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Washoe Co. - general
Item 89

Mineral Resources Inventory and Analysis

of the

Pyramid Resource Area

Carson City District
Nevada and California

by

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1973

COMPLETE INTRODUCTION ONLY

~~See~~ Washoe County-general file for the complete introduction to this report

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INTRODUCTION

The Pyramid mineral resource inventory and analysis is the result of a review of the geology, an inventory of the mineral resources, and an evaluation thereof, by two geologists of the U. S. Bureau of Land Management headquartered at Carson City, Nevada.

As only a limited amount of time was available for field work, this review and inventory can in no way be considered comprehensive. As a result, its analysis and evaluation is (1) largely based on a cursory field reconnaissance (during which not even all known mineralized areas were investigated) by Bennett late in 1972, augmented by Mallery's general knowledge of the areas acquired during the preceding 10 year period, and (2) limited library research by both authors. Bennett was responsible for much of the descriptive portions of the Present Situation (URA-3) and Management Opportunities (URA-4). Mallery contributed much of the introductory text, and both writers are responsible for the analyses and evaluation wherever presented.

The Pyramid resource area encompasses slightly over 897,000 acres, or approximately 1,447 sections of land. The field investigations conducted and the format for this report are based upon procedures outlined in the Bureau of Land Management manual, as supplemented by amendments thereto. These instructions infer that this inventory and analysis shall be based primarily upon mineral resource inventories prepared over the years by geologists employed by BLM. The inventory for Nevada lands, however, is relatively old and has not been properly maintained.

Reference is made to the published literature insofar as is practicable. It goes without saying, however, that this study could not have been accomplished--and in fact would have very little value--without the considerable quantity of information and assistance provided over the years by numerous individuals and organizations. These contributions are hereby gratefully acknowledged, as is the cooperation and assistance of N. P. Stark, BLM's nonmetallic specialist in Nevada, in the evaluation of nonmetallic mineral commodities in these units.

The narrative portion is composed of two parts, the Present Situation and the Management Opportunities. Additionally, two sets of maps were prepared on plastic overlays in order to present some of this information graphically. They are referenced to both the existing Mineral Resource Inventory and to this narrative.

1. Mineral Status - depicts status of the mineral estate (ownership) of the units, regardless of surface ownership.

2. Mineral Resources - depicts "indicated mineral areas", "mineral resource areas", and "potential mineral extraction (mining) areas".

"Indicated mineral areas" are large areas, that based on geology, may contain mineral deposits, but the exact location of the deposits may not be known. Known areas of mining claims, without regard to geology, are also included. "Mineral resource areas" are located within indicated mineral areas and have a greater potential in terms of discovery of significant mineral deposits. "Potential mineral extraction areas" contain known mineral deposits that are in production, are being developed, or are capable of being developed under existing technology. Also included in this catagory are adjacent lands necessary for dump sites, mill or plant sites, and other activities associated with the necessary development of an ore deposit.

Any attempt to assess the mineral potential of an area is a difficult task at best. When time does not permit a thorough analysis, the problems involved become impressive. These factors must be kept in mind by anyone using this document and its related exhibits for contrary to popular impression, mineral resources are not finite in quantity, but change over time.

I. PRESENT SITUATION - MINERALS (URA-3)

The Pyramid resource area includes a portion of southern Washoe County, nearly all of Storey County, and a portion of Lyon County, Nevada, three counties situate in the western portion of the state.

