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Schrader, Frank Charles

Unpublished report on the Carson Sink area, Nevada.

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Unpublished Report on the

CARSON SINK AREA, NEVADA

By
Frank C. Schrader

Broken Hills District (3)

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Broken Hills District 1/

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 Belmont vein near the Broken Hills mine, and he named the place Broken Hills (fig. 48). But 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 on 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.[2/] Following this transaction the most of the surrounding

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2/ American Mine Reporter, March 23, 1921. San Francisco, Calif.

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country within a radius of 5 or 6 miles, then known as the Broken Hills distfict, suffered a prospecting "boom" during which a town 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 250-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 west. This faised 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 prdduction 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.

~~xxx~~ 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 shaly 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 ottcrops 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 Thin Peak Butte 3/4 of a mile to the north of Broken Hills mine, the capping is reddish andesite, which is porphyritic with small phenocrysts of whitish andesine - labradorite and dark biotite. It consists mostly of a microlitic glassy base with dominant flow structure and inclu

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 croppings 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

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 andesite breccia 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 ut 150 feet. The sulphides begin to appear at the depth of 120 or 130 feet increase downward as the oxides decrease. Also a little sulphide mineral galena may be scattered through the oxidized ore, even near the surface, zzzz as was illustratedd in several small veins or stringers on the mont ground.

In the Broken Hills mine the dominant ore minerals in the oxidized zone n to about the 150-foot level are cerargyrite or horn silver, and the d carbonates cerussite and anglesite and zinc carbonate smithsonite ?, and ow that depth in the so-called sulphide zone the dominant ore minerals are ck 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 bout 150 feet, its position at that level is not due to the present ground- r 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 et 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

xtending 20 feet or mote laterally into the footwall. It dips 80° to the west. t the time of visit in 1920 it was known to be ore-bearing for the length of 50 feet, as tested by several shafts sunk to the south of the main or Broken ills shaft and lesser openings to the north. The gangue is about all andesite reccia, and tuff altered, crushed, and in part replaced by quartz. The breccia onstitutes the best gangue and is the best indication of, and guide to, ore.

The vein on the whole is massive. But in places it is slightly parallel anded or streaked, and locally on the 100-foot and 150-foot levels rich black ulphide 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 in silver 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 ong by 10 feet wide, of which 3 feet averaged $21 in silver to the ton. In nother part of the drift 3feet 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 50-foot level, than near the surface. According to the report of the Broken ills Silver Corporation, the shaft from the 150-foot level to the 250-foot evel is excavated all the way down in a 5-foot wide ore body that ran $50 the ton, and the vein is 9 feetwide. On the 150-foot level the company was id 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 run of mine ore, unsorted waste and wallrock included, would run $15 to the ton, 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, cobalt and bismuth are reported.

Plumbojarosite and jraosite are present and gypsum is common in places. From several specimens tested in the present work, jarosite and plumbojarosite are more or less characteristically present in the yellowish-gray or lightish mottled brecciated ore, with the jarosite occurring mostly in the coarse breccia phases and plumbojarosite in the more crushed or finer grained phases, while kaolinite 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 from 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 drifting 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 and downward concentration of the ore minerals by meteoric waters.

Following discovery of the ore conditions in depth most of the ore blocked 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 ore present in the camp to warrant the building of a mill there.

At present, the best solution seems to be expansion in exploration and development and discovery of more ore deposits in the surrounding country as well as in the Broken Hills camp, with the view that the deposits collectively may suffice for a mill to be built, as at Broken Hills, Quartz Mountain, or somewhere nearby, 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, 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 oppositely 60° to the east. It is only 15 inches in width but is said to carry rich ore from the surface down.

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 good 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 said to widen to a width of 10 feet on the 150-foot level and to dip gently southward, its low dip giving it a stoping depth of 250 feet measured on the stopes above the 150-foot level. It is opened by a 90-foot incline shaft and a 150-foot vertical shaft and in depth notably on the 250-foot was worked in part through the Broken Hills shaft. On the 350-foot level it intersects

the Broken Hills vein at 20 feet south of the main shaft. It carried 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 drifted on at that depth with encouraging results.

Other Prospects

Silver Trailer

Of the properties 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 bonded 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 $10 in gold to the ton, which is an exception to the Broken Hills ore being non-auriferous. 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 50° to 60° dip.

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

Origin of the deposits

The Broken Hills deposits seem to owe their origin to hot magmatic solutions 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 ally the unaltered country rock is less silicified and more porous at feet or more from the vein or fissure than nearer to it, and, in ces, as on the 250-foot level the wallrock tuff breccia is highly altered icified and drusy and contains many vugs lined with white kaolin-like terial.

The intrusive rock was probably andesite or at least andesitic in acter. It is not definitely known, however, to appear at the surface in the mines. The Broken Hills Silver Corporation reports that during 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 ffectively produced on a small scale widespread mineralization or enrichment the surrounding tufaceous country rock. In every instance it is said the n or stringer together with its fissure or fracture lying in the ff breccia formation extends up to or very nearly to the intrusive where fracture loses its regularity, becomes wavy and indefinite with marked rease in ore content and finally feathers out at the boundary of intrusive, or extends but slightly into the intrusive if at all, and that no 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 re 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 me later and perhaps still buried intrusive.

Outlying Prospects

Mines and prospects besides Quartz Mountain neighboring to Broken Hills as follows:

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 slope of Elsworth Range in limestone and intrusive porphyry. It was worked in 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 and 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 working from 1870, has produced $100,000 worth of ore. The ore is silver-lead-gold ore averaging about 20% in lead, and $18 in gold, and silver

h to raise the value of the ore to $200 to the ton. The mine was worked
depth of 400 feet with windlass by the Welsh Brothers. The ore was
ed to Austin. In 1908 a 100-ton smelter was built on the ground by Burt
Eaton, but later was taken to Tilne (?) and in 1920 the mine and a small
were being operated successfully by the Joseph Brothers, and a large
of high-grade silver-lead ore had been opened up.

Lodi mine

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 le silver-lead ore, was shipped about 1916.

Red Hills prospect

The Red Hills prospect being opened by W. W. Woodruff and Campbell, eavily 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 s of watery appearing quartz in hard Birdseye porphyry. They carry only where the porphyry is heavily iron stained. About 1900 they were ored for several years by J. M. Stratford, who does not regard them to f commercial value. Limestone outcrops through the porphyry, but it is known to be connected with the deposits.

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BELL MOUNTAIN DISTRICT, (FAIRVIEW)

NEVADA

by

F. C. Schrader

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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 6,200 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. A/ took an option on the property in

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A/ Nevada Wonder Mining Company, Thirteenth Annual Report, for the year 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, some 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 work 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 surrendered.

In 1925 a prominent mining company of San Francisco was said to have taken an option on the property. 1/

1/ 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 at the mine a 25-horse power Fairbanks engine for running the compressor and 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 and flow breccias. Their composition probably ranges from that of rhyolite to that of dacite or quartz latite, but they have been so hydrothermally 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 examined to have been glassy, but it is completely devitrified and probably 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 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, devitrified, 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 appearance, is found on microscopic examination to have been originally a

tuff, but it now consists almost wholly of secondary minerals. Many small vugs in these rocks are lined with quartz or with a mixture quartz and adularia that corresponds closely to the quartz-adularia found in the vein; vugs of this character occur even at considerable nces from the vein.

The rocks are cut by a dominant sheeting that strikes N. 75° E. and 80° 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 figure 45. The vein, which has a known extent of more than 3,000 feet, in the rhyolitic rocks just described and is associated with a fault. strikes about N. 70° E. and dips about 50° S. Its width varies from 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 crops differ in altitude by 500 feet. It does not outcrop prominently; t everywhere it had to be located by cross trenching. Nor do the vein s in general stand high above the surrounding surface, though in places may be well silicified. In places the wall rock, especially the hang- all, contains quartz stringers 2½ inches in maximum width, parallel- the vein. The vein in part is rudely and coarsely banded. Much of s been crushed or brecciated and re-cemented with silica, which is y fine-grained. The walls of the vein are mostly without well-defined , the crushed vein material itself being directly in contact with the rock. The walls are partly smooth, but in places they are rough and de deeply into the vein. The shattered condition of the vein has

de it permeable for leaching and deposition of secondary ore in depth. To determine whether such enrichment had taken place was the purpose of the deep development work done by the Nevada Wonder Co.

The ore is irregularly distributed but tends to occur in parallel streaks or bands, some of which have considerable continuity.

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 360 feet deep. There are no 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

with almost pure quartz, especially of the greenish variety. It nearly always pans considerable silver sulphide as well as gold, and on weathering it turns bluish owing to oxidation of its silver sulphide content. The ore, especially the more siliceous ore, is drusy and contains small vugs lined with crystalline quartz and adularia.

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 winze or 360-foot level (figure 46). This work is on the western third of the vein, the part most deeply eroded. At the depth of 260 feet, or about 100 feet above the bottom of the winze, the vein is disturbed by a fault nearly parallel to it and becomes adulterated with yellowish-brownish barren clay or waste mud, which here makes up about two-thirds of the vein, the other third being hard bouldery quartz, which runs about $3 to the ton. At the bottom of the winze, as shown in a 35-foot cross cut, this mixture of barren mud and bouldery quartz is 20 to 25 feet wide.

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 4 or 5 feet wide. Toward the face of the drift, however, it seems to widen and to improve in quality. The face shows 30 inches of good-looking $3 quartz ore, underlain by 2 feet of low-grade sparry hard quartz and overlain by 2 feet or more of mixed mud and quartz. It thus appears likely that the effects of shearing, which are so conspicuous at the bottom of the winze, may be rather local and that farther east or at greater depth the ore may improve and become normal.

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 a 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 and 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.

MACKAY SCHOOL OF MINES
UNIVERSITY OF NEVADA

CARSON SINK
RAWHIDE

CARSON SINK AREA, NEVADA

By

F. C. Schrader

RAWHIDE DISTRICT (4)

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 placed at the disposal of the writer by the Nevada New Mines Co., who also was 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 company's various mines.

Mineral deposits of the Rawhide District

Location

The Rawhide district is at Rawhide and vicinity in the northern part of Mineral County near the Churchill County line, 40 miles south-southeast of Fallon and 25 miles east of Shurz, the nearest railroad station and supply points on the Southern Pacific Railroad. It is on the southern border of the U. S. Geological Survey Carson Sink topographic map in a hilly 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 Fallon-Carson City stage route which here forms the main and principal

ness street of the town. Though the district is variously regarded as
ring a large and indefinite area, the ore deposits which placed it on
map, namely its deposits occurring in the volcanic rocks are about all
ined in an east-west belt about 5 miles long by 3 miles wide with the
of Rawhide and the principal mines situated in its eastern part, about
hown in the southern half of fig. 52.

History and Production

Rawhide is famous for its precious metal deposits in Tertiary volcanic
. In February 1906, promising silver- gold-bearing veins were found in
rocks at the site of the Black Eagle mine and vicinity in what was then
as the Regent District, 2 miles northwest of Rawhide.[1] This discovery

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1/ Consequently the Regent-Rawhide region became and still is officially
Regent district, although it together with the Camp or town is almost
ersally known as Rawhide. The mining claims are all recorded in the Regent
rict.

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ed considerable excitement which resulted in much surrounding ground
staked. The first location was made by J. M. Schadler and associate
n. Late in June ground below Regent in what is now Rawhide was discovered
gold-bearing. Here the first location was made December 25, 1906 by
anson.[2] Also 2 miles west of Rawhide locations were made on October 24

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

Mann, Gorrill and Stockton, who panned free gold and horn silver from
ings of "porphyry" and founded the camp of Reward, later known as West

Chas. McLeod and C. A. Bovard located on Hooligan Hill[4] and Z. T.[3]

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[3] Root, W. A., The development of the Rawhide District: Nev. Mining [illegible], April 25, 1908, p. 671.

[4] Also called McLeoud Hill.

[illegible] in February ~~1908~~ (1907) located on Bluff Hill and Balloon Hill.

In April extensive prospecting by J. H. Barrett of the Rawhide Queen [illegible] disclosed the first remarkable values which attracted mining men generally [illegible] believed that the district would prove as permanent as Goldfield or [illegible]opah, whose ores the deep sulphides of Rawhide resembled, especially those [illegible] the Mint lease on the 500-foot level. The discovery was made on the Davis [illegible] Dunning ground, which with other claims was later incorporated as the [illegible]hide Cons. Mining Co. property, the first company organized in the district. [illegible] its first three months the camp acquired 1,000 inhabitants. The Rawhide [illegible]rsite Co. was formed in September, and town lots which at first sold for [illegible] soon sold as high as $1,500.

The district was opened up under the leasing system in which a block [illegible] ground 300 feet square, constituted a lease. The system proved successful [illegible] a discovery standpoint, and soon, with 330 leases operating, disclosed [illegible] presence of ore or mineralization extending interruptedly over an area [illegible]rly 5 miles square. Under this system George Graham Rice promoted the [illegible]hide Queen Mining Co., the Rawhide Coalition Mining Co., and the Black [illegible]e Mining and Milling Co., whose mines later proved to be the most [illegible]tant in the district. In most cases, however, the size of the lease [illegible] 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 [illegible]. Soon, however, most leases were let for a period of 3 or more years at a flat royalty of 20 per cent.

In 1908, 50,000 feet of work was done at a cost of $1,000,000, and nearly [illegible] percent of it was said to be productive or encouraging. Eight companies were operating, three of whom were receiving monthly about $18,000 in royalties. [illegible] 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. By the close of 1908, however, it was becoming recognized that the deposits consisted mainly of secondary silver veins containing milling grade ore rather than shipping 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 [illegible] extracted from a body about the "size of a burro". Considerable of the early-day ore ran about $500 to the ton.

From the Kearns No. 1 lease purchased for $35,000 and later incorporated in the original Rawhide Mining Company property there was shipped to Goldfield [illegible] loads 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 [illegible] in West Rawhide. ~~Index~~ Twelve properties made ore shipments to the [illegible]ers, and a Weiss mill was in operation.

The log of the well drilled by the Rawhide Northern Water Company in the ...ern part of the town reported a large gold-bearing ledge at the depth ...150 feet, assays of several dollars in gold to the ton at the depth of ... feet and some of $100 at the depth of 156 feet.

The population, which reached its peak in this year, was more than ...00. Main Street, 2 miles long, was built up solidly on both sides (fig. 53). ...re were 3 banks, 2 daily and 3 weekly newspapers, 2 telegraph lines, a long ...stance telephone, and daily auto-stage and mail service from Shurz, Fallon, ... Mina.

The grade for a broad gage railroad, the Rawhide Western, was completed ... of the way from Shurz to Rawhide, a distance of 28 miles, and the track ... about to be laid when the boom collapsed. The road was to have cost ...,000 permile. The greater portion of the grade is only 1 per cent. Water hauled from Deadhorse Well in Alkali Flat, 8 miles to the south, ... for $2.50 a barrell or 8 cents a gallon, and firewood for $25 a cord.

Early in September fire destroyed nearly every business house in town, ... a few weeks later a flood caused by a large cloudburst razed many buildings ... rebuilt.

In this year (1908) the Nat C. Goodwin Company, E. W. King and Eugene ... for $800,000 bought control of the Rawhide Coalition Mining Company. ...roperty consisted of nearly 200 acres and included the townsite, Hooligan ..., and part of Balloon and Grutt Hills, and a mill in which lessees could ... their ore treated for $5 per ton. The extraction usually obtained was ...bove 90%.

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 had 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 Happy Hooligan, Wild Horse, Silver King, Kearns No. 2, Queen and Northern State. 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 Proskey 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 $40 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.[5/] Failure of the early-day mills to satisfactorily

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5/ Wolcott, G. E., Mining and Milling at Rawhide, Nevada: E. and M. J. Vol. 87, No. 7, pp. 345-348, 1909.

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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 20 mines had been opened to depths of 150 to 500 feet, the deepest being the Mint 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

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

About this time with the prospect of procuring electric power from the ...er Line of the California Mono Lake Power Company then being built nearby ...oute to Wonder, the outlook seemed bright for Rawhide's being able to mine ...d mill 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 ...ts a kilowat hour.

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

In 1913 the vein which earlier had been worked to the depth of 225 feet ...e 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 ...raction of about 96 percent.

By January 1914 about 150 mining claims had been patented in the district. During the most of 1914-15 the Nevada New Mines Company was daily milling about 30 tons of $20.00 ore, mostly from the Black Eagle mine, and considerable $12.00 ore from the 600-level of the Victor mine and was sending considerable bullion to the Selby smelter.

Also, a third mill was operated at intervals on ore from the old Mint and Marigold leases. The Mint Lease was mining good ore at the depth of 400 feet. Besides these companies, about 60 miners were working elsewhere in the district, and about a dozen leases were being profitably operated. Also development was commenced on a substantial scale on the Rawhide-Regent group of claims, northwest of town.

The mines of the Nevada New Mines Company were worked by lessees from 1912 to 1916, the production being said to be $800,000 worth of mostly $25 ore. In 1916 the Company resumed operations on its own account but in September 1917, returned to the leasing system, leased all its holdings and received royalties all ore shipped.

In 1916 only the Black Eagle mill, just then taken over by the Nevada Mines Company, was operated. It was a modernly equipped 20-stamp 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 Coalition mine, on the 650-foot level, the Company was mining a of excellent ore. And good mill ore was found to extend down to the -foot level. The ore mined and milled averaged about $15 to the ton. The lion was chiefly silver but carried about $1 in gold to the ounce. Much e Black Eagle bullion, however, it was said carried about $7 in gold to unce 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 patented 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 being developed by 3 shafts, the deepest being 750 feet. The production was $50,000. April 1, 1923, the indicated ore reserves in these mines were said to be $200,000 of milling ore.

The production 6/ of the Rawhide district to date is claimed to be more

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

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

In March 1908 $120,000 worth of ore was hauled out of the district, and from 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 the 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. 7/

7/ 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 most of the valley portion of the Carson Sink region. It is suitable for mining 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.

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 Deadhorse 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 to 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 basin 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 [illegible] and raised enroute 1,390 feet. Also excellent water for domestic use [illegible] hauled from Hot Springs at the eastern end of the playa 14 miles distant [illegible] Rawhide. Hot Springs at the surface discharge an abundance of clear hot [illegible], and during the active days of Rawhide was patronized as a bathing and [illegible] resort.

At Rawhide a little most 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 draining 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 here be referred to as the Cone Mountains from Pilot Cone, a prominent peak and well-known land mark in which they culminate near the center at an elevation of 8,602 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 faulted and folded Tertiary volcanic rocks. It is hilly and mountainous, in part rough but not rugged, nearly all parts of the area being easily accessible. The average relief is about 800 feet. The trend of the mountains and drainage lines, which, however, is not pronounced, is north-northwestward and southeastward.

This 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 to the mile or with a grade of 3.3 percent, and along the Rawhide wash the main drainage line and road the grade is fairly uniform throughout the entire distance.

The mountains on the east culminate in Big Kasock Mountain at an elevation of 7,110 feet at a point 4 miles east-mortheast of the town, fig. 3, but the lines 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 and its nearly perfect conical form, fig. 54, rather than height above its fellow peaks or surrounding summits that makes it a very outstanding and distinctive landmark visible over a wide area of country from nearly all directions, in some it is said for the distance of more than 100 miles. The peak is said to have been an invaluable guide to the pioneer, traveller and prospector before the country was marked out by roads or ~~xxxx~~ 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 to have assigned to Rawhide is 5,012 feet or 140 feet lower than that of 5,152 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 is underlain chiefly by Tertiary volcanic rocks, which as shown in the surrounding

borders 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.

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 southward continuation of the sedimentary belt of rocks described on page (6)- 8 as 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 and dark to blackish shale and slate, fig. 56, photo 21. They seem to largely compose Big Kosock Mountain where they have a thickness of probably 2,000 feet, and perhaps include a considerable quantity of interbedded volcanic rocks (Kaipato) of the same age as they are.

At about 2 miles east-southeast of Rawhide, in the vicinity of the Murphy prospects of pioneer days where the rocks were best seen in the present work, the rocks forming a broad belt extending from 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-bluish or blackish beds and zones 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 the 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 granular rocks, granite, and monzonite and by rhyolite and is capped by dark andesite or basalt, and elsewhere it is intruded and capped by dark-greenish diabase.

At about 2 miles northeast of Rawhide the limestone having a dip of about 0° 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 on 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-southeast. The limestone belt is about 1,000 feet or more in width, but includes as does 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, and in places silicated but does not show pronounced metamorphism.

It has also been reached in the deep workings of the Black Eagle mine 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)-15 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 Regent; at the northern base of the Cone Mountains; and thirdly at about

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 deeply buried by Quaternary alluvium.

The fossil wood at the first-named locality includes well opalized or chalcedonized 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 to more than 100 feet in the valleys and low places. The deposits consist of a heterogenous 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 below 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 in a matrix of clay and iron and lime carbonates to the extent that blasting is

ployed in placer mining them.

Igneous rocks

Mesozoic (late Jurassic or early Cretaceous)

Granular intrusives

Granite

The Mesozoic sedimentary rocks afore described are cut by several types granular intrusives, of which the more important are a granitite and a nzonite porphyry, with both of which ore deposits are associated. Aplite is o 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 about 3 miles east of Rawhide at the lower south base of Big Kasock Mountain, one at the ~~Sun~~ Sunnyside camp a mile farther to the southeast where it forms prominent knob-like hill 300 feet high and is known as the Sunnyside granite. is a massive slightly pressed sub-medium grained gray speckled rock resembling color and texture a salt and pepper mixture. In places, however, the texture ders on porphyritic though the presence of phenocrysts of whitish oligoclase black biotite ranging up to 1/10 of an inch in diameter. The rock weathers ty brown due to its iron content held in the biotite. It is a soda-lime nitite, the commonest of the granites, and is composed chiefly of acidic oclase, quartz, orthoclase, and black biotite. Microcline is also present a little paragonite, apatite, and titanite. The oligoclase occurs mostly ort prisms and cuboidal forms.

Monzonite

The monzonite rock occurs chiefly at about 5 miles east of Rawhide, where mming at a point just east of ~~Sunnyside~~ Sunnyside it occupies an east-west

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

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 ws and associated ejecta forming ten of a dozen formations. They are probably 00 feet or more in thickness. They have a known thickness of at least 833 t, as shown by the well boring made in search of water in the northern part 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 the eroded surface of these older and more deformed rocks in which they ably occupy a pre-Tertiary basin or synclinal valley whose floor slopes theastward toward Alkali Flat about the same as does the present surface.

Following their deposition, the rocks were uplifted and considerably faulted, tures and crushed in persistent north-southerly lines and zones, and as ely noted it is along these zones and lines that much of the mineralization taken place. The earlier members of the series have been also cut, intruded apped 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 covering and disturbed and altered conditions of the rocks underground.

The rocks in places are stained reddish brown and yellowish with hematite and 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

(c) Younger dacite

(b) Cone Mountains rhyolite

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:

Hooligan Hill dacite

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 largely forms, and vicinity, fig. 52 and 54. By some the rock has been called andesite. It is also present in Last Chance Hill, Grutt Hill, Roseberry Hill, and elsewhere, including the Cone Mountains to the southwest of town. Dacite crops 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 breadth of the belt here extending from near the Hotel northwestward to the southeast slope of Burns Hill. The Prince shaft, 200 feet deep, in the lower east slope 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 tuff on the south 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. At Hooligan Hill and vicinity its flow-bedding or sheeting dips eastward, suggesting that here the rock may represent the western rim of a valley or basin in which the younger rocks of Balloon and Grutt Hills were deposited.

As shown in the Marian tunnel, much of the rock is closely sheeted or [illegible] slices from 2 to 15 inches in thickness, and locally it is cleaned and crushed to small bits. Here it is intruded by the Portland rhyolite, with

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 ~~xxxxxxx~~ 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, mostly in relatively stout forms, but it has been too completely sericitized, kaolinized, and epidotized for specific determination, and the biotite and hornblende 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 lava which has come to be known as the Balloon Hill rhyolite from the strength of its 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 and brecciation in solid 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, kaolinization, recrystallization, 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 minute 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 micro-crystalline to glassy base with minute forms of orthoclase and quartz and with flowage 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 banded 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-banded rhyolite with pale greenish 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 adularization 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 altered 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 an 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 688) is likewise lithoidal, similar to that just described from the 500-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 more tuffaceous. It too has a microitic glassy base. Separated from the footwall rhyolite 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 tuff, (specimen 687) forming the hanging wall. It is a greenish-gray dimly mottled 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, microperthite, a little biotite altered to chlorite, and considerable pyrite, as is 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 is altered to chiefly sericite.

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 and 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 Scrutt 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

nnel, are coated with or composed of this mud formation, while exposures nearby re composed of the harder banded rock. The alteration of the rock was brought out probably by hydrothermal sclutions having just the strength and alkaline mposition adequate to completely decompose the rock. In the St. Ives shaft he 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 s contact with 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 mber known as the flow-banded rhyolite which, as noted, forms the upper middle rt of Balloon Hill, where it seems to fill a dish-like depression in the ore yolite and has a thickness of at least several hundred feet extending from he top of Balloon Hill to below the 200-foot level in the mines. It is a dense aphanitic rock and as exposed at the surface in Balloon Hill it is in the in horizontally banded and is composed predominantly of light-gray bands nging from mere lines up to 4/10th of an inch in width and alternating with ilarly narrow bands having a light creamy color, (specimen 342) and fig. 57. he bands in general are well defined, the sharper contacts being those of the der 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 d recemented along the fault planes by veinlets of bluish chalcedonic and assy lustered silica or crystalline comby quartz and by veinlets of white rcelain-like opaque, practically pure alunite, fig. 58, as shown by examination the powdered material. The microscope shows the rock to be a very fine-grained

ly fresh rhyolite, consisting mainly of cryptocrystalline to finely
rstalline orthoclase, quartz, secondary quartz, and adularia in delicate
ucture 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
laria are present in the ratio of one to two. They are generally
ted and in some cases form small aggregates or phenocrystal bodies
fect rhombohedral forms of adularia projecting into the quartz and
ss. Wherefore the Balloon Hill rocks also seem to be more or less
ed with adularia like those of Grutt Hill. Tridimite is sparingly
, zircon as accessory is common in crystals and grains in the base and
lly 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
ical 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
s, some being entirely replaced by silica, were found.
so in the various volcanic rocks of different veins, specimens have been
hich show partial replacement of feldspars by the precious metal-bearing
s, showing the method of ore forming. The mineral-bearing solutions
ted along the smallest rock cracks and cleavage planes of the minerals
ll gradations of replacement appear. There were several periods of
lization following respective periods of eruption.

Portland rhyolite

Following the eruption of the Balloon Hill rhyolite, or perhaps contem-
raneous with it, there was erupted or intruded the Portland rhyolite, so
ed from its prominent occurrence in the Portland lease, where it is the
incipal 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
rth-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
thers rust brown from its pyritic or iron content. It is submedium-grained
compact, aphanitic or lithoidal and porphyritic, or nearly so, with small
enocrysts of whitish feldspar and glassy quartz. In places it contains
so uniformly disseminated minute crystals and grains of pyrite. In its
re compact form it shows a near hackley fracture.

Microscopic examination (of specimens 235, 239, 242 and 340) shows the
k to consist of about 80 percent cryptocrystalline glassy base with a
enish tinge and flow structure arrangement. In the base or groundmass
t small phenocrysts and smaller forms and fragments of orthoclase, quartz,
igoclase, biotite, apatite as an accessory mineral, and pyrite in minute
es are also present. The quartz in some instances contains inclusions of
base. In places, with the oligoclase and orthoclase present in about
al amount, the rock stands near quartz latite. In all the several specimens
ined, however, the rock has been highly altered hydrothermally and by
thering, the feldspar being changed to chiefly sericite and the biotite to
-green or bleached chlorite and iron. There has been also considerable

...itrification and in some instances silicification with development of secondary ...rtz, in some cases forming stringer-like veinlets traversing the rock mass. ...e rock is important, as all the deposits in Hooligan Hill and vicinity are ...ociated with it.

