated with visible particles of free gold in a siliceous gangue.

In the ground here considered there was also mined the so-called New vein thought to be a branch of the Victor vein, which apaxes near the collar of the Phoenix shaft dips 80° SE toward the Phoenix vein, but does not extend to great depth. Along the middle part of its course between the Phoenix shaft and the face of the drift 200 feet to the northeast and from the surface nearly to the 80-foot level, it was about 3 feet wide and was nearly all $25 ore. At near the face of the northeast drift, however, the vein as seen by the writer passes into faulted, crushed and in part tufaceous country rock rhyolite where the ore decreases in tenor to $6 or less to the ton, and the vein finally dies out or becomes lost by faulting.

South of the Phoenix shaft on the 26-foot level, the minimx vein carried a 2-inch streak of ore which for the extent of about 40 feet averaged $1,000 to the ton.

At the Phoenix and Proskey shafts and vicinity the country rock is mostly rhyolite breccia and shows considerable faulting with gouge along the fault planes. In many places the degree of brecciation increases toward the vein, is associated a little ruby silver or pyrite in bodies ranging to the size of a pea, and free gold readily visible with the pocket lens.
Work done by lessees on the Phoenix vein in a comparatively short period which ended about June 1913, developed a large well-defined ore body about 600 feet long which on the Phoenix lease extended to the depth of 325 feet, in the Profkey lease to the depth of 150 feet, and on the Victor lease to the depth of 300 feet. Up to the time these leases expired they had produced under very adverse conditions more than $154,000 in bullion. The Company at this time estimated that between the 500-foot level as then opened and the surface it had 20,000 tons of $20 ore.

Where the two veins are merged on the 500-600 levels and vicinity they are together about 6 feet wide, the Phoenix being a little more than 3 feet at the Victor a little less. Where seen in 1916 at the "new strike" in the section of the 70-foot winze sunk from the 600-foot level at the eastern edge of the mergency of the veins the two veins dipped about 65° to the northeast were separated by about a foot of slightly pyritic country ark rhyolite (Spec. 541) including which the two veins together were about 6 feet wide and carried ore nearly all the way across. The principal showing, however, was a width of about 1½ feet of fairly rich dark or mottled sulphide ore (Spec. 542) on the hanging wall side of the Victor vein of which 6 inches, being a gangue of fairly loose quartz, was estimated to carry about 1,500 oz. silver to the ton. The ore shoots and ore consist mainly of quartz and associated pyritic altered and replaced silicified rhyolite or rhyolite breccia, locally irregularly streaked or banded. The chief ore mineral is argentite with which is associated a little ruby silver or proustite in bodies ranging to the size of a pea, and free gold readily visible with the pocket lens.
The more siliceous or quartz portions of the vein are drusy and conby
structured and contain cavities lined with crystalline quartz, pyrite, and
miller, and partly open parallel spaces or water courses several inches
long containing quartz crystals up to an inch long and 4 inch in diameter
and elsewhere lenses of coarse barren quartz 5 inches long by 1 1/2 inches wide,
the last mineral to be deposited.

Similar though not so good showings occur on the footwall side of the
Phoenix vein, while the intermediate part of both veins is more or less
streaked with stringers and seams of lightish kaolin or so-called "talc",
illomite, and quartz up to an inch wide which nearly always carry values,
horn silver or cerargyrite frequently being found in them, especially the softer
ones. This rich ore was first found just below the 600-foot level from which
point it continued downward to the bottom of the 70-foot winze.

Contained in the ore shoot and veins are inclusions of a pinkish or
reddish rhyolite (locally called "syenite", Spec. 544) which seems to be a
post-vein intrusive and related to the east ridge rhyolite. The vein,
especially the rock breccia portion, is frozen to the country wall rock with,
however, seams of quartz along the contact some of which are in part open.

The deepest mining done at exposure of ore in the Ryndie district
is on the Victor vein at the depth of 760 feet, at a point about 250 feet
northwest of the Victor shaft or 75 feet southwest of the Proskey shaft.
Here on the 750-foot level a body of good ore said to have averaged 3 feet
in but narrowing toward the southwest and downward was stope for the
horizontal extent of about 130 feet, Fig. 67 (Stope diagram). Also from each
boundary of the stope a 10-foot winze was sunk showing the ore shoot to
mine to at least 10 feet below the 750-foot level. The bottom of the
east winze as seen by the writer in 1920 contained a width of 3 feet of ore estimated to run about $20 to the ton and the southwest winze contained inches of ore of about the same grade. The ore is in part banded and consists chiefly of light, dark-gray and in part yellowish and greenish brecciated quartz and altered rock with much sulphide, - pyrite and black silver sulphide minerals chiefly argentite. The yellowish and greenish stain which heavily coats slickenside surfaces is probably jarosite.

The microscope shows the ore to contain considerable vein quartz both coarse and fine in altered crude bands mostly in anhedral crystals and grains and includes also considerable orthoclase or sanadine. Many of the larger quartzes are feathery or flamboyant with zonal growths made up of multi-small quadrangles similarly as shown in Fig. 36. The pyrite is mostly fine-grained and tends to occur along the contact of the quartz banding, and with it in places is associated argentite.

Some of the ore, (Spec. 690), in the winzes at depth of 760 feet is dark-gray nearly coarse salt-pepper resembling a recemented pyritic mixture of crushed vein material and ore. On parallel joint planes or slickensided surfaces it is stained a pronounced greenish-yellow with jarosite.

Here on the 750-foot level the southeast or footwall rock is a pinkish silicified my fine-grained nearly apahanitic firm lithoidal devitrified, silicified and recrystallized rhyolite (Spec. 688), and is sparingly pyritic but too altered for satisfactory determination. The northwest side or footwall rock is quite different in appearance, though it too is rhyolite. It is greenish gray medium-grained porphyritic devitrified, silicified and recrystallized rhyolite matrix (Spec. 687). It contains fragments of other rock up to .2 of an inch in diameter and is pyritic throughout, especially along cracks where the
pite forms veinlets. The groundmass is more crystallized than in the
normal rhyolite (Spec. 544) in No. 4 winze to which it seems to be related.

The narrowing of the ore body toward the southwest in the stope on the
200 and 750-foot levels and between the two winzes sunk between the 750-foot
level, from 3 feet in the east winze to only 8 inches in the west winze seems
to indicate that the vein is pinching out toward the southwest and also with
increase in depth. However, as the vein may again widen in this direction and
contain workable ore bodies a reasonable amount of exploratory work should be
done before abandoning this part of the mine. The vein similarly pinches out
also on the 500 and 600-foot levels.

From the 80-foot stope beginning at about 40 feet east of the Victor
shaft and extending from the surface to the depth of 130 feet, Fig. 67, lessees
from January to mid-June, 1920, mined out $15,000 worth of ore. Here the vein
is said to have averaged about 3½ feet wide, and the ore shoot varied
from 2 to 5 feet in width. Its principal or richer part was ¼-inch width
forming the south (here the hanging) wall side of the vein.

In 1928 the Phoenix-Victor mine was reported to have been recently
flooded and partially filled with wash or surface debris by a cloud burst.

Other deposits in Balloon Hill

Among the other deposits or leases in Balloon Hill and vicinity are
those of Grutt-Balloon, Kearns No. 2, Crown, Dromiac, and Morning Star.

Grutt-Balloon lease

The Grutt-Balloon lease joining the Phoenix on the northwest had by 1913
produced $50,000 under lease more than $53,000. The mine is opened to the
30-foot level, but the main workings do not extend much below the 350-foot
level. The vein or lode strikes about N. 22° E. and in general stands about
vertical, though, in places it dips steeply to the east, Fig. 65. It lies in
the Balloon Hill light-colored rhyolite much of which is tufaceous or brecciated,
and is opened through a horizontal extent of about 200 feet. It averages
about 2 feet in width but in places as on the 113-foot level south ranges up to
3 feet, and in places is encased in fault breccia gouge. The shoot in the
vein, however, averages only a few inches in width and ranges from 1/2 inch
to about 6 inches in width. The vein in places is branched or broken, and
in the 180-foot level where it stands nearly vertical it is intersected at
an angle of 20° by another vein which also is vertical.

The vein is composed mainly of brecciated, altered and mineralized
rhyolite and quartz with locally associated calcite and seams of whitish galena.
The deposits on this lease are said to contain more calcite or spar than those
in any other lease. Pyrite appears in places in both the vein and country
rock on the 250-foot level and is more plentiful on the 350-foot level, where
a pinches out to a mere seam in oxidized manganese and iron-stained light-
infused rhyolite, which pinching, however, seems to be due in large part to
lining.

On the 180-foot level in the drift at 120 feet south of the shaft the
vein is composed mostly of good ore, while the remaining several feet of
face is mostly coarse silicified pyritic breccia.
On the 350-foot level the vein for the extent of about 60 feet in the southern part of its course contained a 1/2 inch to 1-inch wide seam of dark sulphide ore that ran $200 to the ton, and the winze sunk from here to the 300-foot level is said to have had good ore all the way down.

In 1920 the mine was being worked by lessees who reported having just shipped from the 200-foot level 6 tons of ore that ran $833 to the ton.

Kearns No. 2 Lease

The several Kearns leases on Balloon Hill were among the richest in the camp. Some shipments of their ore averaged more than $300 to the ton.

The Kearns No. 2 lease on the Balloon Fraction claim northeast of the Phoenix mine was an important producer, having produced more than $43,000 by 1913. It is famous for its production of rich ore and hand specimens which are claimed to have been instrumental in promoting the Rawhide boom.

The deposits lie in a nearly east-westerly mineralized zone from 10 to 25 feet wide mostly in the white clay or soft mud formation but partly also the fine banded molybdenum. In this zone the ore occurs in irregular bodies partly in the soft rock. On the upper levels much of the white talc-like rock was profusely disseminated with free gold.

The deposits are opened to the depth of 400 feet by 5 levels as shown Fig. 56a. (Turner section).

The rich surface ore continued to below the 100-foot level and some could be worked on the 200-level, which lies about 75' below 2 feet of partially covered the 200-foot level.

Also the Kearns No. 1 lease just north of the Phoenix shaft produced rich ore from mostly shallow workings.
The Crown Mine

The Crown, also known as the Coalition Crown, mine is located about 500 feet west of the Grutt-Balloon Hill mine near the site of the old Rawhide mill, Fig. 64 (Large claim map), and Fig. 53 (Pan. Photos 24-26).

It is opened to the depth of 460 feet in rhyolite chiefly on the 300-foot and 460-foot levels, of which the former is the more important and contains about 500 feet of work including a 180-foot drift east, crosscuts and stopes, and has produced 100 tons of low-grade ore running about $5 to the ton, Fig. 69 (map of 300-foot level).

The shaft stands in relatively firm rhyolite, but beginning at about 30 feet east of the shaft on the 300-foot level there is a 100-foot north-south belt of blue mud rock which is also prominent on the 460 level, Fig. 69. On the east the blue mud rock is in fault contact with a 20 to 50 foot wide belt of oxidized and partially mineralized brown and blackish iron and manganese stained white rhyolite which is loose, locally gritty with easterly dipping structure, and contains irregular bodies of the low-grade ore that milled from $6 to $6 to the ton from the 50-foot crosscut running north from near Station 436 at the end of the drift and the stopes and raise extending from 15 to 50 feet southward in the south crosscut. Some of the ore contained considerable silver. In the stope associated with the ore occurs also some siliceous rhyolite breccia.

The fault with a good footwall dips about 70° E. with 2 feet of partially oxidized gouge on its hanging wall side which is shown in the roof of a south crosscut and slickensides lies nearly horizontal or pitch gently southward.
The principal work done on the 460-foot level is a crosscut which from
shaft extends S. 70° E. for the distance of 225 feet where it terminates
in a gray, coarse-grained rhyolite breccia which contains a few small cubes of
pale disseminated through it. In places the rock also shows considerable
sericitization. A general sheeting or pressure-planes structure dips easterly
in the rock is much slickensided horizontally. The microscope shows the rock
to be about 80% greenish cryptocrystalline to glassy base with flowage structure
in which are contained the remaining 20% of the rock which consists
mainly of what formerly were crystals and fragments of crystals of orthoclase,
quartz, and a few small foils of biotite. But the orthoclase is now mostly
replaced by adularia and sericite and the biotite altered and bleached to
the greenish nearly colorless chlorite. The orthoclase and some quartz
are traversed by veinlets of sericite, and good examples of sericitization
beginning along cracks in the feldspar are shown.

Dromiac Lease

The Dromiac lease in the south end of the Balloon Hill claim in its
early day work at the depth of 60 feet is said to have had 3 inches of high-
grade ore running several dollars to the pound with good pay ore nearly all
the way across the shaft.

Morning Star mine

The Morning Star mine owned by Charles McLeod and associates
located in the extreme south base of Balloon Hill on the Morning Star
section claim, Fig. 70 (Trace map). It was discovered in 1908, and up to
1933 it had been worked mostly by lessees and had produced about $20,000
worth of ore, the most of which was treated in the Rawhide Coalition mill.
From 1913 to 1920 the mine made a considerable production under lease and to P. O. Brien, President of the Black Eagle Mining Co, the hard ore being used in treating the soft kaolinized and alunitized ore of the Black Eagle Mine in the 20-stamp sluices Black Eagle mill built in 1913 on site of the old mill. At the time of visit in June 1920 it was worked jointly by lessees George Frost and Gus Miller who had then been mining it for about 6 months and had taken out 300 tons of good-grade ore of which they shipped 115 tons that ran $4.60 to the ton and 2½ tons of screened ore that ran $1,000 to the ton. There was also said to be accumulated at this time about 220 tons of $25 ore.

The most of the production came from between the 50 and 150-foot levels, the O'Brien stope and the Froast-Miller stope. The latter being about 10 feet south of and at a higher elevation than the former, extending from the 30-foot level up to the 50-foot level. It yielded most of the Froast-Miller section, the cracks and veinlets, and secondary quartz, sericite, and pyrite and furthermore pyritic with very fine-grained pyrite disseminated throughout the ore. (\(249\))

The country rock is the Balloon Hill rhyolite as shown best on the root level. It also has been crushed or brecciated and consolidated or cemented by veinlets and seams of secondary quartz, sericite, and pyrite and furthermore pyritic with very fine-grained pyrite disseminated throughout the ore. (\(249\))

The deposit or so-called vein is a mineralized fault breccia zone or lode-strike about N. 20° E., dips 65° E. and has several offshoots or branches. It has an extent of several hundred feet, ranges up to 32 feet in width, and is thought may connect with the deposits of the adjoining Dromiac mine north.
The vein when seen had no prominent or visible croppings to speak of. Theальнatar of the shaft is only about 25 feet above Rawhide wash, and to the south course of the vein soon passes beneath a covering of wash debris.

The vein is opened by a shaft, drifts and stopes to the depth of 250 feet. It is composed of crushed and consolidated brecciated rhyolite in part silicified in replacement quartz, all more or less well oxidized and stained light reddish yellowish brown (Spec. 248). In places it is traversed by "water courses", obnizt stringers, and seams, or bunches of them, and these siliceous bodies are the best values. They are more abundant on the lower than upper levels, seem to converge and die out toward the surface, which seems to indicate that they were deposited by ascending solutions. Crystalline calcite and barite are most present in the upper workings. The values are about 70 per cent gold and 30 per cent silver.

The deposits differ markedly from those of Hooligan Hill, which are restricted to the cracks and seams and replacements in the face of the adjoining rock. Here the values penetrate and are disseminated throughout all the material, even including contained fragments or blocks and cobbles of rhyolite several inches or more in diameter. "Enlarging the vein splits into two similar slips."

The richest part of the lode "or core" is a lead or ore shoot about 3 feet that is followed by the drift on the 150-foot level. Here in the southern part of the mine, from a block of ground extending from the bottom of the 140-foot level to the top of the 60-foot stop, considerable rich ore averaging $200 to $250 per ton was mined.

The portion of the vein which had lately been crosscut and sampled to the small side of the "core" is 22 feet wide, and beginning at the main ore shoot core averaged as follows:
The first 12 feet, including $12 to the ton,
the next 6 feet, 8 to the ton,
the remaining 4 feet, 5 to the ton,
and which, the foot wall country rock, (similar to specimen 249) carries from
$3 to $4 to the ton, as does also the shaft it is said all the way down.
The part of the vein to the hanging wall side of the "core", and which
also well, has not yet been sampled by the present management.
On the 250-foot level the vein is 32 feet wide and averages about $10
the ton, including everything from wall to wall. But little more has been
here than to crosscut and sample the vein. Here as shown on the tracing,
also a small vein which strikes N. 20° W. and carries fair grade ore
a width of 1 to 3 feet.
On the 150-foot level somewhat more work has been done than is represented
Fig. 70 (Trace map). A crosscut had recently been driven across the vein
the small middle stope. And south of the main workings shown on the
considerable work extending from the 150-foot level above to the 50-foot
or nearly to the surface was done about 1920 or slightly earlier. Here
the 150-foot level south of the OBrien stope the vein splits into two similar
or branches which diverge southward, the main part of each branch varying
8 inches in width to a stringer or mere seam following an irregular frac-
the rhyolite. The right or west branch was slightly the more promising,
principal or most valuable part is a 1/4 inch to 2-inches wide band composed
mix bluish quartz, altered rock, replacement barite and dark metallic ore
running about $1,600 in silver and gold to the ton (Spec. 675), the
of the two valuable metals present being about 11 oz. silver to 1 oz. of
The miners report that it is not rare to find ore running 300 oz. in
fer to the ton and that a 1/4-inch wide seam of the bluish quartz ore yields operator good wages. The remaining 2 to 4 inches of the branch consists only of crushed altered talcose ore-bearing rock which concentrates 3 into 1 ru- ming $50 to the ton.

Grutt Hill

Grutt Hill situated just north of Balloon Hill is a nearly round hill about 40 feet in diameter and 200 feet high, Fig. 53. Like Balloon Hill it is composed chiefly of rhyolite including much of the mud rock formation. The Grutt Hill orebody, 577 feet long extending in a north-northwesterly course almost through the base of the hill, shows the first 90 feet of the course to be in the mud rock and most of the rest in the flow-banded Balloon Hill rhyolite, Fig. 64, large scale claim map.). The Hill was early noted for the occurrence of rich stringers in its upper part. The principal deposits are the

Grutt Hill mint

Grutt mining

Alabama and Marigold, all being part of the

wide Coalition property.

Grutt Hill Mint

The Grutt Hill Mint lease, commonly known as the mint, is at the edge of town in the southwest base of Grutt Hill. It is one of the early discoveries by August 1, 1913, had produced more than $36,000 worth of ore.

The country rock is mostly light-colored volcanic rocks, rhyolite and basalt, and they are nearly all tuffaceous and profusely altered hydrothermally mostly broken or disturbed, recrystallized, silicified, and traversed by

street cuts, mainly in the so-called Mint vein which strikes in a north-northwesterly course, and on a southwesterly course, are confined to rock fractures only 2 to 3 inches wide, of which only the narrow (No. 2) carry ore (Templeton) and in places as on the 142-foot level, ore occurs in numerous small parallel seams in the fractures rock (Templeton).
all stringers and seams of quartz and kaolin, and in places are pyritic with
and veinlets of fine-grained pyrite and difficult of determination. They
are mostly massive and in places show small-faulting and slickensides. The mine
opened to the depth of 533 feet, on 9 levels, Fig. 71 (Traced map).

On the 148-, 273-, and 373-foot levels the country rock is whitish rhyolite
and tuff. On the 373-foot level it corresponds closely to the banded
rhyolite in the upper part of Balloon Hill, except that it is more highly
altered hydrothermally. It dips about 20° NE. In the east crosscut north of
the shaft sheeting in it dips 60° N. On the 473- ("500") foot level the rock
mostly a gray rhyolitic or perhaps dacitic porphyry (Spec. 424) and is tufaceous.

At about 40 feet below the 473-foot level occurs a thickness of 8 or 10
feet of thin bedded tufaceous reddish "sandstone" dipping a little east of north
tnangles of about 20°, some of which occur also at slightly greater depth. But
the bottom of the shaft at depth of 533 feet is in hard silicified tuff. On
the 148-foot level occurs a body of dark earthy basaltic altered andesite
resembling greenstone, which intrudes the rhyolite chiefly at the
shaft, Fig. 71, but is present also farther to the north. It probably represents
an intrusive tongue or dike of the Black Butte andesite.

The deposits are contained chiefly in the so-called Mint vein which strikes
south 10° E. and dips 80° W. in the rocks which have been described. It is
regular, discontinuous and in places consists of 2 or 3 successive stringers
of ore (Thomas) and in places as on the 148-foot level
occurs in numerous small parallel seams in the fractures rock (Templeton).
It has been opened or explored through a maximum extent of 220 feet and to a depth of 530 feet, work being done on 9 levels the most of which, however, are short, the longest being the 148-foot level which has an extent of about 115 feet, and connects the mint with the adjoining Coalition mine on the south.

Ore was found in the crosscut of the 473-foot level, on which also the vein rock throughout is pyritic.

On the 58-foot level the vein was represented by a few small quartz stringers dipping parallel with the drifts and dipping about 70° W. On the 150-foot level the vein dips 80° W. and is opened for the extent of about 120 feet. It varies from a thickness of inches in the north drift up to nearly 3 feet in width near the upraise in the south drift, and is composed mainly of small stringers and seams of quartz within altered iron-stained rock. On the south side of the shaft it has been stoped for a length of about 30 feet and a height of 60 feet, beginning on the 180-foot level. Also north of the shaft it has been mostly stoped for the extent of about 150 feet. The vein and fissure with a good hanging wall show well in the stope about 30 feet above the face of the south drift and where the drift curves near the face.

On the 300- (295) foot level in the most of the drift extending 70 feet south of the shaft the vein consisting mainly of crushed iron-stained mineralized tuffite and irregular ore-bearing quartz stringers in crushed tuff dips 80° normally to the east and is stoped for the height of nearly 20 feet above the mine. On the north the ground has been mostly stoped down to and below the 295-foot level, about 15° N. and dips 85° W. It lies in the light-colored tuff lichens which in general is crushed and massive, on the lower

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[The text continues with detailed descriptions of mining activities and vein characteristics.]

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The vein and fissure with a good hanging wall show well in the stope about 30 feet above the face of the south drift and where the drift curves near the face. On the 300- (295) foot level in the most of the drift extending 70 feet south of the shaft the vein consisting mainly of crushed iron-stained mineralized tuffite and irregular ore-bearing quartz stringers in crushed tuff dips 80° normally to the east and is stoped for the height of nearly 20 feet above the mine. On the north the ground has been mostly stoped down to and below the 295-foot level, about 15° N. and dips 85° W. It lies in the light-colored tuff lichens which in general is crushed and massive, on the lower

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[The text continues with detailed descriptions of mining activities and vein characteristics.]

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On the 400-foot level in the small stope above this level north of the
vein, which was small, apparently consisted of crushed and mineralized
with considerable quartz. It dips 70° abnormally East. In the south drift
is 1/2 foot to 1 foot wide and is said to be locally very rich.

On the 500-foot level the main vein on which the shaft is sunk doesn't show
in the present workings but the "new vein" in the crosscut 75 feet to
northeast of the shaft and which is from 1 to 2 1/2 feet wide carries 3 inches
more of good sulphide ore (Spec. 425). The ore is a hard darkish-gray breccia
consisted of quartz and altered silicified rock. It is pyritic and drusy and
was said to run about $35 in silver and gold to the ton. Argentite and pyrite
were the chief minerals, however, there are two principal ore minerals.

Owing to the narrowness, irregularity, and discontinuity of the Mint vein
the sporadic occurrence of its ore it probably cannot be profitably mined
further, especially not to any great depth.

Grutt Mining Lease

The Grutt Mining lease is in the middle southwest slope of Grutt Hill about
300 feet east-southeast of the Mint. It was formerly worked by the Grutt Mining
Co. By August 1, 1913, it had produced more than $9,300, and is said to have
produced in total more than $2,733,000.

Vein

The vein which is said to be the same vein worked on the Alabama lease
in the south strikes about N. 10° W. and dips 83° W. It lies in the light-colored
Moon Hill rhyolite which in general is crushed and massive, on the lower
levels is altered and softened, and on the 200-foot level west is tufaceous,
(spec. 413), and just east of the shaft it is intruded by the green andesite
(spec. 417), which, however, is probably not genetically connected with the ore
The veins and its parts, branches or associated ore bodies are opened through an extent of about 300 feet and to the depth of 200 feet, mainly on the 150, 100, and 200 levels, Fig. 72, (Level map). The vein ranges from a few inches up to 3\(1/2\) feet in width but in places is interrupted, irregular or ill defined, and has been disturbed by faulting or movement. Extending from the 400-foot level to the surface is an irregular stope from which there is said to have been mined 250 tons of $57 ore.

Alabama Lease

The Alabama Lease joins the Grutt Mining Lease on the south and is on the same vein, than which, however, there are also present two subordinate ones, which on the 65 and 125 levels are situated respectively about 20 and 40 feet west of the main vein. The dip of the veins in general is about 80° W.

The production is reported to have been about $39,000, which figure, however, includes some ore from the Marigold Lease on which data are not at hand. About 1500 tons of the ore are said to have run nearly $25 to the ton.

The deposits lie in the Balloon Hill white rhyolite except that those on the 300-foot level extend into the blue mud formation on the west.

The main vein is opened to the depth of 400 feet on 8 levels, and the ore is said to be about all mined out down to the 350-foot level.

On the 65-foot level south the vein for a considerable extent contained workable ore shoots situated about 2 feet apart. Their gangue was quartz brecciated rhyolite.

Properties north of Grutt Hill

Among the properties north of Grutt Hill are the Bethania, Poor-Boy, Gold Hill, and Wash veins.
Bethania Mine

The Bethania, also called Queen Bethania, mine owned by the Bethania

pany of Yerington who formerly worked it, is in the easterly slope of a low

top northeast of Grutt Hill and which may be regarded as a southerly spur of

mount Black Butte, some of whose greenish andesite appears on the northern

ut of the property. It adjoins the Poor Boy group of several claims on the

orth and the Crystal Queen on the south, which collectively have been called

Queen Bethania group. The group is not known to have made much of a produc-

tion but is regarded by conservative mining men who are familiar with it as

very worthy of development. The property seems to have been idle since the

opy-day work was done on it.

Deposits

There are several veins on the property including the Bethania, Poor

old Reef, and Wash veins. They have been opened to the maximum depth of

0 feet by several shafts and several thousand feet of drifts and laterals.

by occur chiefly in or associated with the Bethania vein which strikes

ings

dips

30° E. and dips steeply NNW. The vein is on a fault fissure and varies

in a non-workable mere seam up to 2 feet or more in width. It is opened by

veral shafts to the depth of 200 feet and drifts. The vein and ore are

ually brownish iron stained breccia, Fig. 72a (Spec. 310) and the ore

ith is generally high grade, some running $1,600 max to the ton with the values

ly all in gold, occurs not only in the vein and seam but equally as replace-

in the facia! part of the wall rock. Some of the ore is cellular or

on the back or fault breccia and the values decreased to only a few dollars.

ish.
Poor Boy vein

The Poor Boy vein, which the mouth of the Bethania tunnel crosses with a fault zone on or near the west, strikes N. 12° W. dips steeply to the west and in general carries fair values in $10 to $16 ore.

It is a fault vein or lode composed mainly of mineralized fault breccia and crushed rock. Besides being opened by the cross cut tunnel it also has a foot winze sunk in it. On the Poor Boy ground to the north it is considerably developed by shafts and drifts and presents a good showing.

Gold Reef vein

The Gold Reef vein of the Gold Reef Mining Co. is about 20 feet wide and composed chiefly of quartz and siliceous low-grade ore which unlike most of the veins in the district does not pan well and consequently is not regarded with favor by the lessee. It strikes N. 30° W. and seems to be in fault at least on the rhyolite-green andesite contact. It is opened by a couple of shafts to the depth of about 200 feet from the north one of which a 200-foot long crosscut connects with the Poor Boy shaft on the west.

Wash vein

The Wash vein, located in the wash on the eastern part of the Bethania mining claim, strikes N. 32° E. and dips 50° NW. It also is on a fault zone on or near the rhyolite-green andesite contact. It is opened mainly by two closely spaced shafts, and is said to contain good ore. According to Mr. E. Nichols of the Black Eagle Mining Co., who worked the lease, the more northeasterly shaft is composed of rock and ore in a production of more than $17,000. It dips steeply to the north at the depth of 30 feet exposed a good 8-inch vein of $50 silver ore, which, however, in depth pinched out. The quartz was succeeded by rhyolite andesite and breccia and the values decreased to only a few dollars.
the ton, although the fissure retains its width. The adjoining southwest
flank shows the same vein with sporadic values.

Murray Hill deposits

The Murray Hill deposits are so named from the low hill they occur in
about just south of Balloon Hill. Murray Hill was early credited with
being some of the richest veins in the district. The hill is country rock
skolite, mostly brecciated and tuffaceous. The structure and sheeting strike
33° E. and dip 65° W. The deposits, their workings and ground, mostly owned
by the Rawhide Consolidated Mines Co., extend from Balloon Hill for a half mile
more southward down Rawhide wash nearly to the National Mill Hill, Fig. 63,
(mineral claim map), Fig. 53, (Photo panorama in right), and Fig. 73 (Murray
hill mines). The company, it is said, bought the property in the early Rawhide
times and became incorporated in October 1907.

The property comprises 13 claims of which by 1913 nine had been patented.
principal leases, openings or mines and their production then were as follows:

<table>
<thead>
<tr>
<th>Lease</th>
<th>Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murray shaft</td>
<td>292 feet deep,</td>
</tr>
<tr>
<td>Burbach &quot;</td>
<td>60 &quot;</td>
</tr>
<tr>
<td>Lillian &quot;</td>
<td>15 &quot;</td>
</tr>
<tr>
<td>Big Four &quot;</td>
<td>300 &quot;</td>
</tr>
<tr>
<td>Trilode &quot;</td>
<td>240 &quot;</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total:</td>
</tr>
<tr>
<td></td>
<td>$25,000</td>
</tr>
</tbody>
</table>

Murray Lease

The Murray Lease was formerly worked by Davis and Triplett. The vein is
worked with a production of more than $25,000. It dips steeply to the west
and is covered with siliceous skolite breccia. On the surface at 40 feet up the slope eastward
the shaft occur intrusive sheets or thin flows of dark gray drab and
bedded skolite dipping 30° E. Some is well banded and some is of the dense
ultramylonite.
variety. Here a branch or vein "feeder" comes in from east or footwall

In fact, the main vein has many feeders or stringers which join it at

angles mostly from the hanging wall x\(\text{minx}\) side on the west and are of

\(\text{minx}\) dip. The vein was early reported to be one of the best in the district.

is 2 to 30 feet wide and is nearly all good milling ore. It is composed of

\(\text{minx}\) and rhyolite breccia more or less replaced by quartz and the pay is nearly

in the quartz or siliceous portion of the vein. It probably meets the

shoring Morning Star vein in depth as the latter dips east.

The Murray Hill mill was built to treat the ore in this lease, but as it

no cyanide process it was not a success.

The shaft, 300 feet deep, is all timbered except 30 feet.

On the 30-foot level the vein stands about vertical, is 4 feet wide and

ists mainly of quartz replacing the rhyolite or rhyolite breccia and nearly

runs about \$17 to the ton which value is mostly in silver.

On the 100-foot level it dips 70° to the west, is 4 feet or more wide, and

about \$12 to the ton. It is siliceous and contains some water courses

druses in the quartz replaced breccia. The stope at 150 feet north of the

it is 15 feet wide and 30 to 40 feet or more long and high, and averages

to \$12 most of the way \(\text{minx}\) across. Beyond the stope the vein narrows

mere stringer and extends 30 feet to the face of drift in rhyolite breccia

(\(\text{Spec. 431}\)), where it is all altered brownish, oxidized, and soft.

At 120 feet in to lee of the stope, the vein is faulted 20 feet to the

and here the walls and fault plain show good fault gouge. To lee of the

a 30-foot crosscut to west shows softened \(\text{minx}\) mud rock and at the face

ly some white rhyolite with gypsum and a few bands of brownish altered

rhyolite or slate? (\(\text{Spec. 432}\)) dipping 40° NW. and containing calcite
the fractures. Rhyolite breccia extends 10 to 15 feet west of vein.

The crosscut 140 feet east of the shaft and vein is mostly in white
rhyolite and a short drift from it on the northeast shows in the white rhyolite
8-inch pale brownish quartz feeder or stringer which has also been stoped
upraised on and is said to average $14 to the ton. Beyond this point the
crosscut curves and extends 40 feet to right on which course it was expected
to tap the Lillian vein but it ends in the rhyolite breccia or tuff.

On the 200-foot level (not visited on account of defective ladders) the
vein is reported to be 30 feet wide and to consist mostly of $5 ore with also
some high-grade ore. The highest grade ore of the mine came from this level.

Here is less work on this level than on the 100-foot level. Some of it follows
the east side feeder or stringer.

On the 300- (292) foot level no work was done except that a station had
been started. Here the lower 2 or 3 feet of the shaft is in the sulphide zone
of white rhyolite? which is said to run $5.40 in gold and silver to the ton.

The production was mostly tied in the 100 and 200-foot levels.

The Lillian lease which adjoining the Big Four and Murray leases and is
owned by the Lillian shaft to the depth of 150 feet is developed mainly on
the 100-foot level and vicinity.

It contains 500 feet of drifts and laterals besides much stoping. Some
of the stopes are 60 feet high.

The vein strikes about north - south and is composed of a bunch of rich
stringers which, however, are irregular in continuity both longitudinally
and vertically, but the first 50 feet of the shaft was all in medium-grade
Considerable rich ore has been mined, but up to 1913 none had been shipped. The ore is siliceous and drusy (Spec. 433) and contains considerable so-called "picture" ore.

**Big Four Lease**

The Big Four Lease (not enterable as the ladders were dry rotted) is just west of the Lillian Lease in a flat of Rawhide wash. It has produced more than 1,000 worth of ore. It was formerly worked by Davis and Triplett. The vein contains about 1,800 feet of work including 600 feet of drifts and laterals. It is nearly all stopped from the 50-foot to the 200-foot level and has produced much ore which was shipped and milled, considerable of which was high-grade ore. At the time of visit there was not much ore in sight.

The production was mostly from between the 100 and 200-foot levels.

The shaft west of the wash is 240 feet deep, well timbered, and is said to contain ore, but has made no production.

**Aspinwall Lease**

The Aspinwall shaft on the upper northwest slope of Murray Hill near the King Star mine, is 300 feet deep, but has produced no ore, nor does it contain vein or ore so far as could be learned. It is said to have been sold for $1,000.

Some other lead minerals resulting from oxidation of galena, and small masses of massive quartz are traversed by calcite veining 1/2 inch wide.
Murray Hill stringers

In the west slope of Murray Hill are many rich quartz stringers or gash

ins, but their values seem to be surface concentrations only and do not continue

depth. obtained in the fault and joint planes and fractures, all being in a much

shattered state. Bodies of ore range up to nearly a foot in width.

Treasure Hill

Also Treasure Hill, the small hill one-third of a mile south of Murray

Hill, is said to contain some very rich veins and to have produced considerable

rich surface ore but that the values do not go down.

Outlying properties

Among the many outlying prospects of the East zone may be noted the

Titanic, Yankee Girl, and Nebob.

Titanic prospect

The Titanic prospect, which is a gold prospect owned by A. E. and Sam

Bull Bros., is 3 1/2 miles northeast of Rawhide in the lower northwest slope

of Big Kassock Mountain at an elevation of about 6,400 feet, Fig. 3. It is in

light gray limestone referred to the Jura-Triassic age, which seems to dip

to the NE. but is too contorted and crushed to afford definite determinations

locally. It is profusely cut by a sheeting and faults at about right angles to

the dip, and it is along these structures that the main ledge and the "ore body"

striking NW. with dip about 55° to SW. occur. The lode or mineralized zone

contains stringers up to several inches wide of crushed and altered rock, quartz,

impure calcite in which occur sporadically smaller stringers of galena and

sulfide and other lead minerals resulting from oxidation of galena, and small

nuggets of massive quartz are traversed by calcite veinlets 1/2 inch wide.
The metal for which the deposits have been worked is free gold which occurs in very fine but relatively heavy particles, and in the pan is usually associated with cerusite. The gold occurs in the highly altered rock and in the quartz and calcite contained in the fault and joint planes and fractures, all being in a much oxidized state. Bodies of quartz present range up to nearly a foot in width, and there is no continuous ledge or anything definite to follow. The ore occurs sporadically.

The deposits have been opened to the depth of 60 feet. Some had been worked as late as 1916, and in places the workings follow only interruptedly gold-bearing joint planes or fractures in the otherwise barren limestone. Believing the limestone itself to be the source of the gold the operators had chemical analyses of the limestone made for gold but with negative results in each instance.

Source of the deposits

The source of the primary lead mineral galena contained in the Titanic and vicinity deposits in the limestone may well be of pre-Tertiary origin and be structurally connected with certain porphyry dikes or eruptive rocks that locally invade the limestone. The free gold, however, for which the deposits have been long known and worked about, and with some indications of mineral exploitation, is believed by the writer to be Tertiary gold and to be secondary to surface concentration origin only, analogous to the Rawhide placer gold, and was derived from formerly overlying and long-since eroded lavas like those of Rawhide and vicinity. In fact, it is probable that the Titanic site was formerly covered by the eastward continuation of certain gold-bearing members of the Rawhide lavas, as are the limestones on the west, where they dip under the Rawhide lavas at an angle of 35°. As the lavas and their inclosed gold veins
some broken down by weathering, and their detritus and gravels were removed by erosion, much of the gold they once contained being fine and of very high specific gravity relatively, percolated downward in the structures, joints, crevices, and fractures in the limestone and other underlying rocks and is here intruded by several igneous rocks ranging from rhyolite to near basalt or diabase in the form of dikes or sills with some

The deposits occur in the Jura-Trias limestone-slate-shale series which forms the country rock and is here intruded by several igneous rocks ranging from rhyolite to near basalt or diabase in the form of dikes or sills with some

Yankee Girl mine

The Yankee Girl mine is about 4 miles north of Rawhide in the southern edge of Churchill County about 1/2 mile north of the Mineral County line. It is in the west base of the Sand Spring range at an elevation of about 5,900 feet. It is located near the center of an interruptedly mineralized northeast-southwest area about 1/4 mile wide by 3/4 of a mile long, Fig. 3 and Fig. 52.

History and production

The Yankee Girl deposit was discovered in 1907 by a prospector named Gould, who made a small shipment of rich gold-silver-copper ore which, it is said, amounted to $1,260.

The deposits

The deposits are associated with all three intrusive types, are probably.

The property comprises a group of 5 claims, known as the Smuggler group, which are in compact form, trend about east and west, and show indications of mineralization in the various prospect openings made on them.

The production consists chiefly of one small shipment of rich gold-silver-

The deposits

The deposits occur in the Jura-Trias limestone-slate-shale series which forms the country rock and is here intruded by several igneous rocks ranging from rhyolite to near basalt or diabase in the form of dikes or sills with some

The deposits occur in the Jura-Trias limestone-slate-shale series which forms the country rock and is here intruded by several igneous rocks ranging from rhyolite to near basalt or diabase in the form of dikes or sills with some
which the deposits are associated. Some of these igneous rocks are probably Tertiary. They include a diabase dike and a so-called iron dike which carries parallel stringers of iron oxide and is said to contain also fair values of gold and copper. The deposits are referred primarily to the pre-Tertiary older group with the note, however, that, like the Titanic deposits, they contain secondary contributions in the form of free gold from the Tertiary rock of mineralization.

The sedimentary rocks have been much disturbed and in most places are turned and stand on edge. Their general strike is nearly north, while the end of the remaining structures, faults, dikes, and zones of mineralization northeasterly with dip steep to the southeast.

The main showing or so-called Yankee Girl mine is on the Smuggler claim near the northern part of the property in the upper southeast slope of a prominent ridge at about 200 feet below its crest, and is in the blue dolomitic limestone in a northeast-southwest zone of mineralization about 75 feet in width. The deposits are opened mainly by an open cut and a 40-foot shaft beyond which a 30-foot drift extends northward into the ridge. These workings are all of a stringer-vein, its fissure or fracture, which is about 4 feet in maximum width strikes about north and stands about vertical in the massive dark blue-gray dolomitic limestone, which is partly crystalline and in part silicified and does not show any pronounced metamorphism, though in places it is silicated. Recementing white dolomite veinlets and stringers (Spec. 284) ring in places a kind of stock work extending 8 to 10 feet back into the rock indicate that the rock was profoundly crushed, probably at the time the noise or fissure was formed, as not displaced the vein.
At the surface and in the top of the cut the vein is but little more than
stringer a few inches in width but gradually widens downward until at a depth
of 16 feet in the bottom of the cut it attains a width of 4 feet.