V. E. Scheid, in Bonham and Papke, relates the basic mining history of the Nevada portion of the area, as follows:

> "In 1859, when vein gold was discovered on the eastern slope of Mount Davidson, in what is now Storey County, the territory that has since become Nevada was a virtually uninhabited wilderness tenuously administered as a part of the Utah Territory. The rush of thousands of prospectors to the Comstock Lode during the next few years caused the federal government to establish a separate Nevada Territory in 1861. Storey and Washoe Counties were among the nine original counties created the same year by the first Territorial legislature. It was the silver and gold of the Comstock, that, by causing the rapid increase in the Territory's population, justified the admission of Nevada to statehood in 1864 by President Lincoln's wartime administration. It may, therefore, truly be said that Nevada was born of its mineral wealth.
>
> "The small camp at the head of Sixmile Canyon rapidly grew into the wilderness metropolis of Virginia City, the prototype of scores of other bonanza type mining camps that, during succeeding decades, were to bloom not only in Nevada but throughout the West. Unlike most of these, however, the Comstock quickly matured into a stable, productive mining center, that would contribute to the nation a total mineral production of almost $400 million during the sixty-odd years of its existence as a viable mining community. Here in this mining area were first developed the square-set timbering methods of stope support, as well as many other mining and engineering advances that would be applied in future years wherever men were forced to endure the extreme pressures and temperatures of the Earth's depths in search of mineral treasure.
>
> "The population and the economic importance of Storey County declined in direct proportion to the decline of mining on the Comstock, and it has not enjoyed growth comparable to neighboring Washoe County in recent uears. In contrast to Storey, Washoe County's growth to date is almost entirely due to factors other than mining; as indicated by its total recorded metallic mineral production of about $4.1 million. Both

counties, however, have received increasing attention as favorable sites for mineral exploration in recent years, and this activity can be expected to continue, and to increase, as more is learned of the geologic structure and the rock sequence of this area."

Bonham, in Bonham and Papke (op. cit.), in addition, states:

"The principal metals produced in Washoe County have been gold, silver, lead, copper, and zinc. Minor amounts of mercury, uranium, tungsten, arsenic, and antimony have also been produced. Occurrences of tellurium, manganese, molybdenum, bismuth, titanium, rare earth minerals and thorium are known in the county, but no commercial deposits of these metals have, as yet, been developed. The total recorded value of metals produced from Washoe County is approximately $4,000,000.

"Storey County, conversely, has a total production of about $400 million in metals, of which $393 million represents silver and gold production from the famed Comstock Lode. Some mercury, copper, and lead have also been produced in Storey County. Antimony, zinc, and selenium are known to occur in the county, principally in the ores of the Comstock Lode, but no production of these metals has been recorded to date.....

"The mining and processing of industrial rocks and minerals is an important and growing industry in Washoe and Storey Counties with a reported production of $5,636,900 in 1965. Materials presently being produced are halloysite clay, diatomite, lightweight aggregate, and sand and gravel. A diatomite plant is located at Clark Station, and a gypsum processing plant and wallboard factory at Empire.

"In addition there has been past production of unconsolidated calcium carbonate, common clays, feldspar, limestone, sodium chloride, borate, silica, and stone. Other types of deposits described in this report which have had little or no production are montmorillonite clay, coal, perlite, and sulfur."

He concludes with:

"The occurrence of relatively little explored areas of extensive mineralization with attendant strong hydrothermal alteration in Washoe and Storey Counties, suggests that significant metallic ore deposits are yet to be found in the area."

Nonmetallic minerals occur widely across the resource area. Many types of these commodities are being extracted today and some have been worked for years. None occur in "mining districts", per se (another good reason for eliminating this term in reference to mineral resources).

The more significant such deposits are summarized below:

Name	Year Developed	Period of Greatest Activity	Commodities Extracted	Recorded Production	References
Terraced Hills	1919	to present	"marl"	moderate	Bonham
Terraced Hills	1962	to present	clay	large	"
Clark Station	1918	to present	diatomite	large	"
Virginia Foothills	1960's	to present	pumice	moderate	"
Steamboat Hills	1950's	1960's	scoria	moderate	"

The value of mineral commodities extracted from the Pyramid resource area to date is approximately $11,000,000 in metallic minerals. The value of nonmetallic minerals far exceeds that of metallic minerals. Recorded production in 1965 alone was about $5,000,000, mostly in sand and gravel. The metallic minerals of economic value occur mainly in veins, replacement deposits, or as particles disseminated throughout pre-existing rock. Generally such deposits occur in volcanic rocks, metamorphosed sedimentary or volcanic rocks, or sedimentary rocks (including sands and gravels). That is, in just about all of the rock types occuring in the resource area with the exception of massive granites.

Frequently, the presence of metallic mineralization is manifested by development of suites of distinguishing minerals, or by geophysical or geochemical anomalies. These diagonistic features are normally not obvious, require the application of considerable experience and resources for their detection, and are not readily interpretable. Furthermore, in the Basin and Range province--which includes the resource area in its entirety--most, if not all, of the as yet undiscovered ore deposits are mantled (concealed) by either Tertiary volcanic rocks in mountainous areas or by unconsolidated sands and gravels in the valleys.

