REPORT ON THE GEOLOGY AND MINERALIZATION OF THE GARVEY RANCH LANDS, HUMBOLDT AND ELKO COUNTIES, NEVADA

By

E. L. Stephenson
Consulting Geologist

Reno, Nevada
November, 1968

Contents

Illustrations

REPORT ON THE GEOLOGY AND MINERALIZATION OF THE GARVEY RANCH LANDS, HUMBOLDT AND ELKO COUNTIES, NEVADA

By

E. L. Stephenson
Consulting Geologist

INTRODUCTION

The purpose of this report is to examine the geologic setting and possibilities for mineralization of lands belonging to Garvey Ranches in Humboldt and Elko Counties, Nevada. The main intent is to present information on the topography, geology, structure, and mineralization, and to note areas where the geology or known mineralization indicate conditions favorable for prospecting, to aid in appraising exploration possibilities. To date no field examinations have been made. The report is based on some of the rather meager literature that is available, and on the writer's long experience in mineral exploration in Nevada.

The lands under consideration total approximately 157,400 acres, of which about 155,000 acres are in the eastern half of Humboldt County and about 2,400 acres are in the extreme western edge of Elko County. This includes all of the listed holdings except 2,040 acres in scattered parcels in the area of the Pine Forest Range in the northwestern part of Humboldt County, far outside of the present map area.

A new geologic map of the main area, which has been prepared by adapting, generalizing, and enlarging the U.S.G.S. preliminary map of Humboldt County[1/], constitutes the principal part of this report. A folded copy is in the attached pocket, and unfolded colored copies have been forwarded separately to the Wichita and Denver offices.

The map is on a scale of two miles to the inch. In addition to the geology, it shows all of the Garvey lands in a lined pattern, various mines and prospects, the areas covered by up-to-date U.S.G.S. 15-minute quadrangles, the township and range net, and various other features. Specifically, the map extends from R. 35 E. to R. 45 E. and from T. 36 N. to T. 47 N. at the Oregon line. For convenience, the area covered by the map will be referred to hereafter as the "Garvey area".

1/ Willden, Ronald, Preliminary geologic map of Humboldt County, Nevada: U. S. Geol. Survey, Mineral Investigations, Field Studies Map MF-236, 1961.

TOPOGRAPHY

The Garvey area lies on the boundary between two major and greatly different physiographic provinces, namely, the Basin and Range Province (Great Basin) on the south and the Snake River Volcanic Plateau on the north. The Great Basin, actually a high plateau with interior drainage, is marked by long narrow mountain ridges and intervening broad valleys that have mainly a north-south trend. The dominant topography is controlled by major high-angle faults of large throw and fairly recent age, most of which lie under cover at or near the range fronts. The ranges are steep and rugged; the valleys are typically broad and flat. The lowest elevations in the valleys are above 4,000 feet, and the range crests reach elevations of about 7,000 to 10,000 feet.

In the Garvey area the main ranges from west to east are the Slumbering Hills, the Santa Rosa Range, of which the Bloody Run Hills are considered a southerly extension, the Hot Springs Range, and the Osgood Range. East of Winnemucca the extreme north end of the Sonoma Range projects into the map area. In the southwest corner the Krum Hills and Blue Mountain constitute a transverse high zone between the south end of the Bloody Run Hills and the north end of the Eugene Mountains.

The three main valleys are Quinn River Valley, Paradise Valley, and Eden Valley. In the southeast corner of the area, east and south of the Osgood Range, is another broad alluvial area that

extends far southeastward toward Battle Mountain, and through which the interior draining Humboldt River flows westward.

In relation to the present problem, those lands lying within the broad valleys largely can be eliminated from prospecting consideration, with the possible exception of narrow structural pediments that might border some of the range fronts. The valleys are down-faulted blocks that generally have from a few thousand to as much as 10,000 feet or more of Tertiary and Quaternary unmineralized alluvium above the bedrock surface. Some of the Great Basin ranges are bordered by rock pediments under shallow cover, probably representing down-faulted slices along the complex range-front faults, and such pediments constitute present day prospecting targets. No information is at hand, however, regarding this possibility in the Garvey area, and in general the valley areas can be regarded as unfavorable.

The northwestern and northeastern parts of the map area are underlain largely by late Tertiary volcanic flows and related volcanic deposits of the Snake River Volcanic Plateau. This is a fairly rugged area of deeply incised young canyons, which in general lacks the well-marked structural trends of the Basin and Range Province. Elevations range mainly from about 5,000 feet to over 6,000 feet.