The gangue is chiefly crushed, altered, ferruginized, mineralized dolomitic
flattened lenticular limestone and gray to brownish gray crystalline dolomite of medium grain.

Associated with the deposits but not necessarily as an essential gangue mineral
is also considerable paligorskite commonly known as mountain leather, mountain
ark, and mineral leather. It is a variety of asbestos or tremolite, a hydrous
dicate of calcium magnesium and alumina. It occurs in whitish or light
brownish sheets or flattened lenticular masses ranging up to nearly a foot in
diameter, and a couple inches in thickness.

The deposit on the whole is oxidized. The ore minerals contained in the
gangue are chiefly the copper carbonates — malachite, azurite, and cerargyrite,
and gold. Chalcocite and free gold have been reported. In places the gangue
is traversed by minute veinlets of malachite, which mineral also incrusts
portions of the less altered limestone. Here at the depth of only 16 feet near
the collar of the shaft and floor of the drift from a vein width of 4 feet
there was mined and shipped 10 tons of ore which ran $126 to the ton in gold,
silver, and copper with the copper averaging 2 per cent. The ore body is said
to have rested on a smooth floor, presumably a fault plane, slightly inclined
to the southeast from which, if the fault is a normal one as seems likely to
the case, the downward continuation of the vein and ore body probably lies
to the northwest of the point that has been mined. Also a pronounced
vertical fault with strike N. 62° E. cuts through the workings 12 feet to lee of
the shaft, but it apparently has not displaced the vein.
Along the south side of the fault is 8 or 10 feet of crushed, decayed, and sheeted and schistened rock or gangue-like material, which is said to from $1 to $6 to the ton in gold, silver, and a little copper.

Other than the ore body described no commercial ore has been found. The fault sunk to the depth of 40 feet on the projected course of the vein found barren limestone. The fissure or sheeting which seems to represent it on the projected course extends through the ridge and is opened by a tunnel on the south side which, however, disclosed no values.

At about 300 feet northwest of the Yankee Girl mine in the so-called zone of mineralization, which also is chiefly in limestone, the Lillia copper-gold prospect and several other prospects have been opened by cuts, trenches and in one instance a 100-foot crosscut tunnel. Some of these prospects present fairly good surface showings in the form of dark gray and silicified limestone, which is traversed by veinlets of crystalline calcite and in part stained greenish and reddish with carbonates and oxides of copper and iron and is said to carry good values in copper and gold.

In the southern part of the property on Smuggler No. 3 claim a 9-foot shaft on the limestone-shale contact which here dips steeply to the east shows a foot width of brownish oxidized vein or ledge material which is said to run $30 in gold and 10 oz. of silver to the ton and appreciable values in copper.

The ore throughout the Yankee Girl camp is said to be good smelting ore, contain no other base metal than copper and iron.
Nabob prospect

In the triangular area several miles in extent between the Yankee Girl and Titanic mines and Rawhide, mostly in the lower northwest foothills of the Kassock Mountain, occur numerous prospects of which the Nabob may be cited as an example. The country rock in general is the Jura-Trias slaty-shale formation which locally contains reefs or bands of intercalated dark silicified limestone, quartz stringers and veinlets, Fig. 52. The formation in general dips about 40° southerly and in many places is unconformably overlain by andesic tuff that is capped by dacite or basalt, Fig. 56, (Photo 21). In the northern part it is light colored and has a silvery sheen, but toward the south it becomes greenish and reddish and contains infolded pressed or partly schistosed feldspar or aplite and is in part overlain by younger rhyolite especially toward the west.

The Nabob prospect, owned by W. C. Hawkins of Rawhide, is about 1 1/2 miles 70° E. from the Yankee Girl mine at an elevation of about 6,000 feet. The property comprises 2 claims and contains two veins in the slaty-shale which are of the light-colored silvery sheen variety and dips 80° SE. The veins are composed of vein quartz more or less banded. They diverge on the north side of a low hill. The larger one which is 6 or 8 feet wide, strikes about N. 70° W. and dips steeply to the west. The smaller strikes about N. 70° W. and ends about vertical, and where opened by an 8-foot shaft it shows a width of 1 1/2 feet of vein quartz which is some disturbed or faulted, crushed, weathered or cellular, rusty brown with iron stain, and carries, it is said, from $10 in gold, and 50 cents in silver to the ton, but other portions of the veins do not average nearly so well.
In closing his remarks on this area northeast of Rawhide the writer would point out that some prospectors hold that a good area in which to prospect is the ground extending from near the Yankee Girl mine 8 miles southeastward across Big Kassock Mountain toward Monte Christo. From what little has been learned of this belt by the writer, however, he has received the impression that there are advantages the belt may offer for prospecting is due rather to better exposures of the formations and veins because of the greater relief caused by uplift and erosion rather than to any greater amount of mineralization it may contain over that in the surrounding country.

Hooligan Hill zone

The Hooligan Hill or Middle zone joins the East or Balloon Hill zone on the west. Beginning on the north it contains the deposits of Silver King, Burns, Hooligan, and Roseberry Hills and vicinity. The production, which is not comparable with that of the Balloon Hill zone, is by estimate about $75,000. August 1, 1913, the production was more than $40,000.

Hooligan Hill

The most important of the deposits are those of Hooligan Hill, which stands in the middle of the zone at the southwest edge of the town of Rawhide. Fig. 54. It is an east-west elongated hill about 1/4 mile long by 600 feet wide and 260 feet high. It lies at nearly right angles to the zone of mineralization and is composed chiefly of the Hooligan Hill dacite, which, however, is overlain and extensively intruded by the Portland rhyolite as afore described in the Geology.
Deposits

The Hooligan Hill deposits occur chiefly in the south base of Hooligan Hill and vicinity. They occur in a cross zone along east-west lines of rock fracture as replacement in the wall rock facing the fractures and in white mil gouge associated therewith, the fracture walls and gouge being generally iron-stained, and forming in places a sort of stock work or brecciated of mineralization, as shown in the Truett mine, Fig. 61, (Photo 23), and 74, (Diagram). The best of the deposits, as well shown in the Truett mine, occur as illustrated in this diagram. The gangue contains also fragments rock in part replaced or enriched by ore. The sequence of events in ore position seems to have been about as follows:

1. Shattering of the dacite, followed by
2. Mineralization along the fractures by siliceous ore-bearing solutions,
3. Intrusion of the Portland rhyolite accompanied or followed by faulting, brecciation, and re-opening of the deposits previously formed in the dacite,
4. Mineralization in both the dacite and rhyolite, that in the dacite being the second period of ore deposition.

The rhyolite apparently is of great importance, it being in many places chief ore-bearing rock. For instance, in Fig. 74 (Sheeting-fault diagram), ore has formed best and is best developed along the larger structures, fractures or fault planes at the intersection of the joint planes, some planes, or flows even of the same or any given rock being apparently more favorable for ore development than other planes. Of the two rocks, the Hooligan Hill rock and the Portland rhyolite, the rhyolite is much the more favorable for development, from which it is inferred that its constituents are probably
easily replaced by the ore depositing solutions. This may be due to one or more of several factors of which one is that the dacite being the older rock may be more hardened by silicification, another is that its plagioclase feldspars may be less easily replaced than the orthoclase feldspars in the rhyolite.

In working the deposits of Hooligan Hill, as at most other places, the fillings are customarily panned with care and are the first guideposts as to the value of the ground. The Hooligan Hill ore averages higher in gold relatively speaking than any other hill in the district. The ore which comes nearest being an exception to this statement is that of the Mint mine in Grutt Hill.

The principal deposits and openings are those of the Miller, Portland, and Truett leases in the south base of Hooligan Hill, on the Happy Hooligan claim, Fig. 64 (Claim map, large scale), and Fig. 54 (Pan. photo 27-28). They are a part of the Rawhide Coalition property, and until 1913 had been worked by lessees only, generally, in an unsystematic manner in quest of the rich pockets and bunches of ore on structures, and their intersections. Along most of the ground mined and stoped nearly all of the country rock left standing on either side for a considerable width ran \( \frac{2}{3} \) to \( \frac{3}{6} \) to the ton. At that time, however, the Company was working some of the deposits on its own account and figured that with improved facilities for mining and milling assured in the near future, the main ore zone, extending with a width of about 50 feet from west of the Truett mine to east of the Portland lease, a distance of nearly 1,000 feet, and to the depth of approximately 200 feet, would yield about 10,000 tons of ore and pay handsomely to mine and mill as a whole.

In 1930 it was reported that the Hooligan Hill deposits in general maintained their replacement-stockwork character downward, but at depths of about 300-400 feet they became leaner.
Miller Lease

The Miller lease in the mid-south base of Hooligan Hill is one of the early-day mines and is said to have produced more than $30,000 worth of ore, including considerable good shipping and much milling ore. The early-day production is reported to have included a recovery of $18.39 a ton from 1409 tons of ore.

The property is opened to the depth of 300 feet or more, chiefly by 5 levels, - the 65, 130, 160, 270, and 300-foot levels as shown in Fig. 75, (level map). The mine is profusely intruded by the Portland rhyolite. Both rocks have been considerably shattered, brecciated, and crushed by faulting and disturbance as shown in Fig. 61 (Photo 23).

On the first, or 65-foot level, the vein or principal ore zone, from one-half foot to 4 or 5 feet in width, is well shown in the stope, drifts, and crosscuts. It dips steeply northerly into the hill. It consists of a zone having joint or fault planes of considerable movement, and is composed of crushed ground up rock material partially silicified and generally well oxidized. In some places the material is gouge-like and slickensided, with the striations showing much movement in several directions. In some places, as shown on the 90-foot level, the country rock, in this instance dacite, along the joint plane is comminuted and hydrothermally altered to white kaolin in which the silver, which is mostly argentite, and the free gold are deposited. The gold is mostly associated with the rusty brown iron-stained portions.
The values in the zone occur mainly in the soft fine-grained material and in the coarse-grained material.

As shown on the map, dacite is present in the southwest part of the mine at the 130-foot level.

The 160-foot level did not show much at time of visit, but considerable ore was said to occur between it and the 130-foot next above it. It contains ore of which the gangue is a hard blue quartz that has replaced the dacite and contains some sulphide, pyrite, but as it does not pan well it is not regarded with favor by the lessees.

The 270-foot level seems to be mostly in dacite. Here the last 10 to 15 feet of the shaft panned well, a 1 to 1 ½ foot streak of crushed rock ore-bearing material dips northwesterly across the shaft into the hill, and a good vertical ore streak extends down the southwest corner of the shaft.

On the 300-foot level the country rock is dull gray altered dacite, standing far latite (Spec. 337). It does not look very auspicious, but a mineralized streak about 1 ½ feet wide, which dips northerly in the southerly side of the shaft, carries low values.

The Portland lease, situated east of the Miller lease, had by 1913 produced about $5,000 worth of ore, but mostly low-grade ore. Its development is indicated in Fig. 75c and Fig. 76.

The country rock, in which the Portland shaft stands, is mainly dacite. The principal rock in the mine, which is situated north of the shaft, is mainly Portland rhyolite and much of it is so altered and soft that the "drill" holes for blasting are easily bored with an auger. In the face of the drift
the stope at about 30 feet below the 50-foot level the rock forms an
exception to the general softness and is more silicified, and well-seamed
fractured like the typical ore-bearing zones in the Truett lease, and here
carries fair values, which occur scarcely anywhere else in the mine.

As shown in the vertical section, at about 55 feet north of the shaft
the 50-foot level occurs the main vein which here is 8 feet wide and consists
very soft whitish and partly brownish iron-stained oxidized rhyolite. But
compared with the Truett mine the deposits in general are/too soft and
rocks too loose and coarse-grained to carry good ore.

**Truett mine**

The Truett mine or lease is in the western part of the south base of
Hooligan Hill and joins the Miller lease on the west with which it is connected
in the 130-foot level, Fig. 75E. By 1913 it had produced about $34,000 worth
of ore and was then being worked by the owning company.

was then working the mine wrote that north of the old Glory Hole workings
was then being bothered with a shear zone or large fault, just beyond which,
however, the indications were favorable for good ground in which to crosscut
northward into the hill.

The mine is opened to the depth of 162 feet by two shafts mainly on the
70, 126, and 160-foot levels of which the most extensive is the 70-foot level,
Fig. 75E (Level map). It is mostly in the Portland rhyolite which profusely
intrudes the Hooligan Hill dacite, and the deposits which are the westward
continuation of those in the Miller lease occur in a zone about 40 feet wide
throughout which the rocks have been intensely fractured, as shown in Fig. 61,
and the zone accordingly is traversed by innumerable cracks and
which carry the gold, the rock itself being barren.

The deposits are peculiar in that there is present no true fissure or vein
but little quartz. They seem to be contained mainly, if not wholly, in the
light, pale-brown or yellowish rhyolite, and its fractures which apparently
are filled or chipped.

Dikes and masses intrude the dacite country rock.

Following the intrusion of the rhyolite, the whole country was considerably
variously faulted and the rocks, especially the rhyolite, fractured mostly
vertically about parallel with the upright dikes, and trend of the hill, and
also diagonally or crisscross, in nearly all directions so that the fractures
are more or less reticulated and linked and form a typical
network, as shown in part in Fig. 61, (Photo 23). A much better example than
this (Fig. 61) was seen in the mine, but it could not be photographed.

In and along fractures, fault and joint planes the ore occurs as seams
stringers in the fractures and as replacements in the faces of the bounding
rock, with little or no gangue other than a little gouge-like material composed
of crushed rock kaolin and a little quartz. The seams and the adjoining faces
of the rock containing the ore are as a rule oxidized and stained with blackish
manganese and iron.

Whether a given vein, shoot, or body will pay to mine is first determined
by panning some of the material collected from and along the seams, stringers,
and cracks by an experienced operator. Sample assays taken across the vein,
body, or body in the manner of an ordinary vein are said to be worthless, or
reliable, as they are found to give very erratic values; in some cases very
high, in others too low.

Assays in the truth mine, corresponded to the following description:
In mining, the ore-bearing stockwork or rock mass containing the mineralization is then blasted down, usually with a double or triple charge of powder explosive, so as to shatter the mass as completely as possible. The coarser material is then at once discarded as waste, much of it not being hoisted to the surface. Of the balance of the material, that which will not pass through a given mesh screen is also discarded, while the screenings are milled or shipped as good ore. From 4,000 tons of the ore that was milled an average of $8 a ton is said to have been recovered.

The first bar of bullion purchased from the Rawhide District, which was about 1903, is said to have represented 14 tons of ore from the Truett mine and contained $432 in gold and $3 in silver, beside which there were 100 pounds of concentrates containing $70 in gold.

Since the figure of the Level map was made most of the stopes, especially those between the 70-foot level and the surface, have been much enlarged but are not at hand for showing their extent. In places the lode has been stoped from near the bottom of the mine to the surface and contained ore 12 to 20 feet in width. At time of visit in July, 1913, the Company just opened up an ore shoot which a lessee had overlooked. It extended on the shaft northeastward, from the surface to below the 70-foot level, about 6 inches wide and averaged about $60 to the ton.

On the 70-foot level, at about 90 feet east of the shaft, the branch pit about 25 feet long is on a mineralized rhyolite dike or so-called vein material on its hanging wall, which seems to be about 20 feet wide which has been stoped.

As seen by the writer at the time of visit about $8 worth of free gold, just had been panned from about 20 pounds of rich ore found in a crevice in its walls in the Truett mine, corresponded to the following description:
gold in general was fine, averaging in size about that of a small shot.

was angular, porous, and cellular, but a large part of it was of rounded

with irregular lobes, convolutions, corrugations, and largely resembled
human brain. The larger contains lenticular and hard

On the 157-foot level, the rock is mostly the brownish and greenish

on the course of the Hooligan Hill ore zone projected westward, on the

New Mines Co. ground are the Montana and Holland-Ricard prospects at

respectively about 300 and 700 feet from the Truett mine, but their mineraliza-

is not known to be a part of the Hooligan Hill ore zone, Fig. 52, (Large

scale map).

The Montana prospect is opened by an 80-foot shaft and is apparently in

mate which is cut by sheeting that strikes N. 20° E.

12

site which is cut by sheeting that strikes N. 20° E.

The Holland-Ricard prospect credited with a small production of rich

is opened to the depth of 70 feet by 2 shafts, spaced 75 feet apart in a

orth-south direction, to the depth of the 50-foot level where they are connected

crosscut, and it contains several hundred feet of additional work including

2-foot winze, Fig. 77, (Level map). It is in rhyolite which apparently

inudes the dacite. In the south shaft and other workings a sharp slip or

dips 30° to the southwest, with a 2 to 3-feet wide band of crushed rock,

breccia, or vein-like material on its hanging-wall side, which seems to

been a source of the ore produced. On its hanging-wall side the vein

rides into coarser and less disturbed rock with no well-defined hanging hanging

present. In the connecting crosscut the rock shows some coarse flow

ing and pronounced northeast-southwest sheeting.
Ellis Lease

The Ellis lease in the southeast base of Hooligan Hill on the eastward projected course of the Hooligan Hill ore zone is opened mainly by a 60-foot shaft and a 90-foot drift extending each from the bottom.

It is mostly in a rhyolitic tuffaceous mud rock formation and hard rhyolite, some of which latter contains wine-colored quartz. The lease contains no seams and considerable faulting, but is not known to have found any ore.

Yellowstone Tunnel

The Yellowstone tunnel is driven south 70° W. in the middle east slope of Hooligan Hill about 220 feet below the top. It is 300 feet north of the Hooligan Hill ore zone, with which it has no relation. It is 220 feet long and is in the white Portland rhyolite, Fig. 75-A, (Level map). The rhyolite is mostly hard and porphyritic. In the portal of the tunnel sheeting in the rhyolite dips 45° SW. into the Hill.

The cropping above the tunnel which correspond to those for the Hill in general are coarse, bouldery, and craggy and are stained reddish and brownish, with manganese and iron, but show no definite ledge or vein.

The tunnel seems to be named from the dirty yellowish stain found on the meeting or joint planes of the rock, probably caused by chromic iron.

Through a considerable part of its course the tunnel follows a crack down in the roof, and at about 60 to 70 feet in from the portal, a fault reccia band gradually develops in the left wall and adjoining part of the wall, widens to 2 or more feet and extends on in for at least 100 feet and was to be mineralized, but carries no ore.
Some good, chiefly gold, ore, but not of much commercial value was pro-
duced from the upraise stope on the left at 210 feet in from the portal and
from the incline winze sunk from the end of the 40-foot crosscut south.
According to Frank Esisson, foreman, the ore occurred sporadically in hard
rhyolite in a brown jaspery quartz in which it was beautifully embedded and
ranged from low values up to $10 a pound. The ore body in the stope was
about 15 feet in horizontal extent by 30 feet high and dipped 50° NW.

In several other openings, as the Marion tunnel, Fig. 75-B, and the
Silver tunnel driven in the north slope of Hooligan Hill, mineralization or a
little ore was found, but there were no indications of ore being present in
commercial quantities.

Roseberry Hill

Roseberry Hill, a south-side ridge or spur of Hooligan Hill, is opened
by several small mines or prospects, Fig. 54, (Photo Pan. 27-28), and has
produced moderate quantities of mostly rich ore from near the surface. For
example, the Silver Zone mine when worked by E. Carter and Andy Lillian in
1914 is said to have produced 12 tons of ore that ran 450 oz. in silver to
the ton and fair values in gold. The vein strikes N. 60° E. and dips 65° N.
Gangue as seen in the upper shaft is chiefly rhyolite breccia cemented
by quartz whose solutions seem to have deposited the ore.

The country rock is mostly rhyolite, (Spec. 338), and is dimly bedded
above flow banded. It is intruded by a couple north-southerly 40-foot dikes of
greenstone andesite. Hooligan Hill dacite is also present, as shown by
amount of material in the gold dumps and croppings at the northeast base of the hill. Other openings
on the Hill and vicinity are .......... ?
Burns Hill and Silver King Hill

Burns Hill and Silver King Hill are respectively the southern and the northern slightly enlarged and higher ends of a partly mineralized low ridge situated a short distance north of Hooligan Hill at the northwest edge of the town, Fig. 54, (Pan. Photo 27-28). Though the hills contain several openings 60 feet deep they are not known to have made any appreciable production. In the low saddle between the two hills a shallow shaft shows a banded rhyolite-dacite mineralized contact which strikes N. 25° E., dips 70° W. and probably presents the vein that appeared in a deeper shaft to the north.

Silver King Hill

In Silver King Hill, the country rock which is rhyolite, especially in the east slope of the Hill, weathers porous or honeycombed as if it had been very pyritic. Jointing as shown in shafts dips steeply westerly.

A 60-foot shaft in the southwest slope of the hill in light partly iron-stained light-colored rhyolite has a little rusty brown material on the dump but not much showing for ore. Just below this shaft in the south slope of the hill a 50-foot incline shaft shows a 6-foot wide sheared and seamed mineralized zone in brownish rhyolite, which strikes N. 70° W., and dips 65° N. into hill, a few tons of silicified rock and quartz, which seem to be low-grade ore, are piled on the dump.

Burns Hill

Dacite occurs in the northeast slope of Burns Hill and also in the southeast slope, whence it extends northward in the east face. It probably connects with the larger body of dacite on the east extending from Last Chance Hill southward to Hooligan Hill.
The Charter Oak prospect in the southwest slope of Burns Hill is opened by a 100-foot shaft in rhyolite and has apparently produced some ore. It is in the mineralode or zone described last under Silver King Hill. In places the rhyolite in small seams has weathered to soft mud-like gouge.

A distinctive feature of Burns Hill is the occurrence, especially in its platy northerly slope, of bodies of pseudomorphic quartz 10 to 12 or more feet in diameter and several feet in thickness, Fig. 59 (spec. 247). Some of the plates are about 3 inches in diameter, and some slabs several feet in diameter are frozen to what seem to be walls of fissures. This and the York mine are reported to be the only localities in the district that contain this pseudomorphic phenomena on so large a scale.

Royal Regent or West zone

The Royal Regent or West zone lies about 2 miles west of the town of Rawhide mostly in hilly or mountainous country of the Cone Mountains, Fig. 54 (Photos 27 and 28). It has a length of about 2 miles and is nearly a mile wide. It extends from the Rawhide Regent mine and camp on the north-southwestward to the Ruby Queen group. Prominent hills or landmarks situated near the zone beginning on the north are Crescent Peak, Black Eagle Hill, Allskin Mountain, Chicago Mountain, and Pilot Cone, Fig. 54 (Photos 27-28).

The country rock in the eastern part of the zone is chiefly Cone Mountains rhyolite, while in the western part it is andesite as described under geology.

Deposits

The deposits are nearly all Tertiary and occur chiefly in the volcanic rocks which have been described mainly in the Cone Mountains rhyolite and in andesite. Their precious metal is chiefly gold in which some of them
very rich due to process of secondary enrichment. The mines and prospects
joining on the north include the Regent, the Black Eagle, Gray Eagle, Bulleskin
main, Penglaze, Indiana, Royal Tiger, Royal Mines Co., Wonder King, McMann,
Steinheimer groups.

The Regent mine, owned by the Virginia Hills Mining Co. of Reno, is
located at Regent 2 miles northwest of Rawhide, in what was formerly known as
Regent district. It is at the edge of the wash at an elevation of about
800 feet in low foothills a couple hundred feet high at the outer edge of
Rawhide Mountains that overlook a broad expanse of detritus-filled
wadi valley, Fig. 52, (Geologic Map), and Fig. 79, (Photo 20).

History and production
The production of the property by 1922 was said to be $150,000. Mineral
land was first located here by J. M. Schadler and the Regent property, now
consisting of about 20 claims, Fig. 80, (Claim map), was first located in
February 1906, with only location work done on it, it was
sold to a syndicate in Goldfield for $55,000 which put down a 100-foot shaft
on Czar Hill, but did very little else.

Later the property was subdivided into lease blocks, but owing to the
stringency of 1907 the lessees were unable to do much development.
Some high-grade silver ore was taken out on Czar Hill near the apex,
from the McKinley vein and shaft.

The property as a whole was located by later owners in June, 1911, but
material work was done until the fall of 1912 from which time till the close
of 1913 the Proskey-Regent Gold Mining Co. of Rawhide mined, shipped, and
milled ore, and there were also three sets of lessees working on the property shipping working out both milling and milling ore.

The total production at that time was $35,000 of which about $12,000 came from the Czar lease; $12,000 from McKinley shaft; $2,000 from the Johnson vein in Silver Spring Hill, and $3,000 from other leases. The ore was said to run about $29 to the ton and that which was then being shipped to the Nevada New Mines Co. Mill $40. In value, it averaged about 90% in silver and 10% in gold.

The total amount of development at that time was 2,400 feet of work extending to the maximum depth of 160 feet, with a good 2- to 3-foot vein of ore in the bottom of the workings.

With the facilities then afforded by the operation of the Nevada New Mines Company's mill, the Regent mines could handle $15 ore, but not ore of such lower grade. The ore haul was about 7½ miles gently down grade from Regent to the Nevada New Mines Co. mill. On completion of the New National Black Eagle mill then building, the haul was later reduced to about 3 miles, which enabled a lower grade than $15 ore to be worked.

In 1917 the property was acquired by the Mogul Mining Co., representing western capital.

In February 1919 it was incorporated as the Seminole-Regent Mining Co. with a capitalization of $1,000,000 and headquarters at Reno. It was soon thereafter equipped with a 15-horse power gasoline hoist, compressor drills at the 125-ton Black Eagle mill. The mine was reopened in 1919 and was operating in 1920, at which time development work had been extended by a foot to the 400-foot level and a crosscut driven there to cut the vein.
In 1923 the Seminole Regent Mining Co. retired and by 1930 the property had been acquired by the Virginia Hills Mining Co. of Reno, who, at that date, reported that for some time only assessment and a little lessee work had been done.

Geology

The geology at Regent is similar to that at Rawhide. The country rock is rhyolite which, in general, is light-brownish gray, fine grained, lithoidal or nearly dense. It is in part silicified, especially along the veins in Czar Hill and Silver Spring Hill, particularly along the hanging-wall side of the Czar vein, and shows other alterations and mineralization characteristic of the Rawhide rocks. The rhyolite is sheeted in an east-westerly direction and also variously crushed and subordinately sheeted in other directions. The flow structure and quartz banding in the rocks strike N. 25° E. and stand about vertical.

At about 1/3 mile west of Czar Hill the rhyolite and wash give way to light-colored rhyolitic tuff, which is very calcareous and is possibly to be correlated with the tuff found at Pilot Cone and at the mill and flats to the south of Rawhide.

In places the rhyolite is cut by dikes of reddish gray Pilot Cone rhyolite, as just below the Regent-Shurz road forks where occurs a dike of this rock (Spec. 272) 30 feet wide which is said to extend southerly to the Glaze and Flynn mines. The rock is strongly parphyritic with large roundish feldspar phenocrysts 3/10 of an inch in average diameter which seem to have been replaced by calcite and other minerals. (Note. Have made of 272 g).
Basalt caps a small north-south hill of the rhyolite at about 1/3 mile
S. 30° E. from Czar Hill and Regent. It is sheeted north northeasterly-south
northwesterly about the same as is the rhyolite.

**Deposits**

The deposits of the camp are gold and silver. They are contained in
six fairly strong veins ranging from 1 foot to 40 feet in width in the
rhyolite including adjacent ore bodies replacing the rhyolite wall rock.

They are about parallel, in general have a north-southerly strike (N. 15° E.)
and steep westerly dip, Fig. 80, (Claim map). They lie chiefly in Czar Hill
and Silver Spring Hill. Those of Czar Hill are chiefly gold bearing, and those
of Silver Spring Hill are chiefly silver bearing. Named in order from east
west the more important are the Czarina, Proskey, McKinley, and Czar Hill
veins, to the west of which latter on the north is the Alexander, Maul, and
by, and on the south in Silver Spring Hill, the Johnson and Josephine veins.

The Annie Jane, a cross or east-west vein apparently about 1,000 feet in
length, lies in low ground to the west of the middle part of the group.

The veins are in part fissure veins. They occupy fissures, fractures and
fault zones. The gangue or filling, (as shown in ore specimen 273), is chiefly
quartz and altered silicified and replaced rhyolite, much of the rhyolite
being flow-banded and the quartz comby and glassy.

Barite as a gangue mineral is associated with some of the veins and
deposits and is well and plentifully developed along some of the fissure
faces, as seen in the Proskey vein and down the McKinley shaft (Spec.
273). Here areas of the rhyolite wall rock 5 or 6 inches in diameter are
porphyroblastic with tabular sheets 3/10 of an inch in thickness of barite
maximum dimension.
Banding is common and well developed, as shown in specimen 274, from the
Hockey vein, where it is about 4 feet wide in the upper south slope of Silver
Springs Hill, and in the rich ore (specimen 275) from the Johnson vein.

Croppings.—The cropings of the veins and the adjoining silicified
all rock are in places prominent, standing 10 or more feet above the surface,
shown in Czar Hill, Fig. 79, and they are stained reddish brown and blackish
with iron and manganese. In general the veins and ore are oxidized as deep
the workings extend, which is 400 feet, though there is commonly associated
with the ore a little pyrite and in a few instances a little chalcopyrite, and
the Czar Hill deposits, as in the Czar vein, some antimony (specimen 276)
also present. It is regarded by the operators as indicating a decrease
in gold values.

Strewed over the surface of the wash on the Seminole group and adjoining
ground on the west occurs considerable good looking quartz folat (specimen 277),
mostly in scattered boulders, some of which range up to 4 or 5 feet in diameter,
the source of which has not yet been determined, and seems to be puzzling.
These form on the east the base of the mountains and hills on the southeast it
ranges.

Some of the float resembles Czar Hill vein cropings and ore, but the
bulk of it seems to be different. Nothing like it has been found in the
mountains on the south beyond Czar and Spring Hills, which caused it to
adjacent as if the float may have been derived from same vein or ledge on the
Seminole group, all traces of which in place have apparently now disappeared
in weathering and erosion.

The ore is only about 12, the lowest grade that the
ore has been worked to mine. One ore body about 3 feet wide is said to have
mined on the Hill. The value ratio of the precious metal content of the
ore is said to be about 90% silver and 10% gold.
The float in general carries high values in gold, which fact has aroused considerable interest in its source. Some of it is slightly greenish quartz and is pseudomorphic after spar, etc., and resembles the type of quartz, which in instance in the Oatman and other districts in Mohave County, Arizona, carries good values. The float has led to prospecting by shafts on the David claim of adjoining ground of the Seminole group, but the results have not been encouraging.

McKinley or Big Vein

The McKinley or "Big" vein lies about 200 feet west of the Proskey vein in rhyolite. It is about 1,000 feet in length and varies from 3 to 40 feet wide and is opened to the depth of 400 feet. Its course is curved with the concavity being westward in which direction the vein also dips at angles of about 60°. It is thought that it may join the Czar Hill vein or be continuous with the Proskey vein on the southwest.

At about 200 feet south of the shaft the Big vein and also the neighboring hanging-wall vein are faulted 100 feet or more to the east on the north side of the fault, from which point, however, the Big vein gradually curves back its course and passing through the lower northeast slope of Czar Hill stands beneath the wash on the northeast.

The vein is composed of quartz and replaced rock including some coarse foliage from 1 to 2 feet in diameter. Some of the quartz is of the glassy men-looking type. The vein is said to have produced about $25,000 worth of silver-gold ore, most of which ran $30 to the ton and some $200 to the ton, while the run-of-mine ore is only about $12, the lowest grade that the company attempted to mine. One ore body about 7 feet wide is said to have $58 to the ton. The value ratio of the precious metal content of the vein is said to be about 90% silver and 10% gold.
The ore varies from very hard firm quartz and cemented rhyolite breccia to relatively soft phases of altered and in part silicified rhyolite.

In 1913 the vein had been opened mainly by the McKinley shaft 60 feet down, started in the wash.

The shaft contained, on the 60-foot level, two 40-foot drifts, one each stopes 20 feet north and to the south and two narrow crosscuts in diameter in the hanging wall, showing the vein to contain the same characteristics, coarse bouldery cemented rhyolite and quartz lenses.

In 1920 the vein was being worked on the 200-, 300-, and 400-foot levels. On the 200-foot level it was 30 feet wide and dipped with variations about 47° NW, and the ore in places was in part sulphide. South of the shaft the vein narrows and joins the hanging-wall vein.

On the 300-foot level, which contained 200 feet of work, the vein is 5 feet wide and has about 3 feet of gouge on the hanging wall. It had been opened mainly by a drift extending 150 feet north of the shaft. A general specimen of the ore (Spec. 677) is siliceous and vuggy and is largely composed of silicified and in part brecciated and replaced rhyolite, with dark blackish bodies containing argentite, and gold.

On the 400-foot level the vein lies 175 feet west of the shaft, where drifts had been run both north and south showing banded quartz ore. It is about 12 feet wide, strikes N. 40° E., and dips with variations 47° NW, but south of the hanging wall stands nearly vertical. Some of the ore consisting of crushed and silicified rhyolite cemented with a network of secondary pyrite-acularia veinlets is pyritic with finely disseminated pyrite and blackish veins and small bodies of argentite (Spec. 673). At 200 feet from the shaft 30 feet beyond the vein the workings crosscut ended in rhyolite tuff.
Alexander of $5 vein.—The "Alexander or $5 vein lies in the northwest portion of Czar Hill. It strikes N. 10° W. and stands about vertical. Shallow workings at several points show it to be 8 feet wide and well banded with gangue in the west wall.

Proskey vein.—Starting in the wash and road near the east base of Czar Hill, the Proskey vein extends southerly through Silver Spring Hill with a length of nearly 2,000 feet. Portions of it have been worked by lease.

In the upper south slope of the hill the vein is about 3 to 4 feet wide and is well banded with quartz and iron-stained mineralized rhyolite (spec. 274). On the north base of the hill it is opened by the Sailor Boy shaft, 160 feet deep, which in 1913 was the deepest opening in the camp, and ended in an adit. In the bottom of the shaft, the vein is reported to have broadened to 2½ feet in width but varried from $40 to $50 ore.

The vein in general was disappointing to the Company in not carrying the values expected of it in Silver Hill. In this connection it may be noted that on the bottom of the 100-foot Czar Hill shaft sunk in the southeast base of Czar Hill in early days, a crosscut extends to a point beneath the top of the hill. The vein for which this crosscut was driven was not found but at 150 feet on the shaft the crosscut cuts a 6 to 8-foot blind vein, which is composed largely of low-grade, $3 to $10, ore, and was too low grade to work.

Czar Hill vein.—Has a length of 1,500 feet or more and is about 5 feet wide. It extends from the south slope of Czar Hill through the hill, thence nearly 1/4 mile northerly into the flats or wash. In 1913 it was opened chiefly in the upper northeast slope of the hill on the Golden Spring claim to a depth of 40 or 50 feet, and by stope at a point where it is faulted. In the south of the fault the dip is 70° to the southeast. To the north it is vertical. The vein has good looking quartz-rhyolite gangue, but the values range from $10 to $50, and are almost entirely in gold, are spotted.
The croppings to the north of the shaft are strong as shown in Fig. 79, (photo 20), and consist of quartz and silicified rhyolite stained with oxides of manganese and iron. Both croppings and the ore near the surface contain considerable "antimony" (?), (spec. 276), which is said to be not beneficial to the gold values.

Isabel or Maul-Nye vein

The Isabel or Maul-Nye vein situated to the northwest of Czar Hill on the Bourbon-Prince claim, trends north-northerly and dips 25° E. in rhyolite outcrops at several points. It is opened by a crosscut tunnel and an adit to the surface. It consists mainly of crushed and partly silicified rhyolite, contains but little quartz, and is said to carry about $15 ore whose value is chiefly in gold. The dump is said to average about $3 to the ton, the values having been derived mostly from a small quartz seam.

The Johnson and Josephine veins.—The Johnson and Josephine veins which lie in the westerly slope of Silver Spring Hill, converge northerly and seem to unite in its mid-north slope at an elevation of about 5,460 feet. In 1913 both veins were being worked by lease. The Josephine vein carries considerable of its values in gold. It dips steeply to the west or northwest, and has gouge showing due to post-mineral movement.

Some of the best looking quartz on the property occurs in the Elm crosscut tunnel on what is thought to be the Johnson vein. It is a mixture of whitish gray quartz, is some sugary and drusy, and a little brownish iron stained, with traces of replaced rhyolite through residual quartz phenocrysts.
Profit Mine

The Profit, (also called Matthews) mine, owned and operated in 1916 by J. F. Matthews and Bro., is 1 1/2 miles northwest of Rawhide and 1/3 of a mile southeast of Regent in the foothills.

The vein, which is 3/4 of a foot to 2-feet wide, strikes north-northeast, dips 70° E., and was opened by an incline shaft to the depth of 110 feet.

It consists of brecciated, somewhat pebbly, silicified quartz and rhyolite, with barite ?, more or less banded, streaked, iron stained, and oxidized. (Spec. 550).

Much of it is said to run $35 to the ton in silver and gold and some is very soft high-grade ore. Some 1/4- to 1-inch wide/talcose or alunitic streaks are said to carry good values.

Hauley Tungsten Prospect

In 1930 there was reported to have been discovered at Regent a deposit containing tungsten as well as silver and gold. It belongs to Dan Hauley and was being developed by a Tonopah party.


Black Eagle Mine

The Black Eagle mine is located in the Cone Mountains 2 miles west of Rawhide at an elevation of about 5,950 feet, Fig. 52, (Geologic map of Rawhide), and Fig. 81, (Photo 22). It is near the head of Black Eagle gulch or so-called canyon which drains northward into Terrell Valley, Fig. 81, and Fig. 52. (Topographic map). The topography, which is typical of that of deeply eroded volcanic rocks, is hilly to mountainous and rough but not difficult of access.
History and production

The Black Eagle mine was discovered in 1907, a year before Rawhide was discovered, by (Billy) W. W. Stockton who soon did considerable development work, before the mine, a little later, was acquired by the present owner, the Black Eagle Gold Mining Co. of Berkeley, Calif. In 1909 the company was reported to be working the mine and hauling several hundred tons of ore to the Victor mill. In 1911 it was said to have sufficient ore blocked out to serve the mill for 3 years, and about this time it was found that cyanidation was the process best suited for treating the ore. Then followed panicky times, the Rawhide fire and the burning of the Company's National Mill, all of which retarded development until 1913.

By 1913 the mine had been opened to the depth of 300 feet by the old shaft and was working 2 shifts of men. Later the new shaft located 500 feet north of the old shaft and with its collar 60 feet lower than that of the old shaft, was sunk to the depth of 300 feet. Both shafts are regarded as having reached the sulphide zone and ground water level. Sulphide ore and ground water are said to occur in the bottom of both shafts.

As the shafts are each 300 feet deep, and the collar of the new or north shaft stands 60 feet lower than that of the old or south shaft, the bottom of the new shaft is 60 feet lower than that of the old shaft.

The production by 1913 was 3,500 tons of ore having a value of $471,500, of which 1,700 tons of $25 ore came from the Wiley Lease skarn stope; 1,000 tons of $18 ore from the manganese stopes, Fig. 82, and 800 tons of $20 ore from the development work lay on the dumps and more than 4,000 tons of $10 ore were said to be blocked out in the mine.
By 1916 the Nevada New Mines Co. had taken out considerable additional
ore, especially from the Blacksmith Shop Tunnel workings, where the vein from
3 to 20 feet wide yielded a large amount of $55 grade ore.

The property comprises a group of about 12 claims, the Black Eagle group,
which in triple file extends north-northwesterly, Fig. 63, (Arnold claim map),
with the mine or most of the development being on the Black Eagle claim in
the south-central part of the group.

Geology

The mine lies in the Cone Mountains rhyolite which for a half mile or
more north of the mine is intruded and overlain by dikes and patches of dark
looking basaltic hypersthene andesite (Spec. 311) and at about 400 feet
north-northwest of the mine and camp by altered andesite (Spec. 312).

In Squaw Peak, Arnold Mountain No. 2, which stands at an elevation
of 6,400 feet, Fig. 81, the rhyolite is capped by a reddish brown quartz-bearing
andesite porphyry (Spec. 325) 50 feet or more in thickness which seems to be
related to that occurring at and a half mile below the Royal mine, Fig. 52
in Fig. 59-a. Sheeting or jointing in both the andesite and the rhyolite
westerly. A N. 30° W. sheeting dips steeply NE., and a N. 40° E. sheeting
to steeply NW.

In Vein Peak, which is 3/8 of a mile southeast of Squaw Peak, the foot-

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A specimen (No. 322) of this rock shows it to be a fine-grained lead-dolomitic brecciated limestone in part silicified. It is locally traversed by calcite quartz veinlets and contains alunite and a little pyrite.

