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Item 1

THE GOLDEN ARROW, CLIFFORD, AND ELLENDALE DISTRICTS, NYE COUNTY, NEVADA.

By Henry G. Ferguson.

INTRODUCTION.

In connection with other work in central Nevada an opportunity arose for brief visits to the three small mining camps here described. Such observations as could be made in the short time available are presented as a minor contribution to information concerning the ore deposits of Nevada.

Golden Arrow and Clifford are situated at the western base of the Kawich Range in Nye County, Nev., and are reached by automobile from Tonopah. The Clifford district is on the main road between Tonopah and Ely, about 35 miles east of Tonopah, and Golden Arrow is 12 miles southwest of Clifford. Neither district has yet produced much ore. At the time of visit one man was working at Clifford and three at Golden Arrow. Ellendale, a few miles east of Tonopah and a short distance south of the Tonopah and Ely road, is now abandoned. The opportunity of visiting these districts was due to the kindness of Capt. W. G. Cotter and Mr. D. Johnson, of Goldfield.

The Kawich Range and its northern continuation, the Hot Creek Range, were visited by Spurr during his reconnaissance of southern Nevada in 1899, and the following description of the Kawich Range[1] is quoted from his report:

> The Kawich Range forms the southern continuation of the Hot Creek Range, from which it is separated at its northern end by a narrow transverse pass. From this point it extends due south about 60 miles, where its southern end runs out into the desert valley. The range is high and is deeply eroded into bold, craggy mountains. On both sides the slope of the mountains is steep, especially on the west, where there are almost impassable cliffs. On the flanks of the range on both sides of the rugged backbone are smooth mesa-like forms.

In 1905 Ball[2] made a more detailed study of the part of the range south of the thirtieth parallel. The accompanying map (fig. 13) is taken from the geologic map in his report. In the southern part

[1] Spurr, J. E., Descriptive geology of Nevada south of the fortieth parallel: U. S. Geol. Survey Bull. 208, p. 181, 1903.

[2] Ball, S. H., A geologic reconnaissance in southwestern Nevada and eastern California: U. S. Geol. Survey Bull. 308, pp. 99–114, 1907.

of the range are areas of Paleozoic sedimentary rocks which are c
related with the Pogonip limestone and Eureka quartzite of t
Eureka section. The section (fig. 14) given in Ball's report[1] sh
eastward-dipping monoclinal structure.

A considerable thickness of Silurian sediments is exposed on t
eastern flank of the Hot Creek Range,[2] and rhyolite forms the w
ern side of the range. The sedimentary series is cut by two nor
faults striking north, with downthrows to the east of 1,000 and
feet. Spurr considers that these faults are pre-Tertiary, and
map indicates that they do not continue into the area covered
Tertiary volcanic rocks.

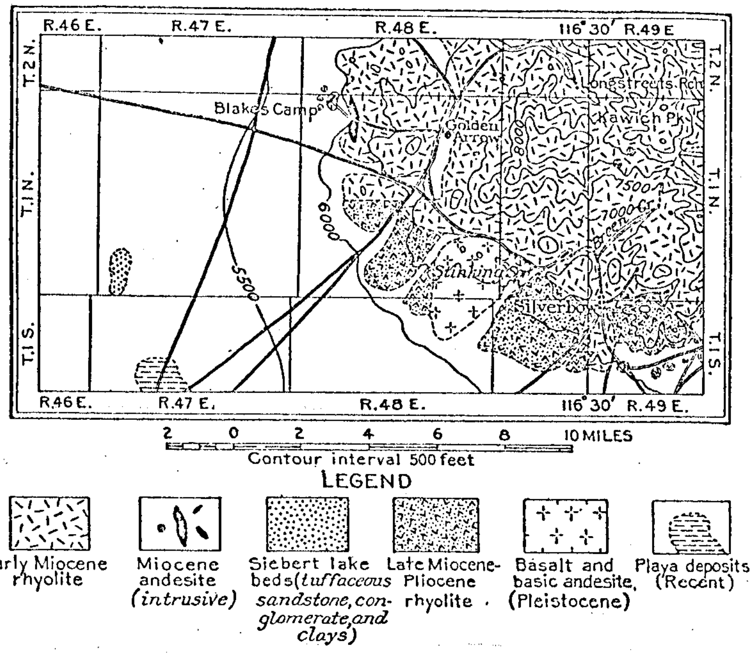

FIGURE 13.—Geologic map of Golden Arrow, Nev., and vicinity. The area without patt is occupied by Quaternary gravels and sand. (After S. H. Ball.)