Much of the volcanic plateau must be regarded as unfavorable for prospecting, with the possible exception of quicksilver deposits, inasmuch as many of the rocks are younger than the known

main periods of mineralization. A principal exception in the Garvey area is the west part of the northeast block, which actually is a volcanic-capped northerly extension of the Santa Rosa Range and which has known mineralization as at the famous National mine and the Buckskin Peak quicksilver mine. It also should be noted that the major Cordero quicksilver mine is at the east edge of the northwest block, in volcanic rocks that may be somewhat older than the majority of the flows.

GEOLOGY

Paleozoic rocks. In the Garvey area Paleozoic sedimentary rocks occur only in the Hot Springs Range and the Osgood Range, where they form the larger part of both ranges. The U.S.G.S. map lists some ten highly variable stratigraphic units, which for simplicity are included under a single symbol on the new map. They are dominantly siliceous clastic rocks, including sandstone, shale, quartzite, chert, argillite, phyllite, and slate. Interbedded with the siliceous rocks are fairly large thicknesses of metavolcanic rocks, usually referred to as greenstone. The Paleozoic sequence in the Osgood Range also includes relatively large amounts of limestone and dolomite, and lesser amounts of limestone occur in the Hot Springs Range.

The Paleozoic rocks are the host or country rocks for a number of mineral deposits, notably gold and tungsten along the central part of the east flank of the Osgood Range, where the sedimentary rocks are cut by two stocks of intrusive igneous rock. Quicksilver deposits occur in the Paleozoic rocks along the southern part of the west flank of the Hot Springs Range. In general the areas underlain by Paleozoic rocks are favorable for prospecting, particularly where these rocks are invaded by igneous intrusions or are cut by major faults.

Mesozoic sedimentary rocks. All of the sedimentary rocks in the western part of the Garvey area are of Mesozoic age, and

nearly all are siliceous clastic rocks. There are four or five recognized formations consisting very largely of phyllite, slate, shale, quartzite, sandstone, and minor chert. In places there are minor amounts of limy shale, limestone, and dolomite and minor amounts of metavolcanic rocks. All of these rocks are grouped under a single symbol on the new map. Most of them are classified as Triassic in age, but part of the sequence may be Jurassic.

The Mesozoic sedimentary rocks make up the larger part of the Santa Rosa Range and Bloody Run Hills, Slumbering Hills, Krum Hills, Winnemucca Mountain, and Blue Mountain. There also is a block at the north end of the Hot Springs Range, containing relatively large amounts of limestone, that has been classified as Permian and Triassic.

The Mesozoic rocks are host for gold deposits in the Slumbering Hills; silver and gold north of the head of Paradise Valley and on the east flank of the Santa Rosa Range; gold and silver in the Bloody Run Hills; gold, silver, copper, and lead on Winnemucca Mountain; gold in the Krum Hills; and quicksilver deposits along the northern part of the west flank of the Hot Springs Range. They are extensively cut by igneous intrusions, as shown on the map, and these localities constitute favorable prospecting areas.

Older intrusive igneous rocks. As shown on the map, the sedimentary rocks in the Garvey area are cut by numerous igneous intrusions. Except for local compositional variations these bodies are composed almost entirely of granodiorite or quartz monzonite, or

both. They occur as stocks and cupolas of various sizes and to a certain extent as bordering or outlying dikes and sills. They mainly are classified as Cretaceous to early Tertiary in age, but some may be as old as Jurassic. The youngest may cut the older Tertiary rocks but none of them cut the younger or post-Humboldt Tertiary formations, although in places the latter may overlap the intrusive bodies.

Igneous intrusions of this type are intimately associated with a great many of the metallic mineral deposits throughout the West. Whether there is a direct genetic relationship between the intrusive rocks and the ore deposits is still a matter of debate, but their close association is an undoubted fact. Some mineral deposits occur within the intrusions, chiefly in the form of fissure veins, and many types of deposits occur in the complex border zones. Even many deposits lying well out from the main igneous bodies are found to be closely associated with dikes, sills, or small cupolas of similar composition. The intrusions, their border zones, and the projections of structural zones associated with them are prime targets for prospecting.

Late Tertiary intrusions. A few late Tertiary intrusions are shown on the map, and probably there are others unrecognized in the volcanic complex. Mainly they are rhyolite and dacite plugs and dikes that may closely resemble the volcanic flow rocks. Where present they of course cut the older rocks as well as the Tertiary

rocks, but seemingly they are not accompanied by any important (?) mineralization. In places, however, they may mark structural zones of possible economic interest.

Tertiary volcanic and sedimentary rocks. The Tertiary rocks in the Garvey area include a wide variety of volcanics, dominantly flow rocks ranging from rhyolite to basalt, related pyroclastic formations, and one major sedimentary unit. All of these rocks are shown under a single symbol on the new map.

Actually there may be a wide range in age, judging from similar deposits in other parts of the state. The U.S.G.S. preliminary map merely distinguishes between acidic and basic types, and it groups all of the rocks as Miocene and Pliocene. This may hold true in the northern plateau area, but it is probable that at least some of the many volcanic remnants shown in the southern part of the area are earlier Tertiary in age. From an economic standpoint the distinction is that the older Tertiary volcanics (pre-Humboldt) may be important hosts for mineralization, whereas the younger ones (post-Humboldt) generally are not mineralized, with the possible exception of certain quicksilver deposits.

In this connection, and in a general way, the widespread Tertiary sedimentary formation is a convenient marker. In late Miocene and early Pliocene time fresh-water beds of water-laid tuff, shale, limestone, oil shale, lignite, and diatomite were widely deposited through northern and central Nevada. This is the Humboldt

formation of northern Nevada, also called Truckee, Esmeralda, or Siebert formation in other parts of the state. The Humboldt formation is present at several places in the Garvey area, notably in large areas around the head of Eden Valley.

Pre-Humboldt Tertiary volcanics, ranging in age from Eocene to middle Miocene, are the hosts for rich mineralization in a number of important mining districts, including the Comstock, Tonopah, Goldfield, Aurora, National, Midas, and Jarbidge, to name a few. The possibility should be kept in mind that, aside from the National district, prehumboldt rocks may be present in some of the other Tertiary areas, perhaps particularly in the down-faulted blocks along the margins of the ranges.

STRUCTURE

Structure in the older rocks is very complex. Both the Paleozoic and Mesozoic rocks have been repeatedly folded and faulted during various periods of orogeny, beginning in Paleozoic time and extending through the young block faulting that has formed and is still forming the present ranges. Major thrust faults occur in many of the ranges, and normal and reverse faults are abundant in all of them. The faulting is much too complex to detail on the present map. Only a few faults are shown, chiefly those that form structural boundaries between formations.

The faults are of economic interest in that some of them are intimately associated with the ore deposits, either by providing channelways through which hydrothermal mineralizing solutions could circulate or by fracturing of the host rock, or both. Stated conversely, it probably is safe to say that most if not all metallic ore deposits in Nevada are directly associated with, and are controlled by faults.

One type of faulting that appears to be of economic importance involves major transverse faults or fault zones that strike or trend diagonally across the ranges and that in places cause pronounced offsetting of a range. Most of these zones have a northwesterly strike or trend, and, since they are cut off by the range-front faults, they probably represent older deep structures that

considerably antedate the Basin and Range faulting. A number of mining districts are located on or near such zones.

In the Garvey area one such transverse zone is strongly suggested by the alignment of intrusions, both older and younger, and by changes in the outcrop pattern at the head of Paradise Valley and across the Santa Rosa Range. The old Paradise Valley mining district is located in the southeast part of this postulated zone.

MINING DISTRICTS

The recognized mining districts that lie within the Garvey area are listed here, inasmuch as they represent areas of known mineralization and production. Not all of them include Garvey land. They are listed alphabetically and, broadly, by township and range, with brief notes on the metals and the mines. Most of the mines are old properties that are not operating at present.

(123) 1. Awakening. Four townships in the north part of the Slumbering Hills. High production of gold and considerable silver beginning about 1912. Scene of "gold rush" in 1936 on discovery of the Jumbo mine.

(127) 2. Dutch Flat. T. 38 N., R. 40 E. Placer gold discovered in 1893, along with placer cinnabar. Minor production of gold and silver. Substantial quicksilver production from Dutch Flat mine during World War II. Includes Last Chance and Red Devil quicksilver prospects.

(133) 3. National. T. 46 N., R. 39 E. Rich producer of very high-grade gold between 1909 and 1921, with some silver. Recorded production about 3.5 million dollars, and at least that much more was "high-graded" by the miners (ore was worth $10 to $75 per pound, old price, according to Lincoln 2/). District later was extended southward by Bailey and Phoenix 3/ to include the Buckskin Peak quicksilver mine and Canyon Creek and Stall quicksilver prospects.

(134) 4. Opalite. T. 47 N., R. 37 E. Nevada part of the district has the Cordero mine, discovered 1924, which is by far the largest quicksilver producer in Nevada and is still operating. Includes the Bretz and Opalite mines in Oregon, discovered 1917, now inactive.

