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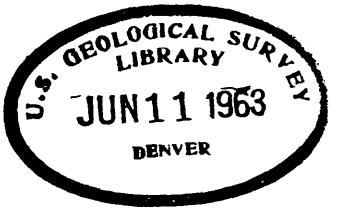

An Exploration Possibility at the Arizona Mine, Pershing County, Nevada

By

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ABSTRACT

At the Arizona mine in Pershing County, Nevada, a block of ground that may contain significant bodies of silver ore at a shallow depth appears to have been very inadequately explored during early mining activity. The block approximates in areal extent a triangle 900 feet on a side and lies between two post-mineral faults, the Ernst and West Side faults.

Production from the Arizona mine has amounted to more than a million dollars in silver since its discovery in 1862. The vein is principally quartz with small amounts of sulfides. The vein is parallel to limestone beds in which it occurs, and both the limestone beds and the vein are in the form of a shallow syncline, the flanks of which dip at angles between 5° and 25°. The vein has been stoped over an area of about 800,000 square feet. The southwestern limit of stoping is a normal fault, the Ernst fault, which truncates the vein. West of this fault little exploration appears to have been carried out, but the history of what actually was done is only fragmentary.

INTRODUCTION

In September 1959, during an investigation of the geology and mineral deposits of the Unionville and Buffalo Mountain quadrangles, Nevada, the Arizona mine near Unionville was examined by the authors.

Several sets of old maps of the mine were made available by the late Clarence A. Ernst of Unionville, the owner of the property. Mr. Ernst also supplied considerable additional data on the history of the mine. One map of unknown authorship, primarily covering the southern half of the mine area, was found to be more accurate than the others and was used as the base for plotting most of the geology, although over 4,000 feet of workings were added to this map by compass and tape survey during the present study. Most of the inaccessible workings in the northern half of the map, however, were taken from maps which conflicted one with another; thus the reliability must be considered extremely poor in that area. Selected points on the surface were surveyed by plane table and alidade.

LOCATION

The Arizona mine is in Pershing County, Nevada, near the small town of Unionville, approximately 30 miles air line northeast of Lovelock, Nevada. It lies within sections 27, 38, 33 and 34, T. 30 N., R. 33 W. The main stopes of the mine are between 6,500 and 6,700 feet above sea level. The mine is shown on the U.S. Geological Survey topographic map of the Unionville quadrangle, 1954 edition.

HISTORY

The mine was discovered in 1862 and was worked almost continuously until 1880. Most of the mining during this early period was in the northern half of the mine area, and it was from there that most of the total production from the mine was obtained. Later work, carried out from about the turn of the century to the 1930's, explored the southern half of the mine area, but the sporadic distribution and relatively small volume of stopes in this part of the mine imply that production was meager.

The total production has been reported variously as something less than $2,000,000 to about $13,000,000 in silver. Production figures listed by Raymond (1870, p. 189; 1872, p. 135; 1873a, p. 207, 216, 217; 1873b, p. 155; 1874, p. 216; 1877, p. 135, 141) indicate a total production of about $1,300,000 for the years 1869, 1870, 1871, 1872, 1873, and 1875, which were among the more active years of the mine. Thompson and West (1881, p. 450) report a total production of $1,302,238.58 from 1871 to 1878. An estimate of the extent of stopes suggests a total production of over 200,000 tons of ore. This, coupled with reports by Raymond (1873, p. 154) and by Mr. Ernst that cut-off values of mill-heads were $50 to $70 per ton, might seem to suggest a production of at least $10,000,000. However, mill-heads represented values of hand-sorted material, for almost all of the stopes have been back filled with discarded poor rock, neatly stacked by hand, so that the value of all of the 200,000 tons of rock may have averaged considerably less than $50 per ton.