Though the country rock on the hanging-wall side of the vein quite generally shows it to be a fine-grained lead-dolomitic brecciated limestone in part silicified. It is locally traversed by calcite quartz veinlets and contains alunite and a little pyrite.

Ore deposits

The ore deposits occur in the Black Eagle vein which strikes about 25° W. and dips with variations about 80° W. in the country rock rhyolite. It apparently extends throughout the length of the claim group and seems to be the same vein which continues southward on the Rawhide Nevada King and McLann groups with the same manganese-quartz characteristics, and to have an extent of more than a mile. On the McLann group especially, it contains pockets and benches of sooty manganese ore said to be very rich. It varies from 2 to 20 feet or more in width and is composed of chiefly quartz and associated or crushed and altered mineralized rhyolite and other rock. The composition, however, varies from place to place. It contains also considerable calcite, alunite, and manganese oxide, and in part is well banded, denoting deposition in open fissure space.
On the Black Eagle property the vein has been opened or prospected for a length of 2,000 feet and to the depth of 300 feet, mainly by two shafts and several crosscut tunnels, Fig. 81, (Photo 22), and Fig. 82, (Stope map). The foot wall in general is well defined, and from it in places where the hanging wall is not well defined the ore deposits in some instances continue replacements for the distance of 25 or 30 feet into the hanging wall.

At 400 feet north-northwest of the mine and camp the vein is 8 feet wide, its 80° W. and consists chiefly of crushed and altered mineralized rhyolite. In the cellar tunnel it is 6 to 8 feet wide, carries considerable quartz and manganese and is all ore with the values as good in the rhyolite as in the quartz, and well disseminated in both quartz and rock. The rock in both levels is crushed for a considerable distance back from the vein.

In the Old tunnel the vein is 12 feet wide and dips 50° to the west. It is about all ore, and contains much alumite (Spec. 317). In the large Howard or manganese stope, which extends from a point near the 150-foot level to the surface, the vein is 12 feet wide, and strong with a good well-defined hanging wall and a fair foot wall, and values are said to favor the foot-wall side. It is all ore, much of which is of the black manganese type, some of which is scotty, with pyrolusite and contains also quartz and kaolin, but the quartz portions do not carry any better values than the rest of the vein.

The croppings of the vein which approximately parallel the canyon about 50 feet above the tunnels are in part prominent, Fig. 81, and consist of a 12 to 20-foot wide reef of black manganese and iron-stained quartz and discrified rhyolite (Spec. 318), and show some crude banding denoting open fissure position.
On the 150-foot level in the new (incline) shaft the vein with depth has
brightened up to a dip of 70° and the dip continues to steepen on down to
the bottom of the mine and 300-foot level. Here the south drift, 430 feet
long, contains 15 well-distributed raises or chutes and most of the way some
prospect stoping extending to the height of 30 to 50 feet. This work was done
only in 1911 when it was learned that a cyanide plant was needed to treat
the ore.

Six to 18 inches of drab argillaceous gouge occurs on the foot wall
only. The hanging wall is hard, smooth polished rock. At some points the
mineral ore-bearing part of the ledge is 20 feet wide and in the face of a
ross cut extending 28 feet into the hanging wall the rock averages about $4 to
the ton.

At about 400 feet south of the shaft the ore for a considerable distance
along the drift runs about $60 to the ton and carries considerable bluish
rushed quartz stained yellowish with limonite (spec. 320).

On the 180-foot level, horizontal slips or faulting are present and
in places,
are mixed disturbed the regularity of the ore and its values, and
are mixed the vein with the crushed wall rock, especially the foot wall
rock and at 120 feet farther down, on the 300-foot level, a 130-foot prospect
crosscut to the west is apparently all in wall rock. It follows a horizontal
dip or fault whose upper surface or plane is highly polished by frictional
deposition. Such faults are usually highly角olate and self-luminous (Spec. 323). As each
flaw in 300-foot down, and the cross section of the ore which is 60 feet lower than
Ore

The general average of the ore in the mine is about $10 a ton. But
range in value is from $2 up to several thousand dollars. In the old
The vein and values are good and regular from the surface all the way down to the bottom of the mine or 300-foot level. A microscopic section of the ore shows it to consist chiefly of shattered vein quartz and adularia with a small amount of dark silver sulphide, all of which after having been faulted and fractured was recemented by a network of secondary veinlets of mostly isotropic minerals composed of chalcedonic silica, kaolin, opal and alunite, resembling fine-grained volcanic tuff.

An economic feature of the mine is the softness of the vein and great ease with which it can be mined. In general, a round of shots at the base of an ore face results in bringing down a large overburden of ore broken in condition to be carted away. On the middle and lower levels augurs instead of drills are used in blasting with the result that a man puts in 15 rounds per shift or a three-foot hole per half hour.

From the stopes known as the Wiley Lease in the old shaft, Fig. 82, 1,700 tons of ore averaged $25 to the ton. Here the vein consists of the talcy ground-up substance with quartz (Spec. 321).

On the 200-foot level of the new shaft the vein is vertical or has a steep reverse dip. The rock is tuffaceous, (spec. 324). The ore is sulphide and runs about $5 to the ton. In general, however, the sulphide ore in the bottom of the mine runs only $3 and the values are mainly in the quartz, which is chiefly darkish gray and has been more or less crushed or brecciated and recemented and is crudely banded, and not calcareous (Spec. 323). As each shaft is 300 feet deep, and the collar of the new shaft is 60 feet lower than that of the old shaft the bottom of the new shaft is accordingly 60 feet lower than that of the old. The supposed ground-water table and upper limit of the sulphide zone stand at the depth of about 300 feet.
Though panning is employed in making preliminary ground tests in mining the deposits, because the manganese coating obscures the particles of gold and ore in the pan, the values are determined by assay where accurate results are required.

Profound hydrothermal alteration has taken place in both the wall rock and the vein, with the result that large quantities of the vein are alunite as described on page 57, and shown in Fig. 60, or kaolin and sericite and large masses of the rhyolite wall rock have been altered to and replaced by chalcedony and opal, which minerals occur also in the vein and ore. In the hill to the north of the Blacksmith Shop and road the chalcedony-opal rock forms a bed or mass 50 feet or more in width. It is whitish with a vitreous luster and hackly fracture (Spec. 549).

North of the Black Eagle claim group near the end line of the Eagle fraction claim, there occurs, according to Mr. E. Nichols, a 6-inch wide vein of barite cutting the country rock rhyolite.

12/ In preparing this statement the field notes of E. C. Templeton have been helpful.

The Gray Eagle Mine, owned by the Nevada-Buckeye Mining Company, of Youngstown, Ohio, is 2½ miles west of Rawhide and about a half mile west of the Black Eagle Mine. The property comprises a group of 18 claims which join the Black Eagle group on the west and flanks Squaw Peak on the same side, Fig. 52 (Special map).
The mine is among the early day (1908) workings, and from its stopes through the tunnel it soon produced some good ore in which, according to W. King, the values were nearly all gold. At time of visit in 1913 some was sacked at the shaft on the southern part of the property.

The mine is developed mainly by a 100-foot shaft and 450-foot tunnel, with cross-cuts, drifts, and stopes, the work being mainly on the tunnel, the plan of which is shown in fig. 83 (Tunnel map).

Geology

The country rock is mainly the white rhyolite and the underlying mud rock formation. Dacite tuff is also present north-northwest of the tunnel. As shown in the workings, mineralization occurs chiefly in the white rhyolite.

The rocks have suffered considerable disturbance and are cut by several small north-south faults and are locally brecciated. Dim flow? structure or sheeting?

In the east fork of the tunnel the hard rhyolite? appears to be imperfectly banded with the bedding structure dipping 60 degrees east-southeast, and the north branch of the main stope the bedding planes dip 64 degrees southeast.

In the north stope of the tunnel at point of forking the contact of the balloon rhyolite on the underlying dacite tuff dips 85 degrees east and in the face of the south fork of the stope the contact here pretty well defined between the rhyolite and the mud formation dips 70 degrees south.

In places the dacite contains considerable fibrous gypsum in layers up to an inch in thickness, and the mud rock, e.g., at 30 feet in from the portal of the tunnel contains a 10-inch lens of so-called talc which, however, microscopic examination shows to be alunite.
Deposits

The deposits occur in several veins which strike a little east of north. They are mostly silver-bearing veins but in the Gray Eagle Vein, which lies toward the western border of the property, the useful metal is chiefly gold. Also in the face of the main workings or stope the vein or ore bed carries a 3-inch to 12-inch band of dark-greenish brown gold ore and the raise in the stope contained on either side a 3-inch breccia vein.

The alunite which is massive, brittle, and nearly white with a slightly reddish tinge occurs in tabular sheets or lenses ranging up to a foot or more in thickness, parallel with the vein (Spec. 317). It is characteristically present on slip planes or slickensides.

In general, the wall rock is considerably shattered for 40 or 50 feet back laterally from the vein, and in places it contains recementing veinlets of quartz and adularia, the two minerals in places being alternately banded (Spec. 315). In Vein Peak and south of there the foot wall seems to be a large dike, a section of which extending from a point in the south slope of the peak for 1/10 of a mile southward is faulted several hundred yards to the east.

**McMann Group**

The McMann, Royal and Royal Tiger groups here described were mostly located by McMann and associates but later acquired by Otto Steinheimer and associates through whom they came to be known as the Steinheimer group or Steinheimer group and Steinheimer. The Steinheimers were among the first to do important mining development in the Reward camp, and by opening up the new Reward-Schurz road greatly shortened the haulage distance to the railroad.
The McMann group or so-called mine joins the Black Eagle mine on the southwest and contains about 4,000 feet of what is regarded as the continuation of the Black Eagle vein which extends longitudinally through the Partnership and McMann claims and across the intervening Partnership No. 2 and Reward claims. Throughout this extent the vein has been prospected at about 40 points by crosscut tunnels, pits and shafts aggregating probably more than 2,000 feet of work, with several of the tunnels exceeding 200 feet long, but so far as learned without production or encouragement. Some of the ground seems to have been worked by the lease block system similar to that in Rawhide.

Much of the deposit is regarded as a replacement quartz vein in a porphyry dike, and capable of producing a good grade mill ore. To the southwest of this property and its mineralization are veins and mineralized dikes of low-grade mill ore running about $4 to the ton and accordingly not now workable.

The Royal mine owned by the Rawhide "Royal Mines Co." joins the McMann group on the east. The property consists of a group of 4 claims known as the Wonder King group, with the United States location mineral monument No. 217 located on its southern border. It is said to have produced considerable good ore in the early days of the camp. Three feet of the lode is said to have assayed nearly $1,400 to the ton, chiefly in gold.

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The vein strikes N. 15° E. and dips 60° W. in shattered mineralized rhyolite. It is about 7 feet wide and seems to consist chiefly of iron and manganese stained mineralized crushed rock and quartz in joints, seams and fractures of the rhyolite much as in the Hooligan Hill ore zone, Fig. 61, (Photo 23). There is in general but little quartz present. A specimen of the ore examined contains disseminated pyrite. The vein is opened by shaft and tunnel to the depth of 400 feet and a trench several hundred yards in extent in the croppings.

The Royal Tiger Mine

The Royal Tiger mine, located nearly 2 miles west of Rawhide, joins the Royal mine on the northeast, Fig. 53, (Arnold claim map). The property consists of 2 claims, the Royal and the Tiger. It was discovered by Carl Bray and later in 1908 purchased by the present company, the Royal Tiger Mining Co. for $30,000, who later sold the Royal Lease, 200 feet by 600 feet in area for $25,000, and which yielded much rich shipping ore running $800 to the ton. A car load of ore shipped from the Stinson lease is said to have averaged $250 to the ton. Also the showings on the Upton lease on the Tiger claim were very exceptional.

The country rock is rhyolite which is much broken, and is locally intruded by rhyolitic obsidian as at the Black Eagle mine and by purplish gray speckled porphyritic Pilot Cone andesite (Spec. 328), as shown by croppings in the hill 50 feet southwest of the tunnel to the hanging wall side of the vein in the tunnel, at 150 feet in from the portal.


14/
There are 3 veins or lodes contained in the shattered rhyolite, of which the main vein strikes N. 23° E., and dips about 60° to the west. The ore occurs chiefly in a belt of blocky or shattered rhyolite forming the hanging wall rather than in the vein itself or what is worked as the vein, the structure in the rhyolite being peculiarly favorable for the accumulation of the ore, and it extends in depth to the 3rd or 200-foot level.

The mine is opened to the depth of 550 feet, including a 100-foot winze at the bottom, mainly by a shaft and tunnel with levels turned at the depths of 25, 110, 200, 450, and 550 feet respectively, and with drifts and crosscuts on each level adequate for testing the ground. Good grade ore containing free gold is said to occur in the bottom of the mine.

The shaft stands at an elevation of about 6,050 feet and the tunnel, which is known as the Tiger tunnel, is about 100 feet lower down the slope, and runs N. 40° W. At the portal of the tunnel just above a pink rhyolite dike (?) occurs a reddish iron and manganese-stained rhyolitic obsidian dike 8 feet or more wide (Sec. 322) dipping 65° to the west, above which is a 1-foot vein of crushed, altered and brecciated rhyolite in part altered to a "mud vein" and containing mostly hard brecciated quartz boulder-like bodies and lenses 10 feet long and said to run 26 ounces in silver to the ton, above which comes the hanging wall of mineralized and in general crushed light rhyolite. At only 40 feet in depth the vein already contains much molybdenite and other ore minerals.

The production is said to be about $8,000 of which about $6,000 was high grade shipping ore running several hundred dollars or more to the ton, later considerable lower-grade ore was hauled to the Nevada New Mines Co., and still later some ore was shipped by H. S. Guinan.
The ore nearly all came from near the surface, mostly from the 1st or 25-foot level, and seems to represent chiefly secondary enrichment. So far as learned the operators found but little encouragement for deep mining.

To the northeast of the Royal Tiger and neighboring mines in the southwest side of the pass which stands at an elevation of about 6,150 feet and separates the Reward drainage on the southwest from that of Rawhide Gulch on the northeast, occur two or more good-looking veins which dip 20° to 60° westerly in the rhyolite and are said to carry fair values. They are more or less faulted and shattered. The cropings and ore are pink and brownish iron and manganese stained rhyolite and quartz, in part streaked with dark silver sulphides (Spec. 330). To the southwest of the pass the ore deposits occur in or below a reddish glassy rhyolite dike or bed which is from 50 to 300 feet in thickness (Spec. 331), whereas to the northeast they occur above, or at a higher horizon than this rock.

Bullskin Mountain Mine

The Bullskin Mountain (or Penglaze) mine is 1 ½ miles west-southwest of Rawhide in the hills forming the lower southeast slope of Bullskin Mountain, at an elevation of about 5,850 feet, Fig. 54. It is owned by the Nevada Silver Co. The property consists of a group of 6 or more claims known as the Bullskin Mountain group, Fig. 84, Vein map. It joins the Rawhide Metals property on the southwest and that of the New York mine on the east. It began to be worked prior to 1913, but the production by 1920 so far as learned had not much exceeded $30,000. Much of the ore was milled at Rawhide, including 500 tons it is said which ran 25 oz. in silver and $4 in gold to the ton. The value ratio of the precious metals contained of the ore as a whole is about 90% silver and 10% gold, assuming silver to be worth $1 an ounce.
The country rock is the Cone Mountains rhyolite, and it is intruded by a lens about 500 feet wide of greenstone or altered andesite, extending in a north-northeasterly direction across the property. The deposits occur in both these rocks, Fig. 84, (Vein map). The east contact between the two rocks dip west-northwest. The andesite, which is dull apple-green in color, seems to contain much epidote, has been highly altered, crushed and cemented with a network of minute veinlets composed of quartz, lime and iron carbonate, including probably ankerite, and ferruginous dust-like material. (Spec. 263). The rock weathers dark or blackish somewhat similar to the Black Buttes andesite, and the manganese and iron material leached from it readily darkens the surrounding rhyolite.

**Deposits**

The deposits occur in a half dozen or more steeply dipping veins in the rhyolite and andesite. The veins in general are small and not extensive. They are composed chiefly of crushed, altered and mineralized rock and contain relatively only a moderate amount of quartz. The valuable metals are silver and gold and the principal ore minerals are cerargyrite, iodyrite, and argentite. The veins consist of two sets or groups, an east-west or lower set and a north-south set locally referred to as the upper or cross veins. Those of the former are the more numerous and important and seem to be the older, as shown in Fig. 85, (Sketch), showing an east-west vein cut by a north-south vein. The prevailing dip of the east-west veins is steeply north and that of the north-south veins steeply west. At the time of visit in 1913 the deposits had been opened to the depth of 200 feet on the shaft vein on the Millskin Mountain claim No. 1, on the rhyolite-andesite contact. The vein is 15 feet wide and dips 70° N. about parallel with the structure in the wall rock.
Rhyolite. At and near its point of intersection by the west vein, as shown in the 45-foot level, it carries a 6-inch wide shoot of rich silver ore. Elsewhere in the vein and to some extent in the wall rock the ore occurs largely in fractures and as replacements. The ore minerals are mainly cerargyrite and iodyrite. The ore as mined is mostly fine or of small size, much of it resembling screenings. It is said to average about 7 oz. silver and $9 in gold to the ton. Panning is employed as a preliminary test in guidance of the operators.

In 1920 there was reported to have been stope from the shaft mine east of the shaft between the surface and the 100-foot level 30 tons of ore that averaged $45 to the ton as indicated in Fig. 86.

Tunnel vein

The Tunnel vein lies about 150 feet south of the shaft vein and is opened by an adit driven westward at a point 300 feet southwest of the shaft and across the gulch. The vein dips 80° S. in chiefly andesite. It is only 3 inches wide but has an extent of 1,000 feet, of which 300 feet lies east of the portal and 700 feet to the west of it. The most of it is said to run about 30 ounces in silver and several ounces in gold to the ton. It contains but little quartz. The ore minerals, cerargyrite and iodyrite, are intimately associated with black manganese oxide.

In No. 2 tunnel, about 200 feet long, the vein is 8 inches wide and contains some sulphide quartz ore of which a considerable quantity runs several hundred dollars to the ton. Some of the later quartz is chalcedonic.

On the Bullskin Mountain No. 2 claim, at an elevation of 5,900 feet, on the Backlin-Flynn lease a fault vein in rhyolite was opened to the depth of
The vein is 3 feet wide and consists largely of shattered rhyolite
with the ore contained in the fractures similar as at Hooligan Hill, Fig. 61.
The values occur mostly in the 16-inch hanging wall part of the vein which
averages about $2 $42 in silver and $8 in gold to the ton. Some of the ore
shipped ran $600 to the ton. At the depth of 50 feet the vein is offset by
a fault with low dip, and shows drag material, and here considerable ore was
mined. Beyond the fault the vein resumes its normal course and values which
it maintains to the bottom of the mine, and considerable ore had been stoped
out especially to the east of the shaft. The vein is thought to extend south-
esterly to the New York ground, and at an intervening point on this course
a prospect opening shows a 3-foot wide "ledge" of compressed or laminated
black ferruginous manganese oxide containing considerable crystalline manganite
(Spec. 266), but the deposit is not regarded as of any commercial value for
manganese at the present time.

New York Mine

The New York mine, owned by the New York Rawhide Mining Co., is south-
east of the Bullskin Mountain mine in the northeast slope of Chicago Mountain
on a fissure or fault seam which dips southwest in the rhyolite, Fig. 63,
(Arnold map), and Fig. 54, (Photos 27-28). It is opened by three adits of
considerable length spaced about 80 feet apart vertically, the upper one being
at an elevation of about 5,650 feet. On the strength of the ore showing in
the portal of the upper tunnel much stock, it is said, was sold and considerable
work done. But the ore, which looks well and contains much rusty brown iron-
stained pale greenish quartz pseudomorph after calcite or other spar, did
not continue in extent but appears to have been only a local pocket or body
similar to those described in Burns Hill near town.
The Rawhide Metals Mine

The Rawhide Metals Mine, credited with having produced some good ore, is about one-third of a mile southeast of the Bullskin Mountain or Penglaze Mine. It is in the southerly side of the ridge that extends southeasterly from Bullskin Mountain at about 100 feet below the crest and at an elevation of 5,750 feet, Fig. 52, (Large scale map). The elevation of the Rawhide Metals saddle is 5,850 feet.

The country rock is the light-colored rhyolite (specimen 262) which is fine grained and considerably kaolinized, much of it being no longer firm.

The shaft which is 150 feet deep and equipped with a hoist is sunk on the contact of the rhyolite with a dike of dacite which is medium grained, drab gray, porphyritic, and contains considerable hornblende and biotite. From here the contact between the light rhyolite on the northwest and the tuff and andesite on the southeast extends southwestward about direct for Pilot Cone. Also a long tunnel with its face beneath the ridge is driven to the northeast.

Outlying prospects in the west zone

The Lappatt Lead Mine is 2 1/2 miles southwest of the Black Eagle Mine and 3 miles southwest of Pilot Cone in the west base of the mountains near the eastern edge of Copper Mountain Basin. It is reached from the southwest by 4 miles of good road which connects it with the Shurz-Dead Horse Well road, Fig. 3, (Topo. map). It has made a small production.
The geology in this area, so far as mineral deposits are concerned, consists mainly of the Jura-Triassic limestone-quartzite-shale-slate series of sedimentary rocks and granitic intrusive by which they are invaded. The mineral deposits or so-called veins, several of which are from 1 to 4 feet wide, occur along the contact of the granitics with the sedimentary rocks, mostly in the sedimentaries as contact metamorphic or replacement deposits. Besides lead, most of the deposits contain also a little copper and some of them iron, but the copper does not appear to be intimately associated with the galena.

The Lappatt Lead Mine, according to the owner, Edward Lappatt, is on a granite-quartzite contact and is opened to a depth of 190 feet. The ore from the surface down is mostly lead carbonate and galena. It occurs seemingly as replacement mainly in the quartzite and in fault breccia and gouge forming a part of the lead along the contact, but as it decreases in value at shallow depths and showed no sign of improvement in the bottom of the mine, Lappatt temporarily suspended active operation but continued to do the required assessment work on the property in 1916.

The Queen Regent Merger Group

The Queen Regent Merger Group, formerly the Queen Regent Copper and Gold Group, comprising 17 claims owned by the Queen Regent Merger Mines Co. of San Francisco, is about 6 miles southwest of Rawhide, Fig. 3, (Topo map), and Fig. 63, (Arnold claim map). It has also been called the Kerr mine. The discovery of mineral on the group is said to have been made by James "Jim" Murray in 1907.
The company was operating with a small force of men in 1913, the manager being Mr. Tridell by whom, and W. E. Davis, who also worked there, much of the present information was kindly supplied.

Deposits

The deposits contain copper, iron, gold, and silver, especially in the gossan andcroppings. They occur mainly on a quartzite-limestone-diorite contact with bluish gray Mesozoic limestone forming the hanging wall and into which the diorite (Spec. 249) seems to be intrusive and probably is genetically connected with the deposits as the limestone is altered and silicated along its contact which in general dips steeply east. These rocks in turn are cut by lighter colored monzonite dikes. The diorite is a dark gray or black and gray speckled medium-grained granitoid rock and contains much hornblende. It is pressed or slightly schistose in texture and is probably of late Mesozoic age.

The deposits are opened mostly by several shafts, short tunnels, and drifts. The deepest shaft, which is about 400 feet deep, and is locally known as the iron mine was started on a quartz cropping for gold and copper. At the depth of 250-300 feet it passes through a 50-foot wide blackish iron dike, dipping about 40 degrees east, Fig. 87, and which, in general, seems to be a fine-grained greenish-blackish iron-bearing amphibole (Spec. 351).

The lode is said to have a horizontal extent of a half mile. At the shaft from the surface to the depth of 300 feet, where it becomes brecciated or conglomeratic with considerable quartz on the foot-wall side and decreases in iron content, it is said to consist mainly of iron ore which averages 50 percent in iron. Study of a specimen (350) from this part of the lode...
under the microscope and in polished section shows the material to be about 60 per cent fine-grained magnetite containing a little greenish amphibole, calcite, quartz, and copper carbonates, all more or less uniformly disseminated. The calcite and quartz occur mostly in jagged interstitial bodies, and were formed later than the magnetite.

Also at about one-fourth mile southeast of the mine shallow workings in the limestone present encouraging showings in copper which are apparently associated with the diorite-limestone contact nearby. At about a third of a mile to the north of the iron mine openings 50 feet deep on quartz veins in tertiary rhyolite present good showings in gold and silver which, however, do not seem to maintain their metal tenor in depth.

Raines Iron Prospect

The present note on the Raines iron prospect, owned by W. M. "Billy" Raines, 7 miles northeast of Double Spring, 12 miles northeast of Schurz, and 10 miles west of Rawhide, is based on an examination made of specimens of the ore and rock and a letter received from Mr. Raines in August 1927. The rock specimen said to form at least one wall of the deposits is a fairly fresh reddish-gray fine-grained quartz monzonite porphyry sparingly speckled with small glassy feldspar and blackish augite and hornblende phenocrysts. It is cut by joint planes and marked by pressure lines and is similar to the intrusive and dike rocks in the neighboring Benway and Copper Mountain camps.

The specimens of ore, of which there is said to be a large quantity in sight, are reddish brown massive botryoidal hematite and finely crystalline blackish hematite, which seems to have been derived from pyrite. The material is of high specific gravity and contains by estimate about 40 per cent iron. With
the crystalline hematite, especially on joint planes, is associated considerable
amounts of alteration resulting from the breaking down of pyritic ore and rock
by weathering.

As the ore specimens appear to be from croppings or gossan, it is
inferred that the deposit probably grades downward into siderite or magnetite
and finally into pyrite.

Placer deposits

Location and topography

The Rawhide placers occur chiefly in Rawhide Wash (also erroneously
called Rawhide Canyon) and a couple of its tributaries near Rawhide. They
extend from the town and Hooligan Hill on the west about 6 miles southeasterward
to Alkali Flat, and are about all contained in a belt about a half mile wide.

The presence of gold throughout most of this distance was shown during
the Rawhide boom days of 1907-1908 by pits and shafts sunk in a somewhat
desultory manner by sundry miners and prospectors and later in the lower
part of the course by wells sunk by mining companies in or near the edge of
the flat for water. In the lower 2 miles of the deposits, however, extending
from the foothills to the Flat the gold is not yet known to be present in
commercial quantities.

Rawhide Wash is about one-fourth mile wide and open, Fig. 54, (Photo), and
has a rock maximum depth to bed rock of about 90 feet. On the north, however,
the deposits have a width of a half mile or more and as such they extend from
Balloon Hill on the east and Hooligan Hill, Climax and Holland-Ricard shafts
in the west, about a mile southeasterward to the National Mill Hill. As noted
elsewhere, the deposit is continued northward to the National Mill Hill and at the Devil's-Lift
with Rawhide Wash near the northern end of Murray Hill.
under Topography, its surface, all parts of which are easy of access, has a fairly uniform gradient of 175 feet to the mile or 3.3 per cent throughout the extent of its course and may be likened to the bed of an aggraded stream.

History and production

The deposits were discovered in the early boom days of Rawhide, 1907 and 1908, during which period and just after they were worked by about 500 men, mostly with dry washers, the ground being divided into claim blocks 50 feet square. Some operators sluiced the gravel with water hauled from Dead Horse well in Alkali Flat for which the price was $1 per barrel. Most of the gold was mined from rich streaks and bars of gravel on bed rock, but considerable was also rocked and panned from shallow deposits in the side gulches almost from the surface down, especially between Hooligan Hill and National Mill Hill.

During this period many pits and shafts were dug of which 25 to 30 shafts were sunk 40 to 90 feet deep to bed rock. Owing to scarcity of water many sorts of dry-process devices were employed to recover the gold, the most important of which were large dry washers driven by gasoline engines. Some of the washers had chain or belt cupped elevators and were quite well equipped. Since then the deposits have continued to be worked at intervals. Any broke prospector, it is said, readily takes out from $2 to $4 worth of gold a day to replenish his larder with flour and bacon.

In 1913 a couple dry washers were in operation at Roseberry Hill and vicinity and by August the merchandise store of J. C. Carter had taken in for that year $500 worth of the newly mined gold.

In 1915-1916 the placers were being worked with dry washers by a few parties mainly between Hooligan and National Mill Hills and at the Davis-Light mine in Rawhide wash near the south end of Murray Hill.
In 1930-1931 the first 1 1/2 miles of the deposit extending from the town to the National Mill Hill was said to be owned by the Grutt Brothers and the remaining 4 1/2 miles by the Hart Syndicate composed of Frank Channing, B. G. Cord, and R. G. Hart. The latter tract contains 1,200 acres and includes several old workings that yielded rich gravel on bed rock and is estimated by the owners to contain about 100,000,000 cubic yards of gravel that will average 50 cents to the cubic yard, or a total of about $50,000,000 worth of


During 1930 and 1931 the syndicate did some drift mining next to bed rock at the bottom of a 92-foot shaft on the Nugget claim using dry washers on the surface to recover the gold. Here the 5 feet of gravel next to bed rock is said to average $2 in gold to the cubic yard, and some to contain as much as $5 to the cubic yard. The gravel is first screened to a grade in which the fines constitute about 40 per cent. One washer was built to treat 100 tons of gravel a day. It employs an air current blown through a wide inclined travell canvas screen or belt studded with ripples to separate the gold from the gravel and a barrel amalgamator.

In November 1930, the Idaho Gold Dredging Company, of Boise, Idaho, took a bond and lease on about all of the deposits, 1,800 acres or more extending from Rawhide to the edge of the foothills, and made a preliminary examination with a view to dredging there if subsequent churn drill tests should indicate enough gold present to warrant consummation of the project, and later

16/ Nevada Mining Press, December 12, 1930, page 1.
The deposits were being thoroughly sampled by the Hammon Engineering Company of San Francisco operating under the same bond and lease, which included payment of $75,000 within five years and certain royalties on the production. In May 1931, however, this company also discontinued sampling and the property reverted to the original owners. The reason for the company's relinquishing the option seems to be the erratic distribution and low average values of the gold.

**Production**

The placer gold production of the district is variously estimated from $100,000 to $250,000. Probably $220,000 is a fair figure. J. C. Carter had by 1913 received and shipped out from the camp over $30,000 worth of the gold. Also during and just after the boom days five or six other firms bought the new gold, and a considerable quantity is known to have been carried out by prospectors individually among whom James "Jim" Borden took out $3,000 worth.

**Deposits**

The Bed rock in which the channel of Rawhide Wash is carved and on which the placer deposit rests for at least the 4 miles of its course, extending from the town to the outer edge of the foothills, is composed of volcanic rocks, chiefly rhyolite, and in cross section the sides or rim rock seem about everywhere to be of fairly gently slope. The deposits fill the channel from the bottom to the present surface to maximum depth of 90 or more feet. They consist mainly of a heterogeneous mixture of coarse- to fine-angular wash material ranging from bits of silt, fine-grained sand and grit up to boulders nearly a foot in diameter. In general, they are crudely or discordantly stratified. They are composed mostly of light-colored volcanic rocks which are predominantly rhyolite.
Of the gravel, especially in the upper part of Rawhide Wash, a considerable portion of the pebbles tend to be dominantly elongated or crudely finger-like in form with rounded terminations, which feature seems to be due to the structure of the slate and other parent rock from which they were derived.

In depth the deposits are not wet but usually just moist enough for the material to cohere or stick together when pressed in the hand.

In many places the 5 or 6 feet of gravel next to bed rock, though not lithified, are partially consolidated or cemented by a sort of manganese-iron oxide argillaceous mixture, which feature causes it to stand so firmly that blasting is employed to loosen it, and widely spaced pillars of the material left standing in mining readily support the 60 to 90 feet of overburden, an important feature in scarcity of timber. The clay in the matrix seems to be derived mostly from decomposition of feldspar in the rhyolite and other rocks.

Gold

The gold occurs irregularly distributed throughout the deposits from the surface down to bed rock, but generally in commercial quantities in the lower part of the section only, mostly on or near bed rock. Here the commercial gold occurs at various horizons in so-called pay streaks, a few of which are as much as 10 or 12 feet above bed rock. As seen in the Lease shaft below Murray Hill, the pay streaks are from 5 to 12 feet wide and from 3 inches to 14 inches in thickness. They represent former water channels and these the miner tries to follow.

In some instances, as shown in the Davis-Light mine, a pay streak may gradually leave the bed rock and in a comparatively short distance become separated from it by several feet of gravel.
In the pay streak the gold is irregularly distributed or bunchy and varies from a few cents to several dollars to the pan. Usually the dark brown, ferruginous oxidized appearing layers of the gravel contain the best values and in most cases are a good guide to follow in search of pay dirt.

On bed rock the richer pay occurs where the floor is sufficiently rough to form natural riffles or where it is benchy with the benches being from 1 to 2 feet above one another.

The erratic distribution of the gold seems to be due mainly to the precipitous manner in which it was deposited, namely by torrential floods or violent rushes of water and debris due to cloudbursts that were of a startling short duration and occurred at comparatively wide intervals.

The gold is mostly coarse and rough and has yielded nuggets up to $50 in value, one of which on exhibit at J. C. Merz's "Dads" restaurant was seen by the writer. It was said to be from bed rock 90 feet deep in the Golden Wonder mine about a half mile below the National Mill.

A small handful of other gold said to be from the Grutt Consolidated placer mine west of Murray Hill contained several pieces worth 75 cents to $1 each.

The gold varies in grade of fineness from $16 to $11 and averages about $14 to the ounce. That in the upper part of Rawhide Wash derived from the Balloon and Murray Hill area is said to be more persistently yellow and of better grade than that in the Hooligan Hill region. The lighter-colored or lowest-grade gold is found in the gulches west of Hooligan Hill and is electrum. It seems to have been derived from silver deposits in the Cone Range.
Notes on a few of the mines follow.

Grutt placer mine

The Grutt placer mine is in Rawhide Wash about a half mile below Rawhide and opposite the south end of Murray Hill. It is opened by a 65-foot deep shaft to bed rock which is rhyolite. It was active when examined by the writer in 1913. The gold was being won by dry washing. Two pay streaks were being worked, one on bed rock and the other at about 3 feet above it. They were each about 8 feet wide and lay nearly horizontal but converged slightly to the north or upstreamward in which direction at no great distance the upper streak was supposed to join the lower. They were separated by about 2 feet of gravel locally called false bed rock but which did not seem to differ from the ordinary run of gravel found elsewhere. The pay streak on bed rock was about a foot in thickness and carried its coarsest gold conspicuously in or near the bottom mostly in the rougher part of the bed rock floor.

The upper pay streak was 14 inches in thickness and consisted mostly of coarse sand or finer material than the average gravel and was slightly argillaceous and consequently less pervious at the base.

The gold in the pay streak is irregularly distributed, bunchy or pocketed and varies from a few cents to $2 to the pan of gravel. It is mostly coarse, rough, and wiry or porous. Some of the largest pieces found on bed rock were worth 75 cents to $1. Parts of some wiry specimens are interlinked and apparently hold the same relations they had in the Mother Lode quartz matrix similar to lode specimens found in the Kearns No. 2 shaft. Though it has a fairly good yellow color, it is said to average only about $14 fine to the ounce.
A tablespoonful of the dry washer concentrates from this mine (spec. 434) examined microscopically by the writer was found to consist of about 90 per cent sand and to contain 16 or more small particles of gold. Eighty per cent of the sand was fine-grained magnetite. Other minerals in the sand mostly angular and but few of them well rounded are mostly quartz and chalcedony with a scattering of garnet, hematite, plagioclase, hornblende, augite, chlorite, olivine, zircon, and muscovite. The gold particles are mostly all of red yellow color except at points where they have been mechanically shattered or bruised by erosion. Here the color is lighter and approaches that of copper. The largest piece is slightly more than two-tenths of an inch long and five-one-hundredths of an inch in width and thickness and is slightly curved. Excepting one side, which is slightly porous or perforated, its surface is mostly nodular, botryoidal, or beady, having the appearance of being exposed of numerous minute nuggets or beads. One side near its middle part contains a small elongated piece of quartz, part of which is stained reddish by hematite.

Golden Wonder Mine

The Golden Wonder mine is about 2½ miles below Rawhide and 1½ miles below the National Mill on the opposite side or east rim rock of Rawhide Wash, there called the benchmark. When visited in 1913 it was opened mainly by a shaft 100 feet deep to bed rock and was being worked by several prospectors jointly. The gold was being extracted by a dry washer driven by gasoline engine which daily handled a ton of gravel per hour. Although the shaft was five years
old, it having been sunk and considerable drifting and mining done in it in 1908, the gravel was so firmly cemented that the ground still stood well, a few remaining pillars without timber supported the 80 odd feet of overburden, and drilling, augering, and blasting were employed to loosen the gravel being mined.

Here the lower 8 feet of the gravel were said to be commercially valuable and to run several dollars to the cubic yard, but operations were then being confined to the lower 6 feet, which were said to run about $5 to the cubic yard. The richer pay occurred in the 8 inches next to bed rock, a considerable portion of which had been mined by the previous owner and is the source of the Herz $50 nugget. Above the 8 inches resting on bed rock the next 5 1/2 feet of the gravel was said to run about $3 to the cubic yard, to have yielded several pieces of gold worth $7.50 each. Twenty cubic yards of the gravel just mined out averaged $3.50 to the yard.

Further down the wash is another 90-foot shaft in which the deposits are said to be promising.

Source of the gold

The roughness and coarseness of the gold and the gravel containing it indicate it to be wholly of local origin and not far traveled. It was derived by erosion and transportation from various Tertiary volcanic veins and lodes within the district, some of which are now being mined as shown by placer pay streaks on bed rock in the Davis-Light, Crawford, and other placer shafts below Rawhide leading up to the Morning Star, Trost, and other lode mines in Murray and Balloon Hills and vicinity.
In some areas, as a couple miles east of Rawhide, the contributing veins and lodes, together with their containing volcanic rocks, have been completely eroded from off the sediments that now underlie the surface, as described under the Titanic prospect, page 598, of fine material, its prospection with churn pit or other means in an area about the lower lying part of the area.

The 5 miles of the deposits extending from Rawhide and Hooligan Hill to the edge of the foothills seem to contain a considerable quantity of gold, but because of the erratic distribution of the gold vertically and the heavy overburden covering most of it, they probably cannot be profitably exploited on a large scale as by dredging, although ample water for this purpose could be pumped from Alkali Flat. Perhaps some gain could be made by working the ground in large tracts through a few long tunnels or gently inclined shafts through which the pay dirt could be brought to the surface by tram and treated in a centrally located plant on a large scale instead of hoisting it through numerous vertical shafts as at present.

The lower 2 miles of the deposits extending from the edge of the foothills to about the middle of Alkali Flat have not been prospected. All of several shafts sunk in them near the edge of the flats to depths of about 100 feet report to contain gold, and some engineers suggest that the deeper "lake" beds in this section, supposedly composed mainly of material discharged from Rawhide ash, probably contain much gold. Even so, unless pay dirt begins at moderate depths, there would be a very heavy overburden to remove, and underground mining would probably not be feasible in depth on account of water. The gold in this area is probably finely divided and doubtless more evenly distributed than
in Rawhide Wash. The depth to which the deposits extend is not known. One well is reported to have attained a depth of 150 feet without reaching bed rock, but whether the deposits are gold-bearing to this depth is not known. As this part of the deposit is composed of fine material, its prospecting with churn drill or otherwise is an easy matter. The lower lying part of the area, however, should be undertaken in dry season only.
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U. S. Min. Res. 1907-1921, Part I.

CARSON SINK AREA, NEVADA

By

F. C. SCHRADER

EAGLEVILLE DISTRICT (5)

The Eagleville district, also known as the Hot Springs district, centers
about 6 miles east of Bridgeport, in a line 10 miles northeast of Fallon,
10 miles southwest of Eagle and 40 miles northwest of Carson City.
The deposits are mostly of quartz, and are about 8 miles long
along a line, Fig. 28, (Topo. and Geologic map).

The topography is mountainous. The district lies in a great fault of the
main that locally connects the north end of the Bodie district with the
main that of the Fairview Mountains on the east and separates Eagle Valley
from Fairview Valley on the north. Most of the district is divided
into 8 1/2 mile blocks.

The 2 small settlements in the district, which are small, are Eagleville and
northeastern part of the district and Fairview toward the southeastern part.

The former electric power line on Fairview and Letter extended northeasterly through

History and production

Mineral in the district was discovered in the early seventies by before
Clair of the mining town of 3 miles northwestern of Eagleville, for the
head of the old Hot Springs mill, then known as the William
built at the time of. 1850. 5 miles southeast of Eagleville.
The only mine was opened in 1874, but this mine was run according to the laws and
was not profitable. In the early thirties, ore of less than 500 grade could
Eagleville (Hot Springs) District

Location and topography

The Eagleville district, also known as the Hot Springs district, centers at a point about 6 miles east of Rawhide. It is 30 miles northeast of Nolan, the nearest railroad station, 36 miles north of Luning, and 40 miles southeast of Fallon to which 25 miles of the route is over the Lincoln Highway.