(136) 5. Paradise Valley. T. 43 N., R. 39 E. & R. 40 E. Early-day producer of silver and gold, probably in excess of 3 million dollars. Mines active 1879-1891 and again 1909-1915. No details known.

2/ Lincoln, Francis C., Mining districts and mineral resources of Nevada: Nevada Newsletter Pub. Co., Reno, 1923, p. 100.

3/ Bailey, Edgar H. and Phoenix, David A., Quicksilver deposits in Nevada: Univ. of Nevada Bull., Vol. 38, No. 5, Geol. and Mining Series No. 41, 1944, pp. 92-95.

136 6. Potosi. T. 38 N. & T. 39 N., R. 42 E. District includes the well-known Getchell mine (gold, tungsten, arsenic). Reilly mine produced much tungsten during World War II. No information at hand on other mines.

137 7. Poverty Peak. T. 40 N., R. 40 E. Quicksilver district discovered in 1936. Substantial production. Includes Cahill mine, now operating, Hapgood mine, and many prospects.

138 8. Rebel Creek. T. 43 N., R. 38 E. Fairly substantial production of silver and some gold. No detailed information at hand.

14 9. Sherman. T. 39 N., R. 38 E. Minor production of gold and silver recorded. No other information at hand.

142 10. Shon. T. 41 N., R. 38 E. Minor production of gold and silver recorded. No other information at hand.

140 11. Winnemucca. T. 36 N., R. 37 E. & R. 38 E. Discovered 1863. Includes a number of mines and prospects on Winnemucca Mountain. An early day producer of very substantial amounts of gold, silver, lead, and copper. Now inactive.

FAVORABLE EXPLORATION AREAS

On the basis of the preceding information and the features and relationships shown on the geologic map, certain areas or zones may be designated as being favorable for exploration. The areas are restricted, of course, to those containing Garvey lands, and are listed below more or less in the order of their probable importance.

The fact that the Garvey lands in the favorable areas for the most part do not constitute unbroken blocks need not be a hindrance. Most of the intervening lands are open public domain, so that, if exploration is undertaken and favorable indications are found, any adjoining or near-by land could be easily and quickly covered by regular mining claims.

1. The area embracing the northwest trending zone of igneous intrusions north and west of the head of Paradise Valley appears to be most favorable. The outcrop pattern and the alignment of the intrusions strongly suggest the presence of a deep-seated transverse structural zone of faulting and possible doming. The southeast part of this zone has produced substantial amounts of silver and gold, and the Stall and Canyon Creek quicksilver prospects in the northwest part also are indicators of mineralized structures. The overlapping volcanics along the northeast border of the zone may be quite thin, so that any of several geophysical methods might be effective. Much of the non-Garvey land, although subject to Forest Service rules, is public domain open to mineral locations.

2. The north central part of the crest and northwest flank of the Osgood Range also appears favorable. The area lies not far west of the Getchell and Reilly mines and other old mines. and close to the large igneous stocks with which the mineralization of the area undoubtedly is associated. The geology is such that both geophysical and geochemical methods might be used in addition to regular geological methods. Much of the immediately adjoining ground is public domain.

3. The Dutch Flat district in the south part of the west flank of the Hot Springs Range has possibilities for both gold and quicksilver. The gold in particular may warrant further investigation, especially as it appears that only placer mining has been done in the past. Geochemical methods might be most useful here for both metals. In conjunction with this district the Garvey lands farther north along the Hot Springs Range also may warrant preliminary geologic examination, particularly in view of the presence of at least two small igneous intrusions as shown on the map.

4. The general area of the Bloody Run Hills probably warrants at least preliminary geologic reconnaissance. Two large igneous stocks are present, and minor production of gold and silver has been recorded from the Sherman district. As the area lacks volcanic cappings, preliminary geochemical sampling also could be done. Essentially all of the non-Garvey land in this area is public domain.

5. The north part of the northeast volcanic plateau area, in which there are extensive Garvey holdings, might warrant preliminary geologic reconnaissance. Although the entire area is mapped as late Tertiary volcanics, it is relatively little known, the topography has not been mapped, and no information is available as to the thickness of the volcanics. They may be thin in places and windows of the older rocks might exist. In this area rapid airborne reconnaissance could be done and a reasonable amount of airborne magnetic surveying might be warranted.

E. L. Stephenson

Reno, Nevada
November 20, 1968

E. L. Stephenson
Consulting Geologist
Registered Professional Engineer
Nevada No. 501