Quartz latite tuff

...he next succeeding of the volcanic rocks is a turf formation, here called ...tz latite tuff, but it varies in character from place to place to that of an ...ite tuff. It is of wide distribution and is heavy bedded or massive, and ...tly 200 feet in maximum thickness. It dips gently toward the south and ... 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. ...ined 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 ...ish pumiceous fine- to medium-grained matrix containing dark brown and ...te-colored dense volcanic rock fragments ranging up to 3/10th of an inch ...diameter. The microscope shows the groundmass to be composed almost entirely ...greenish to greenish-brown isotropic material or devitrified glass with ...egular flow structure, and containing besides fragmentary rock inclusions ...ejecta, a few small crystals or fragments of crystals of oligoclase-andesine, ...thoclase, quartz, and biotite. Elsewhere, as in Reward Wash, three-quarters ...mile north of Pilot Cone, as shown by specimen 259, the rock is slightly ...ter or creamy colored, the isotropic groundmass shows a trachytic radial or ...rolitic and irregular flow structure with marginal devitrification or ...dification along flow lines and fractures.

The tuff is widely distributed in the southern half of the Cone Mountains here, in the southern part, it is overlain by the Pilot Cone andesite and in the 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 deposition of the quartz latite tuff there was erupted and deposited as ~~flows~~ flows at least two younger rhyolites, one in the Cone Mountains and one at West Ridge or Iron Ridge.

Cone Mountains rhyolite

The Cone Mountains rhyolite, as shown in figure 52, is widely distributed in the Cone Mountains 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 small 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.

At about two miles west of Rawhide, in the U. S. location Monument Ridge, between Reward Gulch and Shurz Gulch to the west, the rhyolite, which forms the upper part of the ridge, is a slightly reddish-gray, fresh, hard, fine-grained rock, and consists of 90 percent cryptocrystalline to glassy groundmass with distinct flowage structure ~~xxx~~ in which rest phenocrystic forms of orthoclase, quartz, oligoclase and, sparingly, biotite, ranging up to a maximum of nearly a tenth of an 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-southwesterly toward and probably to Reward wash, a distance of 3/4 of a mile, and seem to represent croppings of a large dike.

It is an attractive medium-grained reddish-gray massive porphyritic rock, speckled with small microphenocrysts of lightish plagioclase feldspars and quartz and black biotite and hornblende, and in the hand specimen has the appearance of having been slightly pressed. Exceptional hornblende prisms are as much as 1/10 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 or 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-stained 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 fresh 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 its iron content, the rock weathers a pronounced brownish-red or near terra ta color. By aid of the microscope the rock is seen to be fresh and consists about 70 percent pale brownish microcrystalline to glassy rhyolitic groundmass th pronounced flow structure, in which rest abundant phenocrysts of quartz d stocky orthoclase in the ratio of about two to one, foils of brown biotite, tly altered to chlorite and iron, and very little hornblende and magnetite an accessory mineral in anhedral forms and grains. The quartz phenocrysts tain inclusions and embayments of the groundmass and some of the orthoclase altered to sericite and kaolin. The pale wine-color of the quartz is due to e hematite dust and allied fine-grained ferritic material contained in ctures in the quartz and in its inclusions of the groundmass. It is arently this class of material that ~~vies~~ gives to the groundmass its pale brownish or.

As shown in the south end of Balloon Hill, the East Ridge rhyolite as l tongues or dikes and sheets intrudes the latite tuff and the ore rhyolite, does not appear to be genetically connected with the ore deposits. In xposure in the shaft on the Grutt Mountain lease, the East Ridge rhyolite ive or six sheets or bands ranging up to 2 feet wide intrudes the country lite and is changed to bluish drab finely banded, dense, hard, hornstone lint.

Black Buttes andesite

The next succeeding formation in columnar order is the Black Buttes ite, which roughly forms a range of low dark hills that are deployed in the of a horseshoe about 2 miles wide and nearly encircle Rawhide on the northeast st (fig. 52 and 54). It seems to be mostly intrusive.

Beginning at about a half mile northwest of Hooligan Hill and west of the ep well boring and main road, the range extends 1½ miles southwestward into e Cone Mountains, forming the Black Buttes Range, which here consists of a ries of 10 or more low rounded dark hills. It occupies a crescentic belt out 1/5th mile wide opened toward the southeast. Figure 52 and 54. Last nce Hill, though isolated in the north end of the town, is in part an eastward ntinuation of this same rock. This view is supported by the fact that shafts ear to bottom in this rock and that the rock is exposed in the nearby rail- d cut just northeast of the road.

To the east of the main road the range and rock are represented by Black tte 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 veral of the mines as specimen 417 on the 200-foot level of the Grutt Mining se, and in the 148-foot level of the Mint lease, seem to belong to this k, 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 ck Butte Mountain one-third mile southeast of Black Butte Monument and three- rters of a mile north-northeast of Rawhide.

In fresh specimen the rock is a greenish dark-slate colored to blackish e-grained or aphanitic rock, except that it is slightly speckled with small enish-gray feldspar phenocrysts ? lighter than the mass of the rock. The k is slightly pressed and is slightly calcareous from the presence of secondary dite. It weathers pale ~~greenish~~ greenish-gray. Microscopically it is found e a calcic basic augite andesite standing near basalt and composed of mainly chytic to glassy base crowded with slender laths of oligoclase-andesine to

andesine-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 ~~xxxx~~ octohedral crystals grains and skeleton crystals. The phenocrysts are mostly 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 greenish-dark ~~xxxxxxxxxxxx~~/earthy loam or clay apparently derived from this green andesite rock by weathering, a dike of which extends southerly from the Monument Black Butte. 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-gray, fine-grained compact massive rock and is sparingly porphyritic, with small black 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, causes 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 base, 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 magnetite in crystals and particles, and some apatite. In some instances the

hornblende 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 flows through nearly all of the Pilot Cone mountains except their northeastern part. Outlying remnants of it occur also to the southeast of Rawhide east of the main road and wash. As flows it probably nowhere exceeds a couple hundred feet in thickness. In the southern part of the Cone Mountains it rests mainly on the eroded surface of the quartz latite and elsewhere on other formations, including the younger rhyolite. It, in general, forms 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 cursory examination, probably includes in places also other rocks.

At Pilot Cone the rock forms a fairly symmetrical conical plug having a relief of 1,100 feet, figure 54, and a basal diameter of about 1/2 mile and perhaps much more. In the surrounding hills the rock in the form of flows rests on the latite tuff at elevations of about 5,800 feet, above which level it is exposed all the way up to the top of the cone, especially on the north and northwest 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, A 592 (photo 19).

Columnar structure in the andesite begins to appear at about 200 feet below 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 0 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 open orifice or vent.

From the present attitude 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.

Basalt

The next succeeding and youngest of the volcanic rocks is basalt, which occurs 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 Yankee Girl Camp in the northeast part of the district (specimen ~~225x2~~ 294) and south of Regent, 1½ miles northwest of Rawhide (specimen 271). It, in general, is dark iron-gray to blackish fine-grained to compact. Some of it has a greenish tinge due to the presence of olivine, and some is slightly porphyritic, containing small phenocrystal forms of whitish feldspar and greenish olivine.

Microscopic examination shows the rock to consist of 60 to 80 percent pale greenish glassy to microcrystalline base with slender laths of andesine-labradorite in pilotaxitic flowage structure and much magnetite in minute grains and small crystals. In the groundmass are small phenocrysts and smaller forms of oligoclase-andesine to andesine-labradorite and pale brownish augite in large and small crystals 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 broad 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 three 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 along the eastern edge of the town in open country. It has a length of about 2 miles and a width of about a mile. It extends from the IXL, Poor Boy and Thania properties on the north south-southeastward to Murray Hill inclusive and includes near its center Grutt Hill and Balloon Hill with their numerous well-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 zone on the east and contains important properties in Hooligan Hill, Roseberry Hill 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
:o 30 feet wide had been developed in 1908 on the Poor Boy, Bethania, Grutt
ll, Kearns No. 1 and No. 2, Murray and other leases. Likewise in the Royal-
gent or west zone bodies of milling ore had been uncovered on the Regent,
ack Eagle, Royal Tiger, Wonder King, McMann, and other properties in association
:h large porphyry dikes. And in the Hooligan Hill zone many small but rich
in s were being found.

The deposits occur as quartz veins up to 5 feet in width and much wider
ies of kaolinized rhyolite in the rhyolite and related rocks. They occur
rgely as replacement veins and irregular bodies along zones of sheeting,
acture, and faulting. In many respects they are similar to the deposits
scribed in the Gold Circle District 8/.

8/ A Reconnaissance of some mining camps in Nevada: U.S.G.S. Bull. 408,
50, 1910.

They have been mined to the maximum depth of nearly 800 feet. As the
ound-water table stands at about 1,000 feet below the surface the mines are
y, but the sulphide zone is regarded as beginning at about the 500-foot level,
ich perhaps marks the level of an earlier water table. In the deep well
ring made by Tex Ricard with a Keystone drill in the northern edge of the
wn, the sulphide zone is said to have been found at the depth of about 420
et, and the top of the mud-rock rhyolite formation in which the rest of the
ring extends, and finally bottoms at the depth of 833 feet below the surface,
:h much iron sulphides present in the last 400 feet but no valuable metal.

Ore deposition was attended by profound hydrothermal alteration of the wallrock and mineralization including devitrification, silicification, kaolinitization and alunitization. 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 trend of the zone.

All of the veins excepting Kearns No. 2 veins in Balloon Hill and the Big Four in Murray Hill dip west.

Bacterium
Galena
Gold (native)
Gypsum
[illegible]
[illegible]
Halloysite
Hematite
Hisingerite - hydrous ferric-iron silicate
Jarosite
Kaolin
Leverrierite
Limonite
Magnetite
Malachite
Marcasite
Molybdenite
Neumannite
Opal
[illegible]
[illegible]
[illegible]
Pyrargyrite
Pyrite
Pyrolusite
Pyrrhotite
Quartz
Silver (native)
Sphalerite
Stibnite ? (Gear Hill)
Tellurium

Following is a list of minerals occurring in the district:

List of minerals in Rawhide District

Adularia (valcencianite)
Almagen
Alunite
Argentite
Azurite
Barite
Calcite
Caledonite
Cerargyrite
Chalcedony
Chaloopyrite
Copper (native)
Covellite
Electrum
Galena
Gold (native)
Gypsum
[illegible]
[illegible]
Halloysite
[illegible]
Hisingerite - hydrous ferric-iron silicate
Jarosite
Kaolin
Leverrierite
Limonite
Magnetite
Malachite
Marcasite
Molybdenite
Naumannite
Opal
Paligorskite
Proustite
Psilomelane
Pyrargyrite
Pyrite
Pyrolusite
Pyrrhotite
Quartz
Silver (native)
Sphalerite
Stibnite ? (Czar Hill)
Tellurium

Tellurides have been reported particularly from Roseberry Hill, southwest of town 9/.

9/ Gehrman, Charles A., The Gold camp of Rawhide, Esmeralda County, Nevada: Mining Science, Vol. 57, 1908, pp. 305-306.

The chief ore minerals in the oxidized zone are cerargyrite, pyrite, native silver, native gold, and electrum, and in the sulphide zone argentite, proustite, 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 ~~xxxxxx~~ about all in the oxidized zone, was mostly friable and free milling and is said to have run in value about 3/4 gold and 1¼ 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 $10 ore was regarded as of commercial value. At that time the larger part of the 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 talky or talcy gouge-like material traversed by stringers and veinlets of

quartz 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 lode kaolin contains also a little crystalline alunite and perhaps also some uncrystalline 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%.

Analysis of alunite (Spec. 317)

From the Black Eagle Mine,

Rawhide District, Nevada.

Analyst, H. B. Hicks

SiO_2	1.24
Al_2O_3	36.90
SO_3	36.50
Na_2O	2.32
K_2O	8.36
H_2O^- 110° C.	.20
H_2O^+ 110° C.	14.17
Cu	trace
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 veinlets of alunite, Figs. 57 and 58, (specm. 342 and 342-A). In Fig. 58 the sawtooth 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 crystallized from a solution which following 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 some 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, has 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 much 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 along side of which commonly occur streaks and sheets of ore, forming in some instances a kind of stock-work, Fig. 61, (Photo 23-1677).

Much of the ore in the several zones occurs also as replacement in reddish iron-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, pyrargyrite, electrum, and gold including free gold.

Mines and prospects

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, some 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:

Rawhide Queen property

Lease	Tons ore	Gross returns		
Brutt Balloon	967.67	$53,184.93		
Bromiac	23.87	4,050.01		
St. Ives	92.9	633.26	St. Ives	
Todd Mines Co.	24.71	963.44	St. Ives	
Phoenix	4,086.91	78,213.69	Victor vein	
Kearns No. 2	276.99	43,118.38	Kearns No. 2	
Queen Co. own work	169.88	15,946.05		
Mains and Sisson	1.00	85.70	St. Ives	
Victor Stanquist, K. 2	646.39	11,989.97	Kearns No. 2	
Dumps from leases	192.39	2,008.42		
Cyanide product from tailings and ore bought		20,282.22		
Total	6,473.23	230,476.07		$230,476.07

Rawhide Coalition property

Brutt Hill Coalition	152.47	5,118.60	Mint vein	
Brutt Hill Mint	1,036.02	36,094.67	Mint Vein	
Dayton Toledo	22.53	151.80		
Brutt Mining Co.	179.80	9,321.75	Alabama Vein	
Holland Rickard	.70	151.81		
Alabama & Marigold	1,562.43	38,706.93	Alabama Vein	
Mugent	17.25	187.35		
Crown	102.00	310.98		
Croskey Rawhide	1,052.99	20,425.16	Victor Vein	
Truett Rawhide	3,952.28	33,876.15	Hooligan "zone"	
Brutt Hill Truitt	86.65	5,267.84	Alabama Vein	
Victor	4,862.67	55,803.03	Victor Vein	
Nevada Rawhide, Miller	1,525.67	28,999.65	Hooligan "zone"	
Yellowstone	.10	130.00		
Even Chance	6.00	83.59	Marion	
Portland	378.51	4,877.51	Hooligan "zone"	
Daily and Monger	2.36	378.16	Mint Vein	
Total	14,940.43	$239,885.47		$239,885.47
	6,470.60			230,476.07
	27,884.26 Tons			103,433.25 Victor Vein
				$573,794.79

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.

roduction by veins to August 1, 1913, of Queen, Coalition, and Nevada New Mines Company's properties showing combined figures for each vein.

	Tons	Gross value
ictor vein combined Phoenix and New Branches	16,472.97	$257,875.13
. Ives combined production	108.61	1,682.40
earns No. 2 combined production	923.90	55,108.35
rutt Hill Coalition combined	154.83	5,496.76
ombined production of Alabama vein	1,828.88	53,296.52
" " " Mint "	1,190.85	41,591.43
" " " Hooligan "zone"	5,856.46	67,753.31

In June 1913 the Nevada New Mines Company had an authorized capitalization $1,200,000 and owned nearly 200 acres of lode mining claims from which ssees had produced from surface or shallow workings about a half million llars. Also much additional property of which the surface equipment amounting 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 kings. The total production by that date was 27,884 tons of ore that lded a gross return of $573,749. The average recovery of all ore treated $20.57 to the ton.

Veins

The chief veins are the:

Phoenix

Proskey

Victor

Grutt-Balloon

Kearns and

New vein

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 lies 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. 540).

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° southerly. 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 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 merged for the horizontal distance of about 50 feet, the mergency being more directly due to local curvature in strike than convergance 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 rhyolite and quartz with parallel stringers of quartz. Here as shown in Fig. 66 (Stope diagram), the vein for the horizontal distance of 250 feet extending 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

ore minerals were argentite, cerargyrite, ruby silver (proustite), free gold, and electrum, fig. 66a (Spec. 436).

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 ore. 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, especially on the 275-foot level and vicinity, the vein and ore occurred very irregularly in sections and pockets and beyond the Proskey shaft occurs much faulting and gouge.

On the 500-foot level the ore is mostly sulphide, and pyrite occurs in in both the wall rock and the veins.

On this level the Phoenix vein first reached by crosscut from the Rutt-Balloon shaft, fig. 65, which is one of the main working shafts, has a known 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 deposition. 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 ruby quartz and solid masses of argentite and ruby silver (proustite) which also 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 ore and averaged about $25 to the ton. Considerable ore was stoped southwesterly from Station 511 between the 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 apexing 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 or 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 gives out or becomes lost by faulting.

South of the Phoenix shaft on thw 26-foot level, the 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 reddish rhyolite breccia and shows considerable faulting with gouge along the fault planes. In many places the degree of brecciation increases toward the vein.

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 500 feet long which on the Phoenix lease extended to the depth of 325 feet, on the Proskey 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 and the Victor a little less. Where seen in 1916 at the "new strike" in the bottom 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 85° to the northwest and were separated by about a foot of slightly pyritic country rock rhyolite (Spec. 541) including which the two veins together were about 4 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, having a gangue of fairly loose quartz, was estimated to carry about 1,500 oz. in silver to the ton. The ore shoots and ore consist mainly of quartz and brecciated pyritic altered and replaced silicified rhyolite or rhyolite breccia, all locally irregularly streaked or banded. The chief ore mineral is argentite with which is associated a little ruby silver or proustite in bodies ranging up 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 comby structured and contain cavities lined with crystalline quartz, pyrite, and adularia, 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 1½ 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", alunite, 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 and exposure of ore in the Rawhide District is on the Victor vein at the depth of 760 feet, at a point about 250 feet northeast 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 wide but narrowing toward the southwest and downward was stoped for the horizontal extent of about 130 feet, Fig. 67 (Stope diagram). Also from each extremity of the stope a 10-foot winze was sunk showing the ore shoot to continue 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 3 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 thw ~~xxxxx~~ winzes at depth of 760 feet is dark-gray nearly coarse salt-papper 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 gray fine-grained nearly apahanitic firm litholoidal devitrified, silicified/~~xxxxxxxxx~~ 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 breccia (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

grite 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 700 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 a 4-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 under lease more than $53,000. The mine is opened to the 500-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 5½ feet, and in places ie 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 on 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 on 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 in places in the fractured banded gray rhyolite it forms a coarse reticulated network or stockwork, Fig. 68 (Spec. 401). The first sulphide ore found in [illegible]hide is said to have been found in this mine on and just below the 350-foot [illegible]vel and that a considerable shipment of the ore averaged $166 to the ton in [illegible]lver and gold.

On the 180-foot level in the drift at 120 feet south of the shaft the [illegible]n pinches out to a mere seam in oxidized manganese and iron-stained light-[illegible]lored rhyolite, which pinching, however, seems to be due in large part to [illegible]lting.

In the face of the south drift on the 250-foot level the vein is 1½ feet [illegible]de and is composed mostly of good ore, while the remaining several feet of [illegible] 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 500-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 70 feet wide mostly in the white clay or soft mud formation but partly also in the flow banded rhyolite. In this zone the ore occurs in irregular bodies mostly in the soft rock. On the upper levels much of the white talc-like mud rock was profusely disseminated with free gold.

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

The rich surface ore continued to below the 100-foot level and some occurred on the 200-foot level.

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

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 Hotel, 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 $5 to $6 to the ton from the 50-foot crosscut running north from near Station 1,296 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 horn 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 mineralized gouge on its hanging wall side which is shown in the roof of the south cross cut and slickensides lies nearly horizontal or pitch gently southward.

The principal work done on the 460-foot level is a crosscut which from the shaft extends S. 70° E. for the distance of 225 feet where it erminates in gray, coarse-grained rhyolite breccia which contains a few small cubes of pyrite disseminated through it. In places the rock also shows considerable sericitization. A general sheeting or pressure-planes structure dips easterly and 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 pale 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 is located in the extreme south base of Balloon Hill on the Morning Star fraction claim, Fig. 70 (Trace map). It was discovered in 1908, and up to 1913 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
d to P. O. Brien, President of the Black Eagle Mining Co, the hard ore being
d as an aid in treating the soft kaolinized and alunitized ore of the Black
gle Mine in the 20-stamp all-slime sluices Black Eagle mill built in 1913 on
e site of the old mill. At the time of visit in June 1920 it was
ing worked jointly by lessees George Frost and Gus Miller who had then been
ding it for about 6 months and had taken out 300 tons of good-grade ore of
ch they shipped 115 tons that ran $46 to the ton and 2½ tons of screened
e that ran $1,000 to the ton. There was also said to be accumulated on the
p at this time about 220 tons of $25 ore.

The most of the production came from between the 50 and 150-foot levels
m the O'Brien stope and the Froast-Miller stope. The latter being about
feet south of and at a higher elevation than the former, extending from the
-foot level up to the 50-foot level. It yielded most of the Froast-Miller
duction.

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

The deposit or so-called vein is a mineralized fault breccia zone or lode
h strikes about N. 20° E., dips 65° E. and has several offshoots or branches.
as a known extent of several hundred feet, ranges up to 32 feet in width,
it is thought may connect with the deposits of the adjoining Dromiac mine
the north.

The vein when seen had no prominent or visible croppings to speak of. The collar of the shaft is only about 25 feet above Rawhide wash, and to the south the 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 and replacement quartz, all more or less well oxidized and stained light reddish and yellowish brown (Spec. 248). In places it is traversed by "water courses", quartz stringers, and seams, or bunches of them, and these siliceous bodies carry the best values. They are more abundant on the lower than upper levels, and seem to converge and die out toward the sufface, which seems to indicate that they were deposited by ascending solutions. Crystalline calcite and barite are 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 wall 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.

The richest part of the lode "or core" is a lead or ore shoot about 3 feet wide 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 stope to the top of the 60-foot stope, considerable rich ore averaging $200 to the ton was mined.

The portion of the vein which had lately been crosscut and sampled to the hanging wall side of the "core" is 22 feet wide, and beginning at the main ore shoot the "core" averaged as follows:

The first 12 feet, $12 to the ton,
the next 6 feet, 8 to the ton,
the remaining 4 feet, 5 to the ton,

yond which, the foot wall country rock, (similar to specimen 249) carries from x $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 oks 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 ne here than to crosscut and sample the vein. Here as shown on the tracing, re is also a small vein which strikes N. 20° W. and carries fair grade ore r 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 neath 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 vel or nearly to the surface was done about 1920 or slightly earlier. Here the 150-foot level south of the O'Brien stope the vein splits into two similar rts or branches which diverge southward, the main part of each branch varying m 8 inches in width to a stringer or mere seam following an irregular fracre in 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 mixx bluish quartz, altered rock, replacement barite and dark metallic ore erals running about $1,600 in silver and gold to the ton (Spec. 675), the io 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

ilver to the ton and that a 1/4-inch wide seam of the bluish quartz ore yields e operator good wages. The remaining 2 to 4 inches of the branch consists inly of crushed altered talcose ore-bearing rock which concentrates 3 into 1 nning $50 to the ton.

Grutt Hill

Grutt Hill situated just north of Balloon Hill is a nearly round hill about 00 feet in diameter and 200 feet high, Fig. 53. Like Balloon Hill it is composed iefly of rhyolite including much of the mud rock formation. The Grutt Hill nnel, 577 feet long extending in a north-northwesterly course almost through e base of the hill, shows the first 90 feet of the course to be in the mud ock 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 re stringers in its upper part. The principal deposits are the

Grutt Hill mint

Grutt mining

Alabama and Marigold, all being part of the awhide Coalition property.

Grutt Hill Mint

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

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

mall stringers and seams of quartz and kaolin, and in places are pyritic with eams and veinlets of fine-grained pyrite and difficult of determination. They re mostly massive and in places show small-faulting and slickensides. The mine s 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 r rhyolitic tuff. On the 373-foot level it corresponds closely to the banded low rhyolite in the upper part of Balloon Hill, except that it is more highly ltered hydrothermally. It dips about 20° NE. In the east crosscut north of he shaft sheeting in it dips 60° N. On the 473- ("500") foot level the rock s mostly a gray rhyolitic or perhaps dacitic porphyry (Spec. 424) and is tufaceous. n the face of the northeast crosscut, however, 300 feet from the shaft and dinity the rock resembles a highly altered tufaceous dacite porphyry (Spec. 426).

At about 40 feet below the 473-foot level occurs a thickness of 8 or 10 et of thin bedded tufaceous reddish "sandstone" dipping a little east of north angles of about 20°, some of which occur also at slightly greater depth. But e bottom of the shaft at depth of 533 feet is in hard silicified tuff ? . On e 148-foot level occurs a body of dark earthy basaltic altered andesite pec. 430) resembling greenstone, which intrudes the rhyolite chiefly at the aft, Fig. 71, but is present also farther to the north. It probably represents intrusive tongue or dike of the Black Butte andesite.

The deposits

The deposits are contained chiefly in the so-called Mint vein which strikes t N. 10° E. and dips 80° W. in the rocks which have been described. It is gular, discontinuous and in places consists of 2 or 3 successive stringers seams confined to rock fractures only 2 to 3 inches wide, of which only the r one (No. 1) carried ore (Thomas) and in places as on the 148-foot level re occurs in numerous small parallel seams in the fractures of rock (Templeton).

It has been opened or explored through a maximum extent of 220 feet and to depth of 530 feet, work being done on 9 levels the most of which, however, short, the longest being the 148-foot level which has an extent of about feet, and connects the mint with the adjoining Coalition mine on the south. lphide ore was found in the crosscut of the 473-foot level, on which also the ntry rock throughout is pyritic.

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

On the 300- (295) foot level in the most of the drift extending 70 feet th of the shaft the vein consisting mainly of crushed iron-stained mineralized olite 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 ue. On the north the ground has been mostly stoped down to and below the 0-("295) foot level.

On the 400-foot level in the small stope above this level north of the ...aft the vein, which was small, apparently consisted of crushed and mineralized ...ff 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 ...ch in the present workings but the "new vein" in the crosscut 75 feet to ...e northeast of the shaft and which is from 1 to 2½ feet wide carries 3 inches ...r more of good sulphide ore (Spec. 425). The ore is a hard darkish-gray breccia ...mposed of quartz and altered silicified rock. It is pyritic and drusy and ... said to run about $35 in silver and gold to the ton. Argentite and pyrite ...em to be the principal ore minerals.

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

Grutt Mining Lease

The Grutt Mining lease is in the middle southwest slope of Grutt Hill about ...00 feet east-southeast of the Mint. It was formerly worked by the Grutt Mining ...o. By August 1, 1913, it had prdduced more than $9,300, and is said to have ...roduced in total more than $273,000.

Vein

The vein which is said to be the same vein worked on the Alabama lease ...to the south strikes about N. 10° W. and dips 83° W. It lies in the light-colored ...alloon Hill rhyolite which in general is crushed and massive, on the lower ...evels is altered and softened, and on the 200-foot level west is tufaceous, ...Spec. 418), 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 ...eposits.

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 0, 100, and 200 levels, Fig. 72, (Level map). The vein ranges from a few inches up to 3½ feet in width but in places is interrupted, irregular or ill defined, and has been disturbed by faulting or movement. Extending from the 0 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 veins, which on the 65 and 125 levels are situated respectively about 20 and 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. But 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 400-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 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 , and Wash veins.

Bethania Mine

The Bethania, also called Queen Bethania, mine owned by the Bethania ...mpany of Yerington who formerly worked it, is in the easterly slope of a low ...dge northeast of Grutt Hill and which may be regarded as a southerly spur of ...mument Black Butte, some of whose greenish andesite appears on the northern ...rt of the property. It adjoins the Poor Boy group of several claims on the ...rth and the Crystal Queen on the south, which collectively have been called ...e 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 ...dag worthy of development. The property seems to have been idle since the ...rly-day work was done on it.

Deposits

There are several veins on the property including the Bethania, Poor ...y, Gold 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. ...ey occur chiefly in or associated with the Bethania vein which strikes ...30° E. and/dips steeply ~~XXX~~ NW. The vein is on a fault fissure and varies ...om 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 ...nerally brownish iron stained breccia, Fig. 72a (Spec. 310) and the ore ...ich is generally high grade, some running $1,600 ~~XXX~~ to the ton with the values ...arly all in gold, occurs not only in the vein and seam but equally as replace-...nt in the facial part of the wall rock. Some of the ore is cellular or ...ney combed.

Poor Boy vein

The Poor Boy vein, which the mouth of the Bethania tunnel crosses with width of about 20 feet, strikes N. 12° W. dips steeply to the west and in neral carries fair values in $10 to $16 ore.

It is a fault vein or lode composed mainly of mineralized fault breccia 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 he veins in the district does not pan well and consequently is not egarded with favor by the lessee. It strikes N. 30° W. and seems to be in rt at least on the rhyolite-green andesite contact. It is opened by a couple hafts to the depth of about 200 feet from the north one of which a 200-foot rosscut 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 laim, strikes N. 32° E. and dips 50° NW. It also is on a fault zone on or ear the rhyolite-green andesite contact. It is opened mainly by two closely paced shafts, and is said to contain good ore. According to Mr. E. Nichols f the Black Eagle Mining Co. who worked the lease, the more northeasterly of he two shafts at the depth of 30 feet exposed a good 8-inch vein of $50 artz ore, which, however, in depth pinched out. The quartz was succeeded crushed rock or fault breccia and the values decreased to only a few dollars

the ton, although the fissure retains its width. The adjoining southwest aft shows the same vein with sporadic values.