The deposits are mostly contained in an east-west area about 8 miles long and 3 miles wide, Fig. 68, (Topo. and Geologic map).

The topography is mountainous. The district lies in a cross belt of low mountains that loosely connects the south end of the Sand Spring Range on the west with that of the Fairview Mountains on the east and separates Gabbs Valley to the south from Fairview Valley on the north. Most of the district is drained northward into Alkali Flat.

The two main settlements or camps, which are small, are Eagleville toward the northeastern part of the district and Sunnyside toward the southwestern part.

The former electric power line to Fairview and Wonder extended northward through Sunnyside.

History and production

Mineral in the district was discovered in the early seventies or before the site of the Harry Mann mine 3 miles northwest of Eagleville, for the treatment of whose ore the old Monte Cristo mill, then known as the Whiting mill, was built at the edge of Alkali Flat 5 miles southeast of Eagleville.

The mill was operated in 1874 but with poor success, owing to the Mann mine being too basic. In these early days ore of less than $90 grade could be...
be shipped. At about this time mineral was also discovered at Sunnyside. Richard "Dick" Flynn who named his first discovery the Sunnyside and next one the Great Eastern.

Also in the early seventies the Murphy copper-lead deposits were discovered. John Murphy, pioneer resident at Alkali Flat, along the granite-limestone contact in the western part of the district from which occasional small shipments were made.

In 1882 the Great Eastern group of four claims was bonded for $16,000 of which $1,000 was paid and the bond later relinquished. Since then the camp has shipped $5,000 worth of mostly gold ore running about $156 to the ton besides which moderate shipments have been made from time to time by Tom Kenyon and other parties. Some were being made from the Kenyon property by lessees in 1/.

1/ Mining Review, August 22, 1934.

The most of the early-day ore averaged about $55 to the ton. The camp can handle $30 ore at a fair profit. The Sunnyside ore of today is gold-silver, copper ore and averages about $20 to the ton of which $12 is in gold and $8 in silver. Two thousand tons of $20 ore is said to be now in sight in the Great Eastern mine, some of which runs more than $40. The ore, it is said, can readily cyanided to a high degree of extraction. In recent years the camp has been making a moderate production of barite and is reported to have discovered deposits of tungsten.

In 1882 mineral was discovered at what is now the site of the Eagleville at Eagle by Albert A. Woodruff who soon thereafter formed the Eagleville Mining Company which began development work in 1884, took out $6,000 from the
No. 2 vein on the upper or tunnel level, and in 1887 $2,000 each from the
Canyon Gate and Summit veins. About 10 tons of the ore averaging $100 to the
was shipped and the rest, about 260 tons, running $35, was milled in the old
Cristo mill then known as the Whiting mill.

In the period, 1891-1895, the company shipped to Selby, Chamberlain and
Lake $10,000 worth of gold ore which averaged $130 in gold to the ton, the
rest being $299. This was the last work done up to 1913 excepting assessment

In 1913 the leading owners in the company were William "Bill" Woodruff,
"Tom" Kenyon, and Mr. McCracken, and the mine was said to be for sale for
$1,000. Under conditions then prevailing the company could handle $30,000 ore.
Haulage to the railroad at Nolan was $10 whence railroad freightage
Thompson near Wabuska was 70 cents a ton. The miner's wage was $4 a day. The
pany then claimed to have in sight in the mine $280,000 worth of ore that
average $12 to the ton.

The mine is opened to the depth of 300 feet and is developed by 8,000 feet
work. It was worked mainly through the cross-cut tunnel and two 230-foot deep
shafts and raises.

In 1925 it was reported that the company had purchased the Black Eagle mill
while which was being moved to the mine and would be in operation at an

Geology

The salient formations and geologic features in the Eagle district beginning
the older rocks are the Triassic (?) limestone shale, sedimentary series,
is intruded and in part overlain by quartz diorite porphyry which, together
by quartz and feldspar forming in almost a sort of graphic structure.
the sedimentaries, is intruded by granite, and all three of these rocks are
finally overlain and locally intruded by Tertiary volcanics, Fig. 88.

Of the older rocks the quartz diorite porphyry is predominant in the eastern
part of the district and the sedimentaries in the western part.

The ore deposits are associated with the older or pre-Tertiary rocks and
are genetically connected with the granite and quartz diorite porphyry. The
sedimentary series occurs mainly in the western part of the district where it
occupies an area of several square miles whence it tends northward into the
Kasock area. It includes considerable white crystalline and blue-gray
limestone in which many of the mineral deposits are formed, especially
those which are copper-bearing.

The quartz diorite porphyry occupies a belt nearly a mile wide extending
nearly 4 miles eastward to a mile from Egleville. It, as seen at
Egleville, Sunnyside, and elsewhere, is an iron gray, fine-grained, nearly
porphyritic rock, sparingly speckled with small dull feldspar and blackish
blende and augite phenocrysts. It shows faint parallelism of structure due
to pressure. Though the rock is typically iron gray, it presents from place to
place phases ranging from blackish or dark as in basalt to comparatively light
as in monzonite. Where weathered, as seen in the Egleville mine, it has
a greenish tinge due to the alteration products, chlorite and epidote, and
is generally calcareous. The microscope shows it to be monzonitic,
containing considerable orthoclase as well as plagioclase feldspar, which latter
is, however, is dominant. It also shows it to be highly altered to kaolin,
biotite, chlorite, and epidote to a degree that the feldspars and other minerals
are difficult to determine. Bent forms of biotite and other minerals show it to
have suffered dynamic disturbance. It shows also small areas of intergrown
quartz and feldspar forming in places a sort of graphic structure.
Granite

The granite occupies an irregular area of about a mile square with Sunnyside near its center. Here on the northwest it forms a prominent roundish hill about 400 feet high called Granite Mountain and abundantly intrudes the limestone-diorite series while on the east it similarly intrudes the diorite. It also occupies a smaller outlying area about three-fourths mile in diameter at about 1½ miles northwest of Sunnyside on the south ridge of Big Kasock Mountain. With its contact with both host rocks, mineral deposits and contact metamorphic phenomena are associated.

It is medium-grained gray or speckled with greasy luster quartz feldspar abundant black shiny biotite resembling very perfectly a coarse-salted pepper mixture. It weathers reddish brown. The microscope shows it to be a lime-soda biotite granite or "granite" and to be composed of acidic oligoclase quartz, orthoclase, microcline, and brown biotite with accessory apatite, feldspar, and magnetite. There is twice as much oligoclase as orthoclase feldspar content. The oligoclase is mostly in stout prisms and in cubic forms with zonal structure. Some of the biotite is altered to chlorite. In the Big rock area the rock is slightly coarser grained and tends to be porphyritic with crystals of feldspar and biotite ranging up to 0.15 of an inch in diameter.

Volcanic rocks

The volcanic rocks are chiefly light-colored rhyolite besides which, however, andesite, trachyte and basalt are also present. As noted later, much of the rhyolite in the northeastern part of the district is the young purple finely banded variety. Proceeding from Granite Mountain north northwestward for a mile the country rock, which is mainly white crystalline and bluish stone, is locally overlain and freely intruded by a dull lead gray fine-grained augite andesite.
The valuable metals contained in the deposits are chiefly gold and silver, some of the deposits contain copper and lead. The deposits are nearly all genetically connected with the intrusive granite. Those in the eastern part of the district occur in or are associated with the diorite porphyry and those in the western part with the limestone sedimentary series.

At Eagleville

In the Eagleville camp the deposits are chiefly gold or gold and silver, occur in a dozen or more small mines and prospects. They occur in quartz porphyry, mostly in the quartz diorite with their openings mostly confined to the oxidized zone. Besides quartz, their veins contain grayish altered diorite rock and barite which in places are important constituents of the ore and some of the barite is secondary. They include the Eagle mine, Joe, Olive, Monitor vein, Snowflake, Prince Albert, North and South American, Buckskin, and Troy. Though the veins nearly all carry fair values, some are obviously too narrow to be profitably mined at great depth. Notes on a few of them are as follows:

**Eagle mine**

The Eagle mine is at Eagleville, mostly in a local land mark, Eagle Hill, the main cross-cut tunnel at an elevation of about 5,600 feet below which the workings extend to a depth of 250 feet where, however, only traces of sulphides occur. The hill is composed mainly of the quartz diorite porphyry, granite and dark volcanic tuff outcrop in its northeast base and rhyolite and basalt occur farther east toward the Jo Dandy prospect.
In the Eagle mine the deposits occur in three parallel veins or lodes spaced at 100 feet apart, the Golden Gate, Eagle No. 2, and Summit veins, Fig. 39, (plan of veins). They strike northwesterly in the diorite across a 300-foot fracture zone in which they are richer. They are opened by about 8,000 feet of worked mostly by cross-cut tunnels, drifts, shafts, and stopes. The valuable metal is gold, of which 10 per cent is said to be free and nearly all the balance to be readily extracted by cyanide treatment. In 1916 the ore was screened and cobbled; the fines and that of intermediate grade netting about 10 to the ton, were sacked and shipped. One-third of the gross, about 600 tons, running $45 to the ton, lay on the dump to be later milled. The shipments 1916 to October 1 were as follows:

<table>
<thead>
<tr>
<th>Tons</th>
<th>Value per ton</th>
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<tbody>
<tr>
<td>16</td>
<td>$114</td>
</tr>
<tr>
<td>20</td>
<td>137</td>
</tr>
<tr>
<td>17</td>
<td>150</td>
</tr>
</tbody>
</table>

Freightage to Fallon was $12 per ton and working charges $17 per ton.

The Golden Gate vein, the most southerly of the three veins, dips 70° south, is opened to the length of several hundred feet and locally to the depth of 200 feet by workings, some of which are indicated in Fig. 39. It averages about 2 feet wide but, as seen in the face of the north drift at about 300 feet from a cross-cut tunnel 12 feet deep, it is about 3 feet wide and is composed of hard oxidized iron-stained quartz more or less well banded and some oxidized heavy spar or barite. Some of the quartz is honeycombed by pyrite.
been dissolved out. In its footwall side the vein carries a 1-foot wide shoot said to be mostly $40 ore while the remaining 2 feet of quartz forming hanging-wall side is mostly good milling ore, the values all being in gold.

The new work in the mine is mostly toward the north end of the Golden Gate. Here for the distance of 100 feet on the tunnel level drift and for 75 feet above it and 60 feet below it the ore has been mostly stoped (Fig. 89).

The portion above the level is said to have yielded 1,000 tons of $45 ore, some of which ran $100 to the ton and that below the level an almost equal quantity of $30 ore. South of the stope the 90-foot winze and about 200 feet of drifts mined from it to the east are said to contain throughout a 2½-foot wide vein that is nearly all $30 ore.

The Eagle No. 2 vein, intersected by the cross-cut tunnel at 750 feet in the portal, dips to the northeast. It varies from a few feet to 30 feet in thickness. It has a sparry barite gangue and contains, besides quartz, much coarsely crystalline barite and country rock diorite breccia. It is opened mainly by drifts and winzes to the depth of 160 feet below the tunnel level, mostly east of the tunnel. The ore in general ran about $6 to the ton of which there is said to be a large quantity. Much of the ore, however, is of higher grade, example given in the Borden 40-foot winze east of the tunnel, the vein is 12 feet wide and the ore is $30 to the ton and the nearby stopes rising above this level produced considerable high-grade ore.

In the bottom of the mine the gangue in this vein is mostly brownish and iron-stained crystalline barite and the wall rock, quartz, diorite, contains little fine-grained pyrite.
Summit vein

The Summit vein, as seen toward the base of the cross-cut tunnel (Fig. 89), only 8 to 10 inches wide, which is seemingly too narrow to be profitably mined at great depth. It extends to and outcrops at the surface where it is also opened into shafts, one being several hundred feet deep. It consists mainly of shattered sheared rock diorite, but is said to carry good values and in early days produced $7,000 in gold ore. By 1916 some new work had been done on its eastern end on the lower level at 350 feet below the surface where it is 5 feet or more wide and consists mainly of a barite-calcite oxidized rock gangue and carries a quantity of $12 to $15 ore.

Jo Dandy prospect

The Jo Dandy prospect, about three-fourths of a mile east of Eagleville, is a quartz breccia vein which dips 80° south-southeasterly in the diorite phryry which here resembles greenstone, and a tongue of the intrusive Sunnyside diorite with which the deposits may be genetically connected extends up the gulch within 200 feet of the prospect.

Thecroppings, some of which are manganese-iron stained, are 3 feet wide, and 3 feet high, and are here traceable for 500 feet and by some are thought to be the extension of the Prince Albert vein. Where opened mainly by a 50-foot drift and drifts, the vein is said to be 15 feet wide and to carry fair values in lead, silver, and gold. A pit 100 feet northwest of the shaft shows a 2½-foot quartz-barite vein containing considerable galena which, however, is not considered to be part of the Jo Dandy vein.
Prince Albert prospect

The Prince Albert Prospect on the Prince Albert vein about a half mile west of Eagleville, is opened by a 25-foot shaft, and the ore is said to average 30 parts lead and $8 in gold and $1.50 in silver to the ton. Where exposed in the southwestern slope of Eagle Hill this vein, 7 feet wide, dips 80° northwest in diorite porphyry and carries considerable galena in a finely crystalline quartz-barite gangue. The vein is claimed to have been traced for several miles to the east and to the west of Eagleville.

Good View prospect

The Good View prospect at about a half mile southwest of Eagleville has veins of which the main one is about 14 inches wide, strikes northwest, and dips about vertical. It consists mainly of a quartz gangue which is in part porphyritic, and the most of it is said to carry about $20 in gold and 30 in silver to the ton.

Olive prospect

The Olive prospect 1½ miles south of Eagleville is on an east-west 12-foot vertical quartz vein opened by a 60-foot shaft and an 180-foot tunnel.

Monitor vein

The Monitor vein near the cabin on the Eagle group dips steeply west, has an extent of 3,000 feet, is about 12 feet wide, and is said to carry about 100 in gold to the ton and a low-grade deposit, with the gold in the nearly all the way across and to contain an 8-inch ore shoot running about in gold to the ton. It is probably a fair low-grade deposit.
North and South America vein

The North and South America vein dips 45° south in light-reddish brown diorite porphyry. It is opened mainly by a 38-foot upper tunnel in which a width of 14 feet is said to average $3.50 in gold to the ton. Near the surface an 18-inch shoot is said to run about $40 to the ton. The face of the lower 200-foot tunnel until 60 feet from the vein.

Sunnyside camp

At Sunnyside the most of the deposits occur just northeast of the camp in an about three-fourths mile square and are covered by four small claim groups, the Star, South Star, Great Eastern, and Borden groups, aggregating about 20 claims in compact form and mostly owned by Tom Kenyon and associates. They occur in small quartz veins in the diorite porphyry associated with its contact the intrusive granite. They are exposed and opened mainly by adit tunnels in northwest and northerly slope of the ridge about half a mile northeast of Sunnyside camp, mostly between the elevations of 5,200 and 5,500 feet (Fig. 88). The minerals are mainly free gold, horn silver, argentite, chrysocolla, and white in a quartz gangue, some of which is glassy and some has been closely cleaved parallel with the vein and recemented with dark seams of lime and iron, Fig. 90.

Rich ore vein

The Rich Ore vein strikes north 75° west almost through the middle of the groups and is opened mainly on the South Star and Borden groups. It is to have a known length of 3,000 feet. It dips about 50° south-southwest diametally conformably with the granite-diorite contact which it seems to follow.
opened mainly by several tunnels and stopes. In the lower tunnel in drift which is 180 feet long and located a little below the 5,200-foot contour is about a foot wide and vein consists mainly of platy or laminated quartz, some of which is drusy. At this elevation the vein and workings extend on up the slope to above the 5,000-foot contour. At about the 5,350 contour, tunnel No. 2 extends in 280 feet of vein which here ranges up to 1 1/2 feet in width and has had considerable stoping on it and has been an important source of the camp's production. A faulting the tunnel portal dips west, and the associated structure shows that both vein and the country rock diorite have been faulted and folded. The diorite is greenish with chlorite and epidote which latter mineral is frequently contained in yellowish green seams and stringers. A 20-foot prospect tunnel near the 4,400-foot contour shows the vein to contain good ore and its dip here to be 55°.

Great Eastern mine

The Great Eastern mine adjoins the South Star group and Rich Ore vein just described on the north. It is on the Great Eastern vein, which strikes N. 70° E. and dips 60° S. The vein is opened mainly on the Great Eastern claim and the extension claim which adjoins it. It is from one-half to 2 feet wide and about a foot in width and looks well. It is mostly gold-silver ore having dark brown or black iron or manganese-stained oxidized quartz gangue. It shows or less depositional banding and later compression that caused it to be sheeted and cleaved parallel to its course, and later it was recemented with carbonate of lime and iron and manganese oxides. In places it contains also but this mineral is not known to be present in commercial quantities. It is fully drusy and honeycombed by casts of pyrite dissolved out. A polished
of a specimen of the banded ore shows it to contain a few small grains of
ice, which may be hypogene, as no pyrite was observed. The XXXXX ores are
run about $20 to the ton. In place a little ore occurs also as replacement
in the adjoining wall-rock diorite which here is hydrothermally bleached
lightish color but weathers dark and becomes coated greenish with epidote.
Great Eastern ground where it is opened by several tunnels and a 30-foot
it carried good ore continuously for the extent of 300 feet. Here at time
it about 10 tons of ore lay on the dump and some sulphide ore was exposed
a vein in the bottom of the winze.
Similarly on the western extension ground, about 1,500 feet to the west, the
is opened by a tunnel whose stop or ore shoot is said to be 200 feet long and
we made a considerable production. In the gulch on the opposite or southeast
of the ridge bouldery float quartz containing or being stained with much
sulphite seems to have come from this vein.

South Star No. 5 prospect

At about 800 feet south-southeast from the Great Eastern mine in the upper
of Kenyon Canyon at an elevation of about 5,330 feet the South Star No. 5 prospect
opened by a 50-foot shaft and drifts from which ore was being mined and 7 tons
usually been shipped at time of visit in 1913. The ore shipped averaged about
the ton and contained $36.16 in gold and 14 ounces of silver to the ton.
contains also considerable copper in the form of chrysocolla. In the
of the shaft the ores seem to be low grade with a glassy quartz gangue.
A short distance upstream from the South Star No. 5 prospect in Kenyon Canyon
wide granite dike cuts the diorite porphyry and, associated with the contact,
ends up to 2 inches wide of silicate rock composed mainly of garnet and
The Gold Reef mine

The Gold Reef or Borden mine is about one-half mile east of Sunnyside camp or east side of Kenyon Canyon at an elevation of about 5,250 feet and 60 feet or the floor of the canyon/wash. It is on a 17-foot wide sill of the diorite very enclosed in the granite and locally known as the "Gold Reef dike." The pit was discovered in January 1913, after many trials by Jim Borden, the owner, 10 years earlier had found very rich gold-quartz float in the wash some distance or down stream. In 1913 the owner was reported to have given a $15,000 option on the property, and in 1920 it was reported that work had recently been done on the property by George Troast.

The zone of mineralization including one or more outlying quartz veins paralleling sill on either side out in the granite and not here treated is about 40 feet wide. Developments at time of visit consisted of only open cuts and pits, none over 2 feet deep.

The sill and veins or lodes 5 feet wide, one on either side of it, strike about 30° W. and dip 50° southwest, apparently conformable with the walls of the sill at contact with the granite on either side and are banded. Along its foot and wall contacts with the granite the sill has been fractured, sheeted and parallel to its walls and at the surface is altered or oxidized and is more porous and contains partially dissolved out crystals of rust brown hematite included in pyrite.

The principal mine openings are on the foot-wall vein. Parts of it are said to vary from $12 to several thousand dollars in gold to the ton. On footwall or granite side the vein consists of (a) a 1-foot wide belt of quartz, fractured, and parallel-seamed quartz which is more or less
or honeycombed, contains some pyrite, is stained with oxide of iron and
case, and carries moderate to high values in gold. The pyrite, some of
cubes measure three-tenths inch on the edge, is mostly oxidized to brownite.

(3) consists of 8 inches of brownish to blackish spar or partially silicified
placed calcite, which, in general, carries high values in gold, its hanging-
portion being much the richer, containing the richest values of the entire
and running several thousand dollars in gold to the ton. An average sample
ore taken across this 8-inch part of the lode by William A. Simkins, engineer
Nevada New Mines Company, is reported to have assayed $2,200 to the ton of
$2,152 was in gold and $48 in silver.

(C) is a 1 to 4-foot wide zone of brownish metamorphosed or hydrothermal
and diorite sill. It is partly silicated, sericitized, and epidotized and in
pores or pitted by dissolved out fine-grained pyrite casts. It contains a
iron and manganese-stained quartz and in general carries fair values in gold.
The hanging wall vein on the upper side of the sill seems to be very similar
at just described on the footwall or lower side and is said to compare with
a gold tenure but had received but little development.

Although the Gold Reef veins may be locally very rich, as reported, they have
been opened deep enough to predict their becoming of sufficient value to make
. Thus far the development done and values found, mostly in free gold, are
ly in the oxidized zone but very near the surface where they may readily
become concentrated by leaching from portions of the vein that formerly stood
fer levels and have since been eroded away. In the sulphide zone the gold
of the ore is certain to be very much less.

Outlook
Murphy copper and lead prospects

The Murphy copper and lead prospects, known as the Big 5 Group of mines, by John Murphy, a pioneer settle at Alkali Flat, occur in the western part of Sunnyside camp and vicinity. Some of them rank among the very early discoveries of about 1870 and some have made small productions, notably during the War period. Notes on some of them follow.

No. 2 copper mine

The Big 5 No. 2 copper mine (Murphy's) is in the northwest base of Granite Mountain on the intrusive granite-limestone contact which dips steeply southeast the mountain with crystalline limestone forming the footwall and granite the hanging wall. The vein or lode, about 9 feet wide, is composed mainly of a quartz-calcite gangue with black and greenish iron and copper-stained croppings. It is opened by a 100-foot deep vertical shaft which starts in the granite, cuts lode in depth, and is all in the oxidized zone. The ore minerals are chiefly oxidized copper minerals, malachite, azurite, and chrysocolla, contained mainly quartz gangue which contains also some hematite, oxidized from pyrite and chloropel, flowish-green hydrous silicate of iron and aluminium. The shaft was not enterable at the time of visit in 1913, and croppings and dump at that time did not seem to indicate the presence of ore in commercial quantities. However, just before the Armistice in 1918 George Troast put in a gasoline hoist and shipped from the deposit in the bottom of the shaft 24 tons of ore averaging 5 percent in copper. He then suspended operations owing to decline in the price of copper.
No. 5 lead mine

The Big 5 No. 5 lead mine (Murphy's) is about one-third of a mile northwest of Granite Mountain. It also is a contact deposit. The lode consists mainly of stibnite-quartz-calcite gangue. It curves from north to westerly in its course across the strike of the limestone. On the south it is on the granite-crystalline limestone contact and on the west on the crystalline limestone-basalt contact. At the latter place it dips 80° northeast with the basalt forming the hanging wall. Scattered through the gangue, some of which is copper stained, is a good looking galena and a little cerussite, mostly in a finely crystalline gangue, but there was not much indication of the lead minerals being present in a commercial quantity.

Murphy Lead Queen mine

The Murphy Lead Queen mine is 1½ miles southwest west of Sunnyside in the south foot of the mountains at an elevation of 5,100 feet in the limestone area described. It is in a prominent ridge on the west side of and 120 feet above a steep-sided gulch. The ridge and workings slope southerly. The limestone dips 70° east-east and the deposits are associated with the contact of white crystalline dolomite overlain by blue or dark dolomitic limestone along which they have an extent of 600 feet. The limestone, especially the bluish limestone, is sheeted, red or schistled. A leading feature of the deposits, especially in the cropings, is brown jaspery quartz. Some white crystalline dolomite is also present. The showing of the deposits is in the upper end or northerly workings in the eastern end of a 150-foot wide belt of the white limestone and the adjoining blue limestone. A 50-foot shaft sunk in an ore chimney or parallel lense about 40 feet long by 15 feet wide, together with other openings and dumps, show the material to contain a
amount of galena, cerussite and other yellowish red carbonate (silver dry-bone) with reddish brown and blackish iron-oxide-stained gangue. With the galena in areas associated a little pyrite and chalcopyrite, and some of the galena is mixed with covellite derived by oxidation from chalcopyrite. A striking mineralogical feature is the galena being altered to cerussite. Small shipments of the cobbed ore are said to have ranged from 12 per cent to 70 per cent in lead.

About 150 feet southwest of the afore described deposit is a second ore chimney which probably connects underground with the first. It too is opened by a 50-foot dump, but the dump consists almost wholly of brownish hematite-stained rock and sand and only a small quantity of lead carbonate ore.

Proceeding from the second chimney downstream southerly to near the 5,020-foot contour are four more lenses or openings corresponding thereto spaced respectively 100 feet apart. They are similar to the one last described but seemingly still promising.

A 135-foot cross-cut tunnel driven from the floor of the gulch is said to lack 50 feet of reaching the lode. Its completion is much desired to disclose the extent of the lode in depth. The deposits probably contain a moderate quantity of silver-lead ore.

Blanco Prince prospect

In 1924 E. J. Nott and associates were working a newly discovered silver-lead deposit, the Blanco Prince, which they regarded as very promising near Granite Creek. The deposit was said to be on the blue dolomitic limestone contact and dated with intrusive monzonite porphyry and the ore mineral galena in a barite matrix. It had been opened to a depth of 70 feet.2

Letters of E. J. Nott dated May 12 and June 24, 1924.
Blue Bell No. 2 prospect

The Blue Bell No. 2 prospect, owned by W. H. Leonard of Rawhide, is north of the Sunnyside-Eagleville road. Here in the steep southerly face of the mountain the granite, which is crushed and blocky is cut by seams, stringers, and veins of mineral-bearing quartz and kaolinized rock material following irregularly a dynamic structure dipping 20° to 50° westerly in the granite. In places several ore of these stringers unite and form lenses or bodies of quartz ranging up to 3 feet in width containing argentiferous galena, cerussite and bismuth which cobbed yields a fair quantity of fairly high-grade silver-lead ore and is to assay in some samples 1 per cent in bismuth. Though 1 per cent is a small quantity, it may be of value in sulphide ore where it can be saved, as bismuth is a $1 a pound. Much of the quartz is stained bluish with iron and manganese, some yellowish with lead carbonate, some greenish and bluish with bismuth (?) contains a little pyrite. In places a little ore occurs also in the altered wallrock.

Judging from the erratic occurrence of the deposits and there being nothing to follow other than the structure in the granite, the deposit does not much promise of making a mine.

Blue Bell No. 5 prospect

The Blue Bell No. 5 prospect, which is a copper-gold prospect, also owned by W. Leonard, is in the upper west slope of Granite Mountain at about 250 feet of the adjoining road. The deposit, which follows the sheeting or planes in the granite, dips gently easterly and locally contains bodies of iron and copper-stained quartz and altered rock up to a foot or more...
containing mostly malachite and azurite, and also a little pyrite, chalcopyrite, chalcocite. Some of the ore is said to assay $120 to the ton of which $100 is in and the rest in copper. The gold is said to be present in telluride form and the ore will not yield a color of gold in panning. The deposits are opened or red interruptedly at several points for the extent of about 200 feet, at one time continuously for 20 feet, but are not known to be connected or contain any continuous ore body.

A little to the northeast of and 60 feet higher up the slope from the Blue Bell prospect occurs another similar prospect in which also the ore appears attractive is said to carry high values, but sufficient work has not been done to indicate continuity of the ledge in extent or depth.

Tungsten prospect

Tungsten ores were discovered in the Eagleville district near Sunnyside about by Frank Channing.

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The deposits are mostly developed by H. H. Leonard who has three claims and in opening them up early in 1930. Later they were being worked by the American Development Company. The lode occurs in granite near a granite-limestone contact.

cropping for a length of more than 200 feet and contains a 15-foot wide ore shoot
runs about 3.4 per cent tungstic acid while some of it runs 40 per cent. The
mineral is scheelite. It has been found at several points more or less extensively
in the course of the lode and contact on which extension claims are owned by John

7/ Nevada Mining Press, op. cit.

Quicksilver prospect

In 1929 it was reported that a quicksilver deposit had been found a few miles
of Eagleville and was being prospected by the R. H. F. Mining Company, the ore
being cinnabar.

8/ Nevada Mining Press of December 13, 1929.

Leonard barite mine

Although barite is common as a gangue mineral in many of the Eagleville deposits,
occurrence in commercial quantity in the district is rare. At Sunnyside, however,
Leonard about 1928 opened up a promising deposit from which considerable barite
since been produced.


During considerable part of the period of 1929 to 1931 the American Development
Company of San Francisco mined and shipped from the deposit to its grinding plant at
and, Calif., about 15 tons of ore a day. The ore was trucked to the railroad

10/ Nevada Mining Press, April 18, 1930.
   " " " May 2, 1930.
   " " " June 13, 1930.
   " " " December 26, 1930.
   " " " January 2, 1931.

3rd.

Big Kasock prospect

As seen from northwest of Sunnyside, the southeast side of Big Kasock Mountain is said to contain considerable diorite porphyry. Its south spur at the elevation about 6,400 feet is said to contain a blanket-quartz vein that runs high in values.

11/Kenyon, Tom, Oral communication, July 30, 1913.
CARSON SINK AREA, NEVADA

By

F. C. SCHRADER

RAND DISTRICT (6)

CARSON SINK AREA, NEVADA

By

F. C. SCHRADER

RAND DISTRICT (6)
Rand District

Location and topography

The Rand district joins the Rawhide district on the southwest. It extends near the middle of Alkali Flat, 25 miles westward to Walker Lake near Schurz, about the same distance southward to the latitude of Thorne; it is nearly all mountainous. On the east it contains the northern part of the Gabbs Valley Range; on the west the Gillis Range, which latter occupies the greater part of its

Its largest drainage line is Nugent Wash, 20 miles long, which drains the mountainous part of the southern half of the district northeastward into Alkali Flat, Fig. 3 (Topographic map). Its principal camps are Copper Mountain, Rand, Gold Pen -- all in the eastern part in the Gabbs Valley Range. Its shipping port is Nolan (Rand, P. O.) near the middle of its western edge on the Hazen-Hendy branch of the S. P. Railway, from which the Mason Valley smelter is 12 miles distant northwest.

History and production

Mineral in the district was first discovered during the Rawhide boom at Mountain, the northern part of the district, June 1, 1906, by Edward Lappat Albert Gay, and in 1907 was discovered in what then became known as the Bovard district covering an area about 2 miles square just southeast of the present Gold camp and mine. Soon after this, further discoveries and locations were made in the Gold pen, Lone Star, and Rand camps and these three have made nearly all production of the district, which amounts to about $530,000. The most of it made by the Gold Pen, Copper Mountain, and Nevada Rand mines, respectively, 1916 (to 1918 and 1917) to 1919.
Geology

The district is underlain by chiefly Tertiary volcanic rocks; mostly andesite, dacite, and rhyolite which, excepting at the mines, have not been differentiated. Exposed section in the northeastern front of Gabb Valley Range is nearly 2,000 ft. in thickness, Fig. 91 (Photo). In places, however, areas ranging up to several square miles of the older Jurassic-Triassic sediments—limestone-shale beds, are well exposed, as in the Gillis Range east of Walker Lake, about 3 miles northeast of Nolan, and in the Gabbs Valley Range in the southeastern corner of the district along the Luning- Rawhide road.

Deposits

The deposits, excepting those at Copper Mountain, are gold and silver-bearing ores of the late Tertiary metallogenetic epoch and occur in the Tertiary volcanic rocks chiefly at Gold Pen and Nevada Rand mines. The wall rocks in general are pyritically altered along the veins.

The veins are mostly contained in a northwest-southeast fracture zone or structure system which has a length of about 5 miles and extends from the southeastern corner of the old Bovard district northwest to beyond the Nevada Rand mine and East Wash, beyond which it is said to lie about 2 miles southwest of Copper Mountain. The zone nearly all is in the northeast front of the Gabbs Valley Range. It varies from about 100 feet to about 1,000 feet in width and some individual veins or lodes in places range up to 60 feet in width. In general the veins and rocks and rock structures dip northeast and in places the deposits are accompanied by tabular sheets of alunite up to 3 feet in width instead of the ordinary argillaceous rock breccia gouge.

In places the alunite occurs in fissures between well-defined walls; it occurs in limestone apart from the metalliferous deposits than which it seems to be most abundant. Alunite is a hydrous sulphate of alumina and potassium. The possible economic value of its deposits as a source of potash and alumina makes them of more than purely commercial interest.

The gangue or vein filling is mainly quartz and crushed or brecciated rock, with rhyolite or andesite, some of which has been xilicified and metamorphosed by infiltrated siliceous solutions or quartz. Some of the quartz is laminated pseudomorphous after an earlier gangue spar mineral, calcite or barite, and is associated with adularia. In the cropping and oxidized zone the deposits mined or contain considerable limonite, hematite, chloropaltcalcite, olivine, and some ochre-yellowish mineral, utahite or jarosite. Locally they are strongly streaked bluish with molybdenite stain, as on the Hidden Treasure Hill outcrops.

Although the veins are good looking and extensive, they are for the most part poor grade and have their deposits too erratically distributed to be profitably mined. They seem, for the most part, to belong to the class of large but comparatively barren or non-productive veins found in many Tertiary lava districts of the West. Although the veins may, in many places, contain fair grade ore bodies down to water level due mainly to concentration by leaching and secondary enrichment, not of these particular bodies will be found to be lower grade and probably not more than a part of that commonly found in the underlying sulphide zone.

This statement concerning the barren or low grade veins applies to that part of the belt extending through the Old Bovard district, southeast of the Gold Pen, and seemingly to most of the mile or more of veins, between the Gold Pen mine to Rand mind, as covered by the Antelope, Railroad, Independent, and other groups.
In neighboring districts—as Rawhide, Wonder, and Fairview,—the main ore
has been found and the main production has come from above the 350-foot level.
The deposits at Copper Mountain in the northeast part of the district are
silver-bearing. They occur in the Jura-Triassic limestone-shale series and are
structurally connected with the Mesozoic intrusives.
The deposits are described more in detail under mines and prospects.

Mines and prospects

Bovard mine

The present note on the old Bovard mine and Bovard district, now a part of
the Gold Pen camp, is here given because of the part it played in the discovery of
deposits in the district rather than any economic value known or supposed to
be contained in the Bovard mine.

Location.—The old Bovard district occupied an area of about 3 square miles,
southeast of the present Gold Pen camp, mostly in the northeastern front of
Gabbs Valley Range between the elevations of 4,800 feet and 6,600 feet, Fig. 3
(map) and Fig. 91 (Photo). It is 17 miles south of Rawhide and 25 miles east
of Gillis, which was then the nearest railroad station. It is named after Albert
Bovard, who in 1907 when mineral in the district was first discovered, headed and
headed with a small group of Rawhide prospectors in a gulch below the Gold Pen
camp. A little later claims of the Bovard group of the Bovard Consolidated Mines
Company, which became the principal operator, were acquired by that company from
Mr. R. Clark of San Francisco, one of the earliest arrivals. The first location
in the district is said to be that of the Golden Gate claim on April 16, 1908, and
was recorded May 15, by W. A. Watson, as shown by the official records at Rawhide
February 27, 1911. By May 1908 the camp is said to have had about 500 tents and
thousand inhabitants.
The Bovard Consolidated Mines Company began operations at its Bovard mine on October 18, 1908, and operated continuously until September 10, 1910, with a force from 4 to 20 men. Though it made no production it did considerable development which proved of much service in disclosing the nature of the deposits. Water was hauled from Dead Horse well, 10 miles distant. The average cost of underground work was about $14 a foot and the cost of mining, handling, and milling ore was at $18 a ton.

Deposits.—The distribution of most of the deposits is shown in Fig. 92 (map and vein map of old Bovard District).

The deposits occur in the northwest-southeast fracture zone, as previously described, intersecting Tertiary volcanic rocks. These rocks, about 2,000 feet in thickness, in ascending order, are mainly dacite, rhyolite, and andesite, Fig. 91 (Photo). The most abundant and important rock is the rhyolite. It seems to form the main mass of the mountain on the southwest. Much of it is pyritic with fine-grained pyrite uniformly disseminated through it and causes the rock to weather reddish brown. The pyrite is thought to be auriferous and probably an important source of the gold that has been concentrated in the veins. Toward the southeast, on the lode claim and vicinity, the volcanic rocks have been removed by erosion and an area overlying bluish-gray limestone which, in general, dips steeply south is referred to the Jura-Triassic. It has been faulted and folded into an anticline which on the Valley View Fraction Ground and vicinity, pitches northeast and has its southwest top beveled off by erosion.

The veins are composed mainly of a quartz, crushed, altered, and silicified, replaced rock gangue which varies from place to place, is mostly stained or streaked with oxide of iron and manganese, which in some instances may be nearly one inch in thickness. Only occasionally is a little sulphide, pyrite, or chalcopyrite present. Some of the quartz, as shown at the Bovard and Hidden Treasure...
is pseudomorphic after calcite or some other spary gangue mineral. Some
ve, as shown at the Gold Pen mine and Hidden Treasure No. 2 60-foot shaft, is
banded quartz brecciated, firmly cemented with a yellowish or ochre-yellowish
ite stained matrix. On the Hidden Treasure No. 1 and No. 2 claims, the lode,
osed of this fault breccia, is 60 feet wide, but seemingly low grade or barren,
some of this class or very similar ore in the Gold Pen mine is composed
ly of quartz fragments ranging up to about an inch in maximum dimension and
considerable microscopic free gold.
Elsewhere, as in the Hidden Treasure No. 4 shaft and the 120-foot tunnel to
orthwest, the quartz, (ore spec. 20), which is very similar, is stained
ish, and is freely parallel marked with streaks or stringers up to 1/10 inch
of bluish-black ilsmannite, a molybdenum mineral Mo 30, derived by oxidizat"
molybdenite.

In places the veins show considerable faulting and the filling may be mainly
ers of iron and manganese-stained quartz. In places, as on the Back vein on
ose claim, the iron-manganese stained quartz, cropping is 10 to 20 feet wide,
8 or 10 feet above the surface, and extends for 200 feet or more.
The veins are generally accompanied by a thick sheet of dark iron-stained
clay crushed-rock casing or gouges, a few inches to a few feet in thickness.
Few places, as already noted, this is substituted by alunite which, where
ed, is locally called "drybone".

The deepest opening on the deposits is in the Bovard mine, which is in the
east corner of the district on the front vein, about 2,000 feet southeast of
ich ore deposit later found on the Lucky Strike claim of the Gold Pen ground.
the northwest end of the Rose claim which, in 1908, was subdivided and
in blocks 150 feet in extent along the vein.
The vein is nearly all in pyritic rhyolite near its contact with dacite and exposed to a depth of 450 feet by a 60° NE inclined shaft known also as the shaft, and when visited by the writer in 1911 contained about 800 feet of including drifts and crosscuts, mostly on the 75, 200, and 300 foot levels. The shaft contained several tons of good looking ore, mined from a large cut, that said to run about $50 to the ton and some about $150. Some of it was banded some contained a little disseminated fine-grained chalcopyrite.

The 75-foot level exposed the vein to be at least 16 feet wide and composed of faulted breccia, manganese-stained rhyolite and quartz, said to assay values in gold and silver. The southwest or footwall showed also considerable values in gold and silver. From the 75-foot level down to the 350-foot level the values found in sinking inclined shaft in the vein were reported to have been small, but few assays more than 90 cents to the ton.

On the 200-foot level the vein showed a width of 12 feet or more of good crushed quartz containing a little disseminated pyrite and chalcopyrite, however, seems to assay only about 50 cents to the ton. The footwall rock rhyolite tuff. It contains quartz stringers that dip southwest. The rhyolite-
vein contact is well exposed in the shaft at the depth of about 230 feet. In the 300-foot level the vein is only 1 or 2 feet wide, stands about vertical, composed of comminuted faulted brecciated quartz and rock containing only low values.

In the 450-foot level, or bottom of the mine, the outlook is not auspicious. A showing was in the 80-foot crosscut to the southwest into the footwall, all in crushed country rock—rhyolite that is pyritic and was said to run $2.50 in gold to the ton.
Other openings to depths of 50 feet or more on the vein to the southeast of this shaft are said to contain similarly low values.

