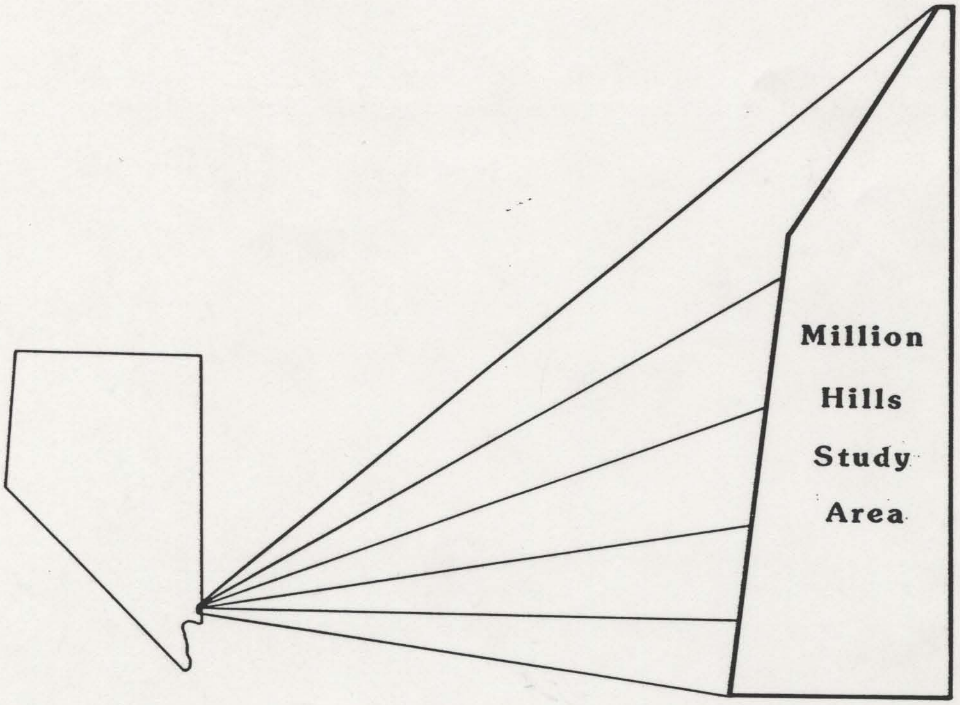
USBM MLA 34-88

MLA 34-88

Mineral Land Assessment/1988
Open File Report

Mineral Resources of the Million Hills Study Area, Clark County, Nevada



BUREAU OF MINES

UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL RESOURCES OF THE MILLION HILLS STUDY AREA, CLARK COUNTY, NEVADA

By
J. Douglas Causey

Western Field Operations Center
Spokane, WA

UNITED STATES DEPARTMENT OF INTERIOR
Donald P. Hodel, Secretary

BUREAU OF MINES
T S Ary, Director

PREFACE

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and U.S. Bureau of Mines to conduct mineral surveys on U.S. Bureau of Land Management administered land designated as Wilderness Study Areas ". . . to determine the mineral values, if any, that may be present . . . ." Results must be made available to the public and submitted to the President and the Congress. This report presents the results of a Bureau of Mines mineral survey of a portion of the Million Hills Wilderness Study Area (NV-050-233), Clark County, NV.

This open-file report will be summarized in a joint report published by the U.S. Geological Survey. The data were gathered and interpreted by Bureau of Mines personnel from Western Field Operations Center, East 360 Third Avenue, Spokane, WA 99202. The report has been edited by members of the Branch of Resource Evaluation at the field center and reviewed at the Division of Mineral Land Assessment, Washington, DC.

CONTENTS

ILLUSTRATIONS

UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

cps	count per second
ft	foot
in.	inch
mi	mile
oz	troy ounce
oz/ton	troy ounce per ton
ppb	part per billion
ppm	part per million
%	percent

SUMMARY

In 1987, at the request of the Bureau of Land Management, the U.S. Bureau of Mines studied a part of the 21,296-acre Million Hills Wilderness Study Area (NV-050-233) in order to evaluate its identified mineral resources. The study area is located in Clark County, NV, about 46 miles south of Mesquite, NV.

The area is on the east edge of the Gold Butte mining district and has had minor production of copper and zinc from the Azure Ridge mine in the early 1900's. Assessment work was being done on the Esperanta claims, which covers the mine workings, in March 1987.

Three properties were examined during this study, two in the study area and one near the southwestern corner. Two properties, the Esperanta claims and the Quartz claim have inferred subeconomic copper-lead-zinc-cobalt-gold-silver resources. The Azure Ridge (Bonelli) mine (Esperanta claim group) is on a mineralized fault containing copper, lead, and zinc, with minor gold, silver, and cobalt in Paleozoic-age dolomite. This fault, which trends approximately north, has scattered mineralized outcrops over about 5,000 feet of strike. However, the fault does not contain economic quantities of metals over much of this distance. The other claim in the area, the Quartz claim, is on alluvium. The claim overlies limited exposures of sinter, travertine, and massive aragonite containing metal-rich manganese encrustations which are on a projected extension of the Gold Butte fault. Of special significance is the presence of as much as 0.6 percent cobalt associated with the manganese. The cobalt grade is comparable to that found in the Blackbird mining district, Idaho, the nation's only primary cobalt deposit. The association is similar to Mississippi Valley-type deposits and should be subject to a detailed study. The third property examined consists of minor digging in an area containing no obvious mineralized rock.

Several Paleozoic carbonate formations are in the area. However, most of the rock is thin bedded, cherty, and dolomitized with thin interbeds of sandstone and shale. Carbonate rocks are classified as an occurrence.

Although much of the northern part of the study area is covered by alluvium, the sand and gravel are not economic resources. The alluvium has a caliche layer within a foot of the surface. The area is also remote from major roads and population centers. This limits the use for sand and gravel from this area because of it's sensitivity to transportation costs and results in it being classified as an occurrence.

No radioactive anomalies were found in the area. There are no known oil and gas reservoirs in the vicinity of the study area. However, there has been some interest by companies in leasing the land for oil and gas.

INTRODUCTION

This report describes the USBM (U.S. Bureau of Mines) portion of a cooperative study with the USGS (U.S. Geological Survey) to evaluate mineral resources and potential of part of the Million Hills WSA (Wilderness Study Area) at the request of the BLM (U.S. Bureau of Land Management). The USBM examines individual mines, prospects, claims, and mineralized zones, and evaluates identified mineral and energy resources. The USGS evaluates potential for undiscovered resources based on areal geological, geochemical, and geophysical surveys. Results of the investigations will be used to help determine the suitability of the study area for inclusion into the National Wilderness Preservation System. Although the immediate goal of this and other USBM mineral surveys is to provide data for the President, Congress, government agencies, and the public for land-use decisions, the long-term objective is to ensure the Nation has an adequate and dependable supply of minerals at a reasonable cost.

Setting

In 1987, the USBM studied 9,599 acres of the 21,296-acre Million Hills WSA, located in southeastern Nevada on the Arizona border. The study area is in Clark County, NV, about 46 mi south of Mesquite and is bordered on the east and south by the Lake Mead National Recreation area.

Access to the study area is from dirt roads through Garden Wash and also into New Spring Wash. A dirt road to the Azure Ridge mine is the only road that reaches the area (fig. 2). There is no road access to the east or south side of the area.

The terrain consists of rugged mountains with elevations ranging from about 1,770 to 3,946 ft. Vegetative covering is sparse consisting of grasses, cacti, and other succulants. The climate is hot and dry most of the year, with an occasional snowfall or rain during the winter months.

Previous Studies

A bibliography of geologic literature of Nevada was prepared by Gianella (1945). The geology and mineral resources of Clark County have been described by Longwell and others (1965). Bohannon (1978, 1979, 1984) did several geologic studies of the region. Several other geologic mapping and stratigraphic studies in the vicinity of the study area were also done (Bower and others, 1958; Volborth, 1967; Morgan, 1968; Longwell, 1974; and Brenner and Glanzman, 1979). Very brief discussions of the Gold Butte mining district are found in Lincoln (1923), Hill (1931), Hewett and others (1936), and Couch and Carpenter (1943). Yale (1906, 1907, 1908), Naramore and Yale (1909), and Naramore (1911) report that only exploration and development work were being done in the district between 1905 and 1909. Mention of production from the Gold Butte district is in Heikes (1913, 1914, 1916, 1917, 1919, 1921a, 1921b), but no production is mentioned for the Azure Ridge mine. However, Vanderburg (1937, p. 36) did report production in 1918 from the mine.

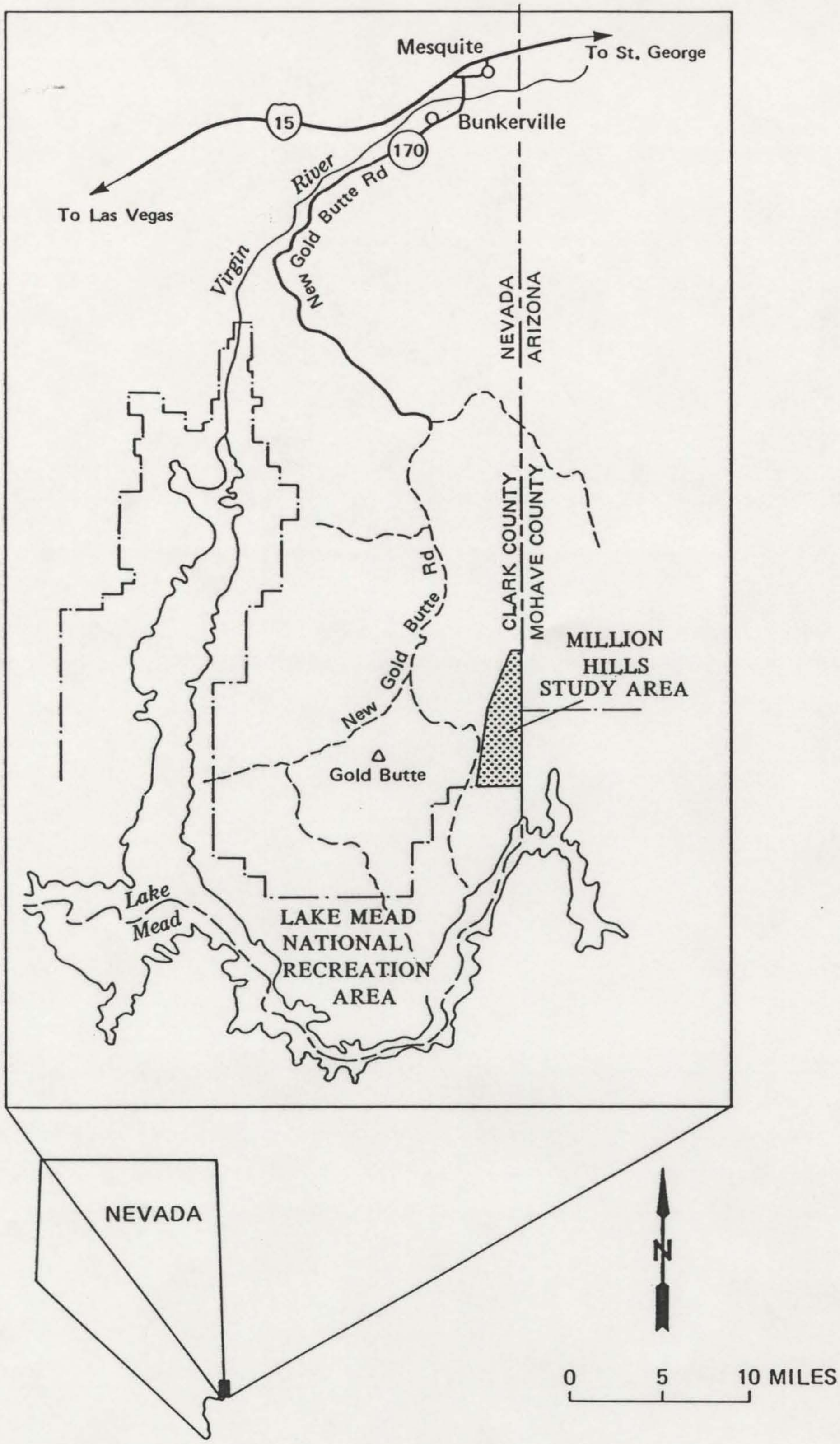


FIGURE 1.– Location of the Million Hills study area, Clark County, NV