Murray Hill deposits

The Murray Hill deposits are so named from the low hill they occur in tuated just south of Balloon Hill. Murray Hill was early credited with ving some of the richest veins in the district. The hill is country rock yolite, mostly brecciated and tuffaceous. The structure and sheeting strike , 33° E. and dip 65° W. The deposits, their workings and ground, mostly owned 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, rnold claim map), Fig. 53, (Photo panorama in right), and Fig. 73 (Murray ll mines). The company, it is said, bought the property in the early Rawhide ys and became incorporated in October 1907.

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

				Production
Murray shaft,	292	feet	deep,	$25,000
Murbach "	60	"	" (all silver)	1,500
Lillian "	15	"	"	3,000
Big Four "	300	"	"	8,000
Trilode "	240	"	"	

Murray Lease

The Murray Lease was formerly worked by Davis and Triplett. The vein is edited with a production of more than $25,000. It dips steeply to the west siliceous rhyolite breccia. On the surface at 40 feet up the slope eastward m the shaft occur intrusive sheets or thin flows of dark gray drab and kish rhyolite dipping 30° E. Some is well banded and some is of the dense

inty variety. Here a branch or vein "feeder" comes in from east or footwall ie. In fact, the main vein has many feeders or stringers which join it at rp angles mostly from the hanging wall side on the west and are of eep 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 rtz and rhyolite breccia more or less replaced by quartz and the pay is nearly l in the quartz or siliceous portion of the vein. It probably meets the ighboring 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 l 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 sists mainly of quartz replacing the rhyolite or rhyolite breccia and nearly l 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 s about $12 to the ton. It is siliceous and contains some water courses l druses in the quartz replaced breccia. The stope at 150 feet north of the ft is 15 feet wide and 30 to 40 feet or more long and high, and averages) to $12 most of the way across. Beyond the stope the vein narrows a mere stringer and extends 30 feet to the face of drift in rhyolite breccia pec. 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 t and here the walls and fault plain show good fault gouge. To lee of the lt a 30-foot crosscut to west shows softened mud rock and at the face ingly some white rhyolite with gypsum and a few bands of brownish altered led rhyolite or slate ? (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 a 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. There is less work on this level than on the 100-foot level. Some of it follows an 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 in white rhyolite ? which is said to run $5.40 in gold and silver to the ton.

Lillian Lease

The Lillian lease which adjoins the Big Four and Murray leases and is opened 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 ore.

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 below the Lillian Lease in a flat of Rawhide wash. It has produced more than $3,000 worth of ore. It was formerly worked by Davis and Triplett. The vein dips west and receives "feeders" from both sides. It contains from 2 inches to 1 foot wide of quartz which is all high-grade ore, and it usually has 6 inches of "talcy" gouge on the footwall side that carries good values in silver. It is opened to the depth of 300 feet, mainly on the 100-, 200-, and 300-foot levels, and contains about 1,800 feet of work including 800 feet of drifts and laterals. It is nearly all stoped 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 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 Morning Star mine, is 300 feet deep, but has produced no ore, nor does it contain any vein or ore so far as could be learned. It is said to have been sold for $30,000.

Murray Hill stringers

In the west slope of Murray Hill are many rich quartz stringers or gash veins, but their values seem to be surface concentrations only and do not continue in depth.

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 Nabob.

Titanic prospect

The Titanic prospect, which is a gold prospect owned by A. E. and Sam Turnbull Bros., is 3½ 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 bluish gray limestone referred to the Jura-Triassic age, which seems to dip 30° 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, and impure calcite in which occur sporadically smaller stringers of galena and cerusite and other lead minerals resulting from oxidation of galena, and small bodies 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 gouge 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, but there is no continuous ledge or anything definite to follow. The ore occurs very 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 genetically connected with certain porphyry dikes or eruptive rocks that locally intrude the limestone. The free gold, however, for which the deposits have been exploited, is believed by the writer to be Tertiary gold and to be secondary or of 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

became 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 where it is now found by the miner, from which it seems evident that no gold deposit of the Titanic class here described can be profitably mined.

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, and in the autumn of that year it was purchased by W. B. Nichols who owns it. The property comprises a group of 5 claims, known as the Smuggler group, which lie in compact form, trend about east and west, and show indications of mineral in the various prospect openings made on them.

The production consists chiefly of one small shipment of rich gold-silver-copper ore which, it is said, amounted to $1,260.

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

which the deposits are associated. Some of these igneous rocks are probably
re-Tertiary. They include a diabase dike and a so-called iron dike which
arries parallel stringers of iron oxide and is said to contain also fair values
n gold and copper. The deposits are referred primarily to the pre-Tertiary
r older group with the note, however, that, like the Titanic deposits, they
ay contain secondary contributions in the form of free gold from the Tertiary
poch 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
rend of the remaining structures, faults, dikes, and zones of mineralization
s northeasterly with dip steep to the southeast.

The main showing or so-called Yankee Girl mine is on the Smuggler claim
ward the northern part of the property in the upper southeast slope of a
rominent ridge at about 200 feet below its crest, and is in the blue dolomitic
imestone in a northeast-southwest zone of mineralization about 75 feet in width.
re the deposits are opened mainly by an open cut and a 40-foot shaft beyond
hich a 30-foot drift extends northward into the ridge. These workings are all
n a stringer-vein, its fissure or fracture, which is about 4 feet in maximum
idth strikes about north and stands about vertical in the massive dark blue
gray dolomitic limestone, which is partly crystalline and in part silicified
t does not show any pronounced metamorphism, though in places it is silicated.
ny recementing white dolomite veinlets and stringers (Spec. 284)
rming in places a kind of stock work extending 8 to 10 feet back into the
allrock indicate that the rock was profoundly crushed, probably at the time the
ssure or fissure was formed.

At the surface and in the top of the cut the vein is but little more than a 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 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 cork, and mineral leather. It is a variety of asbestos or tremolite, a hydrous silicate 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 be the case, the downward continuation of the vein and ore body probably lies well 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 ...red, sheeted and schisted 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 ...t sunk to the depth of 40 feet on the projected course of the vein found ...y barren limestone. The fissure or sheeting which seems to represent it on ... projected course extends through the ridge and is opened by a tunnel on the ...th side which, however, disclosed no values.

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

The ore throughout the Yankee Girl camp is said to be good smelting ore, ...o 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 uncomformably overlain by volcanic 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 schisted rhyolite 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 1½ miles N. 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 here is 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 slope of a low hill. The larger one which is 6 or 8 feet wide, strikes about north and dips steeply to the west. The smaller strikes about N. 70° W. and stands about vertical, and where opened by an 8-foot shaft it shows a width of 1½ feet of vein quartz which is some disturbed or ~~fau~~ faulted, crushed, honeycombed or cellular, rusty brown with iron stain, and carries, it is said, about $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 ...e that some prospectors hold that a good area in which to prospect is the ...t of country extending from near the Yankee Girl mine 8 miles southeastward ...ross Big Kassock Mountain toward Monte Christo. From what little has been ...n of this belt by the writer, however, he has received the impression that ...y advantage the belt may offer for prospecting is due rather to better exposures ... the formations and veins because of the greater relief caused by uplift and ...osion rather than to any greater amount of mineralization it may contain over ...at in the surrounding country.

3rd

Hooligan Hill zone

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

2d

Hooligan Hill

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

Deposits

The Hooligan Hill deposits occur chiefly in the south base of Hooligan ll and vicinity. They occur in a cross zone along east-west lines of rock cture as replacement in the wall rock facing the fractures and in white lin gouge associated therewith, the fracture walls and gouge being generally nish 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 , 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 sition 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, ctures 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 ore development than other planes. Of the two rocks, the Hooligan Hill te and the Portland rhyolite, the rhyolite is much the more favorable for development, from which it is inferred that its constituents are probably

ore 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 tailings 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 $3 to $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 100,000 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 ...rly-day mines and is said to have produced more than $30,000 worth of ore, ...cluding considerable good shipping and much milling ore. The early-day ...oduction is reported to have included a recovery of $18.39 a ton from 1409 ...ns of ore.

The property is opened to the depth of 300 feet or more, chiefly by 5 ...vels, - the 65, 130, 160, 270, and 300-foot levels as shown in Fig. 75, ...level map).

The country rock is the Hooligan Hill dacite which, however, as shown ...the mine is profusely intruded by the Portland rhyolite. Both rocks ...ve been considerably shattered, brecciated, and crushed by faulting and ...sturbance as shown in Fig. 61 (Photo 23).

On the first, or 65-foot level, the vein or principal ore zone, from ...e-half foot to 4 or 5 feet in width, is well shown in the stope, drifts, ...d crosscuts. It dips steeply northerly into the hill. It consists of a zone ...long joint or fault planes of considerable movement, and is composed of crushed ...d ground up rock material partially silicified and generally well oxidized. ...n places the material is gouge-like and slickensided, with the striations ...owing much movement in several directions. In some places, as shown on the ...0-foot level, the country rock, in this instance dacite, along the joint ...lanes is communuted and hydrothermally altered to white kaolin in which the ...lver, which is mostly argentite, and the free gold are deposited. The gold ...ng mostly associated with the rusty brown iron-stained portions.

The values in the zone occur mainly in the soft fine-grained material and ct in the coarse-grained material.

As shown on the map, dacite is present in the southwest part of the mine n the 130-f0ot level.

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

The 270-foot level seems to be mostly in dacite. Here the last 10 to 15 eet of the shaft panned well, a 1 to 1½ foot streak of crushed rock ore-bearing aterial dips northwesterly across the shaft into the hill, and a good vertical re streak extends down the southwest corner of the shaft.

On the 300-foot level the country rock is dull gray altered dacite, standing ear latite (Spec. 337). It does not look very auspicious, but a mineralized treak about 1½ feet wide, which dips northerly in the southerly side of the haft, carries low values.

4/ Portland Leame

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

The country rock, in which the Portland shaft stands, is mainly dacite. t the principal rock in the mine, which is situated north of the shaft, is inly Portland rhyolite and much of it is so altered and soft that the "drill" oles 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 of very soft whitish and partly brownish iron-stained oxidized rhyolite. But throughout the mine compared with the Truett mine the deposits in general are/too soft and the 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.

In January 1930, W. H. Leonard (of the United Gold Mines, Inc., and New Co.) who was then working the mine wrote that north of the old Glory Hole workings he 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,

oto 23), and the zone accordingly is traversed by innumerable cracks and
ms 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
itish, pale-brown or yellowish rhyolite, and its fractures which apparently
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
rtically about parallel with the upright dikes, and trend of the hill, and
so diagonally or crisscross, in nearly all directions so that the fractures
the whole in many places are reticulated and linked and form a typical
ockwork, as shown in part in Fig. 61, (Photo 23). A much better example than
is (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
llrock, with little or no gangue other than a little gouge-like material composed
crushed rock kaolin and a little quartz. The seams and the adjoining faces
the rock containing the ore are as a rule oxidized and stained with blackish
nganese and iron.

Whether a given vein, shoot, or body will pay to mine is first determined
panning some of the material collected from and along the seams, stringers,
d cracks by an experienced operator. Sample assays taken across the vein,
hoot, 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
ch too high, in others too low.

In mining, the ore-bearing stockwork or rock mass containing the mineralization is then blasted down, usually with a double or tripple charge of powder gelatine, so as to shatter the mass as completely as possible. The coarser rock 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 1908, 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 data 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 bodies from 20 to 30 feet in width. At time of visit in July, 1913, the Company had just opened up an ore shoot which a lessee had overlooked. It extended from the shaft northeastward, from the surface to below the 70-foot level, was 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 drift about 25 feet long is on a mineralized rhyolite dike or so-called vein 3 feet wide which has been stoped.

As seen by the writer at the time of visit about $8 worth of free gold, which 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:

e gold in general was fine, averaging in size about that of a small shot. t was anguler, porous, and cellular, but a large part of it was of rounded rm with irregular lobes, convolutions, corrugations, and largely resembled human brain.

On the 157-foot level the rock is mostly the brownish and greenish eathered dacite.

On the course of the Hooligan Hill ore zone projected westward, on the evada New Mines Co. ground are the Montana and Holland-Ricard prospects at espectively about 300 and 700 feet from the Truett mine, but their mineralization is not known to be a part of the Hooligan Hill ore zone, Fig. 52, (Large cale map).

The Montana prospect is opened by an 80-foot shaft and is apparently in acite which is cut by sheeting that strikes N. 20° E.

Holland-Ricard prospect

The Holland-Ricard prospect credited with a small production of rich e is opened to the depth of 70 feet by 2 shafts, spaced 75 feet apart in a rth-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 20-foot winze, Fig. 77, (Level map). It is in rhyolite which apparently trudes the dacite. In the south shaft and other workings a sharp slip or an dips 80° to the southwest, with a 2 to 3-feet wide band of crushed rock, ult breccia, or vein-like material on its hanging-wall side, which seems to ve been a source of the ore produced. On its hanging-wall side the vein des into coarser and less disturbed rock with no well-defined hanging l present. In the connecting crosscut the rock shows some coarse flow ding 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 ~~xxxxxx~~ east and west from the bottom. It is mostly in a rhyolitic tuffaceous ~~xxxxxxxx~~ mud rock formation and hard rhyolite, some of which latter contains wine-colored quartz. The lease contains many 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 ~~200~~ 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 croppings above the tunnel which correspond to those for the Hill in general are coarse, ~~xxx~~ 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 sheeting or joint planes of the rock, probably caused by chromic iron.

Through a considerable part of its course the tunnel follows a crack shown in the roof, and at about 60 to 70 feet in from the portal, a fault breccia band gradually develops in the left wall and adjoining part of the roof, widens to 2 or more feet and extends on in for at least 100 feet and seems to be mineralized, but carries no ore.

Some good, chiefly gold, ore, but not of much commercial value was pro-
ced from the upraise stope on the left at 210 feet in from the portal and
me from the incline winze sunk from the end of the 40-foot crosscut south.
cording to Frank Scisson, foreman, the ore occurred sporadically in hard
yolite 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
out 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
iller tunnel driven in the north slope of Hooligan Hill, mineralization or a
ittle ore was found, but there were no indications of ore being present in
mmercial quantities.

Roseberry Hill

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

The country rock is mostly rhyolite, (Spec. 338), and is dimly bedded
r flow banded. It is intruded by a couple north-southerly 40-foot dikes of
he greenstone andesite. Hooligan Hill dacite is also present, as shown by
haft dumps and croppings at the northeast base of the hill. Other openings
n the Hill and vicinity are ..... ?

Burns Hill and Silver King Hill

Burns Hill and Silver King Hill are respectively the southern and the orthern slightly enlarged and higher ends of a partly mineralized low ridge ituated a short distance north of Hooligan Hill at the northwest edge of the own, Fig. 54, (Pan. Photo 27-28). Though the hills contain several openings 0 feet deep they are not known to have made any appreciable production. In he low saddle between the two hills a shallow shaft shows a banded rhyolite-acite mineralized contact which strikes N. 25° E., dips 70° W. and probably epresents 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 he east slope of the Hill, weathers porous or honeycombed as if it had been ery pyritic. Jointing as shown in shafts dips steeply westerly.

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

Burns Hill

Dacite occurs in the northeast slope of Burns Hill and also in the outheast slope, whence it extends northward in the east face. It probably onnects with the larger body of dacite on the east extending from Last Chance ill 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 mineral lode 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 upper northerly slope, of bodies of platy 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 New 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 south-southwestward to the Ruby Queen group. Prominent hills or land marks situated in or near the zone beginning on the north are Crescent Peak, Black Eagle Hill, Hillskin Mountain, Chicago Mountain, and Pilot Cone, Fig. 54 (Photos 27-28). The country rock in the eastern part of the z one 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 the andesite. Their precious metal is chiefly gold in which some of them

very rich due to process of secondary enrichment. The mines and prospects ginning on the north include the Regent, the Black Eagle, Gray Eagle, Bullskin untain, Penglaze, Indiana, Royal Tiger, Royal Mines Co., Wonder King, McMann, Steinheimer groups.

Regent mine

Location

The Regent mine, owned by the Virginia Hills Mining Co. of Reno, is cated at Regent 2 miles northwest of Rawhide, in what was formerly known as e Regent district. It is at the edge of the wash at an elevation of about 00 feet in low foot hills a couple hundred feet high at the outer edge of e Rawhide Mountains that overlook a broad expanse of detritus-filled rrell 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 ound was first located here by J. M. Schadler and the Regent property, now nsisting of about 20 claims, Fig. 80, (Claim map), was first located in cember 1905. In February 1906, with only location work done on it, it was ld to a syndicate in Goldfield for $55,000 which put down a 100-foot shaft Czar Hill, but did very little else.

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

The property as a whole was located by later owners in June, 1911, but terial work was done until the fall of 1912 from which time till the close 1913 the Proskey-Regent Gold Mining Co. of Rawhide mined, shipped, and

illed ore, and there were also three sets of lessees working on the property taking out both shipping 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 2400 feet of work extending to the maximum depth of 160 feet, with a good 2- to 3-foot vein of $7 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 much 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 or 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 eastern capital.[10/]

10/ Mining and Scientific Press, April 28, 1917, p. 596.

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 and 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 shaft 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 alon g 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 ? andesite, 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 Penglaze and Flynn mines. The rock is strongly porphyritic with large roundish tabular feldspar phenocrysts 3/10 of an inch in average ~~xxxxxxxxx~~ diameter which seem to have been replaced by calcite and other minerals. (Note. Have slide made of 272 a).

Basalt caps a small north-south hill of the rhyolite at about 1/3 mile E. 30° E. from Czar Hill and Regent. It is sheeted north northeasterly-south southwesterly about the same as is the rhyolite.

Deposits

The deposits of the camp are gold and silver. They are contained in 5 or 6 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 to 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 Wye, 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 phentifully developed along some of the fissure wall faces, as seen in the Proskey vein and down the McKinley shaft (Spec. 277 a). Here areas of the rhyolite wall rock 5 or 6 inches in diameter are overgrown with tabular sheets 3/10 of an inch in thickness of barite in maximum dimension.

Banding is common and well developed, as shown in specimen 274 from the roskey vein, where it is about 4 feet wide in the upper south slope of Silver prings Hill, and in the rich ore (specimen 275) from the Johnson vein.

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

Strewn over the surface of the wash on the Seminole group and adjoining round on the west occurs considerable good looking quartz folat (specimen 277), ostly in scattered boulders, some of which range up to 4 or 5 feet in diameter, e source of which has not yet been determined, and seems to be puzzling, ince on nearing the base of the mountains and hills on the southeast it eases.

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

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 for 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 and 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 and is opened to the depth of 400 feet. Its course is curved with the concavity facing 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 to its course and passing through the lower northeast slope of Czar Hill extends beneath the wash on the northeast.

The vein is composed of quartz and replaced rock including some coarse boulders from 1 to 2 feet in diameter. Some of the quartz is of the glassy barren-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, but the ~~xxxxxx~~ 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 run $58 to the ton. The value ratio of the precious metal content of the ore 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 deep, started in the wash.

The shaft contained, on the 60-foot level, two 40-foot drifts, one each to the north and to the south and two stopes 20 feet in diameter in the hanging wall, showing the vein to contain the same characteristics, coarse bouldery faulted 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 15 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 or blackish bodies containing argentite, and gold.

On the 400-foot level the vein lies 175 feet west of the shaft, where short 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 much of the hanging wall stands nearly vertical. Some of the ore consisting of crushed and silicified rhyolite cemented with a network of secondary quartz-adularia veinlets is pyritic with finely disseminated pyrite and blackish veins and small bodies of argentite (Spec. 678). At 200 feet from the shaft and 50 feet beyond the vein the working crosscut ended in rhyolite tuff.

Alexander of $5 vein.--The Alexander or $5 vein lies in the northwest ope of Czar Hill. It strikes N. 10° W. and stands about vertical. Shallow ifts at several points show it to be 8 feet wide and well banded with gangue the west wall.

Proskey vein.--Starting in the wash and road near the east base of Czar ll, the Proskey vein extends southerly through Silver Spring Hill with a ngth 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 d is well banded with quartz and iron-stained mineralized rhyolite (spec. 274). the north base of the hill it is opened by the Sailor Boy shaft, 160 feet ep, which in 1913 was the deepest opening in the camp, and ended in an cline winze. In the bottom of the shaft, the vein is reported to have rrowed to 2½ feet in width but varried $40 to $50 ore.

The vein in general was disappointing to the Company in not carrying the lues expected of it in Silver Hill. In this connection it may be noted that om the bottom of the 100-foot Czar Hill shaft sunk in the southeast base of ar Hill in darly days, a crosscut extends to a point beneath the top of the ll. The vein for which this crosscut was driven was not found but at 150 feet om the shaft the crosscut cuts a 6 to 8-foot blind vein, which is composed rgely of low-grade, $8 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 ide. It extends from the south slope of Czar Hill through the hill, thence rly 1/4 mile northerly into the flats or wash. In 1913 it was opened efly in the upper northeast slope of the hill on the Golden Spring claim the depth of 40 or 50 feet, and by stope at a point where it is faulted. the south of the fault the dip is 70° to the southeast. To the north it is ut vertical. The vein has good looking quartz-rhyolite gangue, but the values, ch 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-northwesterly and dips 25° E. in rhyolite and outcrops at several points. It is opened by a crosscut tunnel and an upraise 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 $8 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 nothwest, and has gouge casing due to post-mineral movement.

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

Profit Mine

The Profit, (also called Matthews) mine, owned and operated in 1916 by J. F. Matthews and Bro., is 1½ 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, and 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 high-grade ore. Some 1/4- to 1-inch wide soft 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. 11/

11/ Salt Lake Mining Review, Vol. 32, November 30, 1930.

Black Eagle Mine

Location

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 Berkely, 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 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 15 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 fresh 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 and Fig. 59-a. Sheeting or jointing in both the andesite and the rhyolite dip westerly. A N. 30° W. sheeting dips steeply NE. and a N. 40° E. sheeting dips steeply NW.

In Vein Peak, which is 3/8 of a mile southeast of Squaw Peak, the foot-wall of the Black Eagle vein seems to be a dike intruded into the lighter country rock rhyolite and may be genetically connected with the ore deposits.

The country rock rhyolite probably is not more than a few hundred feet in thickness since the lower workings of the Black Eagle mine 300 feet deep seem to penetrate underlying limestone on which the rhyolite appears to rest.

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

Though the country rock on the hanging-wall side of the vein quite generally s rhyolite some of the rock in places on the foot wall corresponds to quartz tite or latite; e.g., in the face of the 30-foot crosscut to east on the 50-foot level the rock is dull reddish gray, highly altered and seems to e a tuffaceous quartz latite (Spec. 316). The feldspar is altered to a mat f sericite.

Associated with the vein in places, chiefly on the foot-wall side, are lso tabular bodies ranging up to 2½ feet wide of blackish rhyolitic obsidian hich seems to represent post vein dikes or intrusions not genetically connected ith the ore, of which an example occurs in shaft No. 1 near the top of the idge.

Ore deposits

The ore deposits occur in the Black Eagle vein which strikes about N. 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 McMann groups with the same manganese-quartz characteristics, and to have an extent of more than a mile. On the McMann ground 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 brecciated or crushed and altered mineralized rhyolite and other rock. The composition, however, varies from place to place. It contains also considerable kaolin, 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 as 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, dips 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 walls 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 alunite (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 sooty, 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 silicified rhyolite (Spec. 318), and show some crude banding denoting open fissure deposition.

On the 150-foot level in the new (incline) shaft the vein with depth has straightened 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 mostly 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 vein or ore-bearing part of the ledge is 20 feet wide and in the face of a cross 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 crushed quartz stained yellowish with limonite (spec. 320).

On the 180-foot level, horizontal slips or faulting are present and have disturbed the regularity of the ore and, in places, its values, and have 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 slip or fault whose upper surface or plane is highly polished by frictional movement.

Ore

The general average of the ore in the mine is about $10 a ton. But the range in value is from $2 up to several thousand dollars. In the old

shaft 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.

Gray Eagle Mine 12/

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 joins 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 E. W. King, the values were nearly all gold. At time of visit in 1913 some ore was sacked at the shaft on the southern part of the property.

The mine is developed mainly by a 100-foot shaft and 400-foot tunnel with cross-cuts, drifts, and stopes, the work being mainly on the tunnel, Fig. 83 (Tunnel map).

Geolbgy

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 ? seen at a few places in the workings dips steeply southeast or easterly.

In the east fork of the tunnel the hard rhyolite ? appears to be imperfectly bedded with the bedding structure dipping 60 degrees east-southeast, and in 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 mine. 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.

Royal Mine

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.[13/]

13/ Root, W. A., The development of the Rawhide district: The Mining World, April 1908, Vol. XXVIII, p. 671.

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 examindd 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 on the croppings.

Royal Tiger Mine

The Royal Tiger mine, located nearly 2 miles west of Rawhide, joins the Royal mine on the northeast, Fig. 63, (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 $150 to the ton.[14] Also the showings on the Upton lease on the Tiger claim

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14/ Amer. Mining Review, Vol. XXIII, No. 22, May 30, 1908, p. 17.

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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 gulch 50 feet southwest of the tunnel to the hanging,wall side of the vein and in the tunnel, at 150 feet in from the portal.

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 pecularily 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 (Spec. 322) dipping 65° to the west, above which is a 4-foot vein of crushed, altered and brecciated rhyolite in part altered to a "mud vein" and containing mostly hard brecciated quartz boulddr-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 pyrite and other ore mineral.

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. Mill, 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 croppings 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 1¼ 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 belt 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 and seems to contain much epidote, has been highly altered, crushed and recemented 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 Bullskin Mountain claim No. 1, on the rhyolite-andesite contact. The vein is 3 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 on 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 stoped 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 500 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

50 feet. 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 18-inch hanging wall part of the vein which averages about ~~$8x~~ $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 southeasterly 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 southeast 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 pseudomorphic 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

Lappatt Lead Mine

The Lappatt Lead Mine is 2½ 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.

Geology

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.

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 and croppings. They occur mainly on a quartzite-limestone-diorite contact with bluish gray Mesozoic limestone forming the hanging wall and into which the diorite (Spec. 349) 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 greenish chloropal, a hydrous silicate of iron and aluminum, which is a secondary product 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 southeastward 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 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 on the west, about a mile southeastward to the National Mill Hill. As noted

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.

3rd 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 1½ 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 4½ miles by the Hart Syndicate composed of Frank Channing, B. G. Good, 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 [15], or a total of about $50,000,000 worth of gold.

15/ Nevada Mining Press, April 10, 1931, p. 1.

During 1930 and 1931 the syndicate did some drift mining next to bed rock at the bottom of a 92-foot shaft on the Nuggett 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 riffles to separate the gold from the gravel and a barrel amalgamator.

In Novembef 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 them if subsequent churn drill tests should indicate enough gold present to warrant consummation of the project, [16] 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 $200,000 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 predominently 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 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' "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.

Bridge N

Mines

Notes on a few of the mines follow

4th 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 ~~bd~~ bed rock was about a foot in thickness and carried its coarsest gold ~~xxxxxxxxxxxx~~ 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 pockety 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 black 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 subangular 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 all of good yellow color except at points where they have been mechanically shattered or bruised by erosion. There the color is lighter and approaches that of electrum. 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 composed 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, here called the bench. When visited in 1913 it was opened mainly by a shaft 90 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 readily 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 Merz $50 nugget. Above the 8 inches resting on bed rock the next 5½ 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.

b. 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.

Outlook

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 wells sunk in them near the edge of the flats to depths of about 100 feet report them to contain gold, and some engineers suggest that the deeper "lake" beds in this section, supposedly composed mainly of material discharged from Rawhide Wash, 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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MACKAY SCHOOL OF MINES
UNIVERSITY OF NEVADA

CARSON SINK AREA, NEVADA

By

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EAGLEVILLE DISTRICT (5)

Eagleville (Hot Springs) District

Location and topography

The Eagleville district, also known as the Hot Springs district, centers a point about 6 miles east of Rawhide. It is 30 miles northeast of Nolan, e nearest railroad station, 36 miles north of Luning, and 40 miles southeast 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 3 miles wide, Fig. 88, (Topo. and Geologic map).