Later the mine was said to have been worked in 1915 by the owner, the Bovard Consolidated Mines Company, and that ore averaging $35 to the ton was shipped.


A little later the mine was acquired by the Gold Pen Pand Mining Company and was known as the G.P.P. mine and in 1920 it was said to be developing a 12-foot of sulphide ore found in a crosscut on the 300-foot level. This was considered tent as it was regarded as the first primary sulphide ore found in the district.

The first 10 inches on the hanging-wall side of the vein was said to assay $60 to the ton in gold and silver and the remaining 11 feet about $5 to the ton, and the ore is readily available to cyanidation.


In 1922 the company was reported to have opened up near the surface some 15 feet from the shaft 15 feet of $25 ore.

4/ Letter from V. V. Rudderow, Nov. 28, 1922.

In 1924 and 1927 the mine was being further developed by the owning company, about 5 feet of the 12-foot sulphide vein averaged $40 in gold to the ton.


The mine is not known to have been active since 1931.
Gold Pen Mine

Location and topography

The Gold Pen mine is about 17 miles south of Rawhide and 25 miles east of the nearest railroad station. It is in the upper northeast slope of Gabbs Range at an elevation of about 5,900 feet, Fig. 23, 91, and 92, and about a mile northwest of the Bovard mine, whose property it adjoins. Its value lies mainly in its large bodies of high-grade milling ore.

History and production

Closely following the discovery of the Bovard mine in 1907, the deposit of Gold Pen Mine was discovered and located in April 1908 by Bert Knap, Charles Hill, and Charles Deadman, who soon found rich ore in it, since when, under several different management, it has produced more than $250,000 in high-grade ore.

In 1908 it was bonded to Tex Ricard, who is reputed to have made a down payment of $21,000, and soon produced $80,000 in high-grade surface ore from the glory hole and then relinquished it.

Later it was leased to Dr. Garnard who mined and shipped to the Weiss mill at Flat below Rawhide $5,000 worth of ore.

The property was next incorporated by Knap and Judge Glen as the Golden Pen Company which worked it for 6 months, started the Lucky Strike winze #1, shipped $2,000 worth of ore.

In December 1912, P. Saturno and J. D. Faretto became the principal owners of the mine and worked it till 1915 when it was sold for $130,000 under a 2-year lease. They found a high-grade ore shoot in the east drift from which in 1913-14 shipped $55,000 worth of 500-dollar ore and had remaining about $30,000 worth of 500-dollar ore in sight in the mine. Ten sacks of the ore shipped weighing 963...
Averaged more than §7,000 to the ton. About this time some of the ore hauled to the railroad station at Luning.

Western Nevada Miner, Mina, Nevada, September 3, 1915.

In December 1915 the mine was leased to J. H. Miller and associates, who, after about 600 feet of underground work and making two shipments which netted them $100, relinquished it with good showings on the third and fourth levels.

About this time (1916) the mine contained 1,500 feet of development work and only $36,000 worth of ore lay on the dump, of which 2,000 tons was said to be dollar mill ore. The property comprised a group of 15 claims including several stions, or a total of about 200 acres of ground in compact form.

Also about this time the Farreto Brothers, Joe and John, became owners of the and soon made several shipments aggregating about $41,000 in high-grade gold.

In 1919 the Gold Pen Mines Company organized by Los Angeles interests and incorporated for $500,000, as the Gold Pen Mines Company, acquired the mine, did 600 feet of development work in it, and made a $100,000-production, of which $100 was high-grade shipping ore and $85,000 bullion. It also materially increased surface equipment but finally, owing to financial difficulties, lost the mine sheriff's sale in April 1921, whereupon it reverted to its former owners, the into brothers.

The improvements made by the company included erection of substantial mine shings, installation of a new hoist and a Kinkaid 20-ton amalgamating mill on mountain side about 400 feet below the mine, and procurement of a permanent or supply by sinking a 112-foot deep well towards the south edge of Alkali Flat, 4 miles from the mine. The water of this well is said to be of better quality that of Dead Horse well, which had hitherto been used by the company.
In 1922 to 1927 the mine was being worked intermittently by the owners, part of the time with a crew of 10 men, and was producing; some of the ore shipped being rich ore found in new ground.

[1/ Nevada Mining Press, May 19, 1922; July 4, 1924; May 8, 1925; May 6, 1927.

In 1927 it was incorporated by the Farreto brothers as the Gold Pen Mines Company which still owns it. In 1927 its ore reserves were estimated at 41,000 tons of ore, mostly in an ore shoot 90 feet long by 5 feet wide. It was opened mainly by a 260-foot deep shaft and a 500-foot tunnel and contained more than 5,000 feet of workings.


The cost of ore shipped to Nolan was $7 per ton and that of ore treatment 60 per ton. A few hundred tons of the medium-grade ore was shipped to the Carson Smelter of the Mason Valley Mines Co. The building of a mill at the mine well and the conveyance of the ore to it by aerial tram was contemplated by the company.

From 1927 to 1933 the mine seems to have been quiet.

Development and equipment

The mine is opened mainly by a 258-foot deep vertical shaft and a 500-foot drift, known as the tunnel. It contains more than 5,000 feet of workings divided on six levels. Mainly on the 50-foot, or tunnel level, and the 130-foot level. The tunnel and workings gain a depth of nearly 200 feet by extend into the mountain side where in a 100-foot winze and vicinity, answerable high-grade ore was mined.
The surface equipment includes a 25 HP gasoline hoist capable of sinking to
1,000 feet; a 20-ton Kinkaid Amalgamating mill, assay and refinery
facilities, and substantial buildings for housing a crew of 20 men. The mill
said to give excellent results yielding an extraction of 90% in good or high-
grade ore ranging about $30 or more to the ton. In the early days no ore under $30
per ton was shipped.

Geology

The country rock is chiefly rhyolite with which is associated some dacite and
dacite, as afore described in the adjacent part of the old Bovard district. On
northeast, on the Lucky Strike claim and vicinity, the dacite tuff of the valley
ends up the mountain slope to an elevation of about 5,840 feet, Fig. 91 (Photo).

On the northeast or Hanging-wall side of the vein the rocks dip gently northeast,
from the vein and mountain while on the southwest or footwall side they dip
characteristically southwest into the mountain, from which structures the fissure
nested by the vein seems to be that of a normal fault whose upthrow is on the
footwall or mountain side of the vein.

Also at about 100 feet back southwest of the main vein is a subordinate quartz
vein about 4 feet wide which also dips southwest away from the main vein into the
mountain.

The rhyolite continues to be the dominant rock for nearly a mile northwest of
Gold Pen mine to where on the Independent claim group it gives way to andesite
amphibolitic rocks which continue on northwestward through the Lone Star and Rand
and then across Nugent Wash.

At the Gold Pen mine the rhyolite is a medium-grained gray rock, normally
with a pinkish or reddish tinge due to the color of the fine-grained groundmass
which varies from the felsitic to mostly crystalline orthoclase. Its flow's structure
Meeting dips gently northeast. It is generally sprinkled with small phenocrysts of lightish orthoclase, glassy sanadin, vitreous quartz, plagioclase ranging up to 1/10 of an inch in diameter and a few small foils of biotite. Even near the surface, as on the 50-foot level, the rhyolite contains disseminated fine grains or pyritohedrons and small aggregates of them become more pronounced in depth, as on the 130-foot level where pyrite occurs with the vein and wall rock. Some of the quartz is reddish or pale wine colored to its hematite content derived from oxidation of the pyrite. Manganese oxide in the ore is probably derived from the overlying andesitic rocks.

In some instances the pyrite seems to be primary, especially in the deeper part of the mine where it is more plentiful.

The microscope shows the rhyolite - specimens 599, 601, and 72β - to consist of 60 percent of pale brownish-gray cloudy microlitic glassy base of principally orthoclase, sanadin, quartz, biotite, and glass containing larger forms or phenocrysts of the above-named minerals. Quartz 25 percent, orthoclase 10 percent, biotite 5 percent, which includes a little acidic plagioclase, pyrite, hematite, etc. The former minerals show parallelism in arrangement which seems to be due to flowage of the magma and the presence of angular fragments up to 1/4 inch in diameter indicate that some of the rock is a flow breccia.

Though microscopically, much of the rhyolite appears relatively fresh and firm, the microscope shows it to be considerably altered hydrothermally, the feldspars sericitized, kaolinized, and alunitized; the biotite changed to chlorite and vermiculite, and the quartz deeply embayed by corrosion.

Locally, as on the 250-foot level, the rhyolite (spec. 727) is more extensively altered and altered to a light gray or whitish color and semi-chalky stage, and is pressed or partially laminated. In the glory hole some of the rock has been highly altered.
Deposits

The deposits occur in the Gold Pen vein which is a northwestward continuation of the front vein, afore described in the old Bovard district. It is contained only in the country rock, rhyolite. It strikes about northwest and for the most part dips about 70° NE., but straightens up in depth and in the bottom of the mine it is almost vertical. It in general has a width of about 20 (?) feet. It is composed mainly of quartz and crushed, altered, and mineralized rhyolite. Much of the ore occurs mostly in shoots ranging up to 90 feet in extent and 3 or 4 feet in thickness. The most important are the Gold Pen ore shoot and the Lucky Strike ore shoot. 

Much of the vein is of the breccia character, some of which shows considerable gold. It, however, contains considerable good looking milky white vein quartz, which is more or less drusy with small cavities lined with minute quartz crystals. Much of the quartz contains disseminated grains and aggregates of dark argentite, which is associated microscopically free gold in disseminated specks and filmy "mustard" coatings in which the quantity of gold present is readily indicated by shining and panning some of the ore which yields a strong head of macroscopic particles of the yellow metal, or by roasting which causes the surface of the specimen to become profusely studded with small beads or froth-like coatings of gold. Some specimens resemble those of finely divided "mustard" gold that normally results from formation of telluride.

In general the vein is separated from the wall-rock rhyolite by 1 to 4 feet of clay or gouge which in places on the upper levels is relatively pure alunite.

at places streaks of thin lenses or kidneys of alunite or clay gouge occur in the vein or ore shoots where it has been dragged by diagonal slips or faults. The rich ore forms beautiful specimens which, however, on drying in the atmosphere become too fragile for preservation. Also a moderate amount of gypsum occurs in the vein.

On about the 200-foot level the ore tends to become sulphide, below which depth it is said but little if any of the gold is free.

The ore carries about two-thirds of an ounce of silver to 1 ounce of gold content and has a slight gain in silver with increase in depth. The gold is mostly fine grained and is associated with horn silver and black silver sulphide, stibnite. There is also present some wire gold and a little wire silver. The gold is mostly of primary ore origin. The following note may shed further light on the character of the gold and ore:

0 of a cubic cm of concentrates panned from 1\frac{1}{2} cubic inches of ore pulp (st. 432) crushed and passed through a 20-inch mesh sieve was found to be composed mainly of comminuted quartz and gold, of which the gold particles were estimated to be about 500 and the most of which required a pocket lens for their differentiation. Some particles were observed floating away on the surface film of water used in panning, probably a goodly number following this route were not recovered. However, most of the gold particles tend to be chunky rather than wiry or flaky, though some particles were observed floating away on the surface film of water used in panning, probably a goodly number following this route were not recovered. However, most of the gold particles tend to be chunky rather than wiry or flaky, though some particles were observed floating away on the surface film of water used in panning, probably a goodly number following this route were not recovered. However, most of the gold particles tend to be chunky rather than wiry or flaky, though some particles were observed floating away on the surface film of water used in panning, probably a goodly number following this route were not recovered. However, most of the gold particles tend to be chunky rather than wiry or flaky, though some particles were observed floating away on the surface film of water used in panning, probably a goodly number following this route were not recovered. However, most of the gold particles tend to be chunky rather than wiry or flaky, though some particles were observed floating away on the surface film of water used in panning, probably a goodly number following this route were not recovered. However, most of the gold particles tend to be chunky rather than wiry or flaky, though some particles were observed floating away on the surface film of water used in panning, probably a goodly number following this route were not recovered. However, most of the gold particles tend to be chunky rather than wiry or flaky, though some particles were observed floating away on the surface film of water used in panning, probably a goodly number following this route were not recovered. However, most of the gold particles tend to be chunky rather than wiry or flaky, though some particles were observed floating away on the surface film of water used in panning, probably a goodly number following this route were not recovered. However, most of the gold particles tend to be chunky rather than wiry or flaky, though some particles were observed floating away on the surface film of water used in panning, probably a goodly number following this route were not recovered. However, most of the gold particles tend to be chunky rather than wiry or flaky, though some particles were observed floating away on the surface film of water used in panning, probably a goodly number following this route were not recovered. However, most of the gold particles tend to be chunky rather than wiry or flaky, though some particles were observed floating away on the surface film of water used in panning, probably a goodly number following this route were not recovered. However, most of the gold particles tend to be chunky rather than wiry or flaky, though some particles were observed floating away on the surface film of water used in panning, probably a goodly number following this route were not recovered. However, most of the gold particles tend to be chunky rather than wiry or flaky, though some particles were observed floating away on the surface film of water used in
Similarly specimens (as 729) of the rich ore on being roasted become studded with small buttons or beads of electrum up to 5/100 of an inch in diameter. Between microscopic beads the surface in some instances is so closely dotted with smaller, mostly microscopic beadlets as to present the appearance of a beady mat.

Source of the deposits

The deposits seem to have been formed by magmatic mineral bearing hydrothermal solutions that circulated through the fissures and fractures following the eruption consolidation of the volcanic rocks, particularly the rhyolite. Quantitatively the rhyolite seems to have been best qualified to furnish the agencies and materials that were needed to form the deposits.

The deposits were originally formed mainly as sulphides, the chief primary ore minerals being pyrite and argentite, in which the gold was primarily contained. Since then the deposits have been oxidized and secondarily enriched by leaching and concentration to the depth of about 260 feet, at which level the mine workings are believed to be entering the sulphide zone. In the sulphide zone or primary ore, the deposits may be expected to have a more uniform tenor but they are probably nearly as rich as in the oxidized zone.

Judging from the size and exposed vertical range of the fissures of the mine vicinity, the deposits probably extend to considerable depth, at least to the bottom of the rhyolite formation which is not definitely known.

Nevada Rand mine

Location and topography

The Nevada Rand, more commonly known as the Rand mine, is in the northeastern part of Mineral County, 15 miles direct (17 by road) east of Nolan, the nearest railroad station on the Hazen-Goldfield branch of the S. P. railway. It is in the
ern slope of Gabbs Valley Range toward the north end of the range at an elevation about 5,650 feet, and is 2 miles north of the Gold Pen mine. It is easily reached by a good road that finally ascends a short wash, Lone Star Wash, that joins Nugent Wash about a mile northwest of the mine, Fig. 3 (topo map). The mountain range in this latitude, though more or less deeply dissected, consists chiefly of a single ridge about 2 miles wide, standing at an elevation of about 6,000 ft with a relief of 1,000 feet. The topography is of the milder type usually produced by longitudinal erosion and weathering of Tertiary volcanic rocks in the desert regions of the Southwest. Its general character is indicated in Fig. 3, and Fig. 94 (photo of mines). Nearly all parts of the range are easy of access.

History and production

In preparing the present report the writer, who visited the mine in 1916 and 1920, has been generously given access by the company to brief progress reports of several mining engineers and geologists who examined the mine or some its rocks and ores for the company.

The mineral deposit of what is now the Rand mine was discovered in June 1908, Frank Thomas and Lou Rose, who named the property the Last Hope mine, which name bore until 1916 and the claims still retain. They soon sunk a 50-foot shaft and 1909 mined and shipped from between the 50-foot level and the surface 7½ tons of ore, whose value was mostly in gold. In 1911 the shaft was extended to the 100-foot level; whence, at Raise No. 58 west, considerable additional ore was

and thenceforth the mine continued to be a nearly steady producer until 1916.
In 1913 the mine was owned by Charles Hubert, Charles Pike, and Charles Koegel, the ore produced was mostly hauled to King's Rawhide mill, 12 miles north, at Ali Flat.

In 1914 the shaft was extended to the 250-foot level and by June the mine had shipped 600 tons of ore running about $110 to the ton.

In July 1916 the property was reorganized and incorporated into a stock company, Nevada Rand Mines Company, and the stock listed on the San Francisco Stock Exchange and on the New York Curb. At this time the mine contained more than 3,000 tons of work and had produced about $31,000 worth of high-grade ore as follows:

(a) High-grade ore from shipments being nearly $1,600 to the ton.
(b) Smelter ore running $90 to the ton.
(c) Mill ore running $40 to the ton.

Besides this production, 1,200 tons of $17 ore lay on the dump and much second-grade ore remained as fill in the mine.

The metal ratio in the ore at this time was said to be 40 ounces in silver to one gold or half and half in money values with silver rated at 50 cents per ounce. As low as $20 grade could be profitably shipped. The wagon haul to Nolan was per ton, miner's wage was $4.50 per day. Beginning about 1916 much of the ore was shipped to the Western Ore Purchasing Company at Hazen.

In 1917 the mine was reported by the examining engineer to have in sight about 100 tons of ore averaging $15 to the ton and in 1921 it was credited with a running record of $50,000 in mostly high-grade ore. The shaft had been deepened the 450-foot level and several newly opened workings showed good grade milling ore. A foot shoot of primary ore was found on the 200-foot level, of which 3 feet ran to the ton.
By 1923-24 the production was said to total $60,000 and the mine continued to produce considerable high-grade ore, mostly from the 250-foot level east and just below where two ore shoots produced about $26,000.

In 1925 the production is said to have totaled $100,000 in high-grade ore, of which the former owners had shipped $40,000 worth that ran $31 to the ton and the Company had shipped 812 tons that netted nearly $65 to the ton. The potential in the mine was estimated to be 30,000 tons of $15 ore besides which about 2,000 tons of $20 ore lay on the dump.

In 1927 the mine under lease shipped to the Thompson Smelter some low-grade ore running about $20 to the ton on which the charges were as follows:

<table>
<thead>
<tr>
<th></th>
<th>Per ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Truck haulage to Nolan</td>
<td>$3.00</td>
</tr>
<tr>
<td>Railroad freight</td>
<td>.60</td>
</tr>
<tr>
<td>Smelter treatment</td>
<td>4.50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>8.10</strong></td>
</tr>
</tbody>
</table>

In metal content this ore averaged gold .4 ounces and silver 15.9 ounces to the ton.

10/ V. V. Rudderow, Manager, letter April 4, 1927.

In October 1927 the mine was sold at sheriff's sale for $2,500 to R. J. Randall, the lessee, who in 1931 was still operating it.

Development and equipment

The property of the Rand mine comprises a group of seven claims, aggregating about 160 acres, Fig. 95 (claim map). It is opened mainly through the Rand shaft to a depth of 250 feet, by about 5,000 feet of workings distributed on six levels—only the 50, 150, 250, and 450-foot levels; the 180 and 200 levels being intermediate, Fig. 95-B and C, (Cross section). The workings extend about 400 feet along the strike of the lode.

As the shaft is sunk in the hanging wall side of the lode the main crosscuts are driven in the direction of the footwall and the drifts mostly parallel the lode in its footwall side. The mine is dry, only slight moisture occurs in its deep part. The ground is all easy to work and required almost no timber.

The surface equipment includes a 25 H.P. gasoline hoist, office, camp, and mine buildings for accommodating a small crew of men. As a mill to treat the medium-to-high-grade ore at the mine was needed, the company in 1919 was reported to have purchased a 20-ton mill standing in good condition at Alkali Flat, 12 miles from the mine, with water at the depth of 160 feet, but the writer does not know whether the mill was later moved to the mine or any of the ore was treated in it. A water supply can probably be obtained at a reasonable depth in Nugent Wash, a mile west of the mine.

Geology

The principal rock at the Nevada Rand mine and vicinity is a gray hornblende andesite standing close to trachy-andesite or latite. It is tuffaceous and is of andic type. Concerning the fragmental character of the rock, there seems to be some doubt. Though the rock is considerably altered, it contains fragments of andesite and its minerals, and fragments of the underlying rhyolite and of dark shale or slate.
As the structure or bedding of the andesite is not known, no definite statement can be made as to its thickness. At the mine it appears to have a thickness of at least 500 feet but in the axis of the range, at about half a mile east of the mine, probably has a thickness of nearly 1,000 feet. And in case the rock dips 30° NE., as has been suggested may be the case, the thickness would then be considerably greater as it would then be measured on the hypotenuse instead of the leg of the right angle triangle.

The andesite probably consists of more than one flow, which point is not yet determined. It extends from a point nearly a mile southeast of the mine, through a distance of 2 miles northwest of it, to beyond Nugent Wash.

It occurs throughout the mine and apparently forms the main upper mass of the range back of the mine on the northeast.

It is composed mainly of numerous small phenocrysts of feldspar in a greenish-microlitic groundmass, which latter constitutes 40 to 60 percent of the rock and generally shows flow structure. Hornblende and biotite also occur as small phenocrysts and are essential minerals. Augite is scarce. Accessory minerals are epidote, magnetite, quartz, and zircon. In places accessory magnetite is abundant. The feldspar consists mainly of oligoclase and andesine with the oligoclase predominant in some sections a little orthoclase is present. The feldspar is often altered to kaolin and sericite; the hornblende to green chlorite, epidote, actinolite, and carbonate; the biotite to green chlorite and iron ore.

To the abundance of chlorite the altered rock in most instances owes its green color. In places, as on the 250-foot level, the andesite is vuggy with small dikes lined with quartz crystals. The andesite seems to be sparingly cut by one or more small dikes of a fresher andesite porphyry which is probably related to the rock of the R. A. M. ridge south of the mine.
South of the andesite is a thin series of andesite breccia overlain by a thick ryolite. These rocks are apparently in fault contact with the andesite.

12/ Foshag, W. F., U.S. National Museum Ms., Notes on the Hawthorne district,

13/ Along the road and Wash just south of camp occurs a bed of volcanic agglomerate which Gianella thinks appears in the bottom of the mine, of which he has made


... study for the company. If this view is correct the agglomerate bed beginning the Wash, unless faulted, must dip about 32° to the northeast which agrees in general with the dip of the rocks in the front of the Range at the Gold Peep mine vicinity, and is of interest in possibly affording a clue to the structure of rocks in detail at the mine.

As the rhyolite pitches to the northwest it passes beneath the andesite at a mile or more southeast of the Rand mine and underlies the andesite at a depth about 300 feet at the Lone Star mine situated 1,500 feet southeast of the Rand with the contact between the two rocks dipping toward the Rand mine, it probably underlies the andesite at the Rand mine, though at a somewhat greater depth than yet been reached by the deepest workings. It probably lies at a depth of less than 600 feet. At 1½ miles northwest of the mine the rhyolite is said to form an Hill and dip steeply northeast under the andesite of the range.

The Jura-Trias sedimentary limestone-shale series on whose eroded face the volcanics of the region in general are supposed to rest, is not known to crop within several miles of the mine.
Associated with the lode in the mine ample slickensided surfaces indicate in the mining and movement in several directions, among which the south or hanging wall is to have moved upward as if the fault here were a reverse fault.

Most northeast of the mine where the surface rises steeply several hundred feet and the top of the mountain, the andesite is not only sheeted but is cut by a cleavage that strikes N. 25° W. and dips 80° eastward into the range and by a jointing system with its plane surfaces well slickensided dips 45° SSW toward the mine. Here the andesite, normally gray, weathers brown.

At the mine and vicinity, which is in a faulted, sheared, and crushed zone, andesite has been hydrothermally altered or propylitized and mineralized by natric solutions that circulated through the faults and fractures in the andesite, during its eruption and consolidation and later it was leached and bleached by face water so that it now is stained by iron and manganese oxides and contains sericite and alunite in fractures. The hot mineralizing solutions were the same that formed the deposits last described, and the greater amount of alteration occurs in the deposit.

The zone of the mineralization, whose extent was controlled besides the columns by fissures, fractures, and weathering in the andesite, is irregular in width and intensity. It varies from 20 to 200 feet or more in width and has an extent of 1,000 feet or more. Beginning at the mine it covers the northeast part of the Hope claim, the adjacent part of the Thomas fraction, and of the L. H. extension. As the zone passes into Nugent Wash on the northwest it widens to nearly 1,000 ft. On the southeast it extends to beyond the Lone Star mine. On the southwest it overlaps Hope Extension No. 1 and on Hope Extension 2, it is approximately paralleled by a couple of secondary or subzones, Fig. 95-A (Claim map).
The principal changes produced by the hot solutions in the andesite in the generalized zones were development of finely disseminated pyrite and chlorite and silicification in the rock. The abundance of chlorite locally gives the rock a greenish color, which in places is increased by epidote.

In places the phenocrysts of feldspar in the andesite breccia were altered to sulphurous vapors to alunite. Cubical pits show where pyrite was removed and there is present a trace of kaolin.

In some instances of silicification the andesite is largely replaced by quartz and calcite and in others it is changed to a semi-soft porous rock containing sericite, chalcedony and carbonate.

In places in the mine, as on the 450-foot level, considerable bodies of the andesite have been altered to a dark bluish-gray mud rock or simply mud, especially the drift to the northwestward where it is cut by closely spaced nearly vertical, seting parallel with the lode whose profusely slickensided planes indicate considerable movement. On the east level, however, the andesite, though highly altered is a consolidated fairly firm greenish-gray rock cut by sheeting that dips 90° NW and under the microscope shows good flow structure.

The andesite in general is deeply oxidized, the oxidation being almost as great on the 450-foot level as on the 50-foot level.

The later bleaching of the andesite and the formation of jarosite was caused by oxidation of the pyrite contained in it. In general the pyrite oxidized to pyrite but in places to limonite. On the west side of the shaft on the 250-foot level the rock is a mica andesite but contains labradorite and seems to be a different rock from that in the main 250-foot crosscut.
Deposits

The deposits are gold and silver veins of the replacement type. They occur in the Nevada Rand lode or vein in the zone of bleached and crushed andesite. The lode is about 100 feet wide, it strikes about northwest, and dips 80° SW., or about vertical and seems to pitch to the southeast, Fig. 95 (Map). It contains numerous small fissures and fractures which, in general, parallel the course of the lode, but dip steeply northeast or southwest and have controlled the irregularity of the ore deposits which mostly occur in them.

The walls of the lode are irregular, as are also those of the individual veins or ore shoots. In places deposits are separated from the country rock by a sheet of yellowish clay gouge or "talc" ranging up to a foot or more in thickness. The gouge seems to be very similar to that which carried fair values in the Nevada mine; but here it is mostly barren—example given on the 250-foot level, the south or hanging wall has a well defined sheet of gouge which, however, is very low in silver, and barren while the adjacent crushed andesite carries good values in both gold and silver.

The deposits occur in irregular fissures and fractures as flattish lens-like bodies, ranging up to 10 feet in width and 100 feet in extent.

On the 150-foot level in the main east winze and vicinity is an 8-foot shoot of 20 ore, of which 10 inches runs about $500 to the ton. On this level the vein strikes N. 70° W., and carries 5 feet of $10 ore, while to the northeast it a secondary shoot strikes N. 20° W., with dip 75° W., and at 120 feet out from shaft carries several feet of $8 mill-grade ore. This shoot, further north, similarly feathers out in oxidized vertically banded barren andesite.
On the 180-foot level a 13-foot wide ore shoot, consisting mainly of quartz and other minerals streaked and banded with magnetite and manganese, averaged $15.40 to the ton, which $7 was in gold and the rest silver. All the ore contains silver.

On the 200-foot level occurred an ore shoot 60 feet long.

On the 250-foot level occurred a 12-foot shoot of $3 quartz ore and farther to the footwall side, a 7-foot shoot of $6 "sand" or loose quartz ore. On the footwall side of the lode in the raise, winze, and drift, in an ore body 7 1/2 feet wide by 30 feet long, there remained 3 1/2 feet of $82 ore after more than 4 feet of high-grade ore had been mined out.

A polished section of rich ore ($2650 to the ton mostly gold) from the east end of this level showed the gangue to be mainly hematite containing the precious metals mainly in the form of electrum and free gold. The hematite seems to be secondary after pyrite but the electrum according to M. W. Short is undoubtedly a supergene process would separate the gold and silver. This ore contained also a little selenium, argentite, tetrahedrite, calaverite, wulfenite, the iron oxide, pyrite, and copper minerals especially malachite and tenorite.

Wulfenite occurred in disseminated yellowish platy, crystals, and is probably an important source of the high lead content of the ore. Several of these minerals may be derived from tetrahedrite.

On the 450-foot level the vein or ore shoot seems to be disturbed by a slip fault, but some good manganese-stained high-grade ore was found in and near the corner of the drift.

In 1925 it was reported that six shipments of high-grade ore averaged about 5.6 ounces gold and 190 ounces silver to the ton; a metal ratio of about 34, 1 ounce of silver to 1 ounce of gold, and contained additionally per chemical analysis 82 percent; iron 3 percent; lime 2 percent; alumina 6.3 percent.
The deposits are composed mainly of brecciated, silicified andesite and quartz that has been crushed by renewed movement along the fault. The ore bodies strike northwest, parallel with the trend of the zone. They stand about vertical dip steeply to the northeast or southwest, the attitude of any particular ore being dependent on that of the fracture in which it happened to be deposited.

Country rock and lode are so crushed and mineralized that the ground is easy to oxidize is almost complete down to the bottom of the mine or 450-foot level, it probably extends considerably deeper. On the 300-foot level vein is faulted and oxidation pronounced.

Croppings

The general croppings consist mainly of an inconspicuous streak or band of brown and manganese-stained quartz and silicified rock that usually pans well in gold. The surface ores, however, to the depth of 50 feet, though good looking and seemingly rich manganese ore as seen in openings northwest of the mine, are frequently leached to low grade.

The production of the mine has mostly come from between the 90-foot and the 400-foot levels. The ore is mostly brown oxidized manganese-iron stained silicified hard rock coarse quartz containing chiefly free gold and electrum, cerargyrite, argentite, other oxidized minerals. The richest of the ore contains much unctuous greenish cerargyrite, stain of chrysocolla and malachite, and white or yellowish wulfenite.

Some of the ore a little argentiferous cerussite has been reported; also tetra-

sulphide and calaverite and selenium were found in the present work.
The argentite occurs mainly in the quartz and is thought by some to be about primary, whereas cerargyrite is mostly an oxidation product from the argentite. The cerargyrite, however, fills cracks and cavities, and was not formed directly from some original mineral.

Some ore contains much vein pyrite now oxidized.

Two types of gold occur, a light-colored gold in fair-sized particle (prob. pyrrhotite) and a dark-colored gold in very small flakes. Some gold is contained in quartz crystals and must be regarded as primary.

A little secondary pyrargyrite has been found attached to other minerals. Sulfate rims argentite and polybasite.

White quartz ore, formed on the south side of the Mud Gourge that cuts the wall on the 250-foot level east, assayed 5.44 oz. gold and 34.4 oz. silver to the ton. The wall rock adjacent to the vein is much altered and shows a little adularia, clinozoisite, replacement quartz and aggregates of pyrite oxidized to limonite. There also a little primary argentite in the quartz.

Some of the ore is streaked or banded, indicating that it was deposited on a structure. Hard manganese, as psilomelane, is indicative of good values, but sooty manganese or pyrolusite is not. Also copper minerals are indications of ore. The ore stoped averaged about 5 feet in width and is said to have run about $1.25 to the ton. Some of the ore, however, runs as high as several thousand dollars to the ton. On the 180-level and the 200-foot level a few lenses ran $8,000 to the ton. Good grade ores extend from the 90-foot level to below the 250-foot level.

Micro-ore

A specimen of the vein from the 300-foot level was found by Ross to be mostly a mixture of vein (?) quartz and carbonate which latter is abundant, and seems to mostly siderite but the relative age of the carbonate and quartz is not determinable.
Some ore on the 200 level contains considerable adularia in the gangue.
Calaverite is reported by Tomlinson in ore from the 250-foot level and that is considerable tetrahedrite in the black phase of the ore.

Ore treatment

The ores are said to be easily crushed and treated. They are best treated simple cyanidization, which process yields an extraction of 96 percent of the values.

The values in the ore are largely due to concentration of silver and gold in oxidized zone. This is especially evident in the case of the silver where all values lie largely if not entirely in the chloride-cerargyrite. The primary minerals were deposited chiefly as sulphides—namely, auriferous pyrite and antite—by the hydrothermal solutions and subsequently through the breaking down the sulphides during a long period of oxidation, erosion, and percolation of face water the isolated metals were concentrated mainly as free gold and cerargyrite. During oxidation the manganese carbonate in the rocks was changed to the manganese oxides now present in the rocks and ores.

As gold and silver tend to be associated or carried to greater depth with manganese oxide. The presence of a considerable quantity of this mineral in the is thought to favor extension of the deposits in depth. Here is more manganese the 50 than on the 150-foot level.

Excepting remnants of the primary ore type found on the "new" 200-foot level, is known of the primary or unaltered mineralization. Here, at a depth of to 225 feet, was found a 75-foot shoot of primary ore dipping steeply southwest, which a width of 3 feet was said to have run $54 to the ton. Bodies of auriferous
... and chalcopyrite, both minerals believed to be primary though the argenta-
... partly altered to cerargyrite, were contained in hard manganese-stained
... boulders and the ore contained higher proportions of silver to gold than is
... Now, the microscope shows the sulphides to be replacement of the andesite and
... of adularia and quartz containing primary argentite have been replaced by
... or quartz.

So far as its boulder form and its chalcopyrite and argentite content are
... concerned, this primary ore corresponds to the primary bouldery ore occurring in
... Lone Star mine, next described, but the two ore bodies are not yet known to
... connected.

Outlook
The mine still contains a considerable tonnage of medium-to low-grade ore
... as the vein and deposits are reported to be feathering out on the 450-foot
... level, the outlook for the mine at greater depth is not encouraging. Also fissures
... containing good secondary "sulphide" ore in the winze a little below the 250-foot
... level, on the 450-foot level contain only mud.

It seems advisable, however, that exploration work be extended to greater
... for two reasons: (a) to learn whether secondary enrichment of economic import
... have taken place at the top of the sulphide zone, and (b) the character of the
... deposits in the underlying rhyolite, supposed to be present at a depth of about
... feet, or less than 100 feet below the present bottom of the mine.

Jones suggests that "at the type of mine the ore deposits are similar to those found
... at a depth of about 800 feet, there is an excellent chance that with depth the primary ore will be
... to be of commercial grade."
Lone Star mine

Location and topography

The Lone Star mine is in the southwestern slope of Gabbs Valley Range at elevation of about 5,740 feet. It is just southeast of the Nevada Rand mine, as described, whose property it adjoins and than which it is about 100 feet nearer. It is easy of access. The character of the topography is well shown in figure 3 (topo map) and figure 94 (photo).

History and production

The mineral deposit of the Lone Star mine was discovered December 22, 1907, by E. M. Mims, who still owns it. It seems to be also the first commercial deposit discovered in the district. Development work was soon begun on a small scale. The total production is said to be about $80,000 in gold-silver ore. The mine began shipping ore in 1912 and by the end of 1914 had shipped $21,000 worth of ore that averaged over $40 to the ton.

The total production by the end of 1919 was said to be $26,000, and that 200 tons of $20 mill ore lay on the dump. The ore shipped is said to have averaged 3 ounces silver to 1.01 ounce of gold or about half and half in money value.

In 1914 the Lone Star claim was said to be bonded to the Thompson Smelter Company for $85,000 and the Lone Star No. 1 fraction to P. I. O'Brien for $35,000. 1915 to 1917 the mine was bonded and leased for $60,000 to the Queen Regent Mergering Company of San Francisco, who did about 1,400 feet of work, deepened the pit to the 500-foot level, and regularly shipped considerable ore, mostly from a cut ore shoot on the 80-foot level in Shaft No. 2, where also a large tonnage high-grade mill ore was opened up.

In 1922 it was reported that Walker brothers had taken a two-year lease on mine. By 1925 the total production was said to be $75,000.
Development and equipment

The property comprises a group of five claims; the Lone Star group, of which
cover a length of 4,000 feet on the lode beginning at the Nevada Rand line
as northwest; the other two lie on either side of the middle or Lone Star claim.

The mine is open to the depth of 550 feet by about 3,000 feet of work, about
of which is on the No. 2, or 135-foot level, and about 1,200 feet on the No. 3,
35-foot level. There is also a 75-foot and 175-foot level.

There are three shafts, of which the No. 1 shaft, located about 600 feet south-
of the Nevada Rand mine, is 100 feet deep; No. 2 shaft, located about 1,000
of southeast of No. 1 shaft is 550 feet deep; and No. 3, which is an inclined
located about 600 feet southeast of No. 2, is 250 feet deep. No. 2 shaft is
oped with an 18 H.P. gasoline hoist adequate for sinking to the depth of 700 feet.
surface equipment includes also several buildings adequate to house a small crew
in.

Geology

The geology is similar to that afore described in the Nevada Rand mine, except
the andesite is more brecciated and at the depth of about 250 feet gives way to
to rhyolite or rhyolite porphyry which seems to form the core of the range with
contact between the two rocks dipping to the southwest, from which condition the
is locally said to have andesite on the south or footwall side and rhyolite
north or hanging wall side.
As shown in the 100-foot shaft, just east of the Nevada Rand end line, the site is a comparatively fresh greenish-hornblende andesite.

The rhyolite begins to appear on the 235-foot level. Here a specimen of it collected by the writer in the east side crosscut 12 feet north of the main pit and another at what was then the bottom of the shaft, 300 feet deep with its upper part all in rhyolite. Later a specimen was received from the bottom of the 235-foot level, where also the rock is considerably altered hydrothermally oxidized, though macroscopically it appears to be fairly fresh.

The rhyolite, as seen in the mine by the writer, is massive excepting a dimmage structure and jointing shown in spots. It is a pinkish or reddish-gray, medium-grained, massive rock composed mainly of a fine-grained or felsitic groundmass with flowage structure in which rest numerous small phenocrysts or fragments of phenocrysts of mainly orthoclase, quartz, and sanadine, ranging up to 1/10 inch in diameter and smaller ones of biotite and a little albite, oligoclase altered acidic plagioclase and hornblende. Orthoclase forms about 60 percent of rock and quartz about 20 percent.

The rock is freely disseminated with pyrite is minute macro-cubes and finer grains and contains as accessory minerals apatite and magnetite. On the whole it considerably altered—much of the orthoclase to kaolin and sericite and secondary quartz; the biotite and hornblende to greenish chlorite, calcite, and vermiculite; of the pyrite to iron oxide. Some quartz is partially wine-colored by hematite derived from pyrite. Fragments of other rock material or earlier consolidations of "rhyolite" that are contained in the rhyolite indicate that it may be related to, as a flow breccia or tuff. The rhyolite owes its pinkish or reddish hue to the presence of hematite derived by oxidation from the pyrite. This is best shown in the bottom of the mine where much of the pyrite as seen in individual crystals is
altered to iridescent hematite which has stained the quartz a mild wine-red color, which in milder form is diffused throughout and stains the entire rock.

A dike found on the 550-foot level and said to resemble diorite is probably diorite. In this connection it may be noted that the writer observed lying by the side in Lone Star Wash, just above the Rand camp, a boulder 1 1/2 feet in diameter resembling diorite but which seemed to be too weathered for satisfactory examination.

Deposits

The deposits are gold-silver deposits, similar to those of the Rand mine, described, and occur on the southeastward continuation of the same mineralized fault lode which here varies from 10 to 100 feet in width, strikes about N. 60° W., and steeply 35° NE., or stands nearly vertical, especially on the 75- and 135-foot levels. The deposits occur irregularly in ore shoots in the lode, and they favor north or hanging wall side where some adjacent deposits also occur as replacements in the wall rock, andesite.

The south or footwall side of the lode on practically all levels carries a persistent 1 to 8-inch sheet of dark greenish-brown to yellowish-brown or tough clay gouge, called "gumbo gouge", also locally known as talc. It is present elsewhere, as with ore shoots, faults, etc.

As shown by disseminated pyrite in the andesite and gouge on the 135-foot level, oxidation is general, although the deposit is mostly oxidized.

The deposits consist mainly of crushed or brecciated quartz and andesite with little calcite, limonite, jarosite, manganese, and gypsum.
Limonite and jarosite are the best indications of Fe, though on the 135-foot level occurs some primary boudery ore with milky white vuggy quartz gangue carrying seminalations and small bunches and bodies up to 3/4 inch in diameter of galena, chalcopyrite, light-brown sphalerite and argentite (?). This ore, which is or less a quartz breccia, occurs along the fault or slip. It occurs mainly irregular boulder-like bodies ranging up to 5 or 6 inches in diameter and which encased in or associated with a light-gray, hard, siliceous, lithified fault scia, gouge or matrix composed mainly of finely comminuted or ground-up quartz containing angular fragments of quartz up to 1/2 in diameter and sparsely seminated fine-grained pyrite. In places the gouge is closely laminated by pressure. Some of the ore boulders have been fissured or broken in halves and the contain nuclei-like inclusions of fragmentary andesite up to 3 inches in diameter, which also are cut by quartz veinlets.