Nonmetallic rocks and minerals of economic value occur principally in Tertiary volcanic and sedimentary rocks. Many deposits of the various marketable commodities, however, closely resemble common, valueless rocks, and this situation creates real problems in their identification. Further, the ubiquitous overburden commonly conceals more than is revealed posing significant problems in the discovery and evaluation of this class of deposit.

It is estimated that approximately 60 percent of the Pyramid resource area has a potential for the occurrence of either metallic or nonmetallic deposits of either current economic value, or of economic value in the reasonably forseeable future.

Only two "mines" were in operation in this area late in 1972; both involved the extraction of nonmetallic minerals. Nevada Cement Company was utilizing clay obtained from the Terrace Hills deposit at their cement plant at Fernley, and Eagle-Pitcher Industries, Inc., was obtaining diatomite from the Clark Station deposit for use at their mill at Clark Station.

As of December 1972 only one prospect was active in the area. This prospect is situate on the south slopes of Fort Sage Mountain, approximately 1,000 feet vertically above the toe of the mountain, at a point one mile east of the California-Nevada boundary.

This prospect was being worked by a large bull-dozer for a period of about one week. A series of old, weak copper showings in facies of metavolcanic rocks exist in the area. Apparently the objective of the work was to attempt to expose more mineralization.

For all practical purposes, therefore, as of late 1972 there were no significant mineral exploration programs underway within the Pyramid resource area. It should be remembered, however, that the late autumn is not the season of the year in which most prospecting is attempted. Had the field investigation been affected during the summer months in all likelihood much more activity would have been noted.

In addition to the above, BLM operates four mineral commodity "community pits" in the Pyramid resource area. These are usually active on a year-long basis and serve numerous private individuals and contractors in western Nevada and eastern California. Two of the pits are situate immediately north of Reno, the other two are situate in the southern portion of the county. "DG" (decomposed granite), "top-soil", and native borrow are available from these sources. A fifth "DG" pit is located on public lands west of Reno. It is currently being worked by a Reno contractor by authorization of a material sale contract.

It may be anticipated that the level of metallic mineral exploration in the resource area will increase moderately with time, the non-metallic mineral activities will increase greatly with time, and exploration for geothermal energy resources will be on a high level for at least a period of a few years over the near term.

There is no significant potential for the occurrence of "leasing act" minerals in the resource area, and little or no exploration for such minerals is anticipated.

General Geology

Bonham, in Bonham and Papke (op. cit.) writes:

> "Washoe County, the northwesternmost county in Nevada, has an area of 6,281 square miles, while Storey County, which adjoins Washoe County on the south, is the second smallest county in the State with a total area of 262 square miles. The southern two-thirds of the two-county area has topography more or less typical of the Basin and Range physiographic province: elongate mountain ranges separated by alluviated basins.....
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> "Igneous, metamorphic, and sedimentary rocks, ranging in age from Permian(?) to Recent, crop out in the two-county area. The pre-Tertiary rocks, mostly of Mesozoic age, consist of metasedimentary and metavolcanic rocks intruded by granitic plutons. The metamorphic rocks have been informally divided into two sequences, the Peavine sequence, exposed in the area southwest of Pyramid Lake, comprised of both metavolcanic and metasedimentary rocks, and the Nightingale sequence, exposed to the north and east of Pyramid Lake, consisting of metasedimentary rocks.
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> "Rocks of Tertiary and Quaternary age are widespread in Washoe and Storey Counties.....The Tertiary rocks are predominantly of volcanic origin, consisting of complex, intertonguing piles and sheets of flow, pyroclastic, and intrusive rocks. Intercalated with the volcanic piles are lenses of sedimentary rocks. Two separate assemblages of Tertiary rocks have been distinguished in the Washoe-Storey County area, the Canyon assemblage, present in the northern two-thirds of Washoe County, and the Hartford assemblage, which occurs in southern Washoe County and in Storey County. The rocks of the Canyon assemblage range in age from Oligocene to Pliocene and consist of several thousand feet of basaltic, andesitic, and rhyolitic flows, breccias and pyroclastics with intercalated lenses of sediments, chiefly diatomite and reworked tuff. Rocks of the Hartford assemblage range in age from Oligocene to Pleistocene and exhibit the same pattern of lithologies as the Canyon assemblage rocks, but volcanic rocks of mafic to intermediate composition are more abundant than in the Canyon assemblage.
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> "Rocks of Quaternary age consist predominantly of alluvial and lacustrine sediments. Volcanic rocks of Pleistocene age occur in southern Washoe County and in Storey County.