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

The two main settlements or camps, which are small, are Eagleville toward e northeastern part of the district and Sunnyside toward the southwestern part. former electric power line to Fairview and Wonder extended northward through nyside.

History and production

Mineral in the district was discovered in the eafly seventies or before the site of the Harry Mann mine 3 miles northwest of Eagleville, for the atment of whose ore the old Monte Cristo mill, then known as the Whiting , was built at the edge of Alkali Flat 5 miles southeast of Eagleville. 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 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 ntact in the western part of the district from which occasional small shipments ore were made.

In 1882 the Great Eastern group of four claims was bonded for $16,000 of ich $1,000 was paid and the bond later relinquished. Since then the camp has ipped $5,000 worth of mostly gold ore running about $156 to the ton besides ich moderate shipments have been made from time to time by Tom Kenyon and her parties. Some were being made from the Kenyon property by lessees in 1/ 34.

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, d and copper ore and averages about $20 to the ton of which $12 is in gold and in silver. Two thousand tons of $20 ore is said to be now in sight in the at 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 making a moderate production of barite and is reported to have discovered ising 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 ng Company which began development work in 1884, took out $6,000 from the

le No. 2 vein on the upper or tunnel level, and in 1887 $2,000 each from the den 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 te Cristo mill then known as the Whiting mill.

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

In 1913 the leading owners in the Company were William "Bill" Woodruff, as "Tom" Kenyon, and Mr. McCracken, and the mine was said to be for sale for ,000. Under conditions then prevailing the company could handle $30 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 any then claimed to have in sight in the mine $280,000 worth of ore that ld average $12 to the ton.

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

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

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

ch the sedimentaries, is intruded by granite, and all three of these rocks are ginally overlain and locally intruded by Tertiary volcanics, Fig. 88.

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

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

The quartz diorite porphyry occupies a belt nearly a mile wide extending m near Sunnyside 4 miles eastward to a mile from Eagleville. It, as seen at gleville, Sunnyside, and elsewhere, is an iron gray, fine-grained, nearly se porphyritic rock, sparingly speckled with small dull feldspar and blackish mblende and augite phenocrysts. It shows faint parallelism of structure due pressure. Though the rock is typically iron gray, it presents from place to ce phases ranging from blackish or dark as in basalt to comparatively light y as in monzonite. Where weathered, as seen in the Eagleville mine, it has ull greenish tinge due to the alteration products, chlorite and epidote, and general is slightly calcareous. The microscope shows it to be monzonitic, taining considerable orthoclase as well as plagioclase feldspar, which latter eral, however, is dominant. It also shows it to be highly altered to kaolin, icite, chlorite, and epidote to a degree that the feldspars and other minerals difficult to determine. Bent forms of biotite and other minerals show it to e mxx suffered dynamic disturbance. It shows also small areas of intergrown ndary 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
ap near its center. Here on the northwest it forms a prominent roundish hill
out 400 feet high called Granite Mountain and abundantly intrudes the limestone-
ale series while on the east it similarly intrudes the diorite. It also occupies
smaller outlying area about three-fourths mile in diameter at about 1½ miles
Sunnyside
orthwest of/~~Sunnyside~~ on the south ridge of Big Kasock Mountain. With its contact
th both host rocks, mineral deposits and contact metamorphic phenomena are
sociated.

It is medium-grained gray or speckled with greasy luster quartz feldspar
d ~~abundant~~ abundant black shiny biotite resembling very perfectly a coarse-
ined salt-pepper mixture. It weathers reddish brown. The microscope shows it
be a lime-soda biotite granite or "granitite" and to be composed of acidic
igoclase quartz, orthoclase, microcline, and brown biotite with accessory apatite,
tanite, and magnetite. There is twice as much oligoclase as orthoclase feldspar
esent. The oligoclase is mostly in stout prisms and ~~in~~ cuboidal forms with
h zonal structure. Some of the biotite is altered to chlorite. In the Big
sock area the rock is slightly coarser grained and tends to be porphyritic with
ystals of feldspar and biotite ranging up to .15 of an inch in diameter.

Volcanic rocks

The volcanic rocks are chiefly light-colored rhyolite besides which, however,
e andesite, trachyte and basalt are also present. As noted later on, much of
rhyolite in the northeastern part of the district is the young purple finely
w-banded variety. Proceeding from Granite Mountain north northwestward for
t a mile the country rock, which is mainly white crystalline and bluish
estone, is locally overlain and freely intruded by a dull lead gray fine-
ined augite andesite.

Deposits

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. They occur in a dozen or more small mines and prospects. They occur in quartz veins or lodes, mostly in the quartz diorite with their openings mostly confined to the oxidized zone. Besides quartz, their veins contain grayish altered associated rock and barite which in places are important constituents of the vein and some of the barite is secondary. They include the Eagle mine, Jo Dandy, Olive, Monitor vein, Snowflake, Prince Albert, North and South American mines, Buckskin, and Troy. Though the veins nearly all carry fair values, some of them 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, at the main cross-cut tunnel at an elevation of about 5,600 feet below which all 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 fresh basalt occur farther east toward the Jo Dandy prospect.

In the Eagle mine the deposits occur in three parallel veins or lodes spaced ut 100 feet apart, the Golden Gate, Eagle No. 2, and Summit veins, Fig. 89, lan of veins). They strike northwesterly in the diorite across a 300-foot de fracture zone in which they are richer. They are opened by about 8,000 t of worked mostly by cross-cut tunnels, drifts, shafts, and stopes. The luable 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 ing screened and cobbed; the fines and that of intermediate grade netting about 0 to the ton, were sacked and shipped. One-third of the gross, about 600 ns, running $45 to the ton, lay on the dump to be later milled. The shipments 1916 to October 1 were as follows:

Tons	Value per ton
16	$114
20	137
17	150

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

Golden Gate vein

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 0 feet by workings, some of which are indicated in Fig. 89. It averages about foot wide but, as seen in the face of the north drift at about 300 feet from cross-cut tunnel at 90 feet deep, it is about 3 feet wide and is composed ly of hard oxidized iron-stained quartz more or less well banded and some ociated heavy spar or barite. Some of the quartz is honeycombed by pyrite

ving been dissolved out. In its footwall side the vein carries a 1-foot wide
y shoot said to be mostly $40 ore while the remaining 2 feet of quartz forming
e 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
in. Here for the distance of 100 feet on the tunnel level drift and for 75
et above it and 60 feet below it the ore has been mostly stoped (Fig. 89).
e portion above the level is said to have yielded 1,000 tons of $45 ore, some
which ran $100 to the ton and that below the level an almost equal quantity
$30 ore. South of the stope the 90-foot winze and about 200 feet of drifts
rned from it to the east are said to contain throughout a 2½-foot wide vein
t is nearly all $30 ore.

Eagle No. 2 vein

The Eagle No. 2 vein, intersected by the cross-cut tunnel at 750 feet in
om the portal, dips to the northeast. It varies from a few feet to 30 feet in
ith. It has a sparry barite gangue and contains, besides quartz, much coarsely
ystalline barite and country rock diorite breccia. It is opened mainly by drifts
winzes to the depth of 160 feet below the tunnel level, mostly east of the
nnel. The ore in general ran about $6 to the ton of which there is said to be a
rge quantity. Much of the ore, however, is of higher grade, example given in
Borden 40-foot winze east of the tunnel, the vein is 12 feet wide and the ore
s $30 to the ton and the nearby stopes rising above this level produced consider-
e 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
ttle 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 great depth. It extends to and outcrops at the surface where it is also opened two 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 duced $7,000 in gold ore. By 1916 some new work had been done on its eastern t on the lower level at 350 feet below the surface where it is 5 feet or more le and consists mainly of a barite-calcite oxidized rock gangue and carries a r quantity of $12 to $15 ore.

Jo Dandy prospect

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

The croppings, some of which are manganese-iron stained, are 3 feet wide, nd 3 feet high, and are here traceable for 500 feet and by some are thought to the extension of the Prince Albert vein. Where opened mainly by a 50-foot ft and drifts, the vein is said tobe 15 feet wide and to carry fair values in d, silver, and gold. A pit 100 feet northwest of the shaft shows a 2½-foot le quartz-barite vein containing considerable galena which, however, is not wn 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 Eagleville, is opened by a 25-foot shaft, and the ore is said to average 30 per t lead and $8 in gold and $1.50 in silver to the ton. Where exposed in the thwestern slope of Eagle Hill this vein, 7 feet wide, dips 80° northwest in diorite porphyry and carries considerable galena in a finely crystalline rtz-barite gangue. The vein is claimed to have been traced for several miles h 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 1/4 inches wide, strikes northwest, and nds about vertical. It consists mainly of a quartz gangue which is in part per stained, and the most of it is said to carry about $20 in gold and 50 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 neaf the cabin on the Eagle group dips steeply west, has own extent of 3,000 feet, is about 12 feet wide, and is said to carry about re 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 hyry. It is opened mainly by a 38-foot upper tunnel in which a width of 14 feet he vein 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 till 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 h 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 ly 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 yside camp, mostly between the elevations of 5,200 and 5,500 feet (Fig. 88). ore minerals are mainly free gold, horn silver, argentite, chrysocolla, and hite in a quartz gangue, some of which is glassy and some has been closely ed or cleaved parallel with the vein and recemented with dark seams of onate 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 dmately conformably with the granite-diorite contact which it seems to follow.

s 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.
this elevation the vein and workings extend on up the slope to above the
0-foot contour. At about the 5,350 contour, tunnel No. 2 extends in 280 feet
he vein which here ranges up to 1½ feet in width and has had considerable stoping
on it and has been an important source of the camp's production. A fault
sing 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
lly greenish with chlorite and epidote which latter mineral is frequently con-
ated in yellowish green seams and stringers. A 20-foot prospect tunnel near
5,400-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
ibed on the north. It is on the Great Eastern vein, which strikes N. 70° E.
ips 60° S. The vein is opened mainly on the Great Eastern claim and the
rn extension claim which adjoins it. It is from one-half to 2 feet wide and
ged about a foot in width and looks well. It is mostly gold-silver ore having
ty dark brown or black iron or manganese-stained oxidized quartz gangue. It
more or less depositional banding and later compression that caused it to
e 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
ally drusy and honeycombed by casts of pyrite dissolved out. A polished

...n of a specimen of the banded ore shows it to contain a few small grains of ...te, which may be hypogene, as no pyrite was observed. The xxxxxx ores are ...o run about $20 to the ton. In place a little ore occurs also as replacement ...ts in the adjoining wall-rock diorite which here is hydrothermally bleached ...ightish 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 ... vein in the bottom of the winze.

...ilarly on the western extension ground, about 1,500 feet to the west, the ...is opened by a tunnel whose stope or ore shoot is said to be 200 feet long and ...ve made a considerable production. In the gulch on the opposite or southeast ...of the ridge bouldery float quartz containing or being stained with much ...hite seems to have come from this vein.

South Star No. 5 prospect

...t 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 ...ened by a 50-foot shaft and drifts from which ore was being mined and 7 tons ...ently been shipped at time of visit in 1913. The ore shipped averaged about ...to the ton and contained $36.16 in gold and 14 ounces of silver to the ton. ...re 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.

...short distance upstream from the South Star No. 5 prospect in Kenyon Canyon ...th wide granite dike cuts the diorite porphyry and, associated with the contact, ...seams up to 2 inches wide of silicate rock composed mainly of garnet and ...te.

The Gold Reef mine

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

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

The sill and veins or lodes 5 feet wide, one on either side of it, strike about 0° W. and dip 50° southwest, apparently conformable with the walls of the sill its contact with the granite on either side and are banded. Along its foot and ng-wall contacts with the granite the sill has been fractured, sheeted and d parallel to its walls and at the surface is altered or oxidized and is more ss porous and contains partially dissolved out crystals of rust brown hematite limonite derived from pyrite.

The principal ~~mmm~~ openings are on the foot-wall vein. Parts of it are said ry from $12 to several ~~thousandsdollx~~ thousand dollars in gold to the ton. On ootwall or granite side the vein consists of (a) a 1-foot wide belt of d, fractured, and parallel-seamed quartz ~~whxxxxix~~ which is more or less

s or honeycombed, contains some pyrite, is stained with oxide of iron and nese, 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.

(B) 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 he ore taken across this 8-inch part of the lode by William A. Simkins, engineer he Nevada New Mines Company, is reported to have assayed $2,200 to the ton of h $2,152 was in gold and $48 in silver.

(C) is a 1 to 4-foot wide zone of brownish metamorphosed or hydrothermal red diorite sill. It is partly silicated, sericitized, and epidotized and in es porous or pitted by dissolved out fine-grained pyrite casts. It contains a le 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 hat just described on the footwall or lower side and is said to compare well with n gold tenure but had received but little development.

Outlook

Although the Gold Reef veins may be locally very rich, as reported, they have een opened deep enough to predict their becoming of sufficient value to make e. Thus far the development done and values found, mostly in free gold, are nly 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 gher levels and have since been eroded away. In the sulphide zone the gold e of the ore is certain to be very much less.

Murphy copper and lead prospects

The Murphy copper and lead prospects, known as the Big 5 Group of mines, d by John Murphy, a pioneer settle at Alkali Flat, occur in the western part the Sunnyside camp and vicinity. Some of them rank among the very early coveries of about 1870 and some have made small productions, notably during the ld 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 tain on the intrusive granite-limestone contact which dips steeply southeast the mountain with crystalline limestone forming the footwall and granite the ing wall. The vein or lode, about 9 feet wide, is composed mainly of a quartz- stone-calcite gangue with black and greenish iron and copper-stained croppings. 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 chloropal, llowish-green hydrous silicate of iron and aluminum. The shaft was not enterable the time of visit in 1913, and croppings and dump at that time did not seem to icate the presence of ore in commercial quantities. However, just before the ing of the World War Armistice in 1918 George Troast put in a gasoline hoist and d and shipped from the deposit in the bottom of the shaft 24 tons of ore averaging r cent in copper. He then suspended operations owing to decline in the et 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 barite-quartz-calcite gangue. It curves from north to westerly in its course cuts across the strike of the limestone. On the south it is on the granite-talline limestone contact and on the west on the crystalline limestone-basalt act. At the latter place it dips 80° northeast with the basalt forming the ing wall. Scattered through the gangue, some of which is copper stained, is good looking galena and a little cerussite, mostly in a finely crystalline gangue, te, but there was not much indication of the lead minerals being present in ercial quantity.

Murphy Lead Queen mine

The Murphy Lead Queen mine is 1½ miles southwest west of ~~Summit~~ Sunnyside in south foot of the mountains at an elevation of 5,100 feet in the limestone area re described. It is in a prominent ridge on the west side of and 120 feet above teep-sided gulch. The ridge and workings slope southerly. The limestone dips 70° heast-east and the deposits are associated with the contact of white crystalline stone overlain by blue or dark dolomitic limestone along which they have an nt of 600 feet. The limestone, especially the bluish limestone, is sheeted, red or schisted. A leading feature of the deposits, especially in the croppings, ch brown jaspery quartz. Some white crystalline dolomite is also present. The showing of the deposits is in the upper end or northefly workings in the eastern 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 et 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) much reddish brown and blackish iron-oxide-stained gangue. With the galena in as are associated a little pyrite and chalcopyrite, and some of the galena is d with covellite derived by oxidation from chalcopyrite. A striking mineralogical re is the galena being altered to cerussite. Small shipments of the cobbed ore said to have ranged from 12 per cent to 70 per cent in lead.

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

Proceeding from the second chimney downstream southerly to near the 5,020-foot ur 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 e of the lode in depth. The deposits probably contain a moderate quantity of rcial ore.

3rd.

Blanco Prince prospect

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

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 yside on the Sunnyside-Eagleville road. Here in the steep southerly face of mountain the granite, which is crushed and blocky is cut by seams, stringers, and l veins of mineral-bearing quartz and kaolinized rock material following irregularly 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 eing 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 tity, it may be of value in sulphide ore where it can be saved, as bismuth is h $1 a pound. Much of the quartz is stained blackish with iron and manganese le, some yellowish with lead carbonate, some greenish and bluish with bismuth (?) some contains a little pyrite. In places a little ore occurs also in the cent altered wallrock.

Judging from the erratic occurrence of the deposits and there being nothing nite 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 . H. Leonard, is in the upper west slope of Granite Mountain at about 250 feet e the ~~adjoining~~ adjoining road. The deposit, which follows the sheeting or planes in the granite, dips gently easterly and locally contains bodies or s 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 sed interruptedly at several points for the extent of about 200 feet, at one e continuously for 20 feet, but are not known to be connected or contain any inuous ore body.

A little to the northeast of and 60 feet higher up the slope from the Blue Bell 5 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 inuity of the ledge in extent or depth.

3/ Tungsten prospect

Tungsten ores were discovered in the Eagleville district near Sunnyside about 6, 3/ by Frank Channing. 4/

3/ Schrader, E. J., letter of July 4, 1926.

4/ Nevada Mining Press, May 30, 1930.

The deposits are mostly developed by W. H. Leonard who has three claims and n opening them up early in 1930. 5/ Later they were being worked by the American

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5/ Leonard, W. H., Letter of January 21, 1930.

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lopment Company. 6/ The lode occurs in granite near a granite-limestone contact.

6/ Nevada Mining Press, October 31, 1930.

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tcrops 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 the course of the lode and contact on which extension claims are owned by John er. 7/

7/ Nevada Mining Press, op. cit.

3rd.

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 ral being cinnabar. 8/

8/ Nevada Mining Press of December 13, 1929.

3rd.

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. 9/

9/ Leonard, W. H., Letter of January 21, 1930.

During considerable part of the period of 1929 to 1931 the American Development my of San Francisco mined and shipped from the deposit to its grinding plant at

land, Calif., about 15 tons of ore a day.[10] 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.

allon.

3rd.

Big Kasock prospect

As seen from northwest of Sunnyside, the southeast side of Big Kasock Mountain ears to contain considerable diorite porphyry. Its south spur at the elevation bout 6,400 feet is said to contain a blanket-quartz vein that runs high in values.[11]

11/Kenyon, Tom, Oral communication, July 30, 1913.

MACKAY SCHOOL OF MINES
UNIVERSITY OF NEVADA

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
m near the middle of Alkali Flat, 25 miles westward to Walker Lake near Schurz,
d about the same distance southward to the latitude of Thorne; it is nearly all
ntainous. 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
ea.

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

History and production

Mineral in the district was first discovered during the Rawhide boom at
er 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
rict 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
he 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
ade 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, chyte, 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 t in thickness, Fig. 91 (Photo). In places, however, areas ranging up to eral square miles of the older Jura-Triassic sediments, - limestone-shale ies, are well exposed, as in the Gillis Range east of Walker Lake, about 3 miles theast of Nolan, and in the Gabbs Valley Range in the southeastern corner of district along the Luning-Rawhide road.

Deposits

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

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

1/ Alunite at Bovard, Nevada: U.S.G.S. Bull. 540 - 1, pp. 351-356, 1914. Econ. Geol. Vol. 8, pp. 556-767, 1914.

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 [illegible]. Alunite is a hydrous sulphate of alumina and potassium. The possible economic [illegible] of its deposits as a source of potash and alumina makes them of more than purely [illegible]logical interest.

The gangue or vein filling is mainly quartz and crushed or brecci[illegible] rock, [illegible]y rhyolite or andesite, some of which has been silicified and metasomatically [illegible]ced by infiltrated siliceous solutions or quartz. Some of the quartz is laminated [illegible]seudomorphic after an earlier gangue spar mineral, calcite or barite, and [illegible]ly is associated with adularia. In the cropping and oxidized zone the deposits [illegible]tained or contain considerable limonite, hematite, chloropal, calcite, [illegible]nolane, and some ochre-yellowish mineral, utahite or jarosite. Locally they are [illegible]ngly streaked bluish with molybdenite stain, as on the Hidden Treasure [illegible].

Although the veins are good looking and extensive, they are for the most part [illegible]ow 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 [illegible]n 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 [illegible]water level due mainly to concentration by leaching and secondary enrichment, [illegible]re of these particular bodies will be found to be lower grade and probably not [illegible]ble in the underlying sulphide zone.

This statement concerning the barren or low grade veins applies to that part [illegible]e belt extending through the Old Bovard district, southeast of the Gold Pen [illegible]and seemingly to most of the mile or more of veins, between the Gold Pen mine [illegible]the Rand mind, as covered by the Antelope, Railroad, Independent, and other [illegible]groups.

In neighboring districts--as Rawhide, Wonder, and Fairview,-- the main ore
es have 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
er-bearing. They occur in the Jura-Triassic limestone-shale series and are
tically 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
Rand district, is here given because of the part it played in the discovery of
r deposits in the district rather than any economic value known or supposed to
contained in the Bovard mine.

Location.--The old Bovard district occupied an area of about 3 square miles,
t 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
o map) and Fig. 91 (Photo). It is 17 miles south of Rawhide and 25 miles east
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
ped with a small group of Rawhide prospectors in a gulch below the Gold Pen
md. A little later claims of the Bovard group of the Bovard Consolidated Mines
pany, which became the principal operator, were acquired by that company from
rge R. Clark of San Francisco, one of the earliest arrivals. The first location
the district is said to be that of the Golden Gate claim on April 16, 1908, and
as recorded May 15, by W. A. Watson, as shown by the official records at Rawhide
ember 27, 1911. By May 1908 the camp is said to have had about 500 tents and
housand inhabitants.

The Bovard Consolidated Mines Company began operations at its Bovard mine tober 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 k which proved of much service in disclosing the nature of the deposits. Water s hauled from Dead Horse well, 10 miles distant. The average cost of underground k was about $14 a foot and the cost of mining, handling, and milling ore was out $18 a ton.

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

The deposits occur in the northwest-southeast frac ture zone, aforedescribed, nsversing Tertiary volcanic rocks. These rocks, about 2,000 feet in thickness, ed in ascending order, are mainly dacite, rhyolite, and andesite, Fig. 91 (Photo). e most abundant and important rock is the rhyolite. It seems to form the main ss of the mountain on the southwest. Much of it is pyritic with fine-grained ite uniformly disseminated through it and causes the rock to weather reddish own. The pyrite is thought to be auriferous and probably an important source the gold that has been concentrated in the veins. Toward the southeast, on the hawk claim and vicinity, the volcanic rocks have been removed by erosion and e way to underlying bluish-gray limestone which, in general, dips steeply south is referred to the Jura-Triassic. It has been faulted and folded into an anti- ne which on the Valley View Fraction Ground and vicinity, pitches northeast n stream 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 rusted with oxide of iron and manganese, which in some instances may be nearly inch in thickness. Only occasionally is a little sulphide, pyrite, or chalco- ite present. Some of the quartz, as shown at the Bovard and Hidden Treasure

s, is pseudomorphic after calcite or some other spary gangue mineral. Some
ue, 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,
e 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
northwest, 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 MoO_3, derived by oxidation
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,
s 8 or 10 feet above the surface, and extends for 200 feet or more.

The veins are generally accompanied by a tabular sheet of dark iron-stained
h 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
ned, is locally called "drybone".

The deepest opening on the deposits is in the Bovard mine, which is in the
west 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.
on 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
pened to a depth of 450 feet by a 60° NE inclined shaft known also as the
e 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.
dump 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
ly of faulted breccia, manganese-stained rhyolite and quartz, said to assay
ll values in gold and silver. The southwest or footwall showed also considerable
ge.

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 ~~300~~ 200-foot level the vein showed a width of 12 feet or more of good
ing crushed quartz containing a little disseminated pyrite and chalcopyrite,
h, however, seems to assay only about 50 cents to the ton. The footwall rock
hyolite tuff. It contains quartz stringers that dip southwest. The rhyolite-
te 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,
is composed of comminutely faulted brecciated quartz and rock containing only
low values.

On the 450-foot level, or bottom of the mine, the outlook is not auspicious.
est showing was in the 80-foot crosscut to the southwest into the footwall,
is 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 ...ose shaft are said to contain similarly low values.

Later the mine was said to have been worked in 1915 by the owner, the Bovard ...olidated Mines Company, and that ore averaging $35 to the ton was shipped. 2/

2/ The Mines Handbook, vol. 16.

...A little later the mine was acquired by the Gold Pen Rand Mining Company and ...me known as the G.P.R. 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 ...rtant 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 ...he ton in gold and silver and the remaining 11 feet about $5 to the ton, and ...the ore is readily available to cyandation. 3/

3/ Nevada Mining Press, Dec. 10, 1920.

In 1922 the company was reported to have opened up near the surface some ...nce from the shaft 15 feet of $25 ore. 4/

4/ Letter from Wm. 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. 5/

5/ The Mines Handbook, Vol. 18, pt. 1, p. 1469.

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 ...ley 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 ...ists mainly in its large bodies of high-grade milling ore.

History and production

Closely following the discovery of the Bovard mine in 1907, the deposits 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, ...r several different managements, it has produced more than $250,000 ...old ore.

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

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

The property was next incorporated by Knap and Judge Glen as the Golden Pen ...g 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 ...e mine and worked it till 1915 when it was sold for $130,000 under a 2-year ... 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 ...h-grade ore in sight in the mine. Ten sacks of the ore shipped weighing 963

ds averaged more than $7,000 to the ton. About this time some of the ore hauled to the railroad station at Luning. 6/

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

In December 1915 the mine was leased to J. H. Miller and associates, who, after g about 600 feet of underground work and making two shipments which netted them ,500, 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 t $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 tions, 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 orporated for $500,000, as the Gold Pen Mines Company, acquired the mine, did 00 feet of development work in it, and made a $100,000-production, of which ,000 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 reto brothers.

The improvements made by the company included erection of substantial mine ldings, 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 r supply by sinking a 112-foot deep well towards the south edge of Alkali Flat, t 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 the time with a crew of 10 men, and was producing; some of the ore shipped being rich ore found in new ground. 7/

7/ 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 pany which still owns it. In 1927 its ore reserves were estimated at 41,000 tons $20 ore, mostly in an ore shoot 90 feet long by 5 feet wide. It was opened mainly a 260-foot deep shaft and a 500-foot tunnel and contained more than 5,000 feet workings. 8/

8/ The Mines Handbook, Vol. 18, pt. 1, 1931.

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 pson Smelter of the Mason Valley Mines Co. The building of a mill at the pany well and the conveyance of the ore to it by aerial tram was contemplated 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 buted on six levels. Mainly on the 50-foot, or tunnel level, and the 130-foot , Fig. 93 (Level map). The tunnel and workings gain a depth of nearly 200 feet ey extend into the mountain side where in a 100-foot winze and vicinity derable high-grade ore was mined.

The surface equipment includes a 25 HP gasoline hoist capable of sinking to pth of 1,000 feet; a 20-ton Kinkaid Amalgamating mill, assay and refinery ratories, 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- le ore ranging about $30 or more to the ton. In the early days no ore under $30 the ton was shipped.

Geology

The country rock is chiefly rhyolite with which is associated some dacite and esite, 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 nds 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 racteristically southwest into the mountain, from which structurew the fissure pied by the vein seems to be that of a normal fault whose upthrow is on the wall or mountain side of the vein.

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

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 ndesitic rocks which continue on northwestward through the Lone Star and Rand s and then across Nugent Wash.

At the Gold Pen mine the rhyolite is a medium-grained gray rock, normally a pinkish or reddish tinge due to the color of the fine-grained groundmass h varies from the felsitic to mostly crystalline orthoclase. Its flow structure

sheeting dips gently northeast. It is generally sprinkled with small phenocrysts fragments of 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 n biotite. Even near the surface, as on the 50-foot level, the rhyolite contains ite in disseminated fine grains or pyritohedrons and small aggregates of them h become more pronounced in depth, as on the 130-foot level where pyrite occurs both 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 the ore is probably derived from the overlying andesitic rocks.

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

The microscope shows the rhyolite - specimens 599, 601, and 726 - to consist of t 60 percent of pale brownish-gray cloudy microlitic glassy base of principally hoclase, sanadin, quartz, biotite, and glass containing larger forms or phenocrysts the above-named minerals. Quartz 25 percent, orthoclase 10 percent, biotite 5 cent, which includes a little acidic plagioclase, pyrite, hematite, etc. The er minerals show parallelism in arrangement which seems to be due to flowage the magma and the presence of angular fragments up to 1/4 inch in diameter icate that some of the rock is a flow breccia.

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

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

Deposits

The deposits occur in the Gold Pen vein which is a northwestward continuation the front vein, afore described in the old Bovard district. It is contained nly in the country rock, rhyolite. It strikes about northwest and for the most t dips about 70° NE., but straightens up in depth and in the bottom of the mine nds about vertical. It in general has a width of about 20 (?) feet. It is posed mainly of quartz and crushed, altered, and mineralized rhyolite. Much the ore occurs mostly in shoots ranging up to 90 feet in extent and 3 or 4 feet e. The most important are the Gold Pen ore shoot and the Lucky Strike ore shoot. laria is present but is not an important gangue mineral as in some other camps.