The microscope shows this boudery ore to be mostly fine-grained vein quartz narrow prisms with rough or jagged edges and dagger-like terminations containing places a mixture of the ore minerals—chalcopyrite, sphalerite, and galena. In quartz and associated with the chalcopyrite is a small amount of adularia or orthoclase, some in perfect rhombohedral crystals.

When visited by the writer in 1916 this ore was well exposed in the east out on the 135-foot level where it formed an ore shoot 8 feet wide, of which 2 feet on the hanging wall side in the last 30 feet of the drift was said to contain about 31 to the ton and to average 13 percent lead and 8 percent copper with balance of the values in gold and silver. From this it appears that the galena is only argentiferous and both it and the chalcopyrite are probably auriferous.
her work showed this ore shoot to continue with considerable gain in depth to a
int more than 300 feet beyond the face of the drift, or about 1,200 feet east
Shaft No. 3, and the crosscuts indicated it to be confined to the fault. This
bary bouldery ore is in general similar to the ore (spec. 72.8) from the upper
go of the Gold Pen mine, which also contains galena, chalcopyrite, and light-known
own sphalerite in milky white vuggy quartz.

The best ore is said to be the "fines" and to have much associated black
anganese oxide. The andesite is more favorable for ore than the rhyolite and the
ge nearly all appears to be of andesitic origin.

The most of the production has come from the ground in the vicinity of Shaft
3 and which extends from there southward where a block of the vein 7 feet wide
about 1,000 feet in extent and ranging from near the surface to 120-feet deep
the northwest and 200-feet deep on the southeast, is said to have averaged about
0 to the ton. Below that block to the east of the shaft occurred a 10-foot shoot
$3 ore and to the west of the shaft a 25-foot shoot of $4 ore.

Shaft No. 1

On the surface at 120 feet west of the shaft No. 1 are prominent siliceous
izedcroppings of "primary ore". At the shaft the vein is 12 to 30 feet wide;
the 76-level it stands 30 feet northeast of the shaft. In the workings east
the shaft the vein or ore shoot is 29 feet wide and is mostly $9 ore and has
et or more of relatively pure quartz ore on the footwall side, which is succeeded
uish clayey gumbo gouge.

On the second, or 135 level, at from 100 to 300 feet northwest of the shaft the
was 10 to 20 feet wide, of which only 10 to 2 feet was $6 ore, but southeast
the shaft the ore shoot was 10 feet wide and was mostly $5 ore. Beneath this
, however, ore of medium grade was more or less continuous from 300 feet north-
 of Shaft No. 1 to several hundred feet southeast of Shaft No. 2. On the third,
4 235 level, only small bunches of quartz were found representing the vein.
Shaft No. 2 (550 feet)

On the 76-foot level of Shaft No. 2 the vein carries a 9-foot ore body, of which 2 feet is shipping ore and 7 feet high-grade milling ore.

On and below the 135-foot level, and especially below it, medium- to low-grade material is exposed both east and northwest of the shaft for about 250 feet. Northwest of the shaft the vein is 7 to 15 feet wide and carries mostly $2 to $3 ore.

A cross cut on the 300-foot level shows 10 feet of good looking quartz and vein material which, however, carries only small values. The cross cut on the 400-foot level is said to show ore containing much silver sulphides, argentite, stephanite, and a little chalcopyrite supposed to be primary.

On the bottom, or 550-foot level, the 35-foot crosscut to the southwest is in reddish-gray rhyolite which is said to assay a trace of gold and 1 ounce silver to the ton. As there seems to be no trace of silver minerals present, the condition suggests that the silver as well as the gold is probably contained in pyrite.

On the 76 level the vein carries about 7 feet of mostly stoping ore both east and northwest of the shaft as before noted.

On the 135 level west the vein is 25 feet wide and has considerable $3.00 ore, and for 1,200 feet east it carries 10 feet of $3 ore and for 1,200 feet east it carries 7 feet of the primary bouldery quartz sulphide ore. Also in this (135') level, as shown by a crosscut 1,200 feet southwest of the shaft, there occurs at the foot northeast of the primary bouldery vein a 75 foot mid-zone of hydrothermally dark red crushed, but hard/greenish chloritic andesite porphyry (740-A) which fractures and cleavage contains much FeS2 MnO in dendritic form and carries sufficient free gold and cerargyrite to constitute low-grade ore, though it is not as yet be regarded as an important asset of the mine.
The gold and cerargyrite in this zone apparently are of secondary deposition and were derived by oxidation and leaching from higher levels, and the andesite shown by the microscope is altered to mostly a greenish mat of chlorite scales of radial fibrous actinolite derived from biotite and hornblende and forming in places "spheralitites". In the mass occur phenocrysts and fragments or remnants of basic plagioclase in prisms and lathes, also hornblende, biotite, small bodies of calcite, sericite and magnetite. Here we have apparently a 75-foot oxidized of secondary ore separated from the primary ore vein along the fault by 125 of less altered country rock andesite. This latter andesite is the same as which appears on the surface above. It is broken, contains disseminated pyrite small cubes and in its fractures gouge similar to that found in general along fault.

**Outlook**

From the foregoing sketch it is apparent that nearly all the production of the mine has come from relatively shallow depths, from ground lying between the face and the 250-foot level and the most of it from ground not extending much the first or 135-foot level. This probably is in large measure due to the fact that below the 250-foot level the mine is mostly in rhyolite, which rock, hydrothermally altered, seems to have been less favorable for ore deposition as the overlying andesite. So far as learned but little if any commercial ore yet been found in the rhyolite, though this rock has been penetrated about 300 by Shaft No. 2. The outlook for finding commercial ore in depth is not promising. How, it seems advisable to extend Shaft No. 2 a few hundred feet deeper if need and crosscut for the lode to guard against missing any secondary enrichment may have taken place at the top of the sulphide zone.
Outlying prospects

Between the Lone Star and Gold Pen mines situated about two miles apart, the and along the Big Big fault, or mineralization zone, has been all staked for a of about 3,000 feet, and to a less width for about 2 miles northwest of the mine. It contains prospects at a dozen or more points, among which the slope, Salt Lake, and Walker prospects are the more important.

Antelope prospect

The Antelope prospect, owned by L. C. Merz and associates, comprises a group several claims joining the Gold Pen property on the northwest. The vein is in shed and altered andesite and dips steeply southwest into the mountain. It is ed mainly by a 100-foot shaft and a 200-foot tunnel. It contains much good ring quartz, and where crosscut by the tunnel is said to carry about 3 feet of gold-silver ore, some of which averages about $4 to the pound. Outcroppings sit of an inconspicuous streak of manganese-stained quartz-rock breccia, said be barren, but of the type usually regarded as indicating ore, at the comparatively allow depths of 100 to 150 feet.

Randall prospect

The Randall prospect adjoins the Antelope prospect on the northwest. It wise is opened by several hundred feet of work and is said to be similarly rising.

Salt Lake prospect

The Salt Lake Prospect, owned by the Salt Lake Mines Company of Reno, is three-sters of a mile north-northeast of, and just over the crest of the mountain, from the mine, and at about the same elevation of 5,650 feet. It is 1½ miles south the Nugent Wash road. The property comprises a group of 8 claims. It was ited by R. S. Enslow in 1919.
The vein or lode ranges up to 50 feet in width. It strikes about N. 60° W.,
dips southerly across the structure of the hydrothermally altered and leached
rock andesite that dips 60° NNE. It is composed mainly of glassy lustered
quartz breccia, is firmly cemented, more or less vuggy and is stained yellowish-green
jarosite and reddish and blackish with hematite and manganous manganese. It is
used mainly by a 1,200 foot crosscut tunnel that runs S. 20° W. Twelve feet of
vein was said to average $10 to the ton in gold and silver. A seemingly
remarkable feature is the liberal distribution of quartz almost throughout the lode,

Walker (N. York - Nevada) prospect

The Walker (New York - Nevada) prospect, owned by Walker Brothers, is located
at 2 miles northwest of the Rand mine and one-half mile beyond Nugent Wash in
lower northeast slope of the range. Here a replacement quartz breccia vein
25 feet wide and associated stringers dip 70° SW in which whitish leached andesite
is stained with limonite and jarosite and is opened by a 1,200 foot tunnel and
drill shaft. It is said to carry only low-grade gold-silver ore, mostly silver
running about $15 to the ton, but it seems to become more siliceous and to
dee in depth. Nearby the less altered andesite as exposed on the southwest
basic iron gray hornblende biotite rock with fluidal structure and contains
considerable magnetite. The prominent ("Beacon") hill surmounting the ridge on the
west is said by Montgomery to be composed of rhyolite. The vein is said to
have been traced for a mile northwest of the present prospect on the northwest and
the same vein that appears on the Idaho group between Nugent Wash and the
mine on the southeast.

Kelly Copper prospect

The following 4 prospects are located 5 miles directly south-southwest of the
mine and 12 miles east-southeast of Nolan, in the lower northeast slope of
Gillis Range on the Nugent Wash--Thorne road and in Nugent Wash drainage at an elevation of about 5,800 feet. Fig. 3.

They differ markedly from the Tertiary deposits afore described in the Gabbs Valley Range in that they occur in the Jura-Triassic limestone on its contact with quartz monzonite porphyry, a mesozoic granitic intrusive with which they are genetically connected, and are, therefore, for the most part probably contact metamorphic deposits.

Over a considerable area surrounding the deposits outside the garnetiferous silicate rock zone, the country rock limestone has been completely metamorphosed to a gray medium-grained crystalline marble, as at the Brink deposit. (Spec. 702). Fractures and joint planes are coated with whitish calcium carbonate nearly 1 inch in thickness.

The quartz monzonite porphyry is a dull gray medium-grained, granitic rock, containing stout prismatic phenocrysts of feldspar ranging up to 2/10 of an inch maximum dimension. It is composed of about 30 per cent each of plagioclase (ranging from oligoclase to andesine), orthoclase, and quartz, and 10 per cent mica, biotite, augite and other minerals, including sphene, apatite, and zircon. The ferromagnesian minerals are mostly altered to greenish chlorite and talc oxide.

The Kelly Copper prospect, or so-called "copper mine", owned by Joe Kelly, on the southeast side of the Nugent Wash road at about 1/5 of a mile northeast where it crosses the saddle of a low northward sloping ridge and is easy of access. The deposit or ledge is on the quartz monzonite-limestone contact. It is accompanied by the usual contact garnetiferous and silicate rock zone. It extends northwest-southeast, parallel with the reef-like quartz monzonite and on the southeast is said to have an extent of a mile. Openings on it
and for an eighth of a mile northwest and one-third of a mile southeast of the

... prospect. Sheetin in the quartz monzonite and the lode dips steeply south-

... A secondary or branch lode trends S. 15° E. toward the saddle.

The deposit is opened mainly by a 50-foot shaft sunk in the garnetiferous
diacted limestone zone. At the depth of 40 feet drifts extend to the northwest
southeast and seem to follow the lode, whose structure dips 50° southwest.

The limestone, for a width of several feet or more, is altered to dark purple
or amorphous silica with opaline luster, light-brown chert, or flint and a
new-brown or yellowish-brown jasperoid silica. Veinlets and stringers of the
jasper cutting the purple jasper indicate the brown to be the younger of
two rocks. Both rocks are heavy and seem to contain iron oxide and perhaps
little copper, particularly the brown rock which is associated with or forms
part of the ore, as does also a hematite limonite-stained quartz rock breccia which
is present in considerable amount and largely gives the ore pile and dumps their
brown color. In places also the quartz monzonite is garnetized.

Most of the ore consists of medium- to fine-grained hematite in a siliceous
mix and contains, together with chloropale, chrysobolla and a little malachite,
the, and chalccocite. There is also present fine-grained magnetite. Much of
the ore is a blackish pale greenish speckled mass being composed mainly of hematite
chloropale. Fracture planes of this ore are heavily coated with chrysocolla.

A large dump at the shop is mostly heavily dark-brown iron stained, and much of
dark brown material is piled aside as ore.

Origin of the deposit

The deposit seems to have been formed by hypogene mineral-bearing thermal
mineralizations that arose from the quartz monzonite magma and circulated through the
Fissures and fractures soon after the intrusion and consolidation of the quartz monzonite. By the solutions the ore minerals were originally deposited as fine-grained cupriferous pyritic minerals/including possibly a little chalcopyrite within small bodies and disseminations in the fissures, fractures and wall rock limestone which may have been arenaceous, as suggested by the siliceous sandy matrix and in some of the ore. There is also suggestion that some of the ore may replace the monzonite. The deposits were formed at considerable depth, but after a long period of erosion were subjected to oxidation and leaching by surface waters which successively oxidized the pyrite to hematite, limonite, chlorophyll, magnetite, and operated the copper which with one or more other elements respectively formed chalcite, azurite, chrysocolla and chalcocite, the present ore minerals. It is possible that due to leaching and concentration by redeposition, the deposits may be found to be enriched in depth.

Brink prospect

The Brink Copper prospect owned by Newt. Brink, is about a mile southwest of the Kelly Copper prospect afore described on the opposite or northwest side of Nugent Wash-Thorne road at an elevation of about 5,900 feet. It is on the Coper King No. 7 claim, and is said to have been located in 1917. Most of the development work, however, seems to be much older. It is in the gray crystalline tact metamorphosed limestone (702) with fine-grained intrusive quartz monzonite lying a few hundred feet east between the prospect and the road, and which seems to be related to the monzonite at the Kelly Copper prospect. The bed rock is mostly covered by a surface covering of rock debris.

The deposit is opened mainly by a 40-foot incline shaft at the bottom of which is a garnetiferous copper-bearing lode several feet or more wide strikes about east and stands about vertical.
Some deposits occur also along joint planes most of which dip $60^\circ$ westerly and seem of the crushed and sheared rock. About 10 tons of the ore said to average $1$ per cent in copper lay on the dump. The ore mineral is mostly bluish-green symcolite in a brown to dark-brown siliceous ferruginous gangue composed mainly of altered hematite and iron carbonate including probably siderite. Besides, the symcolite there is also present a little residual chalcopyrite. Associated with the deposit is much calcium carbonate but little or no quartz.

The source of the deposit seems to be similar to that of the Kelly copper deposit, the copper minerals having been originally deposited as cupriferous minerals and chalcopyrite.

**Kelly Mica prospect**

The Kelly mica prospect, owned by Joe Kelly, is a short distance south of the Kelly Copper prospect afore described. It seems to be on the same general fault monzonite-limestone contact as the copper prospect, and is genetically related with the quartz monzonite, some of which as E forming the hanging wall of the lower mica bed in Fig. 96, though not pegmatitic, is coarser grained and contains several times as much biotite as the average quartz monzonite rock.

The deposit is opened by an 8-foot pit on a lode or dike that strikes $N. 10^\circ W.$, dips about $40^\circ W.$, Fig. 96, and contains as its principal economic feature 2 or "dikes", C and F, of mica aggregating more than 4$\frac{1}{2}$ feet in thickness, the wall of bed F not having yet been reached.

In the beds the mica occurs in a siliceous matrix. It occurs in the form of booklets which range up to about an inch in thickness and 3 inches in length whose largest available plates will yield circular plates $1\frac{1}{2}$ inches in diameter. This is about the smallest size used in commerce and is known as "punch"
Kelly graphite prospect

The Kelly graphite prospect, owned by Joe Kelly, is near the Kelly Copper and Buckley prospects afore described. The country rock is the liver-brown jasper which contains some disseminated hematite and probably represents altered silicified limestone. The deposit consists mainly of a 2-foot wide vein which lies mainly in the jasper, though at the collar of the shaft the hanging wall is a fine-grained micaceous quartz monzonite with which the deposit is probably genetically connected. The vein dips 50° southwest about parallel with the structure or jointing in the jasper which toward the vein contains seams or stringers of graphite up to 2 inches in width.

It is opened by a 16 ft. shaft with a 10 ft. crosscut to the southwest at the bottom, and drifts in either direction which show it to contain considerable fairly amorphous graphite in tabular shoots ranging up to 3 inches or more in width. Kelly the graphite shows lamination due to pressure and is slightly streaked by some lamination planes with red hematite. The deposit seems worthy of exploration.

Buckley prospect

At Buckley camp, (abandoned), 4 miles west of the Kelly Copper prospect and 3 miles southeast of Nolan, the deposit is said by Lappat to consist of several small veins that contain a little disseminated free gold. They are on a graphite-limestone contact and are capped with iron gossan. Fig. 3, (Topo map).
CARSON SINK AREA, NEVADA

By

F. C. SCHRADE

Holy Cross (Terrell) District (?)
Holy Cross (Terrell) District

The present report is based mainly on a ½ day examination of the district by the writer in August 1913, in which, for aid generously extended, thanks are due members of the several mining companies especially Geo. Pollinger.

Location and topography

The Holy Cross district, perhaps better known as the Terrell district, is 28 miles south of Fallon and 14 miles northeast of Shurz, the nearest railroad station on the Hazen-Goldfield Branch of the S. P. Railway, from both of which it is reached by a good road. It is in the southwestern part of Churchill County and the adjacent border of Lyon and Mineral counties and is on the Carson Sink topographic sheet of the U.S.G.S., Fig. 3. It is mainly in the northeast slope of the southern part of the Desert Mountains with Terrell the camp located on the gently sloping wash or valley fill at the foot at an elevation of about 4,200 feet, above which the mountains have a maximum maximum relief of about 2,400 feet, Fig. 3 (Topo map), and Fig. 100 (Photo). Though the topography is semi-rugged as is characteristic of eroded Tertiary volcanic rocks, the deposits are not difficult of access.

The deposits are nearly all contained in an east-west rectangular area 2 miles long by one mile wide with Terrell located in the northeast part. The area is drained northeastward into Terrell valley which has no outlet. The climate is very dry, the annual rainfall being only about 5 inches, but good water occurs at depths of about 90 feet in several mines in the front part of the range.

History and production

Mineral in the district was first discovered in 1910 by J. V. (Judd) Terrell and George Pollinger on the Silver Star claim. They were soon joined and financially aided by Craig Catterson of Oregon and the trio sunk a shaft 107 feet deep and crosscut
the vein with encouraging results. They finally acquired a group of 24 claims which they bonded, in July 1911, to George Wingfield. This group contains most of the mines and prospects described in the present report and they nearly all had been discovered by 1913.

In 1912 the district was quite active, the Loma Mining Co. in driving a 160-foot tunnel had struck a 1-foot wide vein of mostly galena, and when visited by the writer in August 1913, the camp had 30 cabins and tents and the July shipment was said to have been 10 tons of ore averaging $68 to the ton. The cost of ore haulage in Shurz was $4 per ton. In 1914 the Minerva Mining Co. of Minneapolis, Minn., had small deposits at about 100 feet below the surface rich in silver-lead-gold ore, and considerable nickel was reported to have been found in one of the ore by Francis McDonough and associates who were working an 8-foot vein. In 1915 the Scotia mine was reported to be active. In 1918 several tons of manganese were mined and shipped by the Bullion Company. In 1919 there was moderate activity. In 1920 the Minerva Company, with a shaft 95 feet deep, mined and made a shipment of copper ore containing silver, and in 1921 a small shipment of miscellaneous gold-silver ore was made from the Last Hope mine.

The total production of the district seems to have been about 150 tons of only high-grade ore having a value of $9,000. Complete records, however, are not available. The principal ore shipments to 1913, as given by the several mining companies appears in the following table.

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<table>
<thead>
<tr>
<th>Mine</th>
<th>Tons</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silver Star</td>
<td>11.0</td>
<td>$920.00</td>
</tr>
<tr>
<td>1st Hope</td>
<td>5.5</td>
<td>1,120.00</td>
</tr>
<tr>
<td>1st Hope No. 1</td>
<td>6.2</td>
<td>543.00</td>
</tr>
<tr>
<td>1st Hope No. 3</td>
<td>0.5</td>
<td>78.00</td>
</tr>
<tr>
<td>Jack Butte</td>
<td>1.5</td>
<td>150.00</td>
</tr>
<tr>
<td>Rosenblum</td>
<td>2.8</td>
<td>172.00</td>
</tr>
<tr>
<td>Total</td>
<td>11.0</td>
<td>1,958.00</td>
</tr>
</tbody>
</table>

Statements on the production from 1913-1927 appear in the U. S. M. Res. reports. For instance in 1916, "The Silver Star, Pyramid, Fraction, and four other properties produced an output valued at $1,522 in gold, silver, copper, and lead, but in most cases the quantity or value of the ore is not given. The Silver Star mine and the 1st Hope mine seem to have been the most steady producers.

Development and equipment

Several of the mines or properties are equipped with gasoline hoists or air compressor drills and engines and most of them are opened to depths of 80 to 100 feet. The occurrence of water at depths of 90-100 feet in the front part of the mountains seems to explain why more of the workings have not been sunk much below the 100-foot level. In 1915 there was talk of putting in a mill to treat ore that is too low grade to be profitably shipped.

Geology

The geology at Terrell and vicinity consists mostly of Tertiary volcanic rocks, rhyolites, and andesites, and related types and phases disposed in flows that are more or less heavy.

Proceeding from the foot of the range southerly and ascending in the geologic column the succession of the principal rock formations, broadly speaking, is as follows:
(1) gray andesite (spec. 446)
(2) white rhyolite (spec. 439)
(3) lavender rhyolite (spec. 440)

These formations each occupy a northwest-southeast belt of variable width running almost parallel with the front of the range and are each at least several hundred feet and probably much more in thickness. The most abundant is the white rhyolite and the next abundant the lavender rhyolite. The andesite is equally important, however, from standpoint of deposits that occur in it. From its frontal position and to differentiate it from other andesite rocks it is here referred as the front andesite. It is also locally known as the water-shaft rock or andesite from the fact that the so-called water shaft or mine is sunk in it. It is a darkish gray sub medium hornblende biotite andesite porphyry speckled with lighter feldspar phenocrysts and abundant smaller forms including those of hornblende and biotite. About 70 percent of it is composed of microcrystalline nearly felsitic glass with flow structure in which rest the larger forms which are mostly prismatic. The feldspar is mostly olig-andesine but ranges to and-lab. The green hornblende occurs in long prismatic forms the brown biotite in short broad foils. Some of it is altered to greenish chlorite; augite and magnetite are also present.

On the northeast the andesite passes beneath the wash or valley fill while in the southwest it is unconformably overlain by the white rhyolite next described. It is exposed at a point a few hundred feet southerly from the Water Shaft mine. In the deeply eroded main or camp gulch it is exposed extending up the gulch for a mile or more from camp and the mouth of the gulch. At about a third of a mile up from the mouth (of the gulch) it exhibits a fairly well developed vertical columnar structure, several of the columns having castle-like and some pseudo-columnar terminations.
White rhyolite

Next above and back of the front andesite the white rhyolite occupies about 3 of the width of the northeast slope of the range extending from a point 1 mile more southeast of Terrell to an equal distance to the northwest of it.

It is a whitish or light-gray rock with a pale greenish tinge. It has a chondal texture and is a tuffaceous rhyolite standing near trachyte (spec. 439 and 440). About 80 percent of the rock consists of crypto-crystalline to glassy rhyolite has been id dissolved out. Besides orthoclase and quartz some oligoclase and a little biotite and hornblende are present.

Lavender rhyolite

The next abundant rock is a lavender or reddish fine-grained rhyolite (spec. 440), which forms the upper one-third of the northeast slope of the range and is co-extensive with the light rhyolite which, in places at least, it unconformably overlies. It is a lavender-colored sub-medium grained massive tuffaceous rhyolitic rock containing stout prismatic feldspars ranging up to about 2/10 of an inch maximum dimension and numerous small microscopic forms of quartz and biotite.

Besides the three formations above-described, there is also present occurring as flow bands or sills well up in the range and locally as the cap rock, a dark, medium-grained rhyolite (spec. 441) that weathers with a greenish tinge.

Deposits

The deposits are mostly silver and gold-bearing small veins that occur in the tertiary volcanic rocks mainly in the front andesite near its contact with the white rhyolite. Some of the veins, however, carry also lead, copper and zinc, and a few are reported to contain also nickel. Some of the veins, as at the Furnish utica mine, are decidedly manganiferous.
The veins are composed mainly of faulted and crushed mineralized andesite containing or heavily stained dark brown or blackish with iron and manganese oxides. They are generally calcareous and with little or no quartz. In places associated with the veins are mineral-bearing stringers. Both veins and stringers carry the best values and ore more extensive where they lie out in the andesite short distance from the rhyolite contact and parallel with it. Here they generally end for long distances.

The veins do not prominently outcrop. The larger veins occur in the andesite lie about parallel with the andesite-rhyolite contact, but they are not so rich the stringers in the rhyolite which are obliquely, at angles 20° to 30° to the contact. Some stringer zones are as much as 200 feet wide and 1,000 feet long.

Mineralogy

The ore minerals are mainly cerargyrite, gold, argentite, galena, chalcopyrite, pyrite, malachite, gran. and manganese oxides. The galena seems to be argentiferous.

Source of the deposits

The deposits seem to be of hypogene origin and to have been formed by magmatic mineral solutions whose circulation through the issues and fractures followed oblique sections of one or more of the Tertiary volcanic rocks especially the white rhyolite. They were originally deposited as sulphides, the primary ore minerals being mainly pyrite, argentite, galena, chalcopyrite, and rhodochrosite. The pyrite was auriferous some of it cupriferous, the argentite auriferous, the galena argentiferous, the chalcopyrite auriferous, the rhodochrosite argentiferous. From most of these minerals as they through the agency of erosion were exposed to oxidation the first ore minerals—gold, cerargyrite, copper carbonates, oxides of iron and manganese were derived and through the processes of leaching, redeposition, and replace-

and secondary enrichment were concentrated to the present ores.
Outlook

The outlook of the district depends on conditions that would favor the working of small shoots of good-grade silver-gold ore such as have been mined and of which there seems to be a considerable reserve. Below ground-water level in the sulphide zone the deposits will be found to be leaner and some of the veins too small to be profitably mined to any great depth.

Mines and prospects

The district contains about 20 small mines and prospects the most of which are listed in the following list and a few of which are described.

Mines and prospects in the Holy Cross (Terrell) district:

<table>
<thead>
<tr>
<th>Mine or prospect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Shaft</td>
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<tr>
<td>Scotia</td>
</tr>
<tr>
<td>Milton</td>
</tr>
<tr>
<td>Lost Hope</td>
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<tr>
<td>Lost Hope 1</td>
</tr>
<tr>
<td>Lost Hope 3</td>
</tr>
<tr>
<td>Terrell</td>
</tr>
<tr>
<td>Wingfield</td>
</tr>
<tr>
<td>Darr</td>
</tr>
<tr>
<td>Jump</td>
</tr>
<tr>
<td>Cripple Queen</td>
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<tr>
<td>Black Butte</td>
</tr>
<tr>
<td>Anchor</td>
</tr>
<tr>
<td>Pyramid</td>
</tr>
<tr>
<td>Minerva</td>
</tr>
<tr>
<td>Silver Star</td>
</tr>
<tr>
<td>Poorman</td>
</tr>
<tr>
<td>Bullion</td>
</tr>
<tr>
<td>Loma</td>
</tr>
</tbody>
</table>

Water Shaft mine

The Water Shaft mine is about 400 feet west-southwest of Terrell on the Silver Star claim at an elevation of about 4,400 feet. The vein strikes about N. 30° E. in the front andesite at about 200 feet northeast of its contact with the overlying fine rhyolite, and stands about vertical, has a width of about 3 feet on the 100 level,
The Scotia mine, owned by the S. Consolidated Co. of Boston, is 1/2 mile west of Ferrell on the Silver Star No. 2 claim at an elevation of 4,390 feet or but 10 feet lower than the neighboring Water shaft mine. It was reported to be active in 1915.

The vein dips steeply to the south in the front andesite with a small body or stock of white rhyolite exposed a few hundred feet down the slope to the north-east. It is opened mainly by a 150-foot deep shaft 300 feet of crosscuts and a incline extending 100 feet west of the shaft on the 100-foot level. Water was reached at a depth of 90 feet. The shaft is equipped with a 25-horsepower gasoline hoist.
On the 100-foot level the vein is said to be 2½ feet wide and to contain
a narrow veinlet of impure calcite.

In the workings east of the shaft it was found that the rock is altered, and the ground
and vein material shows stringers or vein material to have been dragged by faulting.

The vein is exposed but a couple stringers of blackish calcareous manganese
de 2-10 inches wide dipping 60° E. are said to be mostly good-grade silver ore
(see 445). They and the ore are composed mainly of crudely banded calcareous
carbonate material containing or stained dark brown and blackish with manganese oxide
and is similar to the ore in the Water Shaft mine. They contain parallel
veins and also small cross veinlets of impure calcite.

In the east crosscut jointing in the andesite dips 45° W., and is locally
intersected by another joint system that dips steeply east.

Loma mine

The Loma mine owned by the Loma mining company of San Diego is about ½ mile
south of Terrell. It is on the Green claim at an elevation of about 4,750 feet.

It is on a 3-5 foot wide vein that strikes northeast-southwest and lies mainly
in the front andesite but extends southwestward into the white rhyolite. It dips
northwest. It is opened mainly by a 600-foot adit tunnel drift that extends
southwestward and is equipped with a 15-horsepower Morse-Banks compressor. The
main course of the vein and drift is not entirely straight. At about 100 feet in from
the portal of the tunnel a 40-foot section of the vein is cross-faulted about 20
feet to the northeast or hanging-wall wise and at about the 250-foot point in from
the portal the vein? and drift fork, the so-called right drift continues its
southwest course on the main vein to the 300 ft. point while the left drift follow-
by a branch or stringer extends southward to the 600-foot point, with the last
30 feet or more in the rhyolite.
The vein is composed mainly of faulted crushed and mineralized andesite containing or being heavily stained with iron and manganese oxides and with but little alteration.

In the rhyolite the vein is composed of crushed and recemented rhyolite stained with iron and manganese oxide and both vein and rhyolite wall rock are pressed and heated or made schistose with the structure dipping 60° to the west-northwest.

Considerable portions of the vein are said to carry ore the most of which runs about $10 to the ton in silver. This is essentially true for the 2-foot wide faulted section extending from the 100 to the 150-foot points in front of the tunnel portal. Just beyond the faulted section 6 inches of the vein is said to average $40 to the ton and at the 200-foot point where the vein is 5 feet wide and has a good hard working wall it carries a fair body of $10.75 ore and in the right drift beyond is place is a fair body of $15 ore. At about 550 feet in from the portal a ½ inch stringer in the rhyolite was said to be very rich in both gold and silver.

Last Hope mine

The Last Hope mine is nearly a mile south-southwest of Terrell, at an elevation of 5,050 feet. It is on an east-westerly vein that dips southerly in a narrow belt of andesite near its contact with the overlying white rhyolite and is opened the depth of 130 feet by a 50° southerly incline shaft known as the Green shaft. Drifts and laterals on the 50 and 100-foot levels. At the time of visit in 1913, the company was doing development work, from which it had shipped 7 tons of good-grade ore, and several tons of low-grade ore lay on the dump. Some of the ore is said to be very rich and to run several hundred ounces in silver and $90 in gold per ton.
Also, a small lot of siliceous gold-silver ore was shipped from the mine in 1921.

The vein is from 1/2 ft. to 4 ft. wide, but in its wider portions the ore values occur mainly in a series of parallel stringers. At the surface the vein follows a flat plane and has a dip of 50° but the dip flattens with descent to the extent that in the bottom of the mine it is only about 25°. On the 100-foot level the vein for some distance follows the andesite-phyllite contact, but the ore is best developed in the andesite. It was later reported that at greater depths the vein shears out on the contact. The ore is silver-gold ore, but it contains also considerable lead and a little zinc, especially on and below the 100-foot level. The minerals are cerargyrite, galena, which is probably argentiferous, pyrite, and hematite, and specularite. Gypsum in the form of bands and stringers forms a considerable part of the gangue and in the more oxidized ore at shallow depths the ore is stained reddish and blackish with hematite and manganese and besides calcite the quartz contains also a considerable quantity of other carbonates, judging from the calcareous nature. In the deeper part of the mine the ore is mostly sulphide.

A stringer found in the eastern part of the mine is thought by the company to probably present the vein of the Milton mine on the north, said to have a known extent of 900 feet.

Terrell mine

The Terrell mine is on the westward continuation of the same vein or fissure as the Last Hope mine which here has a width of 2 feet, and is geologically and morphologically similar to what it is in the Last Hope mine except that it is better ended and contains more gypsum and galena and higher silver values. It has shipped several tons of mostly high-grade ore. On the ridge westward from the mine the vein seems to be composed mainly of quartz breccia and contains much greenish horn stone.
Jump mine

The Jump mine is about 1-3/4 miles west of Terrell at an elevation of 5,100 ft. It is owned by Harry Davis of Los Angeles. It is on a 9-foot wide vein or is composed of many mineral-bearing quartz stringers. The lode dips steeply east altered and crushed andesite near its contact with rhyolite. It has a known extent of 700 feet. Several shallow openings made in the lode are said to have produced 11 tons of silver-gold ore valued at $1958.

Wingfield mine

The Wingfield mine opened by a 100-foot southerly inclined shaft on the same in as the Last Hope and Terrell mines was said to have shipped $600 worth of high-grade ore, running 60 ounces silver and 140 in gold to the ton. The vein is 5 feet wide. It is in andesite and the ore is mostly sulphide in the deeper part of the mine.

Darr mine

The Darr mine 1 1/2 miles southwest of Terrell is in a 2½-foot vein that dips 85° in rhyolite. It is opened mainly by a 40-foot shaft and is said to have shipped little ore that ran $12 to the ton. The footwall rock contains many stringers parallel with vein.

Cripple Queen (Martini) mine

The Cripple Queen or Martini mine, owned by F. J. Martini is about 2/3 of a mile southeasterly from Terrell and 1,400 feet higher, being at an elevation of 8,000 feet. It is easterly from the Loma mine. The property comprises an east-west up of 7 claims. It is on a wide mineralized zone dipping 60° northeasterly in front andesite and other volcanic rocks that seem to form the northeast side of a normal uplift. The zone, however, contains a 2½-foot wide vein that carries considerable $22 ore. It is opened mainly by a 135-foot adit tunnel driven northwesterly which the latter half crosscuts the zone diagonally.
Black Butte mine

The Black Butte vein dips west in the front andesite near the andesite-rhyolite porphyry contact. It is 30 inches wide and contains 1/2 feet of sulphide ore that ass 6.50 to the ton. Some of the concentrates assayed $150 in gold to the ton.

A zone of stringers some of which are rich. Thirteen hundred pounds of the ore shipped to the Western Ore Purchasing Co. in 1911 ran $17 in gold and 92 ounces silver to the ton and 12 percent lead, 4 percent copper, 3 percent zinc. A later shipment of 1,740 lbs. from one of the stringers ran $11.30 in gold and 190 ounces silver to the ton.

Belleview prospect

The Bellevue prospect is 1-3/4 miles southwest of Terrell at an elevation of 2,200 feet. It is said to have made a small shipment of ore. The vein dips steeply north in andesite.

Bullion prospect

The Bullion prospect, a manganese property comprising a group of 3 claims owned by R. Z. Hodges, is about a mile southwest of Terrell in Comet Gulch, the first rich west of Terrell, at an elevation of about 5,050 feet. A few tons of manganese was shipped from it in 1913. The deposit consists of manganese oxides in a car zone in rhyolite and rhyolite tuff which rocks seem to overlie the white rhyolite and a short distance south of the deposit the rocks are cut by a 200-foot northwest-southeast dike of dark hornblende biotite andesite porphyry.

The zone is 50 feet wide and extends east-westerly in which direction stringers of small masses of manganese oxide crop out more or less abundantly for the distance about 3/4 of a mile. The structure dips gently northerly downstream.
The ore minerals are mainly psilomelane and pyrolusite that have replaced the rhyolite. The associated or gangue minerals are fine-grained silica and oxides. Some of the deposit which is mostly of the pyrolusite phase though very firm is very fine-grained arenaceous and contains uniformly disseminated particles of specularite. The better grades of the deposit contain tabular pieces of fairly pure hard psilomelane an inch and a half or more in thickness.

According to a later examination and report "the greatest depth attained the workings is 6 feet. The oxides probably extend to a depth of 25 feet. The greatest workable ore body which is 300 feet long and from 5 to 3 feet wide was estimated to contain 10% of manganese and more than 20% of silica and the zone as a whole was estimated to contain 50,000 to 100,000 tons of material that will run from percent to 15 percent of manganese. The material can be concentrated to a high-grade product." "The deposits are in or associated with manganiferous silver veins at the parent mineral from which the manganese oxides were derived is not known."

Lake View mine

The Lake View mine, owned by the Lake View Mining Company 3 (?) miles south of Cerrill, is on a 2½-foot vein in andesite, of which 1 foot averages about $50 to the ton, the values being nearly all in silver with small values in gold and copper. This is thought to be on the same vein as the Loma and Sootia mines.

Anchor prospect

The Anchor prospect was being worked in 1913 by Darr & Timson, lessees, who made two small shipments of $60 ore.
BEBAY DISTRICT (S)

By

F. C. SCHRADE
Benway District

The present notes are based on a half day's examination made by the writer in 1913, in which he was generously aided by lessees who were working at the mines.

Location and topography

The Benway district is 10 miles north of Shurz and 28 miles south of Fallon, nearest available railroad stations, from which it is easy of access. It is 5

as east-northeast of the old Riovista or Reservation station on the Indian Reserve which, however, there is no direct road. It is in the southeast corner of Lyon.

ity, near the Mineral county line and is 6 miles west of Terrell. It is in the

ern part of a 2-mile wide southwest lobe or ridge of the Desert Mountains at
elevation of about 5,200 feet and overlooks the broad Walker River Valley on the t, Fig. 3 (topo map), (which expresses the character of the topography).

The deposits are about all contained in a compact group of about 50 mining

ims in a nearly square east-west area about 2 miles long by 1½ miles wide with
camp located in the western part of the area where also most of the development

k is done. Most of the/ part of the area is occupied by the Smith-Raines

way Group of 8 claims, which on the south is joined by a similar group, the Quinn-

man group.

History and production

The Benway district seems to be an old discovery. It probably is much older than

oall. In 1913 the principal properties were said to be owned by Utah people and
re being worked by only a few men. The production if any must have been small as

record of it seems to be available. In 1916 the company in sinking a new shaft to

depth of 330 feet was said to have found a 12-foot vein carrying considerable

ities of ore running $7 to the ton mostly in gold. Several of the veins are

ed by shafts and tunnels to depths of about 100 feet and one, it is said, to

depth of 330 feet.
Geology

The country rock primarily is the limestone-shale-sandstone series of Jurassic age similar to what it is at Copper Mountain in the Rand district. It is intruded by the mesozoic granitics which are mostly quartz monzonite or closely related types as granodiorite and diorite. The older rocks are also intruded in part overlain by Tertiary volcanic andesite and rhyolite, especially on the northwest. The sedimentary rocks have been much disturbed, folded and faulted. In the western part of the area they dip southeast. Their dominant member is the limestone. It is a light-colored to bluish gray banded dolomitic rock and contains much magnesium. In the vicinity of the intrusives, especially the monzonite, is more or less silicated, or silicified and metamorphosed or partly crystallized and is traversed by seams and veinlets of calcite and quartz.

The dominant contact which is that between the limestone and the quartz monzonite lies in the northwestern part of the area. It trends northeasterly and dips southerly with mostly limestone on the northwest and quartz monzonite on the southeast. It extends from the Bureka ground in the northeastern part of the area west-southwestward across the Appeal to Reason and neighboring ground.

(2) Quartz monzonite

The quartz monzonite is a gray or salt-pepper sub-medium grained massive rock with a reddish tinge, but in places contains much darker and more basic phases that are close to diorite. It is perhaps the most important of the igneous rocks because the ore deposits seem to be genetically connected with it. It and the older rocks are cut by dikes of a light-gray or pale-pinkish finer-grained aplitic monzonite complementary to the quartz monzonite, which, in turn, together with the older rocks, are cut by dikes and in part are overlain especially on the northwest flows of Tertiary volcanic rocks notably hornblende-biotite andesite porphyry and rhyolite.
Deposits

The deposits consist mainly of a series of 10 or more veins that strike nearly west (N. 75° E.) and dip steeply south, mostly in quartz monzonite and limestone. Where contact they are mostly associated but in the south border of the area a of the veins dip northerly.

The veins or lodes range from 3 feet up to 20 feet or more in width. Most of are said to have an extent of about a mile.

The vein filling is mostly crushed or sheared and altered rock, quartz and siliceous gangue-like material much of it stained with iron and manganese oxides. Veins carry one or more of the following valuable metals: copper, silver and gold.

