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Unpublished report on the

CARSON SINK AREA, NEVADA

By

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(Field work 1911-1920)

1947

CFR 47-17

0020 0029

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1947



## 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 road (fig. 3). It is 22 miles east of Rawhide, and 2 miles west of Quartz Mountain (fig. 47). 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 northwest-southeast area about a mile long by half a mile wide.

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

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## 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 stream 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 6,800 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 over 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.<sup>2/</sup> Following this transaction the most

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

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of the surrounding country within a radius of 5 or 6 miles, then known as the Broken Hills district, suffered a prospecting "boom" during which a 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 southwest.

The new company began work at the Broken Hills mine early in June and continued about a year until 1921, when, owing to financial difficulties, a reorganization was effected. During much of the time it worked a force of about 20 men. It sunk the Broken Hills main shaft from the 150-to the 350-foot level, explored and partially mined the Belmont, Broken Hills No. 2, and other veins by extensive trenching and sinking, in some instances to depths of 150 feet, and it is said mined about \$150,000 worth of ore, the most of which was later treated in the Bruner mill at Phonolite, 15 miles to the east. This raised the production figure of the mine to about \$220,000. Since then there has been no work done except by a few lessees working in the Broken Hills mine, by two of whom, Baxter and Browder, a shipment of lead-silver ore running \$80 to the ton was made in May 1923.

Included in the new company's production was its first shipment made Oct. 18, 1920, to the Western Ore Purchasing Co. at Hazen, of 35 tons of sorted ore that ran \$216.<sup>3/4</sup> to the ton, and contained 188.8 oz. silver to the ton and 19.6% lead. This ore, it is said, came from the Belmont Cross vein near the bottom of the Belmont incline at the depth of about 90 feet.

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



## Geology

The area consists of open gentle 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 nearby. The tuff portion of the formation is in part stratified. The rock has been intruded by younger andesite and dikes of black basalt as exposed on the Cracker Jack claim and considerably altered hydrothermally by solutions that accompanied or closely followed the intrusion of the andesite. It is believed to rest unconformably on granite which outcrops at several places about 1/4 mile to the north of Broken Hills mine. And it is unconformably overlain by whitish volcanic ash and tuff 40 feet or more in thickness, which, in places, seems to be waterlaid and to probably belong to the Siebert Lake beds--Esmeralda; overlying the volcanic ash and tuff and capping some of the surrounding low hills or buttes as just west of Broken Hills mine is dark iron-gray basalt 30 to 40 feet in thickness. It is composed chiefly of calcic plagioclase, augite and olivine and contains much magnetite and ilmenite in flow structure arrangement. It weathers brownish and greenish due to its iron, olivine, and augite content, the augite and olivine altering mostly to chlorite and serpentine. Elsewhere, as in the Twin 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 includes considerable spherulitic structure.



The granite believed to underlie the ore-bearing tuff-breccia formation is exposed mainly in a north-south reef or ledge about  $\frac{1}{4}$  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 microperthite 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¢ 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, figure 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 position.



### 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:

#### Cangue minerals:

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

#### Ore Minerals:

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

#### Associated minerals:

Sphalerite  
Molybdenite  
Cobalt ?  
Pyrite  
Chalcopyrite  
Hematite  
Bismuth ?  
Gypsum  
Zinc carbonate (smithsonite ? )

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



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

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

#### Broken Hills vein

The Broken Hills vein is about 2,000 feet in length and normally about 4 feet in width, and 9 feet in maximum width. It varies, however, from 2 feet to 7 or 8 feet in width and locally has associated ore bodies or mineralization extending 20 feet or more laterally into the foot wall. It dips 80° W. At the time of visit in 1920 it was known to be ore-bearing for the length of 550 feet, as tested by several shafts sunk to the south of the main or Broken Hills shaft and lesser openings to the north. The gangue is about all andesite breccia, and tuff altered, crushed, and in part replaced by quartz. The breccia constitutes 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 banded or streaked, and locally on the 100-foot and 150-foot levels rich black sulphide ore is associated with the banding for short distances.

The better ground occurs to the north of the main shaft. Here the ore is more plentiful and richer on all levels and the richest ore in the mine was found. This condition is believed to be due in part to greater secondary enrichment by downward concentration of the ore minerals in this part of the mine. In the north drift on the 150-foot level a width of 5 feet of the vein for a length of 40 feet ran \$21.40 in silver to the ton, and toward the end of the drift a width of 9 feet of vein and wall rock 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 long by 10 feet wide, of which 3 feet averaged \$21 in silver to the ton. In another part of the drift 3 feet of the vein for a length of 21 feet assayed \$26.

The vein is said to be wider and richer in depth, for instance on the 150-foot level, than near the surface. According to the report of the Broken Hills Silver Corporation, the shaft from the 150-foot level to the 250-foot level is excavated all the way down in a 5-foot wide ore body that ran \$50 to the ton, and the vein is 9 feet wide. On the 150-foot level the company was said 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 wall rock 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 ochre, 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 depth 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 jarosite 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 jamesonite 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 elsewhere 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 ore worth \$14 a ton.

#### 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 opposingly 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 northward, its low dip giving it a stopping depth of 250 feet measured on the dip 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 2 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 besides 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  $3/4$  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 degree dip.

Other properties or claims presenting fairly good prospects are, the Go 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 the eruption or intrusion of some member or members of the volcanic rocks into the ore-bearing formation. This is inferred from the fact that normally the unaltered country rock is less silicified and more porous at 10 feet or more from the vein or fissure than nearer to it, and, in places, as on the 250-foot level the wallrock tuff breccia is highly altered, silicified, and drusy, and contains many vugs lined with white kaolin-like material.

The intrusive rock was probably andesite or at least andesitic in character. It is not definitely known, however, to appear at the surface nor in the mines. The Broken Hills Silver Corporation reports that during its campaign of development work in the camp it met with numerous instances in which the deposits frequently rich were associated with intrusive pipe-like or neck-like bodies and dikes of andesite? which it regarded as having collectively produced on a small scale widespread mineralization or enrichment in the surrounding tuffaceous country rock. In every instance it is said the vein or stringer together with its fissure or fracture lying in the tuff breccia formation extends up to or very nearly to the intrusive where the fracture loses its regularity, becomes wavy and indefinite with marked decrease in ore content and finally feathers out at the boundary of the intrusive, or extends but slightly into the intrusive if at all, and that in no instance was the intrusive found to contain any ore or mineralization.

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



### Outlying Prospects

Mines and prospects besides Quartz Mountain neighboring to Broken Hills are 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  $2\frac{1}{2}$  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 dating from 1870, has produced \$100,000 worth of ore. The ore is silver-lead-gold ore averaging about 20% lead, \$18 in gold, and silver enough to raise the value of the ore to \$200 to the ton. The mine was worked to a depth of 400 feet with windlass by the Welsh Brothers. The ore was hauled to Austin. In 1908 a 100-ton smelter was built on the ground by Burt and Eaton, but later was taken to Tilne (?) and in 1920 the mine and a small mill were being operated successfully by the Joseph Brothers, and a large body 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 and porphyry, has considerable ore, but it is too low grade to pay. A little silver-lead ore, was shipped about 1916.

#### Red Hills prospect

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

#### Stratford prospect

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