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

In general the vein is separated from the wall-rock rhyolite by 1 to 4 feet of ing or gouge which in places on the upper levels is relatively pure alunite. 2/

2/ Op. cit., U.S.G.S. Bull. 540, pt. 1, pp. 351-356.

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

On about the 200-foot level the ore tends to become sulphide, below which depth
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
there is a slight gain in silver with increase in depth. The gold is mostly
e and fine grained and is associated with horn silver and black silver sulphide,
entite. There is also present some wire gold and a little wire silver. The gold
said to run about $14 to the ounce.

Locally there is also present in the quartz traces of sphalerite and galena,
ch minerals, however, do not appear to affect the gold.

The following note may shed further light on the chafacter of the gold and ore:
0 of a cubic cm of concentrates panned from 1½ cubic inches of ore ~~pulp~~ pulp
ec. 432) crushed and passed through a 20-inch mesh seive was found to be composed
mainly comminuted quartz and gold, of which the gold particles were estimated to
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
ning, 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
outline they are very irregular, rough surfaced and ragged. Most of the particles
of a good gold yellow color but some are lighter and some contain considerable
ver in alloy with the gold. Many of the quartz pieces have from 1 to several
more particles of gold adhering to or embedded in them. The same is true of horn
ver, pieces of which are common in the concentrates, and to a small extent of
entite.

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 the macroscopic 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 and consolidation of the volcanic rocks, particularly the rhyolite. Quantatively 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 not nearly as rich as in the oxidized zone.

Judging from the size and exposed vertical range of the fissures of the mine and 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

tern 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 ched by a good road that finally ascends a short wash, ~~Omax~~ Lone Star Wash, that ins Nugent Wash about a mile northwest of the mine, Fig. 3 (topo map). The ntain range in this latitude, though more or less deeply dissected, consists nly of a single ridge about 2 miles wide, standing at an elevation of about 6,000 t with a relief of 1,000 feet. The topography is of the milder type usually duced by longitudinal erosion and weathering of Tertiary volcanic rocks in the ert 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 notes 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 8 ore, whose value was mostly in gold. In 1911 the shaft was extended to the -foot level; whence, at Raise No. 58 west, considerable additional ore was ed 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 li Flat.

In 1914 the shaft was extended to the 250-foot level and by June the mine had pped 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 hange and on the New York Curb. At this time the mine contained more than 3,000 t 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- e 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 nce 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 shipped to the Western Ore Purchasing Company at Hazen.

In 1917 the mine was reported by the examining engineer to have in sight about 000 tons of ore averaging $15 to the ton and in 1921 it was credited with a pping record of $50,000 in mostly high-grade ore. The shaft had been deepened the 450-foot level and several newly opened workings showed goodgrade milling ore. -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 p 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-gradd ore, of ch the former owners had shipped $40,000 worth that ran $31 to the ton and the i 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 s of $20 ore lay on the dump.

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

	Per ton
Truck haulage to Nolan	$ 3.00
Railroad freight	.60
Smelter treatment	4.50
Total	8.10

In metal content this ore averaged gold .4 ounces and silver 15.9 ounces the ton.[10/]

10/ W. 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, er lessee, who in 1931 was still operating it.[11/]

11/Mines Handbook, Vol. 18, pt. 1, p. 1545, 1931.

Development and equipment

The property of the Rand mine comprises a group of seven claims, aggregating ...out 160 acres, Fig. 95 (claim map). It is opened mainly through the Rand shaft ...the depth of 250 feet, by about 5,000 feet of workings distributed on six levels--...inly the 50, 150, 250, and 450-foot levels; the 180 and 200 levels being inter-...diate, Fig. 95-B and C, (Cross section). The workings extend about 400 feet along ...e strike of the lode.

As the shaft is sunk in the hanging wall side of the lode the main crosscuts ...e driven in the direction of the footwall and the drifts mostly parallel the lode ...its footwall side. The mine is dry, only slight moisture occurs in its deep ...rt. The ground is all easy to work and required almost no timber.

The surface equipment includes a 25 H.P. gasoline hoise, office, camp, and mine ...ildings for accomodating a small crew of men. As a mill to treat the medium- to ...w-grade ore at the mine was needed, the company in 1919 was reported to have ...rchased a 20-ton mill standing in good condition at Alkali Flat, 12 miles from the ...ne, with water at the depth of 160 feet, but the writer does not know whether ...e mill was later moved to the mine or any of the ore was treated in it. A water ...pply can probably be obtained at a reasonable depth in Nugent Wash, a mile west ...f the mine.

Geology

The principal rock at the Nevada Rand mine and vicinity is a gray hornblende ...desite standing close to trachy-andesite or latite. It is tuffaceous and is of ...idic type. Concerning the fragmental charatter of the rock, there seems to be ...doubt. Though the rock is considerably altered, it contains fragments of andesite ...its minerals, and fragments of the underlying rhyolite and of dark shale or ...te.

As the structure or bedding of the andesite is not known, no definite statement be made as to its thickness. At the mine it appears to have a thickness of t 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., has been suggested may be the case, the thickness would then be considerably ater as it would then be measured on the hypotenuse instead of the leg of the ht angle triangle.

The andesite probably consists of more than one flow, which point is not yet rmined. It extends from a point nearly a mile southeast of the mine, through istance of 2 miles northwest of it, to bdyond Nugent Wash.

It occurs throughout the mine and apparently forms the main upper mass of the ntain range back of the mine on the northeast.

It is composed mainly of numerous small phenocrysts of feldspar in a greenish- y microlitic groundmass, which latter constitutes 40 to 60 percent of the rock generally shows flow structure. Hornblende and biotite also occur as small nocrysts and are essential minerals. Augite is scarce. Accessory minerals are atite, magnetite, quartz, and zircon. In places accessory magnetite is abundant. e felspar consists mainly of oligoclase and andesine with the oligoclase predominent in some sections a little orthoclase is present. The feldspar is tly altered to kaolin and sericite; the hornblende to green chlorite, epidote, atite, actinolite, and carbonate;the biotite to green chlorite and iron ore.

To the abundance of chlorite the altered rock in most instances owes its en color. In places, as on the 250-foot level, the andesite is vuggy with small ities lined with quartz crystals. The andesite seems to be sparingly cut by one more small dikes of a fresher andesite porphyry which is probably related to cap 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 rhyolite. These rocks are apparently in fault contact with the andesite.[12]

12/ Foshag, W. F., U.S. National Museum Mss., Notes on the Hawthorne district, p.

o along the road and Wash just south of camp occurs a bed of volcanic agglomerate ch Gianella[13] thinks appears in the bottom of the mine, of which he has made

13/ Gianella, V. P., Nevada State Bureau of Mines, Reno, Nevada, oral munication, May 30, 1928.

tudy 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 eral with the dip of the rocks in the front of the Range at the Gold Pen 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 f 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 e with the contact between the two rocks dipping toward the Rand mine, it probably o 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 n 600 feet. At 1¼ miles northwest of the mine the rhyolite is said to form con Hill and dip steeply northeast under the andesite of the range.

The Jura-Trias sedimentary limestone-shale series on ~~xhxmbx~~ whose eroded face the volcanics of the region in general are supposed to rest, is not known outcrop within several miles of the mine.

Associated with the lode in the mine ample slickensided surfaces indicate
lting and movement in several directions, among which the south or hanging wall
as to have moved upward as if the fault here were a reverse fault.

Nust northeast of the mine where the surface rises steeply several hundred feet
ard the top of the mountain, the andesite is not only sheeted but is cut by a
ss cleavage that strikes N. 25° W. and dips 80° eastward into the range and by
oarse jointing system with its plane surfaces well slickensided dips 45° SSW
ard 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
matic solutions that circulated through the faults and fractures in the andesite,
llowing 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
osite and alunite in fractures. The hot mineralizing solutions were the same
t formed the deposits last described, and the greater amount of alteration occurs
r the deposits.

The zone of the mineralization, whose extent was controlled besides the solu-
ns by fissures, fractures, and weathering in the andesite, is irregular in width
intensity. It varies from 20 to 200 feet or more in width and has an extent
3,000 feet or more. Beginning at the mine it covers the northeast part of the
t Hope claim, the adjacent part of the Thomas fraction, and of the L. H. extension.
re the zone passes into Nugent Wash on the northwest it widens to nearly 1,000
t. On the southeast it extends to beyond the Lone Star mine. On the southwest
Last Hope Extension No. 1 and on Hope Extension 2, it is approximately parallelled
a couple of secondary or subzones, Fig. 95-A (Claim map).

The principal ~~xxhx~~ changes produced by the hot solutions in the andesite in the neralized zones were development of finely disseminated pyrite and chlorite and licification in the rock. The abundance of chlorite locally gives the rock a eenish color, which in places is increased by epidote.

In places the phenocrysts of feldspar in the andesite breccia were altered sulphurous vapors to alunite. Cubical pits show where pyrite was removed and ere is present a trace of kaolin.

In some instances of silicification the andesite is largely replaced by artz and calcite and in others it is changed to a semi-soft porous rock containing ch sericite, chalcedony and carbonate.

In places in the mine, as on the 450-foot level, considerable bodies of the desite 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 eeting parallel with the lode whose profusely slickensided planes indicate con- derable movement. On the east level, however, the andesite, though highly tered is a consolidated fairly firm greenish-gray rock cut by sheeting that dips ° NW and under the microscope shows good flow structure.

The andesite in general is deeply oxidized, the oxidation being almost as eat on the 450-foot level as on the 50-foot level.

The later bleaching of the andesite and the formation of jarosite was caused oxidation of the pyrite contained in it. In general the pyrite oxidized to matite but in places to limonite. On the west side of the shaft on the 250-foot vel the rock is a mica andesite but contains labradorite and seems to be a different ow from that in the main 250-foot crosscut.

Deposits

The deposits are gold and silver veins of the replacement type. They occur the Nevada Rand lode or vein in the zone of bleached and crushed andesite. The e is about 100 feet wide, it strikes about northwest, and dips 80° SW., or nds about vertical and seems to pitch to the southeast, Fig. 95 (Map). It con- ns numerous small fissures and fractures which, in general, parallel the course the lode, but dip steeply northeast or southwest and have ~~xxxxxxxxxxx~~ largely trolled 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 ore shoots. In places deposits are separated from the country rock by a sheet yellowish clay gouge or "talc" ranging up to a foot or more in thickness. The ge seems to be very similar to that which carried fair values in the Nevada der mine; but here it is mostly barren--example given on the 250-foot level, the th or hanging wall has a well defined sheet of gouge which, however, is very low de or barren while the adjacent crushed andesite carries good values in both d and silver.

The deposits occur in irregular fissures and fractures as flattish lens-like ies, 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 $20 ore, of which 10 inches runs about $500 to the ton. On this level the n 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, lly feathers out in oxidized vertically banded barren andesite.

On the 180-foot level a 13-foot wide ore shoot, consisting mainly of quartz tically streaked and banded with 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 thwest a 7-foot shoot of $6 "sand" or loose quartz ore. On the footwall side the lode in the raise, winze, and drift, in an ore body 7½ feet wide by 30 feet ag, there remained 3½ feet of $82 ore after more than 4 feet of high-grade ore i been mined out.

A polished section of rich ore ($2650 to the ton mostly gold) from the east ift of this level showed the gangue to be mainly hematite containing the precious tals mainly in the form of electrum and free gold. The hematite seems to be condary after pyrite but the electrum according to M. W. Short is undoubtedly imary as a supergene process would separate the gold and silver. This ore con- ined also a little selenium, argentite, tetrahedrite, calaverite, wulfenite, nganese oxide, pyrite, and copper minerals especially malachite and tenorite. e wulfenite occurred in disseminated yellowish platy, crystals, and is probably important source of the high lead content of the ore. Several of these minerals y be derived from telrahedrite.

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 oor of the drift.

In 1925 it was reported that six shipments of high-grade ore averaged ut 5.6 ounces gold and 190 ounces silver to the ton; a metal ratio of about 34 nces of silver to 1 ounce of gold, and contained additionally per chemical analysis lica 82 percent; iron 3 percent; lime 2 percent; alumina 6.3 percent.

The deposits are composed mainly of brecciated, silicified andesite and quartz t has been crushed by renewed movement along the fault. The ore bodies strike t 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 y 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 k.

Oxidation

Oxidation is almost complete down to the bottom of the mine or 450-foot level, it probably extends considerably ~~deeper/on the~~ 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 n and manganese-stained quartz and silicified rock that usually pans well in e gold. The surface ores, however, to the depth of 50 feet, though good looking seemingly rich manganese ore as seen in openings northwest of the mine, are stly leached to low grade.

The production of the mine has mostly come from between the 90-foot and the 0-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 argyrite, stain of chrysocolla and malachite, and white or yellowish wulfenite. some of the ore a little argentiferous cerussite has been reported; also tetra-rite 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 l primary, whereas cerargyrite is mostly an oxidation product from the argentite. e cerargyrite, however, fills cracks and cavities, and was not formed directly m 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. ectrum) and a dark-colored gold in very small flakes. Some gold is contained hin quartz crystals and must be regarded as primary.

A little secondary pyrargyrite has been found attached to other minerals. rite rims argentite and polybasite.

White quartz ore, formed on the south side of the Mud Gourge that cuts the in on the 250-foot level east, assayed 5.44 oz. gold and 34.4 oz. silver to the n. The wall rock adjacent to the vein is much altered and shows a little adularia, lcite, 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 ssure walls. Hard manganese, as psilomelane, is indicative of good values, but sooty manganese or pyrolusite is not. Also copper minerals are indications of h ore. The ore stoped averaged about 5 feet in width and is said to have run ut $125 to the ton. Some of the ore, however, runs as high as several thousand llars to the ton. On the 180-level and the 200-foot level a few lenses ran $8,000 the ton. Good grade ores extend from the 90-foot level to below the 250-foot vel.

Micro-ore

A specimen of the vein from the 300-foot level was found by Ross to be mostly ixture of vein (?) quartz and carbonate which latter is abundant, and seems to ostly 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 re 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 entite--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 cerar- ite. During oxidation the manganese carbonate in the rocks was changed to the nganese oxides now present in the rocks and ores.

As gold and silver tend to be associated or carried to greater depth with nganese oxide. The presence of a considerable quantity of this mineral in the e is thought to favor extension of the deposits in depth. There 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, tle 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

...ite and chalcopyrite, both minerals believed to be primary though the argen-
e is partly altered to cerargyrite, were contained in hard manganese-stained
rtz boulders and the ore contained higher proportions of silver to gold than is
l. The microscope shows the sulphides to be replacement of the andesite and
ches of adularia and quartz containing primary argentite have been replaced by
er quartz.

So far as its boulder form and its chalcopyrite and argentite content are
cerned, 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
el, the outlook for the mine at greater depth is not encouraging. Also fissures
taining good secondary "sulphide" ore in the winze a little below the 250-foot
el, on the 450-foot level contain only mud.

It seems advisable, however, that exploration work be extended to greater
th 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
sits 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 "as the type of the ore deposit is similar to that found
onopah, there is an excellent chance that with depth the primary ore will be
d 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, re described, whose property it adjoins and than which it is about 100 feet her. It is easy of access. The character of the topography is well shown in ure 3 (topo map) and figure 94 (photo).

History and production

The mineral deposit of the Lone Star mine was discovered December 22, 1907, E. M. Mims, who still owns it. It seems to be also the first commercial deposit scovered in the district. Development work was soon begun on a small scale. The al production is said to be about $80,000 in gold-silver ore. The mine began lipping ore in 1912 and by the end of 1914 had shipped $21,000 worth of ore that eraged over $40 to the ton.

The total production by the end of 1919 was said to be $26,000, and that 00 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 pany 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 Merger ing Company of San Francisco, who did about 1,400 feet of work, deepened the ft to the 500-foot level, and regularly shipped considerable ore, mostly from a oot 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
e cover a length of 4,000 feet on the lode beginning at the Nevada Rand line
he northwest; the other two lie on either side of the middle or Lone Star claim.
workings extend continuously about 2,000 feet on the lode.

Like the Nevada Rand mine, the Lone Star mine is dry except that for a while
early (1917) work on the 500-foot level yielded about five barrels of water a
, which, however, ~~xxxxxx~~ seems to have been merely surface water that was impounded
issures, fractures, and perhaps other reservoir cavities in the rocks and lode
to have had no connection with ground-water level.

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
southeast of No. 1 shaft is 550 feet deep; and No. 3, which is an inclined
t located about 600 feet southeast of No. 2, is 250 feet deep. No. 2 shaft is
pped 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
n.

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
ic rhyolite or rhyolite porphyry which seems to form the core of the range with
ontact 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 desite 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 ft and another at what was then the bottom of the shaft, 300 feet deep with its er part all in rhyolite. Later a specimen was received from the bottom of the e, or 550-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 dim wage 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 undmass with flowage structure in which rest numerous small phenocrysts or frag- ts of phenocrysts of mainly orthoclase, quartz, and sanadin, ranging up to 1/10 an 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 ins and contains as accessory minerals apatite and magnetite. On the whole it considerably altered--much of the orthoclase to kaolin and sericite and secondary rtz; the biotite and hornblende to greenish chlorite, calcite, and vermiculite; e of the pyrite to iron oxide. Some quartz is partially wine-colored by hematite ived from pyrite. Fragments of other rock material or rearlier consolidations of rhyolite that are contained in the rhyolite indicate that it may be related to, e a flow breccia or tuff. The rhyolite owes its pinkish or reddish hue to the ence of hematite derived by oxidation from the pyrite. This is best shown in bottom of the mine where much of the pyrite as seen in individual crystals is

inly altered to iridescent hematite which has stained the quartz a mild wine-red lor, 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 site. 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 1½ feet in diameter rock resembling diorite but which seemed to be too weathered for satisfactory rmination.

Deposits

The deposits are gold-silver deposits, similar to those of the Rand mine, afore ribed, 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 85° NE., or stands nearly vertical, especially on the 75- and 135-foot els. 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 replace- s 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 sh tough clay gouge, called "gumbo gouge", also locally known as talc. It is present elswwhere, as with ore shoots, faults, etc.

As shown by disseminated pyrite in the andesite and gouge on the 135-foot level, idization is general, although the deposit is mostly oxidized.

The deposits consist mainly of crushed or brecciated quartz and andesite with ttle calcite, limonite, jarosite, manganese, and gypsum.

Limonite and jarosite are the best indications ofe, though on the 135-foot
el occurs some primary bouldery ore with milky white vuggy quartz gangue carrying
seminations and small bunches and bodies up to 3/4 inch in diameter of galena,
ite, chalcopyrite, light-brown sphalerite and argentite (?). This ore, which is
e 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
ccia, 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
ssure. Some of the ore boulders have been fissured or broken in halves and the
ts recemented by comby banded veinlets 1/3 of an inch wide of later quartz.
e contain nuclei-like inclusions of fragmentary andesite up to 3 inches in
imum dimmansion, which also are cut by quartz veinlets.

The microscope shows this bouldery 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
n orthoclase, some in perfect rhombohedral crystals.

When visited by the writer in 1916 this ore was well exposed in the east
t on the 135-foot level where it formed an ore shoot 8 feet wide, of which
th 2 feet on the hanging wall side in the last 30 feet of the drift was said to
about $53 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
ably argentiferous and both it and the chalcopyrite are probably auriferous.

ter 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 imary bouldery ore is in general similar to the ore (spec. 728) from the upper ope of the Gold Pen mine, which also contains galena, chalcopyrite, and light-brown own sphalerite in milky white vuggy quartz.

The best ore is said to be the "fines" and to have much associated black nganese oxide. The andesite is more favorable for ore than the rhyolite and the uge 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 $8 ore and to the west of the shaft a 25-foot shoot of $3 ore.

Shaft No. 1

On the surface at 120 feet west of the shaft No. 1 are prominent siliceous tized croppings 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 feet or more of relatively pure quartz ore on the footwall side, which is succeeded bluish 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 l, 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, 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 ich 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 e is exposed both east and northwest of the shaft for about 250 feet. Northwest 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 terial which, however, carries only small values. The cross cut on the 400-foot vel is said to show ore containing much silver sulphides, argentite, stephanite, d a little chalcopyrite supposed to be primary.

On the bottom, or 550-foot level, the 35-foot crosscut to the southwest is in itic 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, 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 theast and northwest of the shaft as afore noted.

On the 135 level west the vein is ± 25 feet wide and has considerable $3.00 ore, t of the shaft the vein carries 10 feet of $8 ore and for 1,200 feet east it ries 7 feet of the primary bouldery quartz sulphide ore. Also on this (135') el, as shown by a crosscut 1,200 feet southwest of the shaft, there occurs at feet northeast of the primary bouldery vein a 75 foot mid-zone of hydrothermally red crushed, but hard/dark-greenish chloritic andesite porphyry (740-A) which ractures and cleavage contains much MnO in dendritic form and carries icient free gold and cerargyrite to constitute low-grade ore, though it not as yet be regarded as an important asset of the mine.

The gold and cerargyrite in this zone apparently are of secondary deposition 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 radial fibrous actinolite derived from biotite and hornblende and forming in ces "spherulites". In the mass occur phenocrysts and fragments or remnants basic plagioclase in prisms and lathes, also hornblende, biotite, small bodies calcite, sericite and magnetite. Here we have apparently a 75-foot oxidized e of secondary ore separated from the primary ore vein along the fault by 125 t of less altered country rock andesite. This latter andesite is the same as t 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 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 ow the first or ~~125~~ 135-foot level. This probably is in large measure due to fact that below the 250-foot level the mine is mostly in rhyolite, which rock, gh hydrothermally altered, seems to have been less favorable for ore deposition 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. ver, 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 nd along the ~~Rif~~ Big fault, or mineralization zone, has been all staked for a th of about 3,000 feet, and to a less width for about 2 miles northwest of the d mine. It contains prospects at a dozen or more points, among which the elope, 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 ched and altered andesite and dips steeply southwest into the mountain. It is ned mainly by a 100-foot shaft and a 200-foot tunnel. It contains much good king 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 sist 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 llow depths of 100 to 150 feet.

Randall prospect

The Randall prospect adjoins the Antelope prospect on the northwest. It ewise is opened by several hundred feet of work and is said to be similarly mising.

Salt Lake prospect

The Salt Lake Prospect, owned by the Salt Lake Mines Company of Reno, is three- rters of a mile north-northeast of, and just over the crest of the mountain, from Rand 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 ted 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 ntry rock andesite that dips 60° NNE. It is composed mainly of glassy lustered rtz breccia, is firmly cemented, more or less vuggy and is stained yellowish-green h jarosite and reddish and blackish with hematite and manganese. It is ned 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 rorable 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 t 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 ee feet wide and associated stringers dip 70° SWW in whitish leached andesite. stained with limonite and jarosite and is opened by a 50-foot tunnel and ot 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 we in depth. Nearby the less altered andesite as exposed on the southwest basic iron gray hornblende biotite rock with fluidal structure and contains derable magnetite. The prominent ("Beacon") hill surmounting the ridge on the hwest is said by Montgomery to be composed of rhyolite. The vein is said to 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
h elevation of about 5,800 feet. Fig. 3.

They differ markedly from the Tertiary deposits afore described in the Cabbs
lley Range in that they occur in the Jura-Triassic limestone on its contact
h quartz monzonite porphyry, a mesozoic granitic intrusive with which they are
ctically connected, and are, therefore, for the most part probably contact
amorphic deposits.

Over a considerable area surrounding the deposits outside the garnetiferous
silicate rock zone, the country rock limestone has been completely metamorphosed
a gray medium-grained crystalline marble, as at the Brink deposit. (Spec. 702).
fractures and joint planes are coated with whitish clacium carbonate nearly
10 inch in thickness.

The quartz monzonite porphyry is a dull gray medium-grained, granitic rock,
taining 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
nging from oligoclase to andesine), orthoclase, and quartz, and 10 per cent
mblende, biotite, augite and other minerals, including sphene, apatite, and
yl. The ferromagnesian minerals are mostly altered to greenish chlorite and
n oxide.

The Kelly Copper prospect, or so-called "copper mine", owned by Joe Kelly,
s on the southeast side of the Nugent Wash road at about 1/5 of a mile northeast
here it crosses the saddle of a low northward sloping ridge and is easy of
ss. The deposit or ledge is on the quartz monzonite-limestone contact. It
ccompanied by the usual contact garnetiferous and silicate rock zone. It
trends northwest-southeast, parallel with the reef-like quartz monzonite
ing and on the southeast is said to have an extent of a mile. Openings on it

end for an eighth of a mile northwest and one-third of a mile southeast of the sent prospect. Sheeting 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 silicated 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 per or amorphous silica with opaline luster, light-brown chert, or flint and a r-brown or yellowish-brown jasperoid silica. Veinlets and stringers of the n 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 ittle copper, particularly the brown rock which is associated with or forms of the ore, as does also a hematite limonite-stained quartz rock breccia which present in considerable amount and largely gives the ore pile and dumps their wn color. In places also the quartz monzonite is garnetized.

Most of the ore consists of medium- to fine-grained hematite in a siliceous rix and contains, together with chloropal, chrysocolla and a little malachite, rite, and chalcocite. There is also present fine-grained magnetite. Much of ore is a blackish pale greenish speckled mass being composed mainly of hematite chloropal. Fracture planes of this ore are heavily coated with chrysocolla. 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 utions that arose from the quartz monzonite magma and circulated through the

fissures and fractures soon after the intrusion and consolidation of the quartz
nzonite. By the solutions the ore minerals were originally deposited as fine-
pyrite
ined cupriferous ~~pyrite pyrite pyrite~~/including possibly a little chalcopyrite
small bodies and disseminations in the fissures, fractures and wall rock lime-
one which may have been arenaceous, as suggested by the siliceous sandy matrix
nd in some of the ore. There is also suggestion that some of the ore may replace
rtz monzonite. The deposits were formed at considerable depth, but after a long
riod of erosion were subjected to oxidation and leaching by surface waters which
ocesses oxidized the pyrite to hematite, limonite, chlorophal, magnetite, and
erated the copper which with one or more other elements respectively formed
lachite, azurite, chrysocolla and chalcocite, the present ore minerals. It is
ssible that due to leaching and concentration by redeposition, the deposits may
found to be enriched in depth.

Brink prospect

The Brink Copper prospect owned by Newt. Brink, is about a mile southwest of
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
pper King No. 7 claim, and is said to have been located in 1917. Most of the
velopment work, however, seems to be much older. It is in the gray crystalline
ntact metamorphosed limestone (702) with fine-grained intrusive quartz monzonite
pping a few hundred feet east between the prospect and the road, and which seems
be related to the monzonite at the Kelly Copper prospect. The bed rock is mostly
vered by a surface covering of rock debris.

The deposit is opened mainly by a 40-foot incline shaft at the bottom of which
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° westerly and seams of the crushed and sheared rock. About 10 tons of the ore said to average per cent in copper lay on the dump. The ore mineral is mostly bluish-green ysocolla in a brown to dark-brown siliceous ferruginous gangue composed mainly altered hematite and iron carbonate including probably siderite. Besides, the ysocolla there is also present a little residual chalcopyrite. Associated with 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 posit, the copper minerals having been originally deposited as cupriferous ite and chalcopyrite.

Kelly Mica prospect

The Kelly mica prospect, owned by Joe Kelly, is a short distance south of Kelly Copper prospect afore described. It seems to be on the same general rtz monzonite-limestone contact as the copper prospect, and is genetically nected with the quartz monzonite, some of which as E forming the hanging wall the lower mica bed in Fig. 96, though not pegmatitic, is coarser grained and tains 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° W. dips about 40° W., Fig. 96, and contains as its principal economic feature 2 s or "dikes", C and F, of mica aggregating more than 4½ feet in thickness, the twall of bed F not having yet been reached.

In the beds the mica occurs in a siliceous matrix. It occurs in the form of ks or booklets which range up to about an inch in thickness and 3 inches in th or whose largest available plates will yield circular plates 1½ inches in meter. This is about the smallest size used in commerce and is known as "punch"

The mica is dark or nearly black, and is, therefore, regarded as biotite. The t of it has also a greenish tinge which is attributed to partial chloritization to oxidation.