3 Minerals

Here are but few contact metamorphic minerals. The following minerals were served or reported in the present work:

The ore minerals are:

- Argentite
- Cerargyrite
- Chalcopyrite
- Gold
- Hematite
- Limonite
- Malachite
- Pyrite
- Silver

Of these the principal primary ore minerals are the sulphides - argentite, chalcopyrite, and pyrite.

Other minerals present are:

- Dolomite
- Graphite
Molybdenite
Fluorite
Pyrolusite
Stibnite
Tourmaline

3 Source of the deposits
The deposits are of hypogene origin and are genetically connected with the quartz monzonite. They are, therefore, of late Cretaceous or early Tertiary age. They were formed for the most part by heated magmatic solutions that circulated through the rocks soon after intrusion and consolidation of the quartz monzonite. They were originally deposited at considerable depth as the sulphides — argentite, covellite, and pyrite. All these minerals, perhaps being sparingly auriferous, and in them, on their being exposed to oxidation by erosion the oxidized or secondary minerals were derived and by process of leaching were concentrated at lower levels in sufficient quantity to form ore.

2 Mines and prospects
The following notes on a few of the deposits may help to convey a fair idea of the deposits as a whole.

3 Copper King prospect
The Copper King vein is said to have an east-west extent of more than a mile. It was opened by a 70-foot deep shaft on the Copper King claim of the Quinn-Neuman group. It lies in quartz monzonite. It is about 4 feet wide and dips 70° south. It is composed of mainly crushed quartz monzonite and quartz of which 1 foot of more siliceous mafic-chip-stained part was said to carry about 10 percent copper and 20 ounces silver and $2, in gold to the ton.
Near the vein the wall rock is very siliceous or hydrothermally altered and contains plates of secondary biotite 1/10 inch in diameter developed in both the wall rock and the quartz. Eight hundred feet to the east on the Hunchback ground the vein is marked by several old brown gossan-like croppings. An open cut on a small vein on the north border of the Copper King claim shows about a foot of rusty brown and greenish iron and copper-stained quartz.

† Eureka mine

The Eureka mine is in the center of the north border of the area at an elevation of about 5,100 feet. The property contains two claims covering 3,000 feet of the Eureka lode, which, however, has a much greater extent. The lode or shear zone strikes N. 60° E. along the limestone-quartz monzonite contact and dips 80° southerly. As shown in small gulches crossing it, it is about 60 feet wide. It is opened mainly by the old shaft in limestone on the Eureka claim, the most easterly of the two claims. The shaft and workings show the vein to be about 6 feet wide and to be composed mainly of crushed and altered limestone and to be streaked or banded with iron and manganese-stained crushed rock gangue and clay all sufficiently soft to be easily excavated.

A 10-12 inch width of the vein is said to have averaged 50 per cent and 22 ounces of silver and $3.40 in gold to the ton.

† Riovista prospect

On the Riovista claim of the Quinn-Newman group, the Riovista vein, a copper-bearing quartz fissure vein in the quartz monzonite opened by an 80-foot adit tunnel to the depth of 50 feet, is said to carry workable ore averaging $6.50 to the ton, and about 1,000 feet eastward on the Molalla claim the vein contains considerable malachite in coarse bouldery iron-stained quartz-breccia. In some instances replacement bands of malachite 1/2 inch wide penetrate the altered quartz monzonite to depths of 20 or more inches.
CARSON SINK AREA, NEVADA

By

F. C. SCHRADE

STILLWATER RANGE DISTRICTS (9)

1. Mt. Hooi & Ada Lake
2. Comstock
3. Wheeler
4. Seeley & Charcoal
5. West Tidwell
6. Desolation Canyon
7. Notch
8. Heart Lake
9. Wolf Camp
10. P. 3

11. Wilson & Alta Lake

12. Forbes & Horsehead

13. Humboldt & Charcoal

14. On USA

15. Notch

16. Wolf Camp

17. Notch

18. Desolation Canyon

19. Wilson & Alta Lake

20. Notch

21. Notch

22. Notch

23. Notch
Stillwater Range Districts

The Stillwater Range bounds the Great Carson Sink Valley on the east from whose flat surface it rises steeply to the height of more than 4,000 feet. Fig. 3.

As here considered it extends from Sand Springs about 60 miles northward to the northeast corner of the Carson Sink quadrangle. It is commonly said to be crossed by three main mineral zones or lodes which beginning on the south are those of Mountain Well or Laplata, IXL Canyon, and White Cloud. It, however, contains a score or more so-called mining districts or camps irregularly and sparsely distributed mostly in the various canyons that trench the Range and whose erosion of the overlying rocks has aided in exposing the deposits to view.

Those on the west slope are reached from the Stillwater-Winnemucca Piedmont road and those on the east slope from a similar road skirting the edge of Dixie Valley.

The deposits occur mostly in the Jura-Triassic sediments especially limestone and slate in connection with granitic intrusives. They are largely of contact metamorphic nature and are not persistent in depth nor ore tenor comparable in richness with bodies worked in them near the surface.

Mineral in the range was discovered before 1860 in which year the Silver Hill District northeast of Mountain Well is said by J. Ross Brown to have been organized.

The districts or camps, most of which occur in the west slope of the range are as follows:

Bellmare
Copper Kettle Canyon
Cottonwood Canyon
Cox Canyon
Dunderberg
Fondaway Canyon
IXL Canyon
Job Peak
Lees Canyon
Marvel
Mountain Well
Sand Springs
Shady Run
White Cloud

The following notes on the deposits begin on the south. Some of them are

avoidably very brief due to the fact that many of the mines were idle and access

as rendered very difficult by torrential floods caused by cloudbursts that just

before the date of visit had destroyed much of the Piedmont highway, camp, and mine

roads on the west side of the range.

Sand Springs district

This district is at Sand Springs and vicinity, especially to the east. It is

on

18 miles southeast of Fallon/the Lincoln Highway. It is in a low part of the

Millwater Range, here known as the Sand Springs Range, at an elevation of about

4,500 feet, Fig. 3 (Topo map).

The geology consists mainly of Jura-Triassic sediments - limestone, dark shale,

sandstone series which is intruded by Cretaceous ? granitics and in places overlain

by Tertiary volcanics, rhyolite, andesite and basalt, Fig. 4 (General geologic map).

The limestone includes some fairly heavy bedded light-gray or whitish-crystalline

rock which is prominent in the Sand Springs Range on the south.

The rocks include also some Truckee beds and are in part capped by dark basalt.

At about 2 miles east of Sand Springs near the East Gate road forks the Mesozoic

sediments strike northeasterly and form an east-northeasterly syncline which the Lincoln

Highway for a considerable distance follows.
The steep slope of the mountain just east of Sand "Springs and north of the highway shows very beautifully 5 or 6 well-marked Lahontan Lake Shore terraces standing heights up to several hundred feet above the base of the mountain. The terraces curve around the southwest shoulder of the mountain and extend for a considerable distance northward along its west front. They are constructive and are built up in large part of coarse bouldery black volcanic rock debris or talus descended from the higher slopes of the mountain into the edge of the lake, and since the recession of the lake they have been transversely incised or cut through by the trenchant hanging gullies or gulches.

The sand forming the large white picturesque sand dune extending from near Sand Springs northward into the pass several miles distant seems to have been derived by wind action from the Fairview of Dixie Valley. This is suggested by the stoss-like configuration of the north or pass end of the dune and the tapering lee-like south or Sand Springs end.

The principal mines and prospects are the:

Dan Tucker
Good Hope
Kinney

Dan Tucker mine

The Dan Tucker mine, a gold property owned by the D. T. Mining Co. of Sand Springs, is in the upper east steep slope of the range at an elevation of about 10,000 feet, whence it overlooks the Fairview Valley on the east. Fig. 3. It is credited with having produced considerable ore of both shipping and milling grade. It seems to be in the Jura-Triassic sedimentary rocks near their contact with the intrusive Cretaceous granite.
History and production

Mineral on the site of the mine was first discovered by C. W. Kinney and
her in 1905 but the deposit lay idle until 1912 when Leslie L. Leonard prospected
with good results, following which he and C. W. Kinney jointly sunk a shaft to the
depth of 130 feet and found the 8-foot vein to carry mill-grade ore all the way down
the pay shoot dipping westerly.

In 1919 the Martin Bros. took a lease and bond on the property, sunk several
additional shafts and shipped 150 tons of ore that ran from $125 to $300 to the ton.
They also opened several small parallel veins containing rich pockets of cerargyrite.

In 1923, 44 samples taken through an extent of 3,000 feet on the deposits by
a New York firm are said to have averaged almost $15.80 to the ton, the values being
mostly all in gold.

In 1924 the mine was purchased by Senator H. H. Getchell, who incorporated the
property as the Dan Tucker Mining Co. with a capital stock of a million dollars.
The company soon began working it, and discovered an additional 3-foot wide shoot
of high-grade ore.

The veins strike northeasterly and dip northwesterly into the mountain. The
ore is mostly a siliceous honey-combed light-reddish free milling quartz.

1/ Churchill County Eagle, Fallon, Nevada, May 23, 1925.

In 1927 it was said that the mine was being worked by lessees who had developed
or nearby where they would build a mill to treat the ore.

In 1934 the mine, after an idleness of several years, was said to have been
actually leased to the Rosetta Mines Co. and was becoming active under the stimulus
of higher prices for gold and silver.
At about 1,000 feet east of the shaft, trenches in new ground showed a 9-foot
th of the middle vein to run about $16 in gold to the ton and on the 100 level
5 feet of the vein in the face of the drift ran $18 in gold and silver.


Kinney prospect

The Kinney prospect owned by C. H. Kinney is about 4 miles east of Sand Springs
the south side of the pass at an elevation of about 4,800 feet. Fig. 100-A. It
discovered prior to 1913, the date of visit, but is not known to have made much
production. A few tons of fair-grade ore then lay on the dump.

The main vein or lode strikes southwest and dips 50° south in much altered dark
albic andesite and is also associated with hydrothermally altered light-colored
bodical rhyolite especially on the footwall side. It is said to have an extent
more than a mile. It is about 12 feet wide as shown by croppings and under-
and workings. It is composed largely of laminated and bladed quartz and adularia
ndomorphic after calcite or other spar as is characteristic of many veins in the
iliary volcanic rocks. It is more or less vuggy, with some vugs and much of the
artz containing and being stained with black oxide of manganese with which much of
fl gold is associated.

The ore minerals are mainly cerargyrite, argentite and gold. Much of the gold
free. The vein is said to pan well all the way down. It is opened mainly by a
foot deep incline shaft sunk on the vein. The ore is mostly gold ore. At the
th of 50 feet a considerable body of the ore ran about $23 to the ton and contained
less wire silver but at greater depth the ore averaged only about $5 to the ton.
Both country rock walls contain quartz stringers or so-called feeders that nearly parallel the vein and at about 75 feet to the north on the footwall side occurs a similar but similar vein which probably also contains ore.

**God Hope prospect**

The Good Hope prospect owned by Clayton Blakely and associates is 2 miles east-northeast of Sand Springs. Fig. 3. The vein is said to have an extent of 4,000 feet. A specimen of the rock and ore shown the writer the rock seems to be amphibolite, the vein to be genetically connected with intrusive quartz monzonite or diorite, and therefore seems to belong to the late Cretaceous or early Tertiary group of deposits. The ore is said to carry fair values in copper, gold, and silver. Some of the ore seems to be replacement in the amphibolite.

**Mountain Well (LaPlata District)**

The Mountain Well, Laplata, or Chloride district is at Mountain Well and vicinity about 28 miles east of Fallon. It is mostly in the upper east slope of the Stillwater Range which here has a width of almost 18 miles. Fig. 3. The deposits are mostly contained in an east-west nearly square area, several miles in extent, between the elevations of 5,500 and 6,500 feet.

**History and production**

Mineral in the district was first discovered about 1860 and the "town of Laplata was founded in 1862 and made the county seat and mining center of the region. By 1866 there were three mills in the district. But the boom was without adequate mineral foundation.

The deposits became exhausted about the time of the White Pine rush in 1866, and the district became deserted for the new discovery, and the county seat moved to Still Water. 3/

3/ Lincoln, Francis Church, Mining Districts and Mineral Resources of Nevada, 6th, Reno, 1923.
The production is said to have been mainly several thousand dollars worth of ore whose value was mostly in silver. For want of ore the mills were operated a few days at a time at intervals. The ore came from at or near the surface, of it was very rich silver chloride. There were no deep workings - but few workings were 100 feet deep, and the amount of development was comparatively small.

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At Laplata the vein, it is said, was cut off by a fault and could not be recovered. The country rock is said to be Triassic limy and quartzite and it is intruded granite and porphyry with which latter rocks the deposits seem to be genetically related. Light-colored Tertiary volcanic rocks are also present. Veins up to 2 feet wide have been noted and much of the ore is said to occur radically in pockets or bodies up to several feet in extent chiefly at the interior of veins, fissures, or dikes and to afford little opportunity for systematic mining.

"A little silver ore was shipped from the district by prospectors in 1919 and ..."

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Job Peak district

Job Peak is about 12 miles northeast of Mountain Well. It stands at an altitude of 8,306 feet and is the highest point in the Still Water Range. L. W. Crehore said to have shipped from near Job Peak to the Western Ore Purchasing Co. at Hazen 10,191 tons of ore that ran 31.7% lead, 4.2 percent copper, and 13.2 ounces silver to ton, and that 90 tons of ore of similar grade was blocked out in the mine. The
The Dunderberg mine is in the east slope of the Stillwater Range at about 4 miles north of Job Peak, 4 miles south of IXL Canyon, and 2 miles south of Mud Springs. It is in a cliff or steep slope of the mountainside. The vein is in dark slate- and massive limestone and intrusive granite with which the latter rock the deposits is to be genetically connected. It is opened by a 300-foot shaft, all of which, drifts at the bottom, are in ore.

Dunderberg mine

The Dunderberg mine is in the east slope of the Stillwater Range at about 4 miles north of Job Peak, 4 miles south of IXL Canyon, and 2 miles south of Mud Springs. It is in a cliff or steep slope of the mountainside. The vein is in dark slate- and massive limestone and intrusive granite with which the latter rock the deposits is to be genetically connected. It is opened by a 300-foot shaft, all of which, drifts at the bottom, are in ore.

IXL district

Location and topography

The IXL district is at IXL Canyon and vicinity, on the east slope of the Stillwater Range 40 miles northeast of Fallon and 70 miles southeast of Lovelock, mostly between the elevations of 5,000 and 6,000 feet. It is opposite the Cox Canyon (Silver Hill) district which is in Cox Canyon on the west side of the range. The two districts are on the same east-west zone of mineralization which extends across the range. The range here has a width of 8 miles and a relief of 3,000 feet. The Pass between the two canyons stands at an elevation of nearly 6,900 feet. The topography is mountainous as expressed in Fig. 3.

Water occurs in small springs in both canyons and in a 70-foot deep well at the mouth of Cox Canyon at about 1/5 mile out from the foot of the mountains. In Desert Well, which is a county well, 3 miles southwest of Cox Canyon, the water level stands 30 feet below the surface.
The district is reached by road on either side of the range, but the last 2 miles the Cox Canyon route on the west side is by trail with a rise of about 1,600 feet.

History and production

The district is among the early discoveries in the Range. Some of the mines, as the old Kellogg mine near the head of the canyon, were worked prior to 1880, and in early days the Motini mine, it is said, shipped 300 tons of ore that averaged about $450 to the ton.

Development

The deposits are developed mainly by tunnel, of which there are several thousand feet of work.

Geology

The IXL district lies in the southern border of an area mapped Star Peak "series" the 40th Parallel Survey. The rocks are mostly dark slate, limestone, greenstone, quartzite, belonging to that formation. In general, they dip east and have been disturbed and crushed and are intruded by Cretaceous granodiorite, and volcanics, are referred to the Tertiary age, but some of which may be older. In places they have been hydrothermally altered or metamorphosed by the granodiorite, the limestone places being crystallized, silicified, and silicified with the development of amorphous minerals, garnet, specularite, etc.

The granodiorite is a gray-medium-grained massive sub-porphyritic rock composed mainly of oligoclase, microperthite quartz hornblende and biotite. It contains as accessories magnetite and titanite. It locally contains dark salt-pepper fine-grained mic segregated inclusions up to 4 inches in diameter that correspond to hornblende-biotite-quartz-diorite.

Deposits

The deposits are nearly all contained in a belt about 3,000 feet wide by 2½ miles long, extending from the crest of the range easterly down the slope and IXL Canyon,
of the ground being covered by several groups of claims some of which are
ented. They occur in veins or lodes mostly associated with the granodiorite
imentary rocks. The so-called IXL vein with the granodiorite forming the footwall
like limestone or slate the hanging wall. The so-called IXL vein is said to be
mon in both IXL and Cox Canyons.

Associated with the deposits as gangue and otherwise is considerable contact
amorphic material composed of garnet, magnetite, specularite, calcite, quartz,
oxides of iron and manganese, etc. There are also large bodies of quartz which
re to replace limestone and other rocks.

The valuable metals are mainly silver and gold but some of the deposits contain
so lead and copper. Those that contain copper occur mostly in highly altered
cesite. The silver and gold occur both free and in the sulphides, pyrite, galena,
and chalcopyrite.

Mottini mine

The deposits are best exposed and developed at the Mottini mine and vicinity
the southern side of the mineral zone. The mine is owned by Chas. Mottini who
said to have shipped from it in semi-early days 300 tons of ore worth from $300
$600 a ton, and which averaged $375 in gold to the ton, with the rest of the value
ning mainly silver.

At the time of visit a considerable quantity of mostly oxidized ore lay on
the dumps.

About 1918 it is said the owner was offered $50,000 cash for the property.

The ore is said to contain also a little lead and copper, and about 1\(\frac{1}{2}\) percent
nickel.

The vein strikes northeast and dips 45° southeast with granodiorite forming the
footwall and gray limestone and slate the hanging wall. It is exposed through a
vertical range of about 500 feet. At the elevation of 5,400 feet the country rock,
crystalline limestone, strikes northeast and stands nearly vertical as does the vein which here consists mainly of oxidized mineralized limestone and other rock heavily stained with oxide of iron and manganese and contains a little pyrite; it is traversed by calcite veinlets.

At the elevation of about 5,300 feet the vein is opened by an adit tunnel that is northeast 450 feet with a 60-foot crosscut toward the northwest into its footwall mountain side at the half-way point. The tunnel is seemingly mostly in barren limestone except that it locally follows mineralized beds dipping southeast. The limestone is crushed and fissured. Some is soft, altered, massive, crystalline, or silicified and silicated, and some is cavernous.

At 50 feet southwest of the tunnel portal the course is crossed by a dark metiferous zone containing, besides crystalline and silicated limestone and a little quartz, considerable greenish garnet and magnetite, which latter minerals are the material a high specific gravity. The deposit is said to carry fair values of gold which metal, if present, is probably associated with the magnetite.

Farther down the slope at an elevation of about 5,200 feet, the garnetiferous ore is opened by a lower tunnel, and here also the ore piled on the dump is of high specific gravity, due to its iron content.

Outlook

The Mottini deposits seem to contain a fair reserve of ore, but they seem to mostly contact metamorphic deposits, irregular in distribution and do not promise to be of much value.
Black Prince prospect

The Black Prince prospect owned by Chas. Mottini and nephew is westward up the mountain slope from the Mottini mine at an elevation of about 6,150 feet. It is on IXL 'vein' and is said to be opened by a 200-foot tunnel about all in ore but ore is too low-grade to be shipped. The oxidized dump is pale brown. The property prices the Black Prince group of several claims.

Anglo-American prospect

The Anglo-American prospect is in Calvert Canyon about a half mile northerly in the Mottini mine and IXL Canyon. The country rock here is the thin- to medium-sized black silicified slate or quartzite, the black in places alternating with greenish layers or bands ranging up to 1/3 inch in thickness. It strikes 60° east, and dips 90° northwest into the mountain. It extends westward the slope to and beyond the crest of the range where the pass lies in it.

The rock is very dense and contains disseminated fine-grained, nearly microscopicinite which mineral also occurs in minute seams and thinly coats joint and bedding lines. Small calcite veinlets are sparingly present, mostly parallel with the bedding.

At 70 feet west of the tunnel the quartzite is cut by a 60-foot wide gray brum-grained mica diorite porphyry dike which dips 50° southwest.

The prospect was claimed to be on the IXL vein or a branch of it. It was being used by a crosscut tunnel driving south 18° east. The tunnel was calculated to the vein at a point 1,400 feet in from the portal and a vertical depth of 200 ft. It then had attained a length of 200 feet at which point the mica rocks show pronounced slickensides dipping 40° easterly away from the mountain and cross seams and faults dipping southerly.
Cox Canyon district

Cox Canyon is 30 miles northeast of Fallon in the west slope of the Stillwater and opposite IXL Canyon. Its topography is expressed in Fig. 3. It lies in Kaipato formation. The rocks consist mainly of silicified dark shale or quartzite, stone, and shale, with interbedded andesite or other old volcanic rocks, all considerably disturbed, jointed, cleaved, and crushed, and in places seem to dip hard. The rocks are exposed at the mouth of the Canyon at an elevation of 4,300 feet where they include dark slate colored and light brownish silicated stone and seem to dip westerly. They are much seamed with calcite and quartz dikes and are cut by a north-south 3-foot brown soft altered andesite dike which is interbedded with neighboring fissures dips steep easterly into the Range.

At an elevation of about 4,870 feet, at the site of the old smelter and fork of canyon, and at the spring just west at 5,100 feet elevation, the rock is mostly earthy colored shale. At an elevation of 5,270 feet at the Lower Cabin and Cellar Tunnel they include a bed or reef of light blue limestone. Also at the elevation of about 5,440 feet at the site of the upper cabins they include another bed of light bluish limestone that extends across the Canyon.

Deposits

The Cox Canyon deposits occur mostly in veins in the rocks afore described. They contain silver, gold, lead, and copper. The ore is mostly low grade. The vein dips very steeply into the mountain. They are mostly covered by a group of 50 claims owned by the Silver Range Mines Co. which at the time of visit in 1913 had a camp near the mouth of the Canyon and another at about 4 miles up the Canyon. The Company was incorporated by Davis, J. B. Conley, and Shaeraff.
The Company was said to have done 5,000 feet of underground work, mostly
drilling and to have opened up much ore. It was developing two silver-gold veins,
of which carried also copper and the other lead. In the latter vein the Company
just drifted about 50 feet on a 2-foot ore shoot that assayed $40 in silver and
1 ton, and it planned to build a concentrating plant at the mines.

Near the mouth of the Canyon the fore front or foothills and curving gullies seem to contain a north-south fairly well mineralized belt in
which at an elevation of about 4,500 feet, the deposits are opened mainly by a
2-foot crosscut tunnel. The tunnel runs south 80° east in dark basaltic tuffaceous
andesite (471) which at and near the face for a width of several or more
is pyritic with finely disseminated pyrite and chalcopyrite and locally on joint
turnings is stained with malachite. At 110 feet in from the portal at the table
of the tunnel, a 115-foot drift turned to the north lies mainly in purplish dark massive
tuff and follows a several-foot wide zone of fault gouge or breccia and
shaded and altered rock which conformably with the dominant bedding or structural
the rock dips steeply southwesterly toward the mouth of the tunnel. The zone is
partially mineralized with disseminated pyrite and chalcopyrite and in places is
said to constitute fair-grade ore.

Shady Run (Canyon) district

The Shady Run district is at Shady Run Canyon 36 miles northeast of Fallon in
the west slope of the Stillwater Range between the elevations of 4,500 and 6,200 feet.
lie in Mesozoic granite with the head of the Canyon extending up into
Kaipato rocks on the east. The rocks are said to include an old rhyolite formation
similar to that at Rochester.
The deposits are said to contain gold, silver, lead, and antimony, and to include antimonial silver deposits. They occur in well-defined veins whosecroppings are prominent.

Most of the deposits are said to be covered by a large group of claims owned by Nevada Gold Mining Co., whose development is mostly by tunnel. Also the Nick silver prospect opened by a 170-foot tunnel is said to contain good gold-silver including argentiferous galena. Big Elk Canyon a mile or more south of Shady Run also said to contain rich antimonial silver ore.

Fondaway (Canyon) district

The Fondaway district is at Fondaway Canyon in the west slope of the Stillwater range 38 miles northeast of Fallon, and 3 miles south of White Cloud Canyon, and 4 miles south of Shady Run lying at the west. This Canyon like Shady Run lying at the west lies mostly in the Mesozoic limestone and in rocks of the Keipato formation with its upper part extending in the Car Peak formation on the east. The deposits occur mostly in dark slate of the Keipato formation. They are mostly covered by a score or more of claims lying in fairly compact form. The most developed of the deposits are those of the Nevada Gold Syndicate covered by 5 claims and having an east-west extent of almost 3/4 of a mile. Fuel and water are available on the property. The principal vein, known as the Nevada Gold Ledge, has prominent craggycroppings. It is developed mainly by three crosscut tunnels spaced about 100 feet apart, vertically. The tunnels, beginning with the upper one, are respectively 1120, 70, and 500 feet in length. Each tunnel, it is said, shows the vein to carry 3 or more feet of gold ore, that in the lower tunnel being at a vertical depth of 250 feet.
Iron deposit

At about ½ mile north of Fondaway Canyon in the head of a short gulch at an elevation of about 4,800 feet occurs a deposit of iron ore which is thought may be of commercial value. It is owned by the Buena Vista Iron Mining Co. The lode strikes north-south in quartzite of the Kaipato formation, and seems to be associated with the contact of the quartzite with the underlying intrusive granite on the west, which latter rock it is probably genetically connected.

Thecroppings are not prominent and the few openings made were too badly caved to show much concerning the size or extent of the lode when visited by the writer in 1936, but the dumps which contained chunks of ore several inches or more in diameter indicate the deposit to carry magnetite-hematite material of good grade and to probably be of magmatic origin. The ore is massive and has a very irregular fracture. Some of it is in fact porous or vesicular as if pyrite or some other mineral may have been dissolved out of small cavities. It is estimated by Mr. John T. Reid, who has studied the deposit and did the development work for the Company that the deposit probably contains several thousand tons of fair-grade iron ore.

White Cloud district

Location and topography

The White Cloud district is at Copperfield and vicinity in White Cloud Canyon in the west slope of the Stillwater Range, 40 miles northeast of Fallon and 35 miles northeast of Lovelock. It joins the Fondaway Canyon district on the south, and the Copperfield district on the north, Fig. 3. The principal economic feature is the Copperfield mine which is located near the mid-length of White Cloud Canyon. The mouth of the canyon is a very narrow steep-walled gorge cut in diorite porphyry.

As the mine was closed at the time of the writer's visit, the following statement is based mainly on a report made by Ransom and by Lincoln and supplemental.

2/ Lincoln, F. C., op. cit.
Formation furnished by John T. Reid, Manager of the mine for the Nevada United Mining Company, owner.

History and production

The deposits contain copper, zinc, lead, silver, and iron. They were discovered at the site of Coperred Mine in 1865 and worked on a small scale in 1871-73, and in 1889-90, especially '93-'96, for copper ores, when a small smelter was in operation at the mouth of the canyon and a little copper ore was shipped by the company. Also 50 tons of iron ore was shipped from the red oxide "lode" for testing. 300 tons was used locally for flux in smelting the copper ore.

Then following a decade of quiescence the present Company and owner, the Nevada United Mining Company, was organized in 1906, with a capitalization of $200,000 which later increased to $300,000; shares $1 per value; 240,000 shares were issued, and development was done.

Since 1908 but little more than the required assessment work seems to have been done on the property.

Development

The properties comprise several groups of claims of which 33 claims are patented, they were mostly acquired about 1906 for the purpose of developing their copper, zinc, iron deposits, which from prominent croppings, gossan and surficial development are supposed to give fair promise of commercial value.

The property is developed by tunnels, laterals, and shafts, aggregating about 10,000 feet of work.

The principal development is the exploration, or main crosscut, tunnel with its portal located about 1 1/2 miles up the Canyon from its mouth at an elevation of about 6,200 feet or 1,200 feet above the neighboring Carson Sink Valley. In 1930 it was 3,050 feet long, and 1,400 feet deep vertically beneath the outcrops and it produces considerable water. It is driven in the south side of the Canyon on a general course of S. 30° E. and has about 1,200 feet of crosscuts or laterals.
At about 850 feet vertically above the main tunnel are two tunnels known as the Twin tunnels, one of which has a length of 700 feet and 350 feet above the Twin tunnels at the top of the high ridge bounding the canyon on the south and containing the deposits. The steep hillside between the main tunnel and the Twin tunnels are old shallow workings made in the early '90's for oxidized copper ore, some of which, as noted, was loaded at the mouth of the canyon.

Geology

The lower part of White Cloud Canyon lies in granite, which has been intruded by many dikes of granite porphyry and some of diorite porphyry. Farther upstream and Copperoid the granite seems to grade into granite porphyry which still farther upstream is succeeded by a sedimentary series of limestone and shales of middle Mississippian age which it has intruded and metamorphosed. The limestones are marmorized and altered by the development of metamorphic minerals, especially garnet and epidote, the originally calcareous shales have been converted into dense siliceous hornstones usually called quartzite. Still farther to the east, according to Rensome, the sediments are overlain by volcanic flows and tuffs that there form the crest of the ridge.

Deposits

The deposits occur in a wide zone of mostly mineralized limestone in the high ridge bounding the Canyon on the south. The mineralized zone strikes easterly from the intrusive granite porphyry sedimentary rock contact and dips about 50° N.

The deposits are contact metamorphic deposits and are sporadically distributed in the limestone and shale and its resultant hornstone. On the top of the ridge above the Twin Tunnels at about 300 yards from the granite-porphyry-limestone contact is a large outcrop of specularite containing in ess a little sparingly distributed oxidized copper ore in the form of malachite.
Some estimates that there is probably about 150,000 tons of the iron ore material
placed on the hilltop and in shallow workings that penetrate the mass. Much of the
material is pure specularite ranging in texture from soft greasy rouge-like varieties
carsely foliated kinds. There are several of these masses of iron ore on the ridge.

They are in the zone of mineralization they do not seem to be conformable with
but appear to occur as pods, lenses, and irregular bodies that individually strike
and dip in various directions and do not occur in any definite vein. "They contain con-
ference fluorite and associated with them are also small secondary deposits of
low ocher, some of which have been deposited as "mud" at the base of the outcrops,
the hillside below them and along the drainage lines in tunnels and the canyon
for the portal of the main tunnel. The ocher is evidently derived from decomposed
with the croppings by leaching of meteoric waters. A sample of the
was examined by the U. S. Bureau of Mines at the Seattle Station which reported
to be apparently good ocherous material.

The tunnels, especially the Twin Tunnels, were run under the supposition that
specularite masses on the ridge are the gossan of a large vein. "They, however,
only a little oxidized ore composed of chrysocolla, specularite, limonite, calcite,
rorite, and epidote, and did not disclose anything of value, nor any mass of specu-
rite comparable with that on the ridge.

Similarly the main tunnel and its workings in the limestone contain bunches of
specularite, in places with much garnet and pyrite. In fact, the small amount of
inary sulphide iron ore thus far found consists of pyrite, pyrrhotite and chalcopyrite.

The greater part of the Tunnel is in fine-grained dark limestone and shales altered
to hornstone. These rocks are cut by many veinlets containing calcite, axinite,
harorite, pyrite, and chalcopyrite and pyrrhotite. In places they contain concretions
of several of these minerals up to 6 inches in diameter. Epidote is the most abundant
licate.
The following cross section notes will help to convey a better idea of the character and extent of the mineralization.

The portal of the tunnel is in white-buff crystalline limestone containing small lenses of specularite and in places much garnet and some pyrite, the whole forming the so-called "Canyon vein". At a point almost 400 feet in from the portal and 200 feet of the Tunnel, the workings show a broad zone of marmorized limestone heavily mottled with cupiferous pyrite which locally forms nearly solid masses. The deposit has formed by metasomatic replacement in the limestone and is characterized by mottled mottled boundaries. This is probably the same zone from which oxidized copper ore was mined near the mouth of the Tunnel in the early 1900's, the cupiferous pyrite being the source of the oxidized copper ore. East of the pyrite deposits the limestone is much broken with many open crevices partly filled with earthy limonite by oxidizing processes.

At about the 1,000-foot point in from the portal the tunnel cuts a 20-foot wide mineralized zone containing leached spongy gossan or honeycombed iron oxide said to contain 0.2% in copper.

At about the 1,300 foot point the tunnel is said to pass through a 16-foot wide copper-bearing zone much of which runs about 8 percent in blackjack or 5 percent zinc. This zone is said by Reid to outcrop on the surface at about 1,000 feet west of the east of the tunnel. The material is said to be similar to the "soft" zinc ore of the Mississippi Valley region and can readily be concentrated into a 50-percent product.

Also at about the 2,200 foot point the tunnel cuts a several hundred feet wide or body of rock containing disseminated sphalerite and chalcopyrite, and small masses of these minerals in sufficient quantity to form potentially low-grade ore.
At about the 2,600 foot point the tunnel cuts a 3-feet wide ore shoot whose ore minerals are those of lead or zinc. An analysis of the material yielded 4 percent, lead, 3.9 percent, copper, .06 percent, gold .01 ounce and silver ounces to the ton. At about the 2,650 foot point in from the portal the tunnel is 3 feet of vein material containing considerable chalcopyrite and pyrrhotite.

At about the 2,700 foot point the tunnel cuts considerable masses of specularite associated with pyrite.

At about the 2,800-foot point the tunnel cuts a zone of breccia containing a foot wide lead-zinc seam. A sample of this assayed 3.9 percent lead, 4.7 percent copper, and 20 cents in gold and 0.35 ounces silver to the ton.

At about the 2,900-foot point the tunnel passes through a zone about 100 feet containing masses of medium-grained pyrite and specularite much of it in sufficient quantity to constitute a fair-grade sulphide (pyrite) oxide (specularite) iron ore. Analysis of a sample of the ore made by the Va. Carolina Chem. Co. yielded the following:

<table>
<thead>
<tr>
<th></th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>43</td>
</tr>
<tr>
<td>Sulphur</td>
<td>32</td>
</tr>
<tr>
<td>Silica</td>
<td>8</td>
</tr>
<tr>
<td>Gold</td>
<td>.83 oz. to the ton</td>
</tr>
</tbody>
</table>

The iron contained in the ore as sulphide and oxide is in about equal amount each about 26 percent. This zone the Company regards as the main iron lode ascending from beneath the huge specularite croppings on the top of the ridge which, however, is not proven to be the case.

A width of 3 feet on the hanging-wall side of the lode is said to average 60 cents in gold and .23 ounce silver to the ton, and 1.4 percent in copper.
From the occurrence of specularite closely associated with the fresh metamorphic rite in depth Fansome regarded the specularite throughout the deposits to be of contact metamorphic origin, a primary contact metamorphic mineral and not derived by alteration from pyrite. This view is further strengthened by the similar occurrence of the two minerals on a larger scale in the present lode at still greater depth.

**Outlook**

As conditions are favorable for secondary enrichment of copper ores mainly in the form of chrysocolla it is possible that small additional deposits of such ore may yet be found, at comparatively shallow depths. Also the sulphide deposits accompanied by primary specularite such as have been formed in the deeper part of the mine tunnel probably continue to a considerable depth below the tunnel level, and if large or continuous bodies should be valuable for their iron and perhaps sulphuric acid content, but their sporadic occurrence with no guide mark for the workings to allow in deep exploration where also much water has to be contend with seems to render the deposits of doubtful commercial value.

South of Copprereid, the company has found scattered copper croppings or porphyry copper along the strike of the rhyolite extending as far south as Desert well or Lees Canyon about 14 miles northeast of Stillwater.

2/ Reid, John T., op. cit., letter of May 25, 1926.

**Shamrock prospects**

The Shamrock prospects are said to be copper prospects in granite porphyry just south of Copprereid. They are owned by a group of prospectors.

**Clipper Canyon prospect**

The Clipper Canyon prospect, owned by the Buena Vista Iron Mining Co., is in Clipper Canyon, the first deep canyon south of White Cloud Canyon, Fig. 3. It is
out 2 miles south of Copperfield and about a mile north of Fondaway Canyon. It is
the north side of the Canyon at an elevation of about 5,000 feet, or 1,500 feet
higher than the adjacent Carson Sink Valley. According to Reid, E.M. manager, for the
company, it is on the contact of diorite forming the footwall on the north, and
clastic quartzite forming the hanging wall on the south.


It is probably genetically connected with the diorite.

The lode, roughly conformable with the rock formation contact, dips about 40°
west beneath the canyon and the high ridge bounding the canyon at that point. It is
90 feet wide and is shown by workings and openings to have a horizontal extent of
least 1,000 feet and is believed by the company to contain considerable tonnage
iron ore. It is opened by a fifty-foot shaft at a point about 150 feet above the
floor of the canyon and by cuts.

The ore is mostly fair-grade iron ore running about 60 percent iron and 2 percent
sulfur, and it contains a little gold. It is magnetic and is composed mainly of
magnetite and hematite. An inclined drill hole sunk from the bottom of the canyon and
drilled to intersect the lode at the depth of 250 feet attained the depth of only
10 feet it is said because of the brecciated character of the rock. At this depth,
ever, the drill had penetrated a mineralized zone which is much oxidized.

Another hole sunk in the north side of the Canyon attained a depth of 45 feet
hence the last drill core showed pyrite containing copper minerals from which the
management inferred that it had probably reached the top of the sulphide zone. The
tailings part of this hole is in yellowish garnet which is probably a contact
tanenornorphic deposit.
C. K. Copper "Kettle District"
The district is in Copper Kettle Canyon or Grimes Canyon and vicinity in the
slopes of the Stillwater Range. It adjoins White Cloud District on the north
extends to the north edge of the map, Fig. 2. It was discovered about 1908. It
claims several prospects, some of which are promising for copper and others for iron.

**Copper deposits**

The copper deposits are several miles up the canyon. They occur near the contact
diorite porphyry intruded into limestone.

In 1917 several carloads of about 30% copper ore were shipped from shallow
wells on a large group of claims owned by Welsh & Green. The ore was oxidized and
created copper oxides and chalcocite.

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**Iron deposits**

The iron deposits in the Copper Kettle district occur in the lower west front or
shoulders of the Stillwater Range at an elevation of about 4,700 feet. They occur
in two groups, a south group and a north group.

**South group**

The south group of the iron deposits extends from a point about a mile south of
the mouth of Copper Kettle Canyon, interruptedly southward for the distance of about
miles, and is separated from the canyon on the east by a prominent ridge from 1 to
miles wide (Fig. 3).

The deposits are owned by the Buena Vista Iron Milling Co. They were not visited
by the writer. Data for the present statement have been kindly supplied by John T.
oldham, Manager for the Company.

The iron ore or zone of mineralization occurs along the contact of intrusive
porphyry that formed the footwall and Triassic quartzite that forms the
ring wall. It dips about 60° westward toward Carson Sink Valley. It varies from
et up to 50 feet in width and averages about 6 feet. In most places it is well
exposed, owing, however to the eroded state of the quartzite and the heavy cover of
clay fill abutting the lode, the contact of the lode with the hanging wall quartzite
is rarely exposed.

At several points along its course the lode has been prospected by shallow
tunnel, one of which is 50 feet deep. The ore is composed mainly of magnetite and
pyrite. Tests made indicate it to be of good grade.

The cropings and openings show considerable ore in sight from which the Company
estimates a large tonnage in reserve.

North group

The north group of the iron deposits occurs 2 miles north of the mouth of Copper
Canyon in the western slope. A low ridge which here separates the southern
branch of Buena Vista Valley on the east from Carson Sink Valley on the west. It
near the north edge of the map and the Pershing County line, Fig. 3, and is easy of
access. It corresponds to group No. 3, or Iron Mountain Group of the Buena Vista Co.
deposits. It is owned mostly by John T. Reid. *he deposits are covered by
several groups of 16 or more claims. *hey have an east-west extent of nearly 2 miles
in width of about a mile, and they outcrop through a vertical range of about 300
feet, Fig. 3. Part of a principal mass or lode, the Iron Mountain lode forms a
conical hill several hundred feet in diameter, that stands 80 feet above the base
of its outcrop.

History and production

Assessment work was done on the property in 1898 and about 1911 considerable
additional surface development was done from which a test shipment was made of 50 tons
ore, mined at the base of the Iron Mountain hill and 100 tons was placed on the
market. The average of 3 analyses made of samples from the main mass of this deposit
yielded the following:
Geology

The deposits seem to be genetically connected with intrusive diorite and greenstone especially on the footwall side. At Iron Mountain hill and vicinity they in general have a crudely bedded structure that dips about 30° southwestward toward Iron Sink Valley. Here the footwall rock for at least 200 feet back from the lode is speckled augite-bearing diorite much of which is highly metamorphosed and the intruding silicate minerals are traversed by veins of magnetite which are later in the minerals. Some of the hornblende and iron ore seem to be alteration products from the augite. Owing to the mantle of lakebeds and valley fill, no footwall near the deposits was observed in the present work.