The Reveille Range, the next range of the Kawich, has westwar
dipping Cambrian strata on its east side,[3] and Ball[4] states that th
eastern slope of the range is the more precipitous.

West of the Kawich Range, midway between it and Tonopah
are the Stone Cabin Hills, the southern extension of the Monit
Range. These are a group of low irregular hills which, so far a
could be observed, consist of rhyolite and tuff with small masses of
intrusive andesite. Gilbert[5] has noted a spur of metamorphic ro

[1] Ball, S. H., op. cit., p. 108.
[2] Spurr, J. E., op. cit., pp. 85-87.
[3] Idem, p. 152.
[4] Ball, S. H., op. cit., p. 113.
[5] Gilbert, G. K., U. S. Geog. and Geol. Surveys W. 100th Mer. Rept., vol. 3, p. 121, 187

on the west side of the range at its south end. Ball's map shows Paleozoic sediments and later granitic intrusives on the west side of the Cactus Range, which lies to the south of the Stone Cabin Hills. The northern part of the Monitor Range, according to Spurr,[1] shows a scarp facing westward.

Neither Spurr[2] nor Ball[3] considers that faulting played any important part in the origin of the Basin Ranges, but recent studies by Davis[4] and Louderback[5] have shown that certain of the ranges are undoubtedly due to faulting. As regards many of the ranges, including the Kawich, the evidence is not conclusive in favor of either hypothesis. If the ranges represent tilted fault blocks, erosion has proceeded far enough to remove direct physiographic evidences of faulting. The steeper western front of the Kawich Range, the wall of cliffs on its west side, and its eastward-dipping monoclinal structure constitute evidence favoring the conclusion that the range is a fault block tilted to the east. The monoclinal structure shown in the section is, however, explained by Ball[6] as the western limb of the

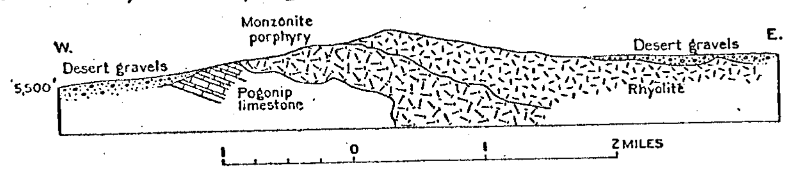

FIGURE 14.—Section across Kawich Range 2½ miles north of Kawich, Nev. (After S. H. Ball.)

Reveille Valley syncline. Evidence against faulting is found in the presence of many small hills, such as Deadhorse Hill, at Golden Arrow, and the andesite hill at Clifford, which form outliers to the east of the range, and the fact that the desert wash does not reach the mountains but is separated by a belt of rock-surfaced plain. These features are not incompatible with faulting, however, if the time since the formation of the range has been sufficient to allow eastward retreat of the fault scarp for a few miles, with consequent loss of regularity.

GOLDEN ARROW DISTRICT.

The Golden Arrow district lies a few miles south of the north end of the Kawich Range and nearly 40 miles east of Tonopah. Although the low Stone Cabin Hills lie between, the lights of the

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[1] Spurr, J. E., op. cit., p. 89.

[2] Spurr, J. E., Origin and structure of the Basin Ranges: Geol. Soc. America Bull., vol. 12, pp. 217–270, 1901.

[3] Ball, S. H., op. cit., p. 42.

[4] Davis, W. M., The mountain ranges of the Great Basin: Harvard Coll. Mus. Comp. Zool. Bull. 42, Geol. ser., No. 6, 1906.

[5] Louderback, G. D., Basin Range structure of the Humboldt region: Geol. Soc. America Bull., vol. 15, pp. 219–346, 1904; vol. 18, pp. 663–669, 1906.

[6] Ball, S. H., op. cit., p. 42.