Kelly graphite prospect

The Kelly graphite prospect, owned by Joe Kelly, is near the Kelly Copper and lly mica prospects afore described. The country rock is the liver-brown jasper ich contains some disseminated hematite and probably represents altered silicified estone. The deposit consists mainly of a 2-foot wide vein which lies mainly in jasper, though at the collar of the shaft the hanging wall is a fine-grained litic quartz monzonite with which the deposit is probably genetically connected. vein dips 50° southwest about parallel with the structure or jointing in the sper which toward the vein contains seams or stringers of graphite up to 2 inches width.

It is opened by a 16 ft. shaft with a 10 ft. crosscut to the southwest at the tom and drifts in either direction which show it to contain considerable fairly e amorphous graphite in tabular shoots ranging up to 3 inches or more in width. ally the graphite shows lamination due to pressure and is slightly streaked some lamination planes with red hematite. The deposit seems worthy of exploration commercial graphite.

Buckley prospect

At Buckley camp, (abandoned), 4 miles west of the Kelly Copper prospect and les southeast of Nolan, the deposit is said by Lappat to consist of several small tz veins that contain a little disseminated free gold. They are on a granite-tone contact and are capped with iron gossan. Fig. 3, (Topo map).

MACKAY SCHOOL OF MINES
UNIVERSITY OF NEVADA

CARSON SINK AREA, NEVADA

By

F. C. SCHRADER

Holy Cross (Terrell) District (7)

Holy Cross (Terrell) District

The present report is based mainly on a 1½ day examination of the district ade by the writer in August 1913, in which, for aid generously extended, thanks e 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 les south of Fallon and 14 miles northeast of Shurz, the nearest railroad station the Hazen-Goldfield Branch of the S. P. Railway, from both of which it is reached a good road. It is in the southwestern part of Churchill County and the adjacent rder of Lyon and Mineral counties and is on the Carson Sink topographic sheet of e U.S.G.S., Fig. 3. It is mainly in the northeast slope of the southern part of e Dessert Mountains with Terrell the camp located on the gently sloping wash or lley 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 g. 100 (Photo). Though the topography is semi-rugged as is characteristic of oded Tertiary volcanic rocks, the deposits are not ~~difficult~~ difficult of ccess.

The deposits are nearly all contained in an east-west rectangular area 2 les long by one mile wide with Terrell located in the northeast part. The area drained northeastward into Terrell valley which has no outlet. The climate is ry dry, the annual rainfall being only about 5 inches, but good water occurs at pths 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 George Pollinger on the Silver Star claim. They were soon joined and financially ded by Craig Catterson of Oregon and the trio sunk a shaft 107 feet deep and crosscut

he vein with encouraging results. They finally acquired a group of 24 claims hich they bonded, in July 1911, to George Wingfield. This group contains most f the mines and prospects described in the present report and they nearly all ad been discovered by 1913.

In 1912 the district was quite active, the Loma Mining Co. in driving a 160-foot unnel had struck a 1-foot wide vein of mostly galena, and when visited by the riter in August 1913, the camp had 30 cabins and tents and the July shipment was aid to have been 10 tons of ore averaging $68 to the ton. The cost of ore haulage Shurz was $4 per ton. In 1914 the Minerva Mining Co. of Minneapolis, Minn., lver-lead-gold ore, and considerable nickel was reported to have been found in me of the ore by Francis McDonough and associates who were working an 8-foot vein. 1915 the Scotia mine was reported to be active. In 1918 several tons of manganese re were mined and shipped by the Bullion Company.[1] In 1919 there was moderate

1/ Pardee, J. T., U.S.G.S. Bull. 710, pt. I, p. 233.

tivity. In 1920 the Minerva Company, with a shaft 95 feet deep, mined and made shipment of copper ore containing silver,[2] and in 1921 a small shipment of

2/ U.S.M. Res. 1920, Pt. I, p. 328.

liceous gold-silver ore was made from the Last Hope mine[3].

3/ U.S.M. Res. 1921, Pt. I, p. 379.

The total production of the district seems to have been about 150 tons of stly high-grade ore having a value of $9,000. Complete records, however, are t available. The principal ore shipments to 1913, as given by the several ning companies appears in the following table.

ine	Tons	Value
ilver Star	11.0	$ 920.00
ast Hope	5.5	1,124.00
ast Hope No. 1	6.2	543.00
ast Hope No. 3	00.5	78.00
lack Butte	1.5	150.00
oorman	2.8	172.00
ump	11.0	1,958.00

Statements on the production from 1913-1927 appear in the U. S. M. Res. reports or instance in 1916, "The Silver Star, Pyramid, Fraction, and four other properties roduced an output valued at $1,522 in gold, silver, copper, and lead, but in most ases the quantity or value of the ore is not given. The Silver Star mine and the ast 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 ompressor drills and engines and most of them are opened to depths of 80 to 100 eet. The occurrence of water at depths of 90-100 feet in the front part of the ountains seems to explain why more of the workings have not been sunk much below he 100-foot level. In 1915 there was talk of putting in a mill to treat ore that s too low grade to be profitably shipped.

Geology

The geology at Terrell and vicinity consists mostly of Tertiary volcanic ocks, rhyolites, and andesites, and related types and phases disposed in flows hat are more or less heavy.

Proceeding from the foot of the range southerly and ascending in the geologic olumn the succession of the principal rock formations, broadly speaking, is as ollows:

(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 trending 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 ~~imfx~~ referred to 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 submedium hornblende biotite andesite porphyry speckled with lighter gull feldspar phenocrysts and abundant smaller forms including those of hornblende and biotite. About 70 percent of it is composed of microcrystalline nearly felsitic base 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 as 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 ~~pinnacle~~ pinnacle-like terminations.

White rhyolite

Next above and back of the front andesite the white rhyolite occupies about ½ 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 lithoidal texture and is a tuffaceous rhyolite standing near trachyte (spec, 439 and 444). About 80 percent of the rock consists of a crypto-crystalline to glassy base. In places where the rock has been hydrothermally altered it is profusely speckled with small rust brown cavities from which disseminated fine-grained pyrite has been 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 afore-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 ~~xxxxx~~ Scotia mine, are decidely manganiferous.

The veins are composed mainly of faulted and crushed mineralized andesite taining or heavily stained dark brown or blackish with iron and manganese ides. They are generally calcareous and with little or no quartz. In places sociated with the veins are mineral-bearing stringers. Both veins and stringers ry 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 tend 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 ntact. Some stringer zones are as much as 200 feet wide and 1,000 feet long.

Mineralogy

he ore minerals are mainly cerargyrite, gold, argeritite, galena, chalcopyrite, pyrite, malachite, gran. and manganese oxides. The galena seems to be entiferous.

Source of the deposits

The deposits seem to be of hypogene origin and to have been formed by magmatic rthermal solutions whose circulation through the tissues and fractures followed tions of one or more of the Tertiary volcanic rocks especially the white rhyolite. were originally deposited as sulphides, the primary ore minerals being mainly te, argentite, galena, chalcopyrite, and rhodochrosite ?. The pyrite was auriferous some of it cupriferous, the argentite auriferous, the galena argentiferous, the copyrite auriferous, the rhodochrosite argentiferous. From most of these rals as they through the agency of erosion were exposed to oxidation the ent ore minerals--gold, cerargyrite, copper carbonates, oxides of iron and man- se 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 small shoots of good-grade silver-gold ore such as have been mined and of which ere seems to be a considerable reserve. Below ground-water level in the sulphide ne the deposits will be found to be leaner and some of the veins too small to be ofitably mined to any great depth.

Mines and prospects

The district contains about 20 small mines and prospects the most of which are med in the following list and a few of which are described.

Mines and prospects in the Holy Cross (Terrell) district:

me of mine:

Water Shaft	Cripple Queen
Scotia	Black Butte
Milton	Anchor
Lost Hope	Pyramid
Lost Hope 1	Minerva
Lost Hope 3	Silver Star
Terrell	Poorman
Wingfield	Bullion
Darr	Loma
Jump	

Water Shaft mine

The Water Shaft mine is about 400 feet west-southwest of Terrell on the Silver tar claim at an elevation of about 4,400 feet. The vein strikes about N. 80° E. n the front andesite at about 200 feet northeast of its contact with the overlying ite rhyolite, and stands about vertical, has a width of about 3 feet on the 100 level,

known extent of 700 feet at the shaft. It is composed mainly of oxidized erials, impure calcite, and other carbonates stained dark brown and blackish with and manganese. In places it has a crudely banded structure and resembles re travertine.

The vein is opened to the depth of 107 feet by a vertical shaft and a 115 cross- on the 100-foot level. Water was reached at the depth of 94 feet and it soon e to the 80-foot level.

At the depth of 50 feet the vein is faulted 105 feet to the south and just west the shaft a 10-foot lateral fault to the south shows on the surface. From just ond this fault 10 tons of $68 ore was mined and shipped in 1913. The value of ore is nearly all in silver, contained in cerargyrite, but the ore carries also ut $2 in gold to the ton.

West of the shaft the vein has a known extent of 700 feet and is so offset by faults that the westerly part of its course is S. 65° W.

In the hydrothermally altered wallrock north of the vein there occur at inter- ls brown oxidized stringers 2-16 inches wide, said to carry good values in silver.

Scotia mine

The Scotia mine, owned by the S. Consolidated Co. of Boston, is 1/5 mile west Terrell on the Silver Star No. 2 claim at an elevation of 4,390 feet or but 10 et lower than the neighboring Water shaft mine. It was reported to be ~~xxxxxxx~~ tive in 1915.

The vein dips steeply to the south in the front andesite with a small body or e ? of the white rhyolite exposed a few hundred feet down the slope to the north- st. It is opened mainly by a 150-foot deep shaft 300 feet of crosscuts and a ift extending 100 feet west of the shaft on the 100-foot level. Water was reached 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

In the workings east of the shaft the rock is altered, and the ground t, and caving shows stringers or vein material to have been dragged by faulting. definite 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 ec. 445). They and the ore are composed mainly of crudely banded calcareous k material containing or stained dark brown and blackish with manganese oxide iron and is similar to the ore in the Water Shaft mine. They contain parallel aks and also small cross veinlets of impure calcite.

In the east crosscut jointing in the andesite dips 45° W., and is locally tersected 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 uth 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 the front andesite but extends southwestward into the white rhyolite. It dips 0° northwest. It is opened mainly by a 600-foot adit tunnel drift that extends uthwestward and is equipped with a 15-horsepower Morse-Banks compressor. The urse of the vein and drift is not entirely straight, At about 100 feet in from e portal of the tunnel a 40-foot section of the vein is cross-faulted about 20 et to the northwest or hanging-wall wise and at about the 250-foot point in from e portal the vein ? and drift fork, the so-called right drift continues its uthwest course on the main vein to the 300 ft. point while the left drift follow- g a branch or stringer extends southward to the 600-foot point, with the last 0 feet or more in the rhyolite.

The vein is composed mainly of faulted crushed and mineralized andesite con-
ining or being heavily stained with iron and manganese oxides and with but little
artz.

In the rhyolite the vein is composed of crushed and recemented rhyolite stained
th iron and manganese oxide and both vein and rhyolite wall rock are pressed and
minated 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 run s
out $10 to the ton in silver. This is essentially true for the 2-foot wide faulted
ction extending from the 100 to the 150-foot points in from the tunnel portal.
st beyond the faulted section 6 inches of the vein is said to average $40 to the
n and at the 200-foot point where the vein is 5 feet wide and has a good hard
nging 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 ¼ inch
de 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
5,050 feet. It is on an east-westerly vein that dips southerly in a narrow belt
front 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
th drifts and laterals on the 50 and 100-foot levels. At the time of visit in 1913,
e company was doing development work, from which it had shipped 7 tons of good-
de ore, and several tons of low-grade ore lay on the dump. Some of the ore is
d to be very rich and to run several hundred ounces in silver and $90 in gold
ton.

Also, a small lot of siliceous gold-silver ore was shipped from the mine 1921. 4/

4/ U. S. Min. Res. 1921, Pt. I, p. 372.

The vein is from ¼ ft. to 4 ft. wide, but in its wider portions the ore values cur mainly in a series of parallel stringers. At the surface the vein follows a int plane and has a dip of 50° but the dip flattens with descent to the extent at in the bottom of the mine it is only about 25°. On the 100-foot level the ne for some distance follows the andesite-rhyolite contact, but the ore is best veloped in the andesite. It was later reported that at greater depths the vein nches out on the contact. The ore is silver-gold ore, but it contains also conderable lead and a little zinc, especially on and below the 100-foot level. The e minerals are cerargyrite, galena, which is probably argentiferous, pyrite, and matite, and specularite. Gypsum in the form of bands and stringers forms a nsiderable part of the gangue and in the more oxidized ore at shallow depths the e is stained reddish and blackish with hematite and manganese and besides calcite d quartz contains also a considerable quantity of other carbonates, judging from s calcareous nature. In the deeper part of the mine the ore is mostly sulphide. 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 000 feet.

Terrell mine

The Terrell mine is on the westward continuation of the same vein or fissure the Last Hope mine which here has a width of 2 feet, and is geologically and neralogically similar to what it is in the Last Hope mine except that it is better nded and contains more gypsum and galena and higher silver values. It has shipped veral tons of mostly high-grade ore. On the ridge westward from the mine the vein ems 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 lode composed of many mineral-bearing quartz stringers. The lode dips steeply east in 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 vein as the Last Hope and Terrell mines was said to have shipped $600 worth of high-grade ore, containing 60 ounces silver and $20 in gold to the ton. The vein is 2 feet wide. It is in andesite and the ore is mostly sulphide in the deeper part of the mine.

Darr mine

The Darr mine 1¼ miles southwest of Terrell is in a 2½-foot vein that dips 85° E. in rhyolite. It is opened mainly by a 40-foot shaft and is said to have shipped a 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 6,500 feet. It is easterly from the Loma mine. The property comprises an east-west group of 7 claims. It is on a wide mineralized zone dipping 60° northeasterly in andesite and other volcanic rocks that seem to form the northeast side of a dome uplift. The zone, however, contains a 2½-foot wide vein that carries considerable $22 ore. It is opened mainly by a 185-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 1½ feet of sulphide ore that runs $6.50 to the ton. Some of the concentrates assayed $150 in gold to the ton. The 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 iron and 3 percent zinc. A later shipment of 1,740 lbs. from one of the stringers ran $11.80 in gold and 190 ounces silver to the ton.

Bellevue prospect

The Bellevue prospect is 1-3/4 miles southwest of Terrell at an elevation of 420 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 gulch west of Terrell, at an elevation of about 5,050 feet. A few tons of manganese ore was shipped from it in 1918. The deposit consists of manganese oxides in a shear 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 wide northwest-southeast dike of dark hornblende biotite andesite porphyry.

The zone is 50 feet wide and extends east-westerly in which direction stringers and small masses of manganese oxide crop out more or less abundantly for the distance of about 3/4 of a mile. The structure dips gently northerly downstream.

The ore minerals are mainly psilomelane and pyrolusite that have replaced the ared rhyolite. The associated or gangue minerals are fine-grained silica and n oxides. Some of the deposit which is mostly of the pyrolusite phase though irly firm is very fine-grained arenaceous and contains uniformly disseminated ute particles of specularite. The better grades of the deposit contain tabular ies of fairly pure hard psilomelane an inch and a half or more in thickness.

According to a later examination and report 5/ "the greatest depth attained

5/ Pardee, J. T., U.S.G.S. Bull. 710, pt. I, p. 234.

the workings is 6 feet. The oxides probably extend to a depth of 25 feet. The rgest workable ore body which is 300 feet long and from 5 to 8 feet wide was timated to contain 10% of manganese and more than 20% of silica and the zone as a ole 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- ade product." "The deposits are in or associated with manganiferous silver veins t 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 rrell, is on a 2½-foot vein in andesite, of which 1 foot averages about $50 to the n, the values being nearly all in silver with small values in gold and copper. This thought to be on the same vein as the Loma and Sootia mines. 6/

6/ Churchill Co. Eagle, Mar. 28, 1914.

Anchor prospect

The Anchor prospect was being worked in 1913 by Darr & Timson, lessees, who d made two small shipments of $60 ore.

SCHOOL OF
UNIVERSITY OF HAWAII

By

F. C. SCHRADER

BEMWAY DISTRICT (S)

Benway District

The present notes are based on a half day's examination made by the writer in ust 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. e nearest available railroad stations, from which it is easy of access. It is 5 es 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 nty, near the Mineral county line and is 6 miles west of Terrell. It is in the thern 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 e camp located in the western part of the area where also most of the development rk is done. Most of the/northwestern part of the area is occupied by the Smith-Raines nway Group of 8 claims, which on the south is joined by a similar group, the Quinn- man group.

History and production

Thd district seems to be an old discovery. It probably is much older than rrell. 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 e depth of 330 feet was said to have found a 12-foot vein carrying considerable antities of ore running $7 to the ton mostly in gold. Several of the veins are ened by shafts and tunnels to depths of about 100 feet and one, it is said, to e depth of 330 feet.

Geology

The country rock primarily is the limestone-shale-sandstone series of jura-
assic age similar to what it is at Copper Mountain in the Rand district. It is
ndantly intruded by the mesozoic granitics which are mostly quartz monzonite or
osely related types as granodiorite and diorite. The older rocks are also intruded
in part overlain by Tertiary volcanic andesite and rhyolite, especially on the
rthwest. The sedimentary rocks have been much disturbed, folded and faulted. In
e western part of the area they dip southeast ?. Their dominant member is the
mestone. It is a light-colored to bluish gray banded dolomitic rock and con-
ins much magnesium. In the vicinity of the intrusives, especially the monzonite,
t is more or less silicated, or silicified and metamorphosed or partly crystallized
nd is traversed by seams and veinlets of calcite and quartz.

The dominant contact which is that between the limestone and the quartz
nzonite lies in the northwestern part of the area. It trends northeasterly and
ips southerly with mostly limestone on the northwest and quartz monzonite on the
outheast. It extends from the Eureka ground in the northeastern part of the area
est-southwestward across the Appeal to Reason and neighboring ground.

(?) Quartz monzonite

The quartz monzonite is a gray or salt-pepper sub-medium grained massive rock
ith a reddish tinge, but in places contains much darker and more basic phases that
nd close to diorite. It is perhaps the most important of the igneous rocks
ecause the ore deposits seem to be genetically connected with it. It and the older
cks are cut by dikes of a light-gray or pale-pinkish finer-grained aplitic
nzonite complementary to the quartz monzonite, which, in turn, together with the
der 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
olite.

Deposits

The deposits consist mainly of a series of 10 or more veins that strike nearly t-west (N. 75° E.) and dip steeply south, mostly in quartz monzonite and limestone h whose 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 m are said to have an extent of about a mile.

The vein filling is mostly crushed or sheared and altered rock, quartz and illaceous 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

There 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, lcopyrite, and pyrite.

her minerals present are:

Dolomite

Graphite

Molybdenite

Psilomelane

Pyrolusite

Stibnite

Tourmaline

Source of the deposits

The deposits are of hypogene origin and are genetically connected with the rtz monsonite. They are, therefore, of late Cretaceous or early Tertiary age. y were formed for the most part by heated magmatic solutions that circulated ough the rocks soon after intrusion and consolidation of the quartz monzonite. y were originally deposited at considerable depth as the sulphides - argentite, lcopyrite, and pyrite all these minerals perhaps being sparingly auriferous, and m them, on their being exposed to oxidation by erosion the oxidized or secondary nerals were derived and by process of leaching were concentrated at lower levels places in sufficient quantity to form ore.

Mines and prospects

The following notes on a few of the deposits may help to convey a fair idea the deposits as a whole.

Copper King prospect

The Copper King vein is said to have an east-west extent of more than a mile. ere opened by a 70-foot deep shaft on the Copper King claim of the Quinn-Newman oup it lies in quartz monzonite. It is about 4 feet wide and dips 70° south. It composed of mainly crushed quartz monzonite and quartz of which 1½ feet of e more siliceous malachite-stained part was said to carry about 10 percent copper d 30 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 at 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. SCHRADER

STILLWATER RANGE DISTRICTS (9)

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 ~~Rinta~~ 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 unavoidably very brief due to the fact that many of the mines were idle and access was 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 28 miles southeast of Fallon on the Lincoln Highway. It is in a low part of the Stillwater 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-westerly 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 at 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 ranging 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 or leelike 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 6,000 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 ith good results, following which he and C. W. Kinney jointly sunk a shaft to the h 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 tional shafts and shipped 150 tons of ore that ran from $125 to $300 to the ton. 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 ew York firm are said to have averaged ~~xmxx~~ $15.80 to the ton, the values being rly all in gold.

In 1924 the mine was purchased by Senator N. H. Getchell, who incorporated the perty as the Dan Tucker Mining Co. with a capital stock of a million dollars. company soon began working it, and discovered an additional 3-foot wide shoot high-grade ore.

The veins strike northeasterly and dip northwesterly into the mountain. The is mostly a siliceous honey-combed light-reddish free milling quartz. 1/

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 er 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 ntually leased to the Rosetta Mines Co. and was becoming active under the stimulus higher prices for gold and silver.

At about 1,000 feet east of the shafttrenches 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
t 5 feet of the vein in the face of the drift ran $18 in gold and silver 2/.

2/ The (Salt Lake) Mining Review, Vol. 36, No. 19, May 8 and May 29, 1934.

Kinney prospect

The Kinney prospect owned by C. W. 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
duction. 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
altic andesite and is also associated with hydrothermally altered light-colored
hoidal 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 [illegible] under-
ound workings. It is composed largely of laminated and bladed quartz and adularia
eudomorphic after calcite or other spar as is characteristic of many veins in the
rtiary 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
e 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
0-foot deep incline shaft sunk on the vein. The ore is mostly gold ore. At the
pth of 50 feet a considerable body of the ore ran about $28 to the ton and contained
e 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 allel the vein and at about 75 feet to the north on the footwall side occurs a rdinate but similar vein which probably also contains ore.

Gold Hope prospect

The Good Hope prospect owned by Clayton Blakely and associates is 2 miles east-theast of Sand Springs. Fig. 3. The vein is said to have an extent of 4,000 feet. m specimens of the rock and ore shown the writer the rock seems to be amphilolite the vein to be genetically connected with intrusive quartz monzonite or diorite. therefore seems to belong to the late Cretaceous or early Tertiary group of deposits. ore is said to carry fair values in copper, gold, and silver. Some of seems to be replacement in the amphilolite.

Mountain Well (LaPlata District)

The Mountain Well, Laplata, or Chloride district is at Mountain Well and vicinity out 28 miles east of Fallon. It is mostly in the upper east slope of the Stillwater nge which here has a width of almost 18 miles. Fig. 3. The deposits are mostly ntained in an east-west nearly square area, several miles in extent, between the evations of 5,500 and 6,500 feet.

History and production

Mineral in the district was first discovered about 1860 and the "town of plata was founded in 1862 and made the county seat and mining center of the region, d by 1866 there were three mills in the district. But the boom was without equate mineral foundation.

The deposits became exhuasted about the time of the White Pine rush in 1868, ereupon the district became deserted for the new discovery, and the county seat s moved to Still Water".[3/]

3/ Lincoln, Francis Church, Mining Districts and Mineral Resources of Nevada, 3, Reno, 1923.

The production is said to have been mainly several thousand dollars worth of
on 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
ngs were 100 feet deep, and the amount of development was comparatively small. 4/

4/ J. Ross Brown, Report on the mineral resources of the States and Territories of the Rocky Mountains, In 1866, p. 128, Wash. G.P.O. 1867.

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 lime and quartzite and it is intruded
ranite and porphyry with which latter rocks the deposits seem to be genetically
ected. 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
adically in pockets or bodies up to several feet in extent chiefly at the inter-
ion of veins, fissures, or dikes and to afford little opportunity for systematic
ng.

"A little silver ore was shipped from the district by prospectors in 1919 and
". 5/

5/ Lincoln, op. cit.

Job Peak district

Job Peak is about 12 miles northeast of Mountain Well. It stands at an alti-
e of 8,806 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
tons of ore that ran 31.9% 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

is said to be in quartz monzonite and is opened by a 40-foot shaft all of which, drifts at the bottom, are in ore.[6/]

6/ Mining and Engineering World, p. 873, Nov. 27, 1915.

Dunderberg mine

The Dunderberg mine is in the east slope of the Stillwater Range at about 4 miles theast of Job Peak, 4 miles south of IXL Canyon, and 2 miles south of Mud Springs. is in a cliff or steep slope of the mountainside. The vein is in dark slate- ored massive limestone and intrusive granite with which latter rock the deposits n to be genetically connected. It is opened by 300 feet of work, which is mostly nel. The metals it carries are chiefly silver and gold, with also some lead and race of copper.

IXL district

Location and topography

The IXL district is at IXL Canyon and vicinity, on the east slope of the Still- er Range 40 miles northeast of Fallon and 70 miles southeast of Lovelock, mostly ween the elevations of 5,000 and 6,000 feet. It is opposite the Cox Canyon (Silver ll) district which is in Cox Canyon on the west side of the range. The two districts ur on the same east-west zone of mineralization which extends across the range. range here has a width of 8 miles and a relief of 3,000 feet. The Pass between two canyons stands at an elevation of nearly 6,900 feet. The topography is ntainous as expressed in Fig. 3.

Water occurs in small springs in both canyons and in a 70-foot deep well at the th of Cox Canyon at about 1/5 mile out from the foot of the mountains. In Desert l, which is a county well, 3 miles southwest of Cox Canyon, the water level stands 40 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 e old Kellog mine near the head of the canyon, were worked prior to 1880, and in ni-early days the Motini mine, it is said, shipped 300 tons of ore that averaged out $450 to the ton.

Development

The deposits are developed mainly by tunnel, of which there are several thousand et 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, d quartzite, belonging to that formation. In general, they dip east and have been ch disturbed and crushed and are intruded by Cretaceous granodiorite, and volcanics, re referred to the Tertiary age, but some of which may be older. In places they ve been hydrothermally altered or metamorphosed by the granodiorite, the limestone places being crystallized, silicified, and silicated with the development of tamorphic minerals, garnet, specularite, etc.

The granodiorite is a gray-medium-grained massive sub-porphyritic rock composed inly of olig-andesine, microperthite quartz hornblende and biotite. It contains as cessories magnetite and titanite. It locally contains dark salt-pepper fine-grained sic segregrated inclusions up to 4 inches in diameter that correspond to hornblende-otite-quartz-diorite.

Deposits

The deposits are nearly all contained in a belt about 3,000 feet wide by 2½ miles ng, extending from the crest of the range easterly down the slope and IXL Canyon,

t of the ground being covered by several groupd 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
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
em 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
desite. The silver and gold occur both free and in the sulphides, pyrite, galena,
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
ing mainly silver.

At the time of visit a considerable quantity of mostly oxidized ore lay on
e 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 1½ percent
ickel.

The vein strikes northeast and dips 45° southeast with granodiorite forming the
otwall and gray limestone and slate the hanging wall. It is exposed through a
rtical range of about 500 feet. At the elevation of 5,400 feet the country rock,

rse, crystalline limestone, strikes northeast and stands nearly vertical as does
o the vein which here consists mainly of oxidized mineralized limestone and other
k heavily stained with oxide of iron and manganese and contains a little pyrite;
e is traversed by calcite veinlets.

At the elevation of about 5,300 feet the vein is opened by an adit tunnel that
s 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
estone except that it locally follows mineralized beds dipping southeast. The
estone is crushed and fissured. Some is soft, altered, massive, crystalline,
e silicified and silicated, and some is cavernous.

At 50 feet southwest of the tunnel portal the course is crossed by a dark
netiferous zone containing, besides crystalline and silicated limestone and a
ttle quartz, considerable greenish garnet and magnetite, which latter minerals
ve the material a high specific gravity. The deposit is said to carry fair values
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
ne is opened by a lower tunnel, and here also the ore piled on the dump is of
gh 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
be of much value.

Black Prince prospect

The Black Prince prospect owned by Chas. Mottini and nephew is westward up the ntain 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 prises the Black Prince group of several claims.

Angle-American prospect

The Anglo-American prospect is in Calvert Canyon about a half mile northerly n the Mottini mine and IXL Canyon. The country rock here is the thin- to medium- ded black silicified slate or quartzite, the black in places alternating with ve greenish layers or bands ranging up to 1/3 inch in thickness. It strikes th 60° east, and dips 80° 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 microscopic ite which mineral also occurs in minute seams and thinly coats joint and bedding nes. Small calcite veinlets are sparingly present, mostly parallel with the ding.