Deposits

The ore is chiefly medium-grained massive magnetite and hematite. It, in general, contains as gangue minerals a little apatite and serpentine or hornblende, epidote, calcite and quartz, and in places, titanite. A specimen (510°) from the Iron Mountain lode is composed of 30 percent or more of massive magnetite partially altered to hematite. The gangue minerals are chiefly apatite and calcite, in general are closely associated.

In places, however, the magnetite is well crystallized as shown by a polished thin section (of spec. 510°) which is a nearly black medium- to fine-grained crystalline mass of magnetite with no other metallic mineral present and only a small quantity of oxide as gangue. Each grain of magnetite shows remarkable multiple lamellae or fringes on the octahedral faces.
The deposits of this group contain a large tonnage of ore in sight and with reasonable extent in depth they should contain probably a million tons of ore.

Other deposits

Beyond the edge of the present map, on the Lovelock quadrangle, in the western part of Buena Vista Valley, at respectively 4 and 8 miles north from the deposits just described and similar to it occur two other groups of iron deposits of which the most northerly is known as the Iron Bluff mine, and has made a small production.

Cottonwood Canyon district

Cottonwood Canyon district is about 5 miles east of the northeast corner of the present map, Fig. 3, near Table Mountain in the east slope of the Stillwater Range, east northwest of Boyer's ranch which has long been a landmark in this part of the country. It contains nickel and cobalt veins a few miles south of which are extensive upper deposits. It was visited by Fansome in 1908.

12/ Fansome, F. L., op. cit.

Nickel deposits

The principal nickel deposit is that of the (Sullivan) nickel mine. It was opened about 1882, when it was worked till 1890 and closed on account of litigation. A carload of 26 percent nickel ore was shipped. Work was resumed in 1904 but ceased in 1907 since when the mine has not been reopened.

In 1913 it was said to be in the hands of the American Nickel Company of New York.

The mine contains about 5,000 feet of development work including 500 feet of driven tunnel and an upper tunnel connected with a lower 450-foot tunnel by an 180-foot sHEME.
The Lovelock mine, Fig. 100-b, a half mile west of the Sullivan nickel mine, produced 500 tons of high-grade nickel-cobalt ore in the early days, but has been idle many years.  

13/ Lincoln, Francis C., op. cit.

Here also the Mines Development Company of Nevada operated a copper-nickel-cobalt property under bond and produced several cars of sorted high-grade copper ore containing trace of nickel and some ore containing 29 percent nickel.  

According to Ransome 14/ the lower half mile of Cottonwood Canyon is in shale.


Restone and quartzite, and the upper part in andesite and andesite breccia. All these rocks are probably of Triassic age and are intricately intruded by dikes and masses of a dioritic rock which are probably Cretaceous. Overlying these rocks at the head of the Canyon is a thick series of Tertiary eruptive rocks.

Seemingly the most dominant variety of the dioritic rock is an altered fine-grained hornblende augite diorite containing considerable titanite and some apatite and magnetite.

In the upper part of the canyon near the nickel deposits the diorite is intrusive into andesite and andesite breccia, much of which is highly altered and near the diorite is silicified and carries particles and bunches of hematite with streaks of copper ore and weathers in craggy outcrops. Both the andesite and diorite are cut by dikes and small masses of a white feldspathic rock in which rutile in small scattered crystals and grains is the only dark constituent. This white rock, like the diorite, is also probably Cretaceous.

The nickel deposits occur in narrow irregular fissures and seams up to 4 inches in width in the andesite and andesite breccia at the diorite contact.
The Sullivan nickel mine about 4 miles above Boyer's ranch, the contact of which is due to faulting, dips 35° northeast, the diorite forming the footwall. The ore has been exploited by tunnels and an inclined shaft about 200 feet deep. It occurs in row non-persistent fissures that make various angles with the contact. Some ore has followed for a distance of 100 feet from the contact. Though the diorite in the wall is fissured and contains stringers of quartz, it contains no ore.

According to Ransome, the ore seems to be all oxidized and consists mainly of individual kernels of sulpharsenide veined and coated with bright green hydrous nickel arsenate determined by Dr. Schaller as probably anabergite. The correctness of this determination was later verified by Schaller in a specimen collected in the present work in 1913, which shows also niccolite. The specimen (No. 486) is 3\(\frac{3}{8}\) inches wide measured across the banding and seems to represent the full width of the vein and the fissure in which it occurred. It consists of about an inch of fairly pure green anabergite on either side of a central 1-inch wide band of dark altered andesite containing disseminated white metallic particles which Schaller determined to be niccolite, NiAs. The andesite band contains also irregular small streaks and seams of anabergite. Schaller estimates that the specimen as a whole will average 30 percent or more in nickel.

Copper deposits

In Cottonwood Canyon at the elevation of 5,000 feet, the J. D. Sullivan group of 6 claims was being worked by the Mines Development Company of Nevada under the management of John T. Reid, mainly on the Echo and Henrietta claims.

These deposits were located about 1872 or earlier and shipped some ore about that time. They also shipped a few cars of ore about 1895. In the summer of 1913
to the time of the visit in August the company had mined 18 tons of 30 percent copper ore and 120 tons of 15 percent ore. It said that it could profitably ship 10 percent ore.

A little later it shipped from these workings several cars of ore that averaged about 22 percent in copper and 32 in gold and silver to the ton. The value of the ore is further enhanced by its cobalt content which in some of the ore is present in considerable quantity.

Much development work is done on the property but none to a greater depth than 100 feet. Water has been a drawback. Acrosscut tunnel being driven on the Henrietta to tap the vein at 800 feet in from the portal had attained a length of 500 feet.

The country rock is altered and sericitized andesite in much of which the ore occurs as replacement. The lode or vein is 20 feet or more wide and dips steeply eastwardly with the slope of the hill. It has a known extent of more than 1,000 feet but is considerably faulted. One fault system strikes N. 30° W. In the lode the ore occurs mostly in small bodies, chambers, lenses, and stringers.

The ore minerals are pyrite, chalcopyrite, chalcocite, and bornite, with a small amount of malachite, azurite, and wovellite.

Pyrite and chalcopyrite seem to be primary and the other secondary minerals to be derived from them. Some of the ore is rich in chalcocite. There is also considerable iron oxide present including some specularite.

In the Henrietta mine the vein is on a fault and is cut diagonally by other faults. It carries 2 feet of high-grade ore which on its hanging wall side is succeeded by 3½ feet of 2 percent ore. At the north end of the nearby Cave Point prospect the lode is said to be 20 feet wide and to average 2 percent in copper (all the way across) while a width of 3 feet on the west or footwall side is high-grade ore rich in chalcocite, bornite, and copper carbonate.
Later development work done on the porphyry copper deposits in this region by Mines Development Company of Nevada in the middle twenties indicates the deposits extend over an area of several square miles.

16/ Reid, John T., Letter of March 20, 1928.

The deposits occur mainly in andesite or andesitic rocks.

Part of the large (copper bearing) area south of Cottonwood Canyon is covered by a group of 40 claims known as the Boyer copper property, after A. Boyer, the owner. It extends to a point 10 miles from Boyer Ranch or 1 mile south of the Valley View formerly Bell Mare, Cornish, or Treasure Box Mine, which it includes. In 1913 the property in part was leased to the London Company.

Later the Valley View mine was worked by the United Mines Company who, by drifting northward from the face of the lower or 400-foot tunnel cut the bedded vein which dips 20° northwest, on the contact of overlying rhyolite and footwall andesite with ore formed in the andesite especially where the andesite is brecciated. The old workings had erroneously paralleled this vein at about 20 feet beneath it. The principal ore mineral in the vein is chalcopyrite, but bornite and chalcocite are also present in appreciable quantities.

Later it was reported that Senator Tasker L. Oddie and associates had purchased the Nevada Copper Group of 5 mines in Bell Mare Canyon.

18/ Mining and Metallurgy, Aug. 1936, p. 404.

Mr. Reid, Manager for the United Mines Company, holds that in this large area on the east slope of the range the copper veins in general dip about 20° northwest instead of standing nearly vertical as was supposed by the early day operators, and
The copper deposits found in the andesite are not indigenous to the andesite as generally supposed by the early day operators, but have been derived from the underlying rhyolite.

Reid, John T., Letter of June 18, 1926.

Marvel district

The site of Marvel, a former ephemeral boom camp, is near Dixie and the mouth of Gold Canyon just north of Dixie Spring in the east foot of Stillwater Range opposite Coppereid and 8 miles south of the northeast corner of the top of map, Fig. 3.

According to E. V. Schulze, mineral was first discovered here by Carpenter in 1907 and in 1912-13 a group of French promoters, mainly from San Francisco, tried to form the prospect with Paris capital by building an elaborate shroom town with aerial passenger and mail service, etc, but the deposits said to have been prospected by 20 men in 1913 did not prove to be workable and the fiasco promptly collapsed and ended in complete desertion of the camp in 1914.


The deposit is said to consist mainly of a mineralized zone or lode about a mile long associated with a contact of rhyolite with the Triassic limestone-shale series. It contains some rich gold-bearing quartz stringers which, however, are too small to be mined individually and too sparsely distributed to enable the lode to be mined as a whole.
CARSON SINK AREA, NEVADA

By

F. C. SCHRADE

Other Districts (10)
Other districts

Jessup district

The Jessup district is in the northwest part of Churchill County, about 19 miles northwest of White Plains (Harley Station). It contains several gold and silver prospects and since 1908 has intermittently made small shipments of gold ore and of other ores.

Bernice district

Location

The Bernice district is at Bernice and vicinity in the northeastern part of Churchill County, 60 miles distant direct or 70 by road southeast of Lovelock, and 60 miles direct or 90 by road east-northeast of Fallon, the two nearest railroad stations on the Southern Pacific Railroad. It is 30 miles northeast of Wonder on upper western slope of the Augusta Range which bounds Dixie Valley and Dixie Marsh on the east. It is served mostly from Fallon via Sand Springs and Dixie Valley. Bernice, the camp site, is near the head of Antimony Canyon 4 miles ve its mouth at an elevation of about 5,550 feet. It is 3/4 of a mile above 200 feet higher than the Bernice mill. The canyon has a moderate gradient and ms the avenue of approach and through it the most of the district is drained tward to the foot of the range. Excepting its lower part it contains a small perennial stream of excellent water fed by springs at the head, and a fair supply of id occurs in the surrounding hills, so that Bernice ordinarily is said to be l supplied with wood and water.

The character of the topography in the district and surrounding mountains is in fig. 101 (Photo 44).

The Bernice belt of mineralization is regarded by mining men as having a length of about 7 miles, and extending from Hoyt Canyon, which lies 1 1/2 miles to the north of Antimony Canyon and Bernice, southwestward to Grant Peak (called Crescent
on the 40th Parallel Survey map) with the Lofthouse mine located in the southern part of the belt. Here in Grant Peak the portion of the Augusta Range lying within Carson Sink area culminates at an elevation of about 8,500 feet (according to the 40th Parallel Survey).

History and production

Mineral was first discovered at what is now the Bernice mine in 1836 by Wallace Well, who soon developed the prospect and Bernice became a flourishing camp. The principal property was next acquired by Bothwell, who built a 10-stamp mill for it. The mill was later passed to ex-Senator J. P. Williams, who operated the mine and mill and shipped the resulting silver-gold bullion to the California Bank at San Francisco.

Production, said to be more than half a million dollars in silver and gold, was sporadically made in 1886 to 1890. Since then the camp has been largely deserted, though development and a little mining has been done intermittently during some silver boom periods almost annually.

In 1882-1892 some of the deposits began to be worked for antimony and they have been operated periodically since when the price of the metal warranted the expense. At 10C the ore has produced much relatively pure stibnite. The antimony deposits have been described by Mallery. The first shipment of antimony ore from the district was made by W. W. Van Reed to the old Star and Matthew's smelter in San Francisco. Other shipments were made by Sanders and Young from 1893 to 1896. Some antimony ore containing silver was shipped in 1906, and a considerable production of antimony ore was made during the World War period. The mill is in a dilapidated condition, but some of the other buildings are in a fair state of preservation.

Geology

Excepting an area of the Star Peak formation about a mile in extent at Bernice, an area of andesite about 2 miles in extent adjoining it on the west, the surrounding region of wide extent has been mapped by the 40th Parallel Survey as olivine.

2/ 40th Parallel Survey, Map 5, east half.

The Star Peak rocks at Bernice consist mainly of thin-bedded black slate or carbonated shale and gray sandstones with occasional intercalated layers of siliceous stone and gray sericitic quartzite. They probably belong to that part of the Star Peak formation section described as black arenaceous slates 200–300 feet in thickness. They are upfolds, folded, locally compressed into sharp anticlines, faulted, Fig. 101 (Photo 44). They, in general, strike northwestward across the end of the range and dip steeply southwest. In places, however, they dip in the opposite direction, as seen in the upper tunnel in the Bernice mine where the dip is to the N.W. The quartzite contains sparingly disseminated minute crystals of talc and some carbonate material and weathers brown and greenish. The rocks are traversed by several cleavages which cause the shale in weathering to break up into small thin shingles or pencils.


4/ Mallery, Willard, op. cit.

As exposed to the northwest and 80 to 100 feet above the mill and farther up slope the Star Peak rocks are overlain unconformably by horizontally bedded an volcanic tuff 100 feet or more in thickness, locally known as basaltic ash, which higher up is capped with brownish andesite.
As exposed on the slope at about half way between the mill and the Bernice mine, the rocks are also cut by dikes of fresh black basalt or basic augite andesite ranging up to 20 feet or more in width. These dikes, the flow capping the green tuff and the adjoining andesite area on the west, may all be the same rock.

Silver-gold deposits

The deposits occur mainly in quartz veins in the Star Peak formation. They are opened principally at 5 localities, as follows: the Bernice mine, the Antimony King mine, the Williams-Hoyt mine, the L.H.A. mine, and the Lofthouse mine.

Mines

Bernice mine

The Bernice mine is located about a mile north of Bernice in the trunk of the ridge separating Antimony Canyon from Hoyt Canyon on the north at an elevation of about 6,300 feet, Fig. 102. It is on the Bernice vein which strikes a few degrees east of north following in part a fault, and dips mostly steeply about 70° to the west in the dark slate-sandstone rocks of the Star Peak formation. The dip, however, varies from 40° to nearly 90° and locally in the middle tunnel it is steep to the west.

The vein varies from 1 to 6 feet or more in width and averages about 4 feet in width. It consists of quartz and crushed, altered, and mineralized rock or fault breccia and is in part banded and some drusy, much of the quartz being hard. It is a silver-gold deposit and contains in the sulphide zone associated with pyrite also some antimony or stibnite. The values are mostly in silver with much of the ore running also 35 to 55 in gold to the ton. The ore was mostly free milling especially in the oxidized zone which extends to the depth of about 100 feet, and contained much rich silver chloride. The sulphide zone begins more or less abruptly. It's upper limit probably marks an ancient water table, for the mine is said to have been always dry. The sulphide ore has an arsenical base. Banded specimens of it having a quartz-
A spar gangue collected by the writer from the 2nd tunnel level contain much
galena, with considerable associated stibnite and a polished section shows
galena replacing sphalerite. But the ore on being treated for 2 1/2 hours with
20 percent of salt is said to liberate 85 percent of its metallic values.
1,200
shovels were collected by the writer from the 2nd tunnel level
containing much galena, with considerable associated stibnite and a polished section shows
galena replacing sphalerite. But the ore on being treated for 2 1/2 hours with
to 20 percent of salt is said to liberate 85 percent of its metallic values.
Most of the ore was milled at the mine and it was mostly of relatively high grade.
1,200
If a vein has a known length of more than 1,200 feet and a vertical range of more
than 500 feet. It has been opened to the depth of more than 400 feet, principally
by levels by 3 adit drifts or tunnels, upper, middle, and lower, which are spaced
respectively about 130 feet and 190 feet apart vertically, and contain extensive stopes
and raises.

The upper tunnel is at an altitude of about 6,300 feet and is about 200 feet
below the highest openings on the vein and 300 feet below the top of the ridge.
The lower tunnel is about 1,100 feet in length and ends in the dark slate.
In others are probably each about 700 feet in length; the upper tunnel for the distance
of 1,100 feet from the portal is stoped to the surface.

From the other levels are projected extensive upraises and stopes in some of
which ore is still in sight. Men who worked in the mine believe it to contain much
ore below its present workings.

The deposits are believed to be pre-Tertiary and genetically connected with
Mesozoic intrusive rocks.

Hoyt mine

The Hoyt mine, not visited in this work, is in Hoyt Canyon about 3 miles
northwest of Bernice and 2 miles northwest of the Bernice mine. It is reached by a
road ascending the canyon from the west. It is owned by Hoyt and John Williams of
Hollon. It is said to have produced more than $60,000 in chiefly silver ore, which
was treated in the Bernice mill. It is said to have produced also considerable
antimony.
The country rock throughout the canyon has been mapped as rhyolite by the 40th \( \text{rail} \) survey, but the deposits probably occur in the underlying black slate, the as those at Bernice to which they are said to be similar. They are opened to depth of more than 200 feet and have been worked mainly by means of adit drift tunnel.

Antimony deposits

At the three mines or prospects remaining to be described, the deposits are antimony deposits. According to Mallory who examined the antimony deposits throughout the district, they all occur in quartz fissure veins in the lower slate member the Star Peak formation, and they are associated with the intercalated siliceous limestone strata which, in general, are persistent with their course across the country marked by prominent crappings. The ore mineral is stibnite, the sulphide of antimony which the yellow oxide cervantite, whose occurrence is of mineralogical interest.

Antimony King mine

The Antimony King mine, owned by J. P. Williams and which has been the principal producer of antimony in the district, is nearly opposite Bernice on the southerly side of Antimony Canyon and approximately on the southerly trend of the Bernice vein. It is mainly on the Antimony King vein, which has been described by Mallory as having

\[ 5/ \text{Mallory, Willard, op. cit.} \]

known extent of more than 900 feet, and is regarded as remarkably persistent for an antimony deposit. It dips 50 degrees westward in the lower dark slate member of the Star Peak formation, which it cuts at nearly right angles. The slate wall rock is altered and contains a little cubical pyrite. The vein traverses also two intercalated siliceous limestone strata each about 8 feet in thickness and spaced about 300 feet apart. It is a quartz fissure vein with a parting of dark slate gouge on either wall and the quartz ranging up to 4 feet in width, all of which width in places is solid ore or stibnite. Sphalerite is very sparingly present in the ore.
The deposits are best developed in association with the limestone strata which consist of a fine-grained massive bluish gray rock. It contains small disseminated pieces of pyrite and specks of stibnite and on the joint and cleavage planes films of stibnite, by reason of which latter mineral itscroppings for long distances are stained yellowish with antimony oxide. But, the stibnite is not present in sufficient quantity in the rock to constitute ore.

"The best ore-shoots occur south of the intersection of the vein with the southern limestone stratum. Here the lower drift has opened up the vein continuously for a distance of 200 feet to a depth of 100 feet. A faulted segment of the limestone strikes nearly parallel with the vein at this intersection, and for a distance of 70 feet this segment has become incorporated into the lode, forming a 'lime spur' lying on the hanging wall. The best orebodies occur in the quartz under this lime spur, here solid stibnite in widths up to 2 feet and a mixture of massive stibnite and quartz in widths up to 4 feet have been discovered. This 'spur' feathers out on the south strike of the vein and the ore becomes less massive in character, showing a banded structure of alternate stibnite and quartz. Northward through the slate though small, continues with occasional good shoots of ore until it intersects the northern limestone stratum, beyond which it is apparently barren." 6/

6/ Mallory, Willard, op. cit.

I. H. X. mine

The I. H. X. mine, known also as the Solomon mine, is in Antimony Canyon, about a mile and a half downstream from the Antimony King mine and a mile from the mill, at an elevation of about 5,100 feet.

The Chapman Smelting Co., of San Francisco, is said to have produced 50 tons of 50 percent antimony ore here in 1915, and that it was expecting to produce 200 tons in 1916.

The country rock is the brown indurated calcareous shale or slate of the Star Peak formation which here and in the vicinity is intruded by dikes of light-gray nearly dense sodic (plagioclase) aplite, with which the ore is associated.

The vein dips 60° to the west. As seen by the writer in 1920, it consists chiefly of alternately banded quartz and stibnite. It ranges up to 3½ feet in maximum width and contains good shoots of relatively pure stibnite.
the principal workings are in the bluff standing about 40 feet above the floor of canyon. They comprise several hundred feet of drift and stopes extending mostly on the face of a lower adit crosscut tunnel. The upper part of the workings show an 8-foot wide dike of the aplite in part at least forms the hanging wall. They show a gouge parting of crushed country rock, aplite, and quartz on the vein walls. The dike contains sparingly disseminated minute cubes of primary pyrite and specks of selenite. Parts of it show also beautiful trachytic and acicular replacements by selenite. Many prospect openings have been made along the dike on the opposite side of the canyon.

Lofthouse mine

The Lofthouse antimony mine, owned by Ralph Lofthouse, of Fallon, is about 5 miles south of Bernice, in Dyer Canyon, the second large canyon south of Antimony Canyon. It is credited with a small production of antimony during the World War. The deposit occurs in the same black slate section of the Star Peak rocks as the Bernice deposits are described. The vein is a fissure with quartz filling and dips 50° to the west like the Antimony King vein. The limestone stratum associated with it is the only one of great thickness of enclosing slate, and is another, good example of the genetic relation of the limestone and the ore bodies characteristic in the district. The ore is less massive than that in the Antimony King mine. It occurs mostly in fibrous and acicular forms.

2/ Mallery, Willard, op. cit.

Alpine district

Location and topography

The Alpine district is near Alpine in the eastern part of Churchill county in the lower east slope of the Augusta Range, at an altitude of about 6,000 feet. It is
the opposite side of the range from the Wonder district, from which it is 20 miles E. It is 50 miles direct and about 80 miles by road east of Fallon, the nearest
road station on the Southern Pacific Railway. It is about 3 miles northwest of
the, a post office, and stock ranch settlement on the Lincoln Highway in the open
of Edwards Valley, from which it is easy of access. The topography, which is
rough, is mostly of the type produced by weathering and erosion in gently tilted
phanic rocks, Fig. 103. (Photo 47-1683), and Fig. 104. (Photo 49 - 1689).

The area is drained southeastward by three drainage ways spaced about a mile and
half apart, and which beginning on the north are Clan Alpine, Star, and Florence
springs, which in turn flow eastward into Cherry Creek which flows 8 miles northeastward
to Dry Lake of Edwards Creek Valley. Alpine is about a mile south of the south margin
the 40th Parallel Survey map. Its altitude is about 5,250 feet.

History

Mineral was discovered in the district in the early 60's or earlier, and the
River Lode Mining Co. was organized to operate here. The district was organized as
a Clan Alpine district in 1864 and a 10-stamp mill was built in Clan Alpine Canyon
in 1866, but the mill was run only a short time and the camp was abandoned soon
afterwards and has been more or less dormant since that time excepting a small
activity reported in 1915.

Production

The production, which was silver and gold, was small. Some ore from the Williams
of the Nevada Lincoln mines was treated in the Clan Alpine mill, some was hauled to
win more than 60 miles to the east, and some was shipped by way of Old Wadsworth to
Virginia City.
Deposits

The so-called "alpine zama" zone of mineralization having a width of about 4 miles said to extend from near Alpine 15 miles northeastward to Granite Point. But the deposits so far as learned and here treated are nearly all contained in a north-south rectangular area about 4 miles long by 3 miles wide near Alpine between altitudes of 3,000 and 6,500 feet. They are silver- and gold-bearing deposits, predominantly silver-

The country rock is the Tertiary volcanics, which in the eastern part of the area are mostly rhyolite or rhyolitic while toward the west they are andesitic in character, Fig. 103 (Photo 47).

In practically all of this part of the range the rocks have been mapped as rhyolite or the 40th parallel Survey. In the Alpine area the rocks are considerably altered by weathering, locally silicified by hydrothermal action, tilted, faulted and sliced by several sets of jointing, example given at the mouth of Florence Canyon a set of joint planes cutting the rocks into medium to heavy slices dips 60° toward the northwest, a closer spaced set dips about 60° to the southeast, and a still closer spaced set standing about vertical strikes northwest.

The deposits are contained in veins and mineralized shear zones in these rocks.

The gangue is mostly quartz and altered mineralized rock, with the quartz-adularia type dominant in places.

The deposits are most exposed on open valleys and a few open areas which for the most part are open drainage ways and facilitate access to the deposits.

Mines and prospects

Of the several so-called mines or prospects in the district the most important seen in the present work are the Williams and the Windlass mines.
Williams mine

The Williams mine, better known as the Old Williams or Senator Williams mine, named by former Senator John Williams of Fallon, is located about 2 miles northwest of Alpine and 3/4 of a mile south of the mouth of Florence Canyon, Fig. 103. It is one of the early discoveries, was worked mostly in the middle 60's and made a moderate reduction, most of the ore being treated in the Clan Alpine mill, and some 40 tons of 20 ore was hauled to the Manhattan Mining Co. at Austin. The mine is in the southern part of the district at an elevation of about 6,000 feet and 80 feet above the gulch joining it on the southeast, which is a south-side tributary of Florence Canyon.

The country rock is rhyolite. It is light gray with a reddish hue, medium- to fine-grained, moderately tuffaceous and brecciated. It is traversed horizontally or parallel with the flowage by irregular yellowish brown bands or streaks of limonite stain. The bands are about 1/4 inch in width and are spaced about 1 to 2 inches apart. Their stain was derived from pyrite contained in the rock along those lines. Quartz phenocrysts in or near the bands are more of the reddish wine-colored type than those found elsewhere in the rock. The microscope shows the rock to be a normal hyalorhyolite, with a glassy to microcrystalline base and flow structure. The phenocrysts which are quartz, orthoclase, and oligoclase, are relatively fresh or well preserved.

Deposits

The deposits are contained in a lode or mineralized shear zone in the rhyolite. The lode is not enterable they were studied mainly in shallow openings and dumps. The lode strikes N. 60° E. and dips steeply (70°) to the N. NW. into the mountains. It is longitudinally sheeted and in part banded with quartz lenses and stringers in part replacing rhyolite, and its strike and dip accord with the dominant sheeting in the rocks, noted later on its alignment 1/2 mile to the west further up in the front of the range. The lode is about 60 feet wide and judging from openings has a known extent of more than 1/4 mile. It consists principally of quartz and altered silicified and replaced rock and is in part stained yellowish brown with limonite. The quartz
ter shows replacement after an earlier spar gangue, and with it is frequently associated much vein orthoclase or adularia.

The ore minerals, chiefly cerargyrite, argentite, and gold are associated mainly with the quartz and the quartz-adularia part of the gangue. Portions of the vein or inches of the ore mined were very rich.

The croppings which are not prominent consist essentially of the vein material just described and include some hard gray flinty quartz. They are in part limonite stained and show pseudomorphic replacement after spar.

The principal opening is a 5- by 7-foot shaft said to be 200 feet deep, with drives and laterals mostly extending 50 or more feet to the northwest. It is sunk near the middle, slightly toward the hanging-wall side of the lode, where the more silicified portion of the deposit occurs, which has a width of about 2 feet and probably carries good values.

Kindless mine

The Kindless mine is about 3/4 of a mile northwest of the Williams mine on the upper northerly slope of the hill at an altitude of about 6,450 feet. The property comprises a group of 5 claims known as the Grand Prize group and is owned by J. P. Williams, Jr., of Fallon. It was discovered in 1912. It is on a nearly east-west vein in purplish rhyolite on or near its contact with quartz latite, which outcrops nearby, and, is opened to the depth of 50 feet, mainly by a 65° incline shaft.

The vein consists of 2 to 5 feet or more of crushed quartz and adularia and altered and silicified rhyolite all more or less banded. Much of the quartz-adularia part of the gangue is closely and distinctly banded, or crustified, the bands in places numbering 18 to 20 to an inch. The margins of the bands are generally crenulate or serrate and are interlocking with those of the adjacent bands, Fig. 105. The microscope shows the quartz-adularia to contain pseudomorphic replacements and other features similar to those shown in Fig. 36, (Spec. 124).
The vein is said to average about 86 to the ton in precious metal of which value about two-thirds is gold and one-third is silver. Five hundred tons of this class of ore lies on the dump. Both the ore and the waste are stained yellowish brown with incrustation.

In the bottom of the shaft the vein is said to be 5 feet wide and to contain a 3-inch wide ore shoot which averages about $22 to the ton. Assays of the surface ores averaged about $9 to the ton.

At about 400 feet to the southwest of the mine is another similarly good looking vein which strikes northwest and stands about vertical. It is opened at intervals by its extending through a distance of several hundred feet.

Healy prospect

The Healy prospect, owned by Dave Healy, W. S. Hoover, and E. R. Bermond of Fallon, is in Florence Canyon 1/2 mile above its mouth and 3 miles northwest of Alpine. It was located about 1910. The floor of the canyon at this point has an elevation of about 6,050 feet. The deposit is in a mineralized shear zone in rhyolite which here is closely sheeted and crushed, with the sheeting in general dipping 60° or more to the northwest, and it locally contains bands and lenticular bodies from 1/2 foot to 2 feet wide or more, which look well and probably carry fair values in gold.

The deposit is opened mainly by two short adit drifts or tunnels driven in the northeast side of the canyon, respectively at 20 and 60 feet above its floor. The upper tunnel follows a fairly well-defined siliceous vein about 1 1/2 feet wide, which contains a seam of rich gold ore, but which was not found in the lower tunnel. From the surface or bench workings, however, just above the lower tunnel good ore was obtained. Here much of the vein consists of clayey or talc-like material, nearly all of which showed or panned free gold.
From the nature of the deposit it is inferred that the pay ore found probably is due to concentration by surface leaching and redeposition and does not continue in depth.

Nevada Lincoln mine

The Nevada Lincoln mine, formerly the Kinney mine, is in the northern part of the district about 6 miles north-northeast of Alpine. It is in the upper part of Clan Alpine Canyon 4 miles from its mouth, near the site of the Clan Alpine mill, in rugged mountainous country at an altitude of about 6,300 feet. It was not visited in the present work.

The mine was formerly owned by Charles Kinney of Fallon who worked it in the middle seventies and thereafter intermittently until 1915, including a 5-month period in 1911. In 1915 it was acquired by the Nevada Lincoln Mining Company of Reno, who capitalized it at $1,250,000. In 1918 it was transferred to the Nevada Wilson Mining Co., and later in 1921 to a new company, the present owner whose name has not yet been announced, but which is controlled by Gilbert S. Johnson of Fort Worth, Tex.


At one time an option was held on the mine for $135,000.

2/ Mining and Scientific Press, May 21, 1921, p. 725.

Production

The production, which was not learned, was probably not large. The most of it seems to have been treated in the Clan Alpine mill on the ground. In 1878-79 Kinney shipped to Virginia City by way of Old Wadsworth, 6 tons of ore which netted $80 to the ton. This ore was mostly mined from a 60-foot shaft.
The country rock has been mapped rhyolite by the 40th Parallel Survey in that part of the Augusta Range.

The deposits are among the early discoveries of the district and seem to have been an important factor in determining the location of the Clan Alpine mill at this point. The property comprises a group of 5 or more claims covering an extent of 3,000 feet in the strike of the veins. It is developed mainly by a 600-foot crosscut tunnel to depths of more than 150 feet. There are also several shafts.

The deposits are contained in 3 veins which are traceable for more than 400 feet on the surface with theircroppings extending through a vertical range of several hundred feet and showing ore or indications of ore throughout this extent.

The veins are said to lie about 200 feet apart, to each be about 4 feet in width, and to dip steeply to the N. NE. in rhyolite and quartzite. The rock here called quartzite may be intrusive aplite similar to that described in the Wonder-Westgate part of the range, which is difficult to differentiate from quartzite without microscopic examination.

The ore is gold-silver ore including free gold often associated with manganese. It occurs mostly in bands and seams in shattered quartz-talcose gouge gangue. The largest ore shoot or band of pay quartz is about 1½ to 2 feet wide. The values are said to occur largely in hard bluish quartz as at the Jack Pot mine in the Wonder district. The ore varies in value from $5 to $60 to the ton.

In the (1st or) east vein the silver values which are important near the surface decrease to almost nil at the depth of 40 or 50 feet, but the gold values continue steady in depth.

In the (2nd or) middle vein the gangue is mainly barren-looking quartz, which however quite uniformly carries about $7 in gold to the ton.
Williams prospect

The Williams prospect is in the head of Clan Alpine Canyon, 1 1/2 miles in a northwesterly direction above the Nevada Lincoln mine and about 5 1/2 miles from the mouth of the canyon. A small quantity of ore from it is said to have been treated by the owner, Senator Williams, each in the Clan Alpine mill and in the Bernice mill.

Scott prospect

The Scott prospect, owned by G. Scott of Fallon, is in the northern end of the Alpine mineral belt. It is 14 miles north-northeast of Alpine, 4 miles north of Rye/Rye ranch, and about 1 mile west of the Shoshone Pass-Rye ranch-Alpine road. It is in the foot of the Range at Granite Point and the mouth of Granite Point Canyon. It is said to be on a shale-granite contact, with the granite lying in a trough or syncline formed by the shale. The shale is the Star Peak formation of Triassic age, of the 40th Parallel Survey, and the deposit probably belongs to the pre-Tertiary class of deposits. The deposit is said to have produced and to be producing good values in gold and to contain molybdenite with which most of the gold is associated.

As the rocks here in the northern end of the Alpine mineral belt include, besides andesite and rhyolite, also granite and hornblende porphyry, seemingly intruded into the Star Peak formation, the geological conditions are regarded as favorable for the occurrence of ore.
NON-METALLIC MINERAL RESOURCES IN THE
CARSON SINK REGION,
NEVADA

By
F. C. SCHRADE
Oil and gas near Fallon

1/ Much of the material in this statement should be credited to the op. cited rep by D. F. Hewett, "Explorations for oil and gas near Fallon".

In 1910 to 1922 numerous wells were drilled in the Fallon region, some to explore for hot water, others for potash and some for gas, and in 1918 to 1922 a number for oil, drilling being the most active in 1921.

The wells are nearly all contained in an east-west rectangular area about 30 miles long by 20 miles wide with Fallon located a little west of the center, Fig. 3, (topo map).

The wells range from 60 to 2,245 feet in depth. At least 15 are over 200 feet deep. Hot water has been struck in 5 or more of the wells at depths of 60-750 feet. Some wells yielded water having a temperature of 150°-250° F., which is used in house heating. Several wells yielded gas at depths of 90-1,076 feet. Well No. 6, nine miles south of Fallon, less than 100 feet deep, in 1922, yielded 700-1,000 cu. feet of gas a day, which was used as a domestic supply on a nearby ranch. The Linder well No. 18, about 20 miles NE. of Fallon, by 1922 had yielded a small flow of gas for several years.

In two of the wells (No. 5 and No. 13) oil is said to have been found, but it seems very doubtful whether oil was found in any other well than well No. 5 and in that in the nearest traces only.

Well No. 5, the Syndicate well afore noted as being 9 miles south of Fallon, in 1922 was 2,245 feet deep, all in unconsolidated fresh-water material, largely thin-bedded greenish-shale clay, probably derived from fine-grained volcanic tuff. No volcanic flow or breccia was found, which is very surprising. Water in the well stands at the depth of 300 feet below the surface. The well shows a slight gas pressure when tapped. The log of the well record showsings of gas at 5 different depths between
The only record of oil contained in the log is, as follows, oil and oil sand at the depth of 1,518-1,520 feet. Mud in the sludge pond contains minute bubbles of oil that may be native to the material in the well. Compared to this trace (of oil) we may note that the log of the Government or Timber Lake well 14 miles north of Fallon shows "oil spots" rising on the "sludge water" at 5 different depths, namely about 125, 140, 155, 280, and 300 feet. The great thickness of the unconsolidated material in the syndicate well is not necessarily all Fallon Lake beds but may include in its lower part underlying possibly Siebert Lake beds (Pliocene) which occur farther south.

Well No. 13, of the Fallon oil and gas company, is about 12 miles east of Fallon and 3 miles from the east foot of the Stillwater Mountains. It was said to be about 30 feet deep, to be in shaly clay material very similar to that of well No. 5, and to have struck a little oil. On the record of this well local residents based their belief that oil and gas existed in the region. The well was idle in 1922 and the log is not obtainable.

In well No. 12, of the Calvera Oil Company, 700 feet north of well No. 13 and in the same class of shaly clay material, at least one flow of volcanic rock (vesicular basalt) was cut.

The hard rocks in the hills surrounding the broad flat Fallon basin are volcanics, consisting of bedded tuffs, breccias, and thin flows that, for the most part, dip gently west. As these same rocks have been found in almost every instance in the deep well drilling they seem without doubt to form the irregular hard bedrock floor that underlies the great thickness of unconsolidated materials that fill the basin. The greater part of most of the wells is in the unconsolidated material, but some wells seem to be wholly in the volcanic rocks.
The volcanic flows are shown by the wells to be very irregular in distribution. According to Hewett, the presence of the Battle Snake Hill residual suggests that this irregularity may be explained by pre-Lahontan north-south eastward dipping normal faults such as appear to be present along the eastern edge of the basin and may repeat parts of the section.

Of the and which seem to be correct is essentially as follows. "Judging from the age and character of the material in the Fallon Basin, the probably structure of the mid-Tertiary and older rocks as indicated in the surrounding hills and explorations by drilling, it seems highly probable that oil in commercial quantities exists in the basin."

Other oil prospects

On the east side of the Stillwater Range near the head of Cottonwood Canyon the sandstone is said to contain oil-bearing shales, of which the section as given by John T. Reid is in descending order as follows:

1. Sandstone containing oil shale
2. Andesite
3. Trachy-andesite containing copper deposits

Coal prospects

At about 20 miles east of Fallon, in the west slope, of the Stillwater Range, Cottonwood Canyon is said to contain a 20-foot thick bed of coal interbedded in sandstone and shale or shale dipping southerly into or under Table Mountain or a part of its mass.

2/ Nevada Mining Press, Nov. 7, 1926.

The coal or lignite, of which a half bushel specimen was shown the writer by Mr. Tray at Stillwater seems to be straticulate or finely bedded or banded and occurs or in slabs into small platy pieces not much over an inch in diameter and 1/3 to 1/4 inch thick. Some of the pieces, however, on being broken are seen to be well meta-
phased and have a black glassy anthracitic luster. In a few instances the coal, it is said, has been used for forging or welding with fair results.

Similar deposits of coal or lignite are reported by Mr. Cunningham of Wonder, to occur also in the east slope of Stillwater Range south of Table Mountain between Sheep Canyon and Mountain Well.

Diatomaceous earth

"City engineer of Fallon reported that two wells 60 and 80 feet deep near Allen Springs showed two beds of diatomaceous earth 24 feet and 30 feet in thickness respectively.

This material probably belongs to the Siebert Lake beds (Pliocene) or their equivalent known farther south.

XX

Water

At Stillwater the water table as seen in the southwest slough and surface wells, stands within 8 feet of the surface, and is generally good, palatable water, suitable for domestic use.

Desert well,—which is a county well near the foot of Stillwater Range, is about 40 feet deep and contains fairly good, palatable cool water.

Salt, Borax, and Nitrate

Salt and borax deposits occur in 8 mile and 4 mile Flats southeast of Fallon, from which these minerals have been produced, on a moderate scale.

Prospects of Turquoise, of graphite, and of mica are described under the Rand district, in which they occur. ** * * *
FIGURE 75
MAP OF WORKINGS IN HOOLIGAN HILL MINES
A IN YELLOWSTONE MINE
B IN MARIAN MINE
C IN PORTLAND MINE
D IN MILLER MINE
E IN TRUETT MINE
SCALE 1" = 30'
Traced from blue line print August 1959
FIGURE 28
A TOPOGRAPHIC & GEOLOGIC MAP
NEVADA HILLS MINING CO'S PROPERTY AND VICINITY
FAIRVIEW DISTRICT, NEVADA,
SCALE
1 INCH = 400 FEET

EXPLANATION

GL ALUVIUM, QUATERNARY

FQ Fairview Peak dacite

Ft Fairview Peak andesite

Pn Pyroclastic tuff

Rt Rhyolite

Gt Grade tuff

Ln Later andesite

Lo Lode andesite

Ac Acid intrusive

Dn Dacite tuff and andesite

Qv Barren quartz vein

Ob Ore bearing veins

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