"The structural geology of the area is complex and still little understood, in large part because of a lack of adequate detailed geologic mapping in most of Washoe County. The data presently available indicates that there have been two main deformational episodes, one of late Mesozoic age, and the other of Cenozoic age.

"The Mesozoic deformation began in the Jurassic with the folding, faulting, and low-grade regional metamorphism of the Triassic and Jurassic volcanic and sedimentary rocks. Numerous granitic plutons were subsequently intruded into these rocks, principally in the Cretaceous, during the waning stages of the orogenic episode.

"The Cenozoic deformation began in the Miocene and has continued into the Recent. Structural elements associated with this deformation include normal faulting and associated tilting, warping, wrench faulting, and related folding and volcanism. The Walker Lane, a major wrench fault system, is the dominant element of the Cenozoic structural framework in Washoe and Storey Counties.....

"The majority of the metals produced in Washoe and Storey Counties were recovered from metalliferous ores in Tertiary volcanic rocks. These ore deposits usually show a clear spatial and probable genetic relationship to Tertiary instrusive bodies. They are generally localized in breccia zones along faults, which commonly exhibit major displacement."

The Pyramid resource area is underlain by rock types common to the northern Sierra Nevada range and thus are categorized as being Sierra Nevadian in character although they lie to the east of the front of the present day Sierra Nevada mountains and are within a geomorphic province referred to as Basin and Range. This has the following significance: strip off the mantle of sands and gravels and remove the layers of volcanic units from this part of the Basin and Range province and the underlying rock types are basically identical to those observed in the higher elevations of the Sierras--old (Mesozoic) metamorphosed sedimentary and volcanic rocks and slightly younger (also Mesozoic) igneous rocks of granitic nature occurring in complex inter-relationships to each other. These older rock types are commonly referred to as the basement complex and have considerable significance in terms of the occurrence of metallic ore deposits. In contrast, the nonmetallic deposits are mainly restricted to the younger (Tertiary) volcanic units--which include intercalated sedimentary rocks--and the much younger (Quaternary) sands and gravels, etc.

The geology of the resource area is further complicated by the existence of both the Sierra Nevada range frontal fault systems, which trend generally northerly, and a deep seated northwest-trending shear zone known as the Walker Lane system. The end result of these major faults is manifested in large-scale dislocations of pre-existing rock units, and the creation of zones with which metallic ore deposits may be associated. An example of the extent of dislocation is demonstrated by the fact that north of Reno the basement complex achieves an elevation of about 7,000 feet above sea level, whereas across the Walker Lane structure a few miles farther to the northeast, as at the north end of Pyramid Lake, the basement complex is found at an elevation of 200 feet below sea level, a displacement of about 7,200 feet vertically within but a few miles lateral distance.

As to the significance of faulting to ore deposits, the Virginia City ores, as well as practically all of the other presently known metallic mineralization in the resource area is intimately and directly associated with fault zones.

There is little or no potential for the existence of petroleum products in the resource area although the region at the northern end of Pyramid Lake conceivably might contain limited quantities. N. P. Stark's (oral commun. 1972) comments in this regard is that any exploration in these units would be "highly speculative". He states he bases these conclusions on the fact that the sedimentary environment contains largely clastics and cherts, that both the rock units and other structures are mainly Pleistocene (early Quaternary) in age, and that if suitable traps had been created in all likelihood they have been broached.

The potential for geothermal energy resources is measurably greater than that for petroleum products. The areas delineated on the base-map overlays are largely after U. S. Geological Survey data modified, to a limited extent, by the authors. Basically, areas containing volcanic rocks are favorable; areas within volcanic terrane exhibiting manifestations of hydrothermal alteration are more so; and, areas containing hot springs have, of course, an even greater potential. Less obvious areas are those containing concealed intrusive rocks wherein probably the greatest potential of all exists for the development of significant sources of geothermal energy. Such areas would not exhibit any indications whatsoever at the surface which a non-earth scientist would associate with geothermal energy.

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