At 70 feet west of the tunnel the quartzite is cut by a 60-foot wide gray ium-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 ned 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 800 t. It then had ~~xxxxxxxxx~~ attained a length of 200 feet at which point the itic rocks show pronounced slickensides dipping 40° easterly away from the mountain ge 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
e 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,
estone, and shale, with interbedded andesite or other old volcanic rocks, all
iderably disturbed, jointed, cleaved, and crushed, and in places seem to dip
ward. The rocks are exposed at the mouth of the Canyon at an elevation of
st 4,300 feet where they include dark slate colored and light brownish silicated
estone and seem to dip westerly. They are much seamed with calcite and quartz
lets and are cut by a north-south 3-foot brown soft altered andesite dike which
ormably 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
nish earthy colored shale. At an elevation of 5,270 feet at the Lower Cabin and
r Cellar Tunnel they include a bed or reef of light blue limestone. Also at the
ation of about 5,440 feet at the site of the upper cabins they include another
e of light bluish limestone that extends across the Canyon.

Deposits

The Cox Canyon deposits occur mostly in veins in the rocks afore described. They
ain silver, gold, lead, and copper. The ore is mostly low grade. The vein dips
erly into the mountain. They are mostly covered by a group of 50 claims owned
he Silver Range Mines Co. which at the time of visit in 1913 had a camp near
mouth of the Canyon and another at about 4 miles up the Canyon. The Company was
esented by Davis, J. B. Conley, and Shaeraff.

The Company was said to have done 5,000 feet of underground work, mostly
eling 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
to the ton, and it planned to build a concentrating plant at the mines.

Near the mouth of the Canyon the fore front or foothills and ~~xxxxxxxxxxxx~~
ervening gulches seem to contain a north-south fairly well mineralized belt in
ch, at an elevation of about 4,550 feet, the deposits are opened mainly by a
-foot crosscut tunnel. The tunnel runs south 80° east in dark basaltic tuffaceous
d andesite (471) which at and near the face for a width of ~~xxxxxx~~ several or more
is pyritic with finely disseminated pyrite and chalcopyrite and locally on joint
ces is stained with malachite. At 140 feet in from the portal at the turn ~~xxxx~~ table
tion, a 115-foot drift turned to the north lies mainly in purplish dark massive
te rock and follows a several foot wide zone of fault gouge or breccia ~~xxx~~ and
shed and altered rock which conformably with the dominant bedding ? or structure
the rock dips steeply southwesterly toward the mouth of the tunnel. The zone is
tially mineralized with disseminated pyrite and chalcopyrite and in places is
d to constitute fair-grade ore.

Shady Run (Canyon) district

The Shady Run district is at Shady Run Canyon 36 miles northeast of Fallon in
west slope of the Stillwater Range between the elevations of 4,500 and 6,200 feet.
lies mainly 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
ilar to that at Rochester.

The deposits are said to contain gold, silver, lead, and antimony, and to include h antimonal silver deposits. They occur in well-defined veins whose croppings are minent.

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 llivan prospect opened by a 150-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 ge 38 miles northeast of Fallon, and 3 miles south of White Cloud Canyon, and pperhead, Fig. 3. A road is said to extend up the Canyon to the summit of the nge. This Canyon like Shady Run lying at the west lies mostly in the Mesozoic anite and in rocks of the Kaipato formation with its upper part extending in the ar Peak formation on the east. The deposits occur mostly in dark slate of the ipato formation. They are mostly covered by a score or more of claims lying in irly compact form. The most developed of the deposits are those of the Nevada ld Syndicate covered by 5 claims and having an east-west extent of almost 3/4 of mile. Fuel and water are available on the property. The principal vein, known s the Nevada Gold Ledge, has prominent craggy croppings. It is developed mainly by ree crosscut tunnels spaced about 100 feet apart, vertically. The tunnels, eginning with the upper one, are respectively 1120, 70, and 500 feet in length. ach tunnel, it is said, whows the vein to carry 3 or more feet of gold ore, that n the lower tunnel being at a vertical depth of 250 feet.

Iron deposit

At about ¼ mile north of Fondaway Canyon in the head of a short gulch at an levation of about 4,800 feet occurs a deposit of iron ore which is thought may be commercial value. It is owned by the Buena Vista Iron Mining Co. The lode strikes out north-south in quartzite of the Kaipato formation ? and seems to be associated th the contact of the quartzite with the underlying intrusive granite on the west ith which latter rock it is probably genetically connected.

The croppings are not prominent and the few openings made were too badly caved show much concerning the size or extent of the lode when visited by the writer in 30, but the dumps which contained chunks of ore several inches or more in diameter dicate the deposit to carry magnetite-hematite material of good grade and to probably e of magmatic origin. The ore is massive and has a very irregular fracture. Some it is in fact porous or vesicular as if pyrite or some other mineral may have been dissolved out of small cavaties. It is estimated by Mr. John T. Reid, who has studied he deposit and did the development work for the Company that the deposit probably ontains several thousand tons of fair-grade iron ore.

White Cloud district

Location and topography

The White Cloud district is at Coppereid and vicinity in White Cloud Canyon n the west slope of the Stillwater Range, 40 miles northeast of Fallon and 35 miles outheast of Lovelock. It joins the Fondaway Canyon district on the south, and the opper Kettle district on the north, Fig. 3. The principal economic feature is the oppereid mine which is located near the mid-length of White Cloud Canyon. The mouth r lower part 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 s based mainly on a report made by Ransome 7/ and by Lincoln 8/ and supplemental

7/ Ransome, F. L., op. cit., U.S.G.S. Bull. 414.

8/ Lincoln, F. C., op. cit.

rmation furnished by John T. Reid, Manager of the mine for the Nevada United ing Company, owner.

History and production

The deposits contain copper, zinc, lead, silver, and iron. They were discovered the site of Coppereid Mine in 1865 and worked on a small scale in 1871-73, and in in 1889-96, especially '93-'96, for copper ores, when a small smelter was in ration at the mouth of the canyon and a little copper ore was shipped by the pany. 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 ited Mining Company, was organized in 1906, with a capitilagation of $200,000 which later increased to $300,000; shares $1 par value; 240,000 shares were issued, and me development was done.

Since 1908 but little more than the required assessment work seems to have been ne on the property.

Development

The properties comprise several groups of claims of which 33 claims are patented. ey were mostly acquired about 1906 for the purpose of developing their copper, zinc, d iron deposits, which from prominent croppings, gossan and surficial development re supposed to give fair promise of commercial value.

The property is developed by tunnels, laterals, ahd shafts, aggregating about ,000 feet of work.

The principal development is the exploration, or main cfosscut, tunnel with its rtal located about 1½ miles up the Canyon from its mouth at an elevation of about ,200 feet or 1,200 feet above the neighboring Carson Sink Valley. In 1930 it was ,050 feet long, and 1,400 feet deep vertically beneath the outcrops and it produces onsiderable water. It is driven in the south side of the Canyon on a general course f 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
n tunnels, one of which has a length of 700 feet and 350 feet above the Twin tunnels
he top of the high ridge bounding the canyon on the south and containing the deposits.
he steep hillside between the main tunnel and the Twin tunnels are old shallow
dings made in the early '90's for oxidized copper ore, some of which, as noted, was
ted at the mouth of the canyon.

Geology

The lower part of White Cloud Canyon lies in granite, which has been intruded
many dikes of granite porphyry and some of diorite porphyry. Farther upstream
ard Coppereid the granite seems to grade into granite porphyry which still farther
tream is succeeded by a sedimentary series of limestone and shales of middle
ssic ? age which it has intruded and metamorphosed. The limestones are marmorized
altered by the development of metamorphic minerals, especially garnet and epidote,
the originally calcareous shales have been converted into dense siliceous hornstones
ally called quartzite. Still farther to the east, according to Ransome, the sedi-
ts are overlain by volcanic flows and tuffs that there form the crest of the
ge.

Deposits

The deposits occur in a wide zone of mostly mineralized limestone in the high
ge bounding the Canyon on the south. The mineralized zone strikes easterly from
intrusive granite porphyry sedimentary rock contact and dips about 50° N.

The deposits are contact metamorphic deposits and are sporadically distributed
the limestone and shale and its resultant hornstone.

On the top of the ridge above the Twin Tunnels at about 300 yards from the
nite-porphyry-limestone contact is a large outcrop of specularite containing in
ces a little sparingly distributed oxidized copper ore in the form of malachite.

ome estimates that there is probably about 150,000 tons of the iron ore material sed on the hill top and in shallow workings that penetrate the mass. Much of the erial is pure specularite ranging in texture from soft greasy rouge-like varieties coarsely foliated kinds. There are several of these massew of iron ore on the ridge. gh they are in the zone of mineralization they do nbt seem to be conformable with but appear to occur as pods, lenses, and irregular bodies that individually strike dip in various directions and do not occur in any definite vein. They contain con- erable 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 hillsides below them and along the drainage lines in tunnels and the canyon ow the portal of the main tunnel. The ocher is evidently derived from decomposed ite contained in the croppings by leaching of meteoric waters. A sample of the posit 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 e specularite masses on the ridge are the gossan of a large vein. They, however, nd only a little oxidized ore composed of chrysocolla, specularite, limonite, calcite, uorite, 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 pecularite, in places with much garnet and pyrite. In fact, the small amount of imary sulphide ~~xxxxx~~ 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 hornstone. These rocks are cut by many veinlets containing calcite, axinite, phalerite, pyrite, and chalcopyrite and pyrrhotite. In places they contain concretions several of these minerals up to 6 inches in diameter. Epidote is the most abundant ilicate.

The following cross section notes will help to convey a better idea of the acter and extent of the mineralization.

The portal of the tunnel is in white-buff crystalline limestone containing small es of specularite and in places much garnet and some pyrite, the whole forming 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 egnated with cupriferous pyrite which locally forms nearly solid masses. The te has formed by metasomatic replacement in the limestone and is xxxx without nite boundaries. This is probably the same zone from which oxidized copper ore mined near the mouth of the Tunnel in the early '90's, the cupriferous pyrite g the source of the oxidized copper ore. East of the pyrite deposits the limestone uch broken with many open crevices partly filled with earthy limonite by oxidizing ers.

At about the 1,000-foot point in from the portal the tunnel cuts a 20-foot wide eralized zone containing leached spongy gossan or honeycombed iron oxide said to y 0.2% in copper.

At about the 1,300 foot point the tunnel is said to pass through a 16-foot wide -bearing zone much of which runs about 8 percent in blackjack or 5 percent zinc. zone is said by Reid to outcrop on the surface at about 1,000 feet west of the se of the tunnel. The material is said to be similar to the "soft" zinc ore of 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 foot wide or body of rock containing disseminated sphalerite and chalcopyrite, and small egates 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 ef ore minerals are those of lead or zinc. An analysis of the material yielded c, 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 s 3 feet of vein material containing considerable chalcopyrite and pyrrhotite.

At about the 2,700 foot point the tunnel cuts considerable masses of specularite sociated 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 pper, 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 de containing masses of medium-grained pyrite and specularite much of it in sufficient antity 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 llowing:

	Percent
Iron	43
Sulphur	32
Silica	8

Gold .83 oz. to the ton.

The iron contained in the ore as sulphide and oxide is in about equal amount ing each about 26 percent. This zone the Company regards as the main iron lode scending from beneath the huge specularite croppings on the top of the ridge which, wever, is not proven to be the case.

A width of 8 feet on the hanging-wall side of the lode is said to average 60 nts in gold and .83 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 Ransome regarded the specularite throughout the deposits to be of ntact metamorphic origin, a primary contact metamorphic mineral and not derived by idation from pyrite. This view is farther strengthened by the similar occurrence f 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 he form of chrysocolla it is possible that small additional deposits of such ore y yet be found, at comparatively shallow depths. Also the sulphide deposits ccompanied by primary specularite such as have been formed in the deeper part of the in 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 id content, but their sporadic occurrence with no guide mark for the workings to llow in deep exploration where also much water has to be contended with seems to nder the deposits of doubtful commercial value.

South of Coppereid, the Company has found scattered copper croppings or porphyry opper along the strike of the rhyolite extending as far south as Desert well or Lees anyon about 14 miles northeast of Stillwater. 9/

9/ 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 outh of Coppereld. hey are owned by a group of prospectors.

Clipper Canyon prospect

The Clipper Canyon prospect, owned by the Buena Vista Kron Mining Co., is in lipper Canyon, the first deep canyon south of White Cloud Canyon, Fig. 3. It is

out 2 miles south of Coppereid and about a mile north of Mondaway Canyon. It is the north side of the Canyon at an elevation of about 5,000 feet, or 1,500 feet gher than the adjacent Carson Sink Valley. According to Reid, xxxx manager, for the mpany, it is on the contact of diorite forming the footwall on the north, and lassic quartzite forming the hanging wall on the south. 10/

10/ Reid, John T., Oral communication, Oct. 3, 1930.

It is probably genetically connected with the diorite.

The lode, roughly conformable with the rock formation contact, dips about 40° uth beneath the canyon and the high ridge bounding the canyon at that point. It is 0 feet wide and is shown by croppings 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 bor of the canyon and by cuts.

The ore is mostly fair-grade iron ore running about 60 percent iron and 2 percent pper, and it contains a little gold. It is magnetic and is composed mainly of agnetite and hematite, An inclined drill hole sunk from the bottom of the canyon and alculated to intersect the lode at the depth of 250 feet attained the depth of only 0 feet it is said because of the brecciated character of the rock. At this depth, wever, 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 145 feet hence the last drill core showed pyrite containing copper minerals from which the anagement inferred that it had probably reached the top of the sulphide zone. The reater part of this hole is in yellowish garnet which is probably a contact tamorphic deposit.

C. K. Copper Kettle district

The district is in Copper Kettle Canyon or Grimes Canyon and vicinity in the slope of the Stillwater Range. It adjoins White Cloud District on the north extends to the north edge of the map, Fig. 3. It was discovered about 1908. It tains 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 dings on a large group of claims owned by Welsh & Green. The ore was oxidized and tained copper oxides and chalcocite [11]/.

11/ Lincoln, Francis C., op. cit. p. 2.

Iron deposits

The iron deposits in the Copper Kettle district occur in the lower west front or thills of the Stillwater Range at an elevation of about 4,700 feet. They occur 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 mouth of Copper Kettle Canyon, interruptedly southward for the distance of about iles, and is separated from the canyon on the east by a prominent ridge from 1 to iles wide (Fig. 3).

The deposits are owned by the Buena Vista Iron Milling Co. They were not visited the writer. Data for the present statement have been kindly supplied by John T. d, Manager for the Company.

The iron lode or zone of mineralization occurs along the contact of intrusive rite porphyry that formed the footwall and Triassic quartzite that forms the ing 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 ned, owing, however to the eroded state of the quartzite and the heavy cover of ey fill abutting the lode, the contact of the lode with the hanging wall quartzite arely exposed.

At several points along its course the lode has been prospected by shallow ts, one of which is 50 feet deep. The ore is composed mainly of magnetite and tite. Tests made indicate it to be of good grade.

The croppings and openings show considerable ore in sight from which the Company imates a large tonnage in reserve.

North group

The north group of the iron deposits occurs 2 miles north of the mouth of Copper le Canyon in the western slope. A low ridge which here separates the southern inage of Buena Vista Valley on the east from Caronn Sink Valley on the west. It near the north edge of the map and the Pershing County line, Fig. 3, and is easy of ess. It corresponds to group No. 3, or Iron Mountain Group of the Buena Vista Co. n deposits. It is owned mostly by John T. Reid. The deposits are covered by eral groups of 16 or more claims. They have an east-west extent of nearly 2 miles a width of about a mile, and they outcrop through a vertical range of about 300 t, Fig. 3. Part of a principal mass or lode, the Iron Mountain lode forms a b-like hill several hundred feet in diameter, that stands 80 feet above the base its outcrop.

History and production

Assessment work was done on the property in 1898 and about 1911 considerable itional 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 p. The average of 3 analyses made of samples from the main mass of this deposit lded the following:

	Average percent
Iron	66.87
Phosphorous	.011
Silica	2.24
Manganese	.071
Sulphur	.668

Geology

The deposits seem to be genetically connected with intrusive diorite and green-
ne especially on the footwall side. At Iron Mountain hill and vicinity they in
eral have a crudely bedded structure that dips about 30° southwestward toward
son Sink Valley. Here the footwall rock for at least 200 feet back from the lode
speckled augite-bearing diorite much of which is highly metamorphosed and the
iltant silicate minerals are traversed by veinlets of magnetite which are later
n the minerals. Some of the hornblende and iron ore seem to be alteration
ducts from the augite. Owing to the mantle of lakebeds and valley fill, no footwall
k near the deposits was observed in the present work.

Deposits

The ore is chiefly medium-grained massive magnetite and hematite. It, in
eral, contains as gangue minerals a little apatite and serpentine or hornblende,
lorite or epidote, calcite and quartz, and in places, titanite. A specimen (510[9])
m the Iron Mountain lode is composed of 80 percent or more of massive magnetite
tially altered to hematite. The gangue minerals are chiefly apatite and calcite
ich, in general are closely associated.

In places, however, the magnetite is well crystallized as shown by a polished
tion (of spec. 510[15]) which is a nearly black medium- to fine-grained crystalline
s of magnetite with no other metallic mineral present and only a small quantity of
cite as gangue. Each grain of magnetite shows remarkable multiple lamellae or
iations 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 last 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, just 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 copper deposits. It was visited by Ransome 12/ in 1908.

12/ Ransome, F. L., op. cit.

Nickel deposits

The principal nickel deposits 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 incline/winze and an upper tunnel connected with a lower 450-foot tunnel by an 180-foot chute.

The Lovelock mine, Fig. 100-b, a half mile west of the Sullivan nickel mine, pped 500 tons of high-grade nickel-cobalt ore in the early days, but has been idle many years.[13]

13/ Lincoln, Francis C., op. cit.

Here also the Mines Development Company of Nevada operated a copper-nickel-cobalt operty 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,

14/ Ransome, F. L., op. cit. p. 55.

imestone and quartzite, and the upper part in andesite and andesite breccia. All hese rocks are probably of Triassic age and are intricately intruded by dikes and asses of a dioritic rock which are probably Cretaceous. Overlying these rocks at he 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 nd 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 be due to faulting, dips 35° northwest, the diorite forming the footwall. The ore 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 n followed for a distance of 100 feet from the contact. Though the diorite in the twall is fissured and contains stringers of quartz, it contains no ore.

According to Ransome 15/ the ore seems to be all oxidized and consists mainly of

15/ Ransome, F. L., op. cit.

sidual kernels of sulpharsenide veined and coated with bright green hydrous nickel senate determined by Df. Schaller as probably anabergite. The correctness of this termination was later verified by Schaller in a specimen collected in the present rk in 1913, which shows also niccolite. The specimen (No. 486) is 3½ inches wide asured across the banding and seems to represent the full width of the vein and flux fissure in which it occurred. It consists of about an inch of fairly pure ple green anabergite on either side of a central 1-inch wide band of dark altered desite containing disseminated white metallic particles which Schaller determined to viccolite. NIAS, The andesite band contains also irregular small streaks and seams f anabergite, Schaller estimates that the specimen as a whole will average 30 ercent or more in nickel.

Copper deposits

In Cottonwood Canyon at the elevation of 5,000 feet, the J. D. Sullivan or cho group of 6 claims was being worked by the Mines Development Company of Nevada nder 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 hat 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 0 percent ore.

A little later it shipped from these workings several cars of ore that averaged bout 22 percent in copper and $2 in gold and silver to the ton. The value of the re is further enhanced by its cobalt content which in some of the ore is present in onsiderable quantity.

Much development work is done on the property but none to a greater depth than 00 feet. Water has been a drawback. A crosscut tunnel being driven on the Henrietta o 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 ccurs as replacement. The lode or vein is 20 feet or more wide and dips steeply east early with the slope of the hill. It has a known extent of more than 1,000 feet but s considerably faulted. One fault system strikes N. 30° W. In the lode the ore ccurs mostly in small bodies, chambers, lenses, and stringers.

The ore minerals are pyrite, chalcopyrite, chalcocite, and bornite, with a small mount of malachite, azurite, and wovellite.

Pyrite and chalcopyrite seem to be primary and the other secondary minerals to e 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/

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 a group of 40 claims known as the Boyer copper property, after A. Boyer, the owner. extends to a point 10 miles from Boyer Ranch or 1 mile south of the Valley View rmerly Bell Mare, Cornish, or Treasure Box Mine, which it includes17/. In 1913 the

17/ Ranscme, F. L., op. cit. p. 58.

roperty in part was leased to the Landon 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 ips 20° northwest, on the contact of overlying rhyolite and footwall andesite with he ore formed in the andesite especially where the andesite is brecciated. The old orkings had erroneously parallelled this vein at about 20 feet beneath it. The rincipal ore mineral in the vein is chalcopyrite, but bornite and chalcocite are also resent in appreciable quantities.

Later it was reported that Senator Tasker L. Oddie and associates had purchased he Nevada Copper Group of 5 mines in Bell Mare Canyon18/

18/ Mining and Metallurgy, Aug. 1936, p. 404.

Mr. Reid, Manager for the United Mines Company, holds that in this large area n 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

t the copper deposits found in the andesite are not indigenous to the andesite as s generally supposed by the early day operators, but have been derived from the erlying rhyolite 19/.

19/ 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 Gold Canyon just north of Dixie Spring in the east foot of Stillwater Range about posite 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 07 and in 1912-13 a group of French promoters, mainly from San Francisco, tried to om the prospect with Paris capital by ~~xxxxxxxxxxxxx~~ building an elaborate shroom town with aerial passenger and mail service, etc, but the deposits said to ave been prospected by 20 men in 1913 did not prove to be workable and the fiasco romptly collapsed and ended in complete desertion of the camp in 1914. 20/

20/ Goldfield News, May 30, 1914.

The deposit is said to consist mainly of a mineralized zone or lode about a mile ong associated with a contact of rhyolite with the Triassic limestone-shale series. t contains some rich gold-bearing quartz stringers which, however, are too small o be mined individually and too sparsely distributed to enable the lode to be mined s a whole.

CARSON SINK AREA, NEVADA

By

F. C. SCHRADER

Other Districts (10)

Other districts

Jessup district

The Jessup district is in the northwest part of Churchill County ~~xxxxxxxxxxxxxxxx~~ ~~xxxxxxxxxxxxxxxx~~ ~~xxxxxxxxxxxxxxxx~~

on the 40th Parallel Survey map) with the Lofthouse mine located in the southern 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 40th Parallel Survey).

History and production

Mineral was first discovered at what is now the Bernice mine in 1886 by Wallace ddell, who soon developed the prospect and Bernice became a flourishing camp. principal property was next acquired by Bothwell, who built a 10-stamp mill for it. later passed to ex-Senator J. P. Williams, who operated the mine and mill and pped 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 tly 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 iods almost annually.

In ~~1882~~ 1892 some of the deposits began to be worked for antimony and they e been operated periodically since when the price of the metal warranted the expense they have produced much relatively pure stibnite. The antimony deposits have n described by Mallery[1/]. The first shipment of antimony ore from the district was

1/ Mallery, Willard, Antimony veins at Bernice: Mining and Scientific Press, . 112, April 15, 1916, p. 556.

e by W. W. Van Reed to the old Star and Matthew's smelter in San Francisco. Other pments were made by Sanders and Young from 1893 to 1896. Some antimony ore con- ning silver was shipped in 1906, and a considerable production of antimony ore made during the World War period. The mill is in a dilapitated condition, but o 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 rounding region of wide extent has been mapped by the 40th Parallel Survey as olite.[2]

2/ 40th Parallel Survey, Map 5, east half.

The Star Peak rocks at Bernice consist mainly of thin-bedded black slate or urated shale and gray sandstones with occasional intercallated layers of siliceous estone and gray sericitic quartzite. They probably belong to that part of the Peak formation section described as black arenaceous slates 200-300 feet in ckness.[3] They are uptilted, folded, locally compressed into sharp anticlines,

3/ Ransome, F. L., Notes on some mining districts in Humboldt County, Nev.: U.S.Bull. 414, p. 31, 1909.

faulted, Fig. 101 (Photo 44). They, in general, strike northwestward across the nd of the range and dip steeply southwest. In places, however, they dip in the osite direction, as seen in the upper tunnel in the Bernice mine where the dip is to the N.E. The quartzite contains sparingly disseminated minute crystals of ite and some carbonate material and weathers brown and greenish. The rocks are o traversed by several cleavages which cause the shale in weathering to break up o small thin shingles or pencils.[4]

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 en 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 I.H.λ. 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 east.

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 $5 to $6 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-

ldspar gangue collected by the writer from the 2nd tunnel level contain much enopyrite, with considerable associated stibnite and a polished section shows nesonite replacing sphalerite. But the ore on being treated for 2½ hours with to 20 percent of salt is said to liberate 85 percent of its metallic values. st of the ore was milled at the mine and it was mostly of relatively high grade.

e vein has a known length of more than 1,200 feet and a vertical range of more an 500 feet. It has been opened to the depth of more than 400 feet, principally 3 levels by 3 adit drifts or tunnels, upper, middle, and lower, which are spaced spectively about 130 feet and 190 feet apart vertically, and contain extensive stopes d raises.

The upper tunnel is at an altitude of about 6,300 feet and is about 200 feet elow 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. he others are probably each about 700 feet in length; the upper tunnel for the distance 500 feet from the portal is stoped to the surface.

From the other levels are projected extensive upraises and stopes in some of hich ore is still in sight. Men who worked in the mine believe it to contain much re below its present workings.

The deposits are believed to be pre-Tertiary and genetically connected with lesozoic 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 Salbon. 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 allel 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 imony deposits. According to Mallery who examined the antimony deposits throughout district, they all occur in quartz fissure veins in the lower slate member the Star Peak formation, and they are associated with the intercallated siliceous mestone strata which, in general, are persistent with their course across the country rked by prominent croppings. The ore mineral is stibnite, the sulphide of antimony which the yellow oxide cervantite, whose occurrence is of mineralogical interest ly, forms coatings in the croppings and ore at or near the surface.

Antimony King mine

The Antimony King mine, owned by J. P. Williams and which has been the principal roducer of antimony in the district, is nearly opposite Bernice on the southerly ide of Antimony Canyon and approximately on the southerly trend of the Bernice vein. t is mainly on the Antimony King vein, which has been described by Mallery 5/ as having

5/ Mallery, Willard, op. cit.

known extent of more than 900 feet, and is regarded as remarkably persistent for an ntimony deposit. It dips 50 degrees westward in the lower dark slate member of the tar Peak formation, which it cuts at nearly right angles. The slate wall rock is ltered and contains a little cubical pyrite. The vein traverses also two intercallated ilıceous limestone strata each about 8 feet in thickness and spaced about 300 feet part. It is a quartz fissure vein with a parting of dark slate gouge on either wall nd the quartz ranging up to 4 feet in width, all of which width in places is solid re 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 ...es of pyrite and specks of stibnite and on the joint and cleavage planes films ...stibnite, by reason of which latter mineral its croppings for long distances are ...ained yellowish with antimony oxide. But the stibnite is not present in sufficient ...antity in the rock to constitute ore.

"The best ore-shoots occur south of the intersection of the vein with the ...uthern limestone stratum. Here the lower drift has opened up the vein continuously ...r a distance of 200 feet to a depth of 100 feet. A faulted segment of the limestone ...rikes nearly parallel with the vein at this intersection, and for a distance of 70 ...eet this segment has become incorporated into the lode, forming a 'lime spur' lying ...xt 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 ...artz in widths up to 4 feet have been discovered. This 'spur' feathers out on the ...uth strike of the vein and the ore becomes less massive in character, showing a ...nded structure of alternate stibnite and quartz. Northward through the slate the ...ein though small, continues with occasional good shoots of ore until it intersects ...he northern limestone stratum, beyond which it is apparently barren." 6/

6/ Mallery, Willard, op. cit.

I. H. X. mine

The I. H. X. mine, known also as the Solomon mine, is in Antimony Canyon, about ...mile and a half downstream from the Antimony King mine and a mile from the mill, at ...n elevation of about 5,100 feet.

The Chapman Smelting Co., of San Francisco, is said to have produced 50 tons of ...0 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 ...idth 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 om the face of a lower adit crosscut tunnel. The upper part of the workings show at an 8-foot wide dike of the aplite in part at least forms the hanging wall. They so show a gouge parting of crushed country rock, aplite, and quartz on the vein walls. e dike contains sparingly disseminated minute cubes of primary pyrite and specks of ibnite. Parts of it show also beautiful trachytic and acicular replacements by ibnite. Many prospect openings have been made along the dike on the opposite side the canyon.