An interpretation of reports by Raymond (1870, 1872, 1873a, 1873b, 1874, 1877) suggests that prior to 1870 mining was confined to the Manitowoc and Arizona workings near the north end of the Stewart tunnel. Between 1870 and 1874 mining apparently was extended west about to the McDougald fault and south about 1,100 feet from the portal of the Stewart tunnel. The Fall tunnel may be the one referred to by Raymond (1877, p. 185) as having been driven in 1875, and the stopes between the McDougald and Ernst faults very probably were mined in the period 1875 to 1880. The record for the period 1880 and 1917 is incomplete. Ransome (1909, p. 39) reports that in 1908, "The newer workings, which are developmental, are south of the old stopes. There are two tunnels, which connect with extensive exploratory drifts, crosscuts, and winzes and raises." Also, he reports, "At the south end of the hill, and probably on the same vein as the Arizona, is the Nevada-Union mine * * * long abandoned * * * ." About 1917 E. R. Van Dyke reopened the mine, and in the 1930's the Sunset Mining and Development Company carried on further exploration. Tunnels on the "A", "B", and "C" levels were driven during this period, and the possible southeastern extension of the vein was rather thoroughly explored. A few bodies of ore were stoped but in general the vein was too low-grade and values too sporadic to allow a profitable operation. Mr. Ernst obtained control of the property about 1939 and between 1953 and 1959 produced scheelite ore from a stope about 60 x 15 x 6 feet in size in the southern half of the mine (see Ernst tungsten stope on figure 1). The present main

portal which is about 6,520 feet above sea level, was opened and a tunnel was driven by Mr. Ernst to by-pass the caved portal of the "B" level. All access to the mine at present is through this portal. During September 1959 Mr. Ernst with two helpers explored part of the vein at a point 30 feet east of the 6,573 elevation marker in the East Horse winze.

Structure of vein

As indicated on map and the structure sections on figure 1, the vein is in the form of a shallow syncline having flanks that dip at angles generally less than 20°. The axis of the syncline plunges very gently to the southeast. The vein is parallel to the bedding of the enclosing limestone of Middle Triassic age except on the eastern flank where other veins branch upward and follow crosscutting fractures that dip steeply west. None of these steep-dipping veins were seen in 1959, but Cameron (1939, fig. 8) illustrates an example on the "C" level near the south end of the mine, and Raymond (1873a, p. 154) describes winzes sunk below a tunnel 220 feet east of the Stewart and at about the same level. These winzes were along a vein that probably dips eastward, although they are essentially below the Manitowoc vein which dips westward. Apparently it was this structural relation that resulted in a lawsuit in 1870 and the ultimate merger of the two competing companies, the Arizona Company and the Silver Company.

The nearly flat-lying vein, slightly undulatory in places, is cut by several normal faults which trend northwestward and have dips ranging from 30° to 55° westward. The west or hanging wall of each fault has dropped down, and the vein has been offset downward in a series of steps from east to west. Net displacement on individual faults ranges from a few feet to about 30 feet. Gouge and breccia zones along the larger faults are about 1 or 2 feet wide.

Two other post-mineral faults form boundaries to the limestone block containing the enclosed vein. One such fault, here named the West Side fault, strikes about N. 15° E., and judging by the lack of deflection by topography of its surface trace, must be nearly vertical. Net displacement on the West Side fault has been between 240 and 300 feet; the limestone on the east side has dropped down against rhyolite tuff and felsite on the west side. The other bounding fault, here named the East Side fault, strikes irregularly north, and may dip west. Along the East Side fault the limestone on the west side has dropped down against rhyolite porphyry intrusive rock on the east side.

Nature of ore

The vein is principally white to gray quartz in bands from a fraction to several inches wide, separated by septae of black limestone, and aggregating in total thickness as much as 10 feet. The average thickness is reported to have been about 2½ feet. Only rarely are minerals other than quartz visible in the ore and abundant assays were necessary to identify minable rock. Pyrite is

the most commonly observed sulfide mineral, and greenish stains are found on ore high in silver, presumably from the alteration of freibergite to copper carbonates and sulfates. Other ore minerals reported by Cameron (1939, p. 605) include argentite (probably the principal ore mineral), native silver, covellite, chalcocite, galena, sphalerite, arsenopyrite, scheelite, gold and stibnite. In addition to quartz, carbonate is a common gangue mineral.