The sulphide ore was seen in place on the 200-foot level of the shaft at the western point of the hill. The shaft itself is sunk entirely in andesite, but the drift enters rhyolitic agglomerate a few feet east of the shaft. Along the line of junction both rocks are much sheared and heavily pyritized. The contact is approximately vertical, and this fact, together with the presence of andesitic material in the agglomerate, makes it probable that the andesite is here older than the agglomerate and faulted against it. From the smallness and irregularity of the stopes it may be inferred that the ore is spotty in its occurrence. Most of the stopes are less than 6 feet in width by 20 feet in length. Although the andesite is pyritized near the contact, the ore appears to be entirely within the agglomerate. The greater part of the material shows heavily pyritized agglomerate, in places almost completely converted into pyrite, the matrix and pebbles being equally affected. The richer ore consists of agglomerate with less pyrite but cut by small drusy quartz veins. The vugs of these veins contain small crystals of stephanite, pyrargyrite, and proustite, as well as pyrite and more rarely marcasite, resting on the projecting quartz crystals, and the silver sulphide minerals also occur in minute streaks between quartz and wall rock. No gold or native silver was found in the concentrates. The presence of marcasite is taken to indicate that this ore does not represent the original ore as deposited but is to a large extent, at least, the product of enrichment by downward-migrating surface waters.

ELLENDALE DISTRICT.

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The deserted district of Ellendale lies on the road between Tonopah and Stone Cabin, a few miles east of Tonopah. The claims were located a few years ago, and the rich surface showings started a rush which was a miniature repetition of those following the discovery of such camps as Tonopah, Goldfield, and Manhattan. A town was laid out and houses were built, but to-day a single empty house marks the site of the town. The extent of the older workings is considerable, but apparently only a very small amount of ore was of sufficiently high grade to be shipped. In 1909, according to Mr. F. M. Chambers,[1] a shipment of 5 tons assaying 205.68 ounces of gold and 145.7 ounces of silver was made, in addition to other shipments with a gross value of about $40,000. In 1910 there was shipped from the district 26 tons of ore containing $18,349 in gold and 718 ounces of silver, valued in all at $18,737, or $720.65 a ton.[2] In 1911, 94 tons was shipped, carrying $54,702 in gold and 1,823 ounces of silver with a total value of $55,668, or $592.21 a ton.[3]

[1] Letter, Dec. 9, 1916.
[2] U. S. Geol. Survey Mineral Resources, 1910, pt. 1, p. 525, 1911.
[3] Idem, 1911, pt. 1, p. 689, 1912.

Most of the workings are in rhyolite, near the contact of andesite porphyry. The rhyolite is fine grained and rather siliceous and carries small phenocrysts of quartz and feldspar. Biotite in rare and minute plates is the only ferromagnesian mineral present. The andesite is similar to that of Clifford and Golden Arrow, but the relations of the two rocks could not be determined.

So far as a very hasty inspection showed, no mining of any importance had been undertaken in the andesite area.

The mineralization consists in the irregular veining of the rhyolite by numerous little fissures filled with iron-stained quartz and the silicification and to a less degree the sericitization of the adjacent rock. The rhyolite in the mineralized zone also shows numerous brown specks, resulting from the alteration of pyrite. Microscopic examination of the ore shows that these rusty specks are composed in part of jarosite. The silicified rhyolite is also cut by minute veinlets of jarosite, few of which exceed 0.1 millimeter in width. It appears that the oxidation of the pyrite in conjunction with the weathering of a potassic rock has resulted in the formation of the sulphate jarosite instead of merely the hydrous oxide limonite.

CONCLUSIONS.

The three districts here described, although varying in the nature of their ore, show certain features in common. The deposits belong to the class of shallow vein deposits in which the mineralization followed closely the extrusion of lavas, or the welling up of intrusives that reached close to the surface. In each case the occurrence of the ores in close association with andesite is significant. It may be that one of the principal periods of Tertiary mineralization is to be associated with an epoch of andesitic volcanism. In the Manhattan and Tonopah districts there are masses of similar andesite, intrusive at Manhattan and occurring both as flows and intrusions at Tonopah, but in the Manhattan district the relations of the andesite and ore are not clear, and at Tonopah, according to Spurr,[1] the ores of the different periods of vein formation are associated with rhyolite rather than with andesite.

At Clifford and Ellendale jarosite, a sulphate of iron and potassium, takes the place of part of the limonite as a result of the oxidation of pyrite. It is believed that the potash necessary to form this mineral has been obtained from the rhyolite.

[1] Spurr, J. E., Geology and ore deposition at Tonopah, Nev.: Econ. Geology, vol. 10, p. 764, 1916.