Lofthouse mine

The Lofthouse antimony mine, owned by Ralph Lofthouse, of Fallon, is about 5 miles uth of Bernice, in Dyer Canyon, the second large canyon south of Antimony Canyon. It s credited with a small production of antimony during the World War. The deposit curs in the same black slate section of the Star Peak rocks as the Bernice deposits fore described. The vein is a fissure with quartz filling and dips 50° to the west ike the Antimony King vein. The limestone stratum associated with it is the only one n great thickness of enclosing slate, and is another good example of the genetic elation of the limestone and the ore bodies characteristic in the district. The ore s less massive than that in the Antimony King mine. It occurs mostly in fibrous nd acicular forms. 7/

7/ 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 NE. It is 50 miles direct and about 80 miles by road east of Fallon, the nearest ilroad station on the Southern Pacific Railway. It is about 3 miles northwest of ...e, a post office and stock ranch settlement on the Lincoln Highway in the open ...t 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 ...canic rocks, Fig. 103. (Photo 47-1688), and Fig. 104 (Photo 49 - 1689).

The area is drained southeastward by three drainage ways spaced about a mile and ...alf apart, and which beginning on the north are Clan Alpine, Star, and Florence ...yons, which in turn flow eastward into Cherry Creek which flows 8 miles northeastward ...o 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 ...lver Lode Mining Co. was organized to operate here. The district was organized as ...e Clan Alpine district in 1864 and a 10-stamp mill was built in Clan Alpine Canyon ...1866,[1] but the mill was run only a short time and the camp was abandoned soon

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1/ Brown, J. Ross, Report upon the mineral resources of the States and Terri- ...ries west of the Rocky Mountains for 1866, Washington G.P.O., 1867, p. 128.

...terwards and has been more or less dormant since[2] that time excepting a small

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2/ Lincoln, Francis C., Mining districts and mineral resources of Nevada, p. 1. ...no, 1923.

...tivity reported in 1915.

Production

The production, which was silver and gold, was small. Some ore from the Williams ...d the Nevada Lincoln mines was treated in the Clan Alpine mill, some was hauled to ...stin more than 60 miles to the east, and some was shipped by way of Old Wadsworth to ...rginia City.

Deposits

The so-called Alpine zzzzzf zone of mineralization having a width of about 4 miles said to extend from near Alpine 15 miles northeastward to Granite Point. But the eposits so far as learned and here tfeated are nearly all contained in a north-south ectangular area about 4 miles long by 3 miles wide near Alpine between Altitudes of ,000 and 6,500 feet. They are silver- and gold-bearing deposits, perdominantly silver-

The country rock is the Tertiary volcanics, which in the eastern part of the rea are mostly rhyolite or rhyolitic while toward the west they are andesitic in haracter, Fig. 103 (Photo 47).

In practically all of this part of the range the rocks have been mapped as rhyolite y the 40th parallel Survey. In the Alpine area the rocks are considerably altered by eathering, 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 best exposed on [illegible] 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, ned by former Senator John Williams of Fallon, is located about 2 miles northwest Alpine and 3/4 of a mile south of the mouth of Florence Canyon, Fig. 103. It is e of the early discoveries, was worked mostly in the middle 60's and made a moderate roduction, most of the ore being treated in the Clan Alpine mill, and some 40 tons f $40 ore was hauled to the Manhattan Mining Co. at Austin. The mine is in the southern art of the district at an elevation of about 6,000 feet and 80 feet above the gulch djoining 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 ine-grained, moderately tufaceous and brecciated. It is traversed horizontally or arallel with the flowage by irregular yellowish brown bands or streaks f limonite stain. The bands are about 1/4 inch in width and are spaced about 1 to 2 nches apart. Their stain was derived from pyrite contained in the rock along those ines. Quartz phenocrysts in or near the bands are more of the reddish wine-colored ype than those found elsewhere in the rock. The microscope shows the rock to be a ormal hyalo rhyolite, 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. As the mine was 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 farther 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 associ-
ted much vein orthoclase or adularia.

The ore minerals, chiefly cerargyrite, argentite, and gold are associated mainly
ith the quartz and the quartz-adularia part of the gangue. Portions of the vein or
nches of the ore mined were very rich.

The croppings which are not prominent consist essentially of the vein material
ust described and include some hard gray flinty quartz. They are in part limonite
tained and show pseudomorphic replacement after spar.

The principal opening is a 5- by 7-foot shaft said to be 200 feet deep, with
rifts and laterals mostly extending 50 or more feet to the northwest. It is sunk
ear the middle, slightly toward the hanging-wall side of the lode, where the more
ilicified portion of the deposit occurs, which has a width of about 2 feet and probably
arries good values.

Windlass mine

The Windlass mine is about 3/4 of a mile northwest of the Williams mine on the
pper 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.
illiams, 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. ~~195~~ 194).

The vein is said to average about $6 to the ton in precious metal of which value bout two-thirds is gold and one-third is silver. Five hundred tons of this class of re lies on the dump. Both the ore and the waste are stained yellowish brown with limonite.

In the bottom of the shaft the vein is said to be 5 feet wide and to contain a 8-inch wide ore shoot which averages about $22 to the ton. Assays of the surface ores veraged about $9 to the ton.

At about 400 feet to the southwest of the mine is another similarly good looking ein 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. E. 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 1½ 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-months[3] period in 1911. In 1915 it was acquired by the Nevada Lincoln Mining Company of Reno, who capitalized it at $1,250,000.[3/] In 1918 it was transferred to the Nevada Wilson Mining Co., and later in 1921 to a new company, the present owner whose same has not yet been announced, but which is controlled by Gilbert S. Johnson of Fort Worth, Tex.[4/]

3/ Weed, W. H., The mines handbook, vol. 13, 1918, p. 1060.

4/ Weed, W. H., The mines handbook, vol. 16, 1925, p. 1427.

At one time an option was held on the mine for $135,000.[5/]

5/ 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. 6/

6/ 40th Parallel Survey, Map 5, east half.

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 on 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 their croppings 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 stteply 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, 1½ miles in a northwesterly direction above the Nevada Lincoln mine and about 5½ 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 Byer ranch, and about 1 mile west of the Shoshone Pass-Byer 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

(11)

By

F. C. SCHRADER

Oil and gas near Fallon 1/

1/ Much of the material in this statement should be credited to the op. cited eport 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 or hot water, others for potash and some for gas, and in 1918 to 1922 a number for il, drilling being the most active in 1921.

The wells are nearly all contained in an east-west rectangular area about 30 iles long by 20 miles wide with Fallon located a little west of the center, Fig. 3, Topo map).

The wells range from 60 to 2,845 feet in depth. At least 13 are over 200 feet eep. Hot water has been struck in 5 or more of the wells at depths of 60-750 feet. ome wells yielded water having a temperature of 150° to 250° F., which is used in house eating. Several wells yielded gas at depths of 90 to 1,076 feet. Well No. 6, nine miles outh 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 merest traces only.

Well No. 5, the Syndicate well afore noted as being 9 miles south of Fallon, in 1922 was 2,845 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 capped. The log of the well records showings of gas at 5 different depths between

4 and 2,705 feet. The only record of oil contained in the log is, as follows, ale and oil sand at the depth of 1,518½-1,520 feet". Mud in the sludge pond contains ny minute bubbles of oil that may be native to the material in the well. Compared th this trace (of oil) we may note that the log of the Government or Timber Lake ll 14 miles north of Fallon shows "oil spots" rising on the "sludge water" at 5 fferent depths, namely about 125, 140, 155, 280, and 300 feet. The great thick- ss of the unconsolidated material in the syndicate well is not necessarily all honton Lake beds but may include in its lower part underlying possibly Siebert Lake eds (Pliocene) which occur farther south.

Well No. 13, of the Fallon oil and gas company, is about 12 miles east of Fallon nd 3 miles from the east foot of the Stillwater Mountains. It was said to be about 50 feet deep, to be in shaly clay material very similar to that of well No. 5, and o have struck a little oil. On the record of this well local residents based their elief that oil and gas existed in the region. The well was idle in 1922 and the log as not obtainable.

In well No. 12, of the Calvera Oil Company, 700 feet north of well No. 13 and in he same class of shaly clay material, at least one flow of volcanic rock (vesicular asalt) 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 ently west. As these same rocks have been found in almost every instance in the deep ell drilling they seem without doubt to form the irregular hard bedrock floor that nderlies the great thickness of unconcolidated materials that fill the basin. The reater part of most of the wells is in the unconsolidated material, but some wells eem 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 Rattle 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.

The conclusion reached in [illegible] of the [illegible] and which seem to be correct is essentially as follows. - "Judging from the age and character of the material in the Fallon Basin, the probable structure of the mid-Tertiary and older rocks as indicated in the surrounding hills and explorations by drilling, it seems highly improbable 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) Rhyolite

(3) Trachy-andesite containing copper deposits

Coal prospects

At about 20 miles east of Fallon, in the west slope, of the Stillwater Range, Lee's Canyon is said to contain a 20-foot thick bed of coal interbedded in sandstone and slate or shale dipping southerly into or under Table Mountain or a part of its mass. 2/

2/ Nevada Mining Press, Nov. 5, 1926.

The coal or lignite, of which a half bushel specimen was shown the writer by Mr. Syrac at Stillwater seems to be straticulate or finely bedded or banded and occurs or air-slacks into small platy pieces not much over an inch in diameter and 1/8 to 1/4 inch thick. Some of the pieces, however, on being broken are seen to be well meta-

rphosed and have a black glassy anthracitic luster. In a few instances the coal, it 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 ·cur also in the east slope of Stillwater Range south of Table Mountain between Sheep nyon and Mountain Well.

Diatomaceous earth

"City engineer of Fallon reported that two wells 60 and 80 feet deep near Allen prings showed two beds of diatomaceous earth 24 feet and 30 feet in thickness respectively 3/

3/ Hewett, D. F., op. cit.

his 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 ~~sandy~~ 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.

..... prospect of potassium nitrate is said to have been found east of Salt Well by Charles Kinney who has an office in Fallon.

Prospects of Turquoise, of graphite, and of mica are described under the Rand district, in which they occur.

* * * * * * * * *

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FIGURE - 28

203(275-)
Sch 69C

A SET CONSISTING OF

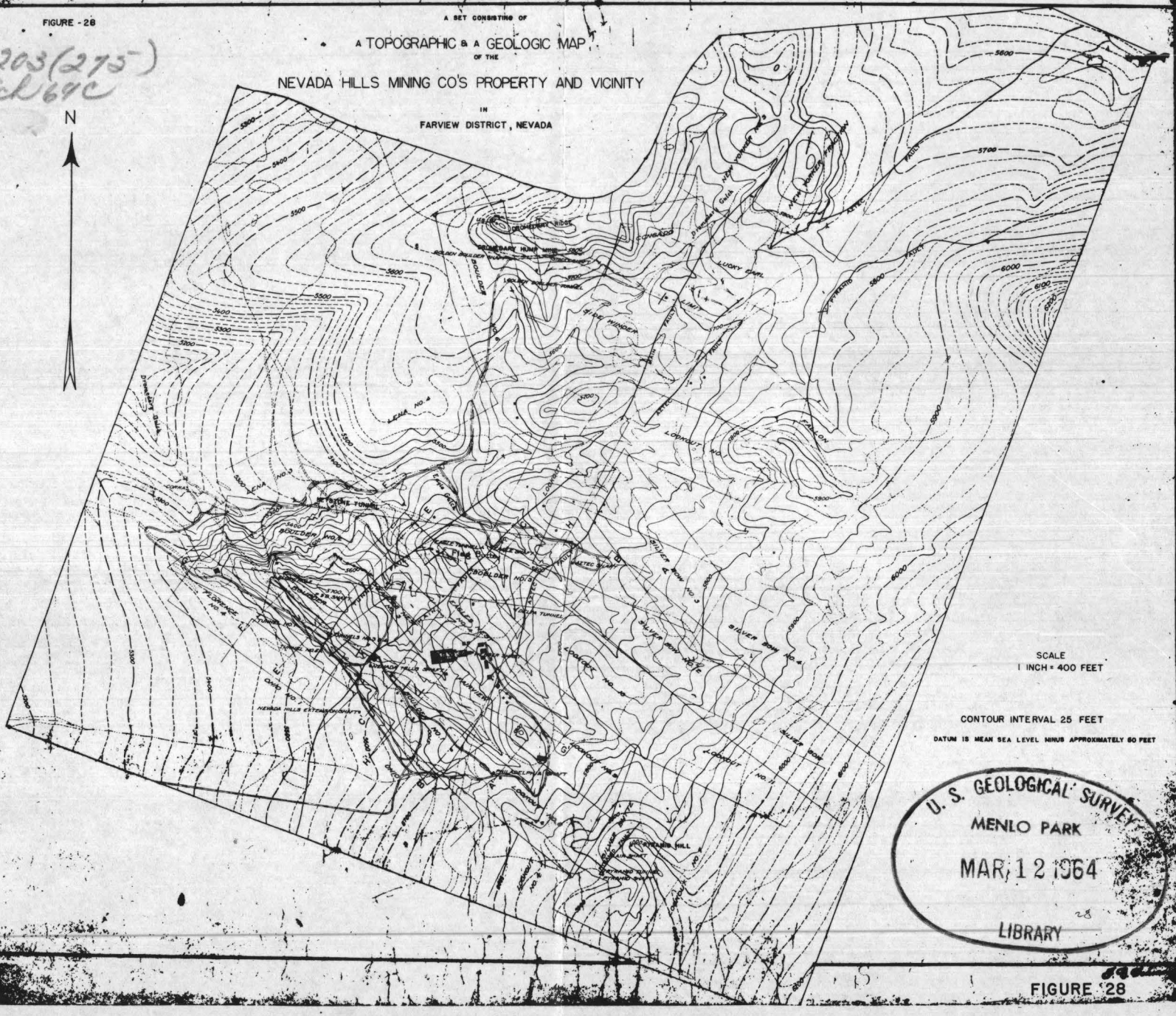
A TOPOGRAPHIC & A GEOLOGIC MAP

OF THE

NEVADA HILLS MINING CO'S PROPERTY AND VICINITY

IN

FARVIEW DISTRICT, NEVADA



U. S. GEOLOGICAL SURVEY
MENLO PARK
MAR 12 1964
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FIGURE 28

203(275)
Sch 69C

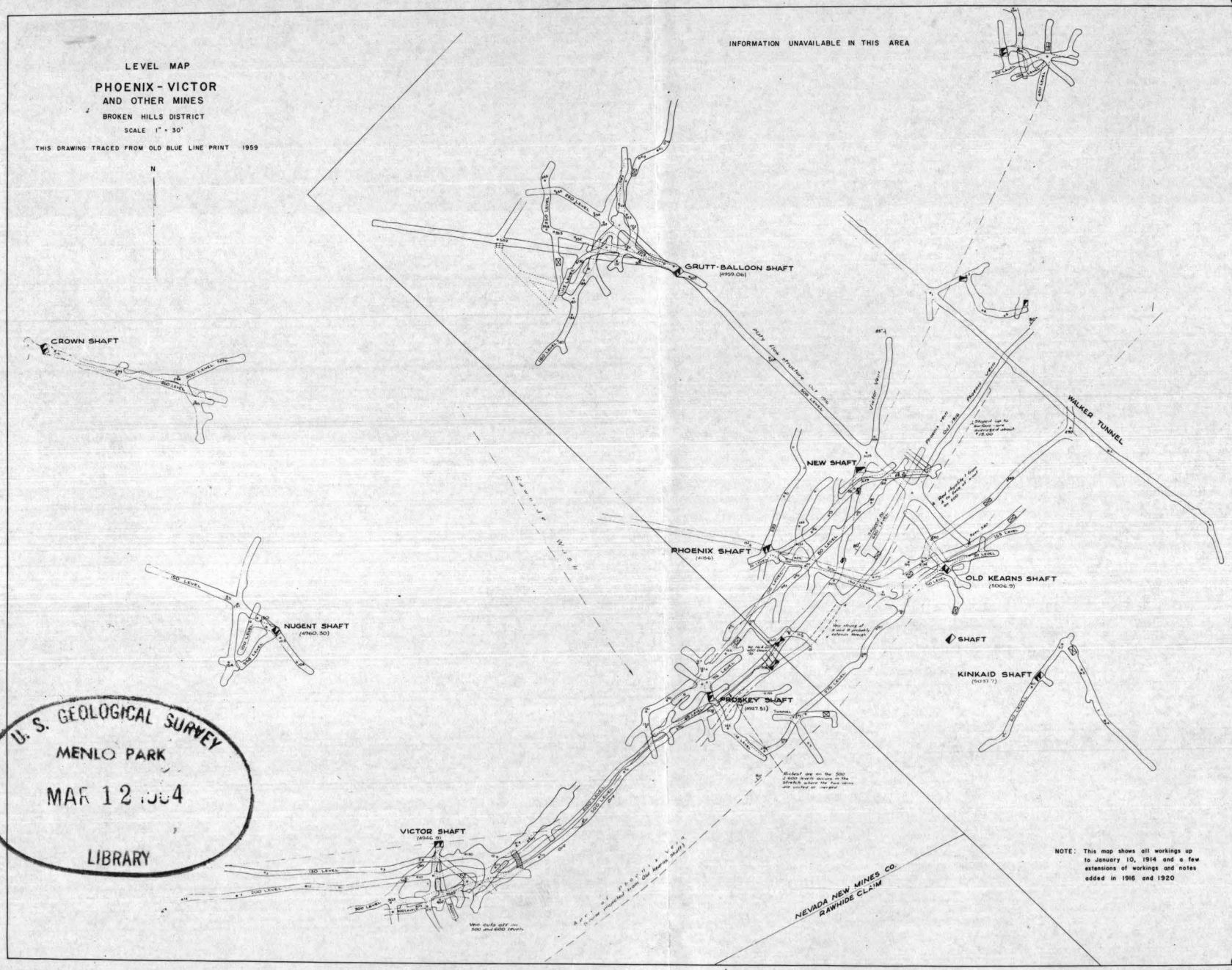

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FIGURE 65

203(275)
Sch 69C

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

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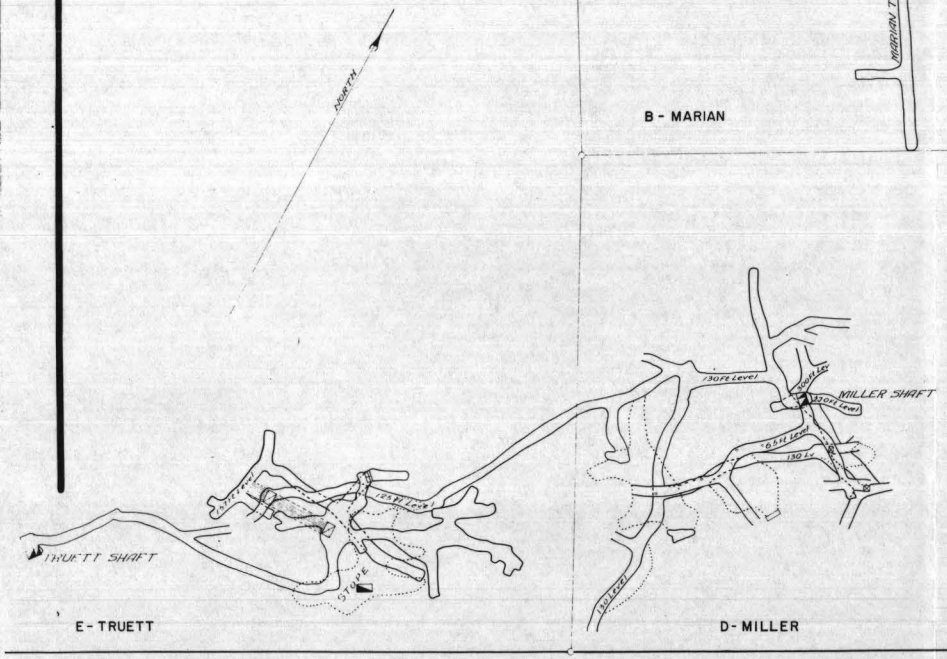

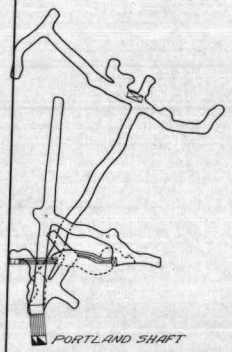

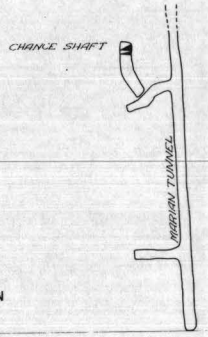



FIGURE 75

203(275)
Sch 69C

FIGURE - 28
A SET CONSISTING OF
A TOPOGRAPHIC & A GEOLOGIC MAP
OF THE
NEVADA HILLS MINING CO'S PROPERTY AND VICINITY
IN
FARVIEW DISTRICT, NEVADA.

SCALE
1 INCH = 400 FEET

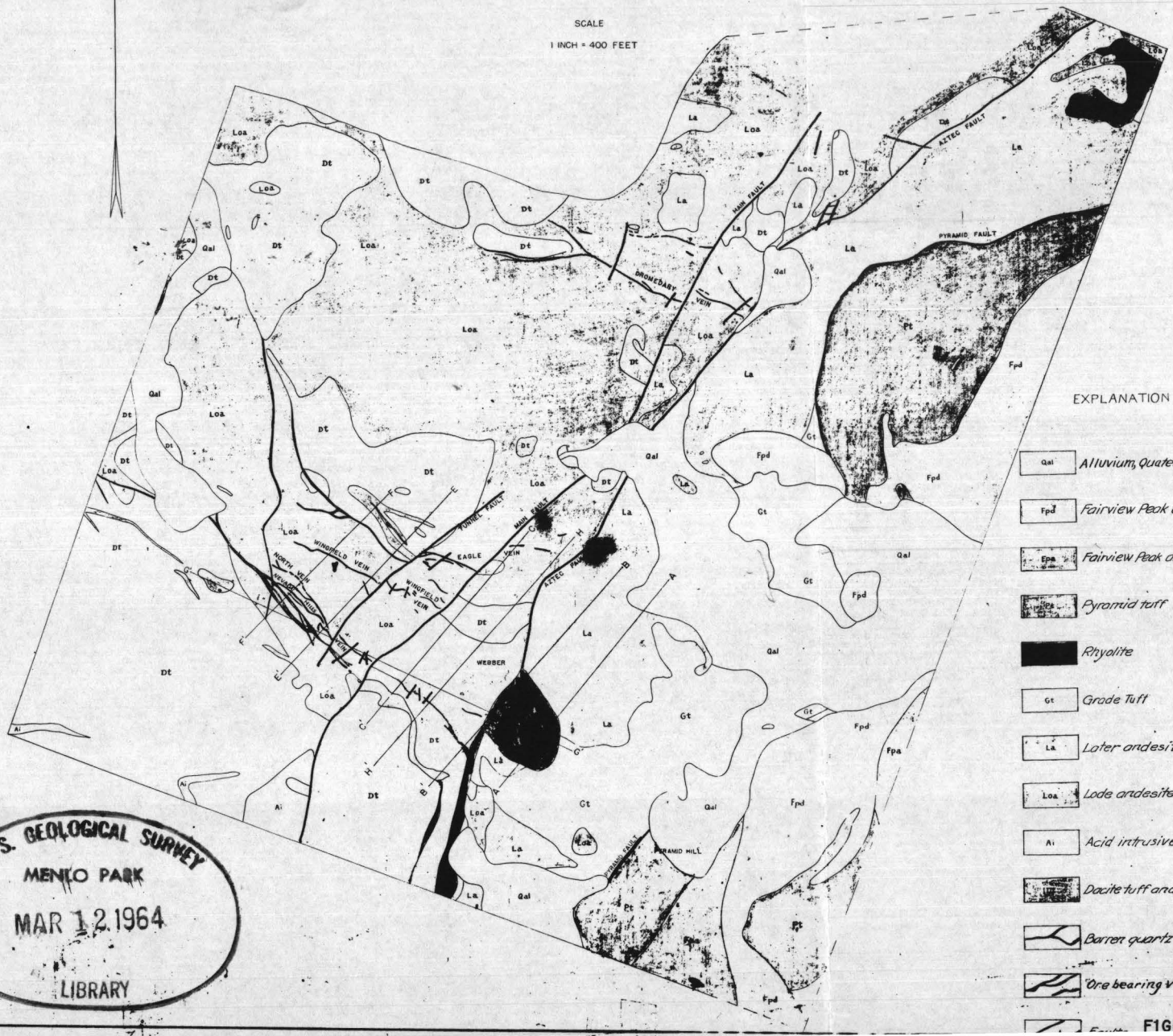

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FIGURE 28

203(275)
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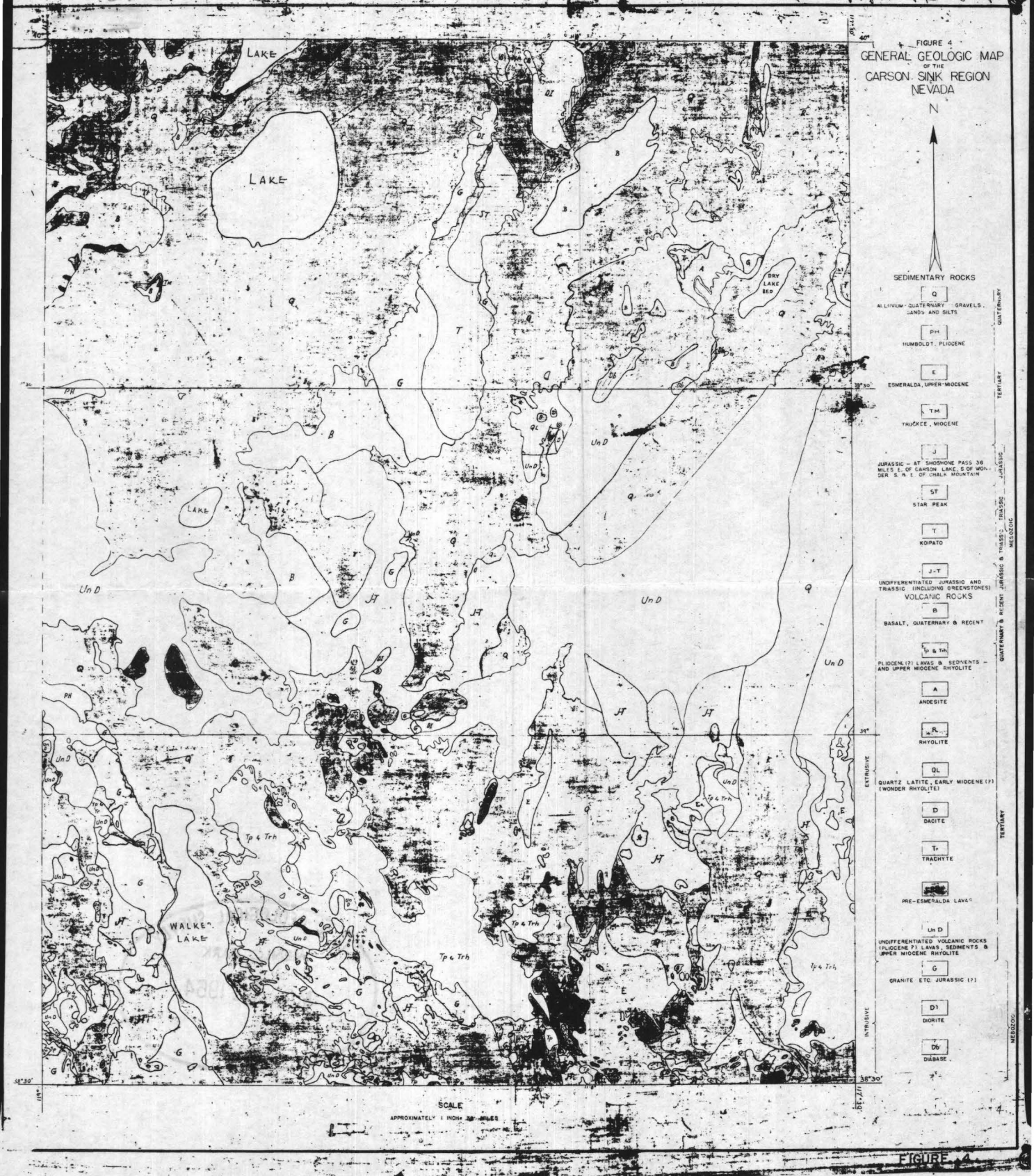

FIGURE 4