Suggestions for exploration

A block of ground, triangular in areal pattern, bounded by the Ernst and West Side faults and extending southward to about the line at which section B-B' is drawn, appears to constitute a promising target for exploration.

Stopes have been mined westward to the Ernst fault, and for at least 800 feet along this fault and (or) the nearby subsidiary fault adjacent to it to the east. Although the block west of the Ernst fault has been cut into along four short winzes and tunnels, as far as can be determined, the vein was not located in this area. It seems highly unlikely that the value of the vein would drop coincidentally at the precise position of the post-mineral fault; thus it seems reasonable to assume that the block west of the fault may contain a significant amount of ore. The possible westward extension of the vein is depicted on figure 1, sections A-A' and B-B'.

It should be possible to appraise the extent and tenor of the vein by drilling from the surface before costly underground work is attempted. Holes no deeper than 400 feet should penetrate the horizon followed by the vein as shown in sections A-A' and B-B'.

Speculation as to why so little exploration or mine development was carried out west of the fault involves both an interpretation of the geologic structure, and also the history of development of the mine.

As for the interpretation of the structure, the pattern of offset by the northwest-trending, southwest-dipping, post-mineral faults seems clear. Thus the vein west of the Ernst fault almost certainly has been displaced relatively downward, but the amount of displacement probably is between 10 and 25 feet. This estimate is based on a comparison of the amount of gouge and breccia along the Ernst fault to gouge and breccia along other faults of the set on which displacement is known.

The failure to carry out more complete exploration of the block west of the Ernst fault may have been governed by one or more of the following considerations:

1. Where the vein was cut by the four known tunnels and winzes, the value may have been lower than cut-off at the time.

2. In the southern and longest tunnel driven west of the Ernst fault, a small vein that is parallel and above the main vein seems to have been confused with the main vein. The possibility exists that the other three openings into the block also were driven westward on veins other than the main vein. In the northernmost of these openings (the one about 250 feet north of the Tramway incline) the vein that was followed is a foot thick in places, and probably is the main vein. If all of these workings had been extended 10 to 20 feet deeper along the fault, the possibility of a "main" vein below the one followed could have been checked.

3. Surface trenching and other exploration on the west slope of the hill was unsuccessful, probably because any westward continuation of the vein must be truncated by the West Side fault as shown in sections A-A' and B-B' of figure 1. Also, other small relatively barren veinlets that can be found on the west slope may have been thought to be the main vein, and thus considered evidence of a decrease in the size and tenor of the vein west of the Ernst fault.

4. Stopes mined along the east side of the Ernst fault may have been mined just prior to the drop in the value of silver in 1881, so that exploration to the west, which might have been pushed more aggressively, was not timely. When active exploration was again begun after the turn of the century, efforts were directed toward exploring the southern extension of the vein, and inasmuch as this block of ground contained a little ore, the attention of the operators possibly was diverted away from the block west of the Ernst fault.

Reservations as to the potential value of this target block that should be considered include: (1) It is possible that exploration or even mining was more extensive than old maps and records show or than accessible workings now indicate. This may be true particularly in the northern apex of the triangular target area, where maps published by Cameron (1939, p. 596) indicate tunnels that probably extend west of the fault. These workings seem to be limited to the northern apex, but how far south workings might have extended is unknown. (2) The tenor of the vein may diminish to the west so that the vein west of the Ernst fault may be uneconomical to mine. Raymond (1877, p. 185) reporting on activities in 1875 says, "The richness of the ledge has diminished at all points worked, especially on the western side, going up on the ledge toward the outcrop. At the end of the year the average assay of the pulp at the mill is estimated at $30 per ton." It is not clear in Raymond's report exactly what area is referred to other than that it probably is west of the "McDougald shaft" which may be the so-called McDougald incline on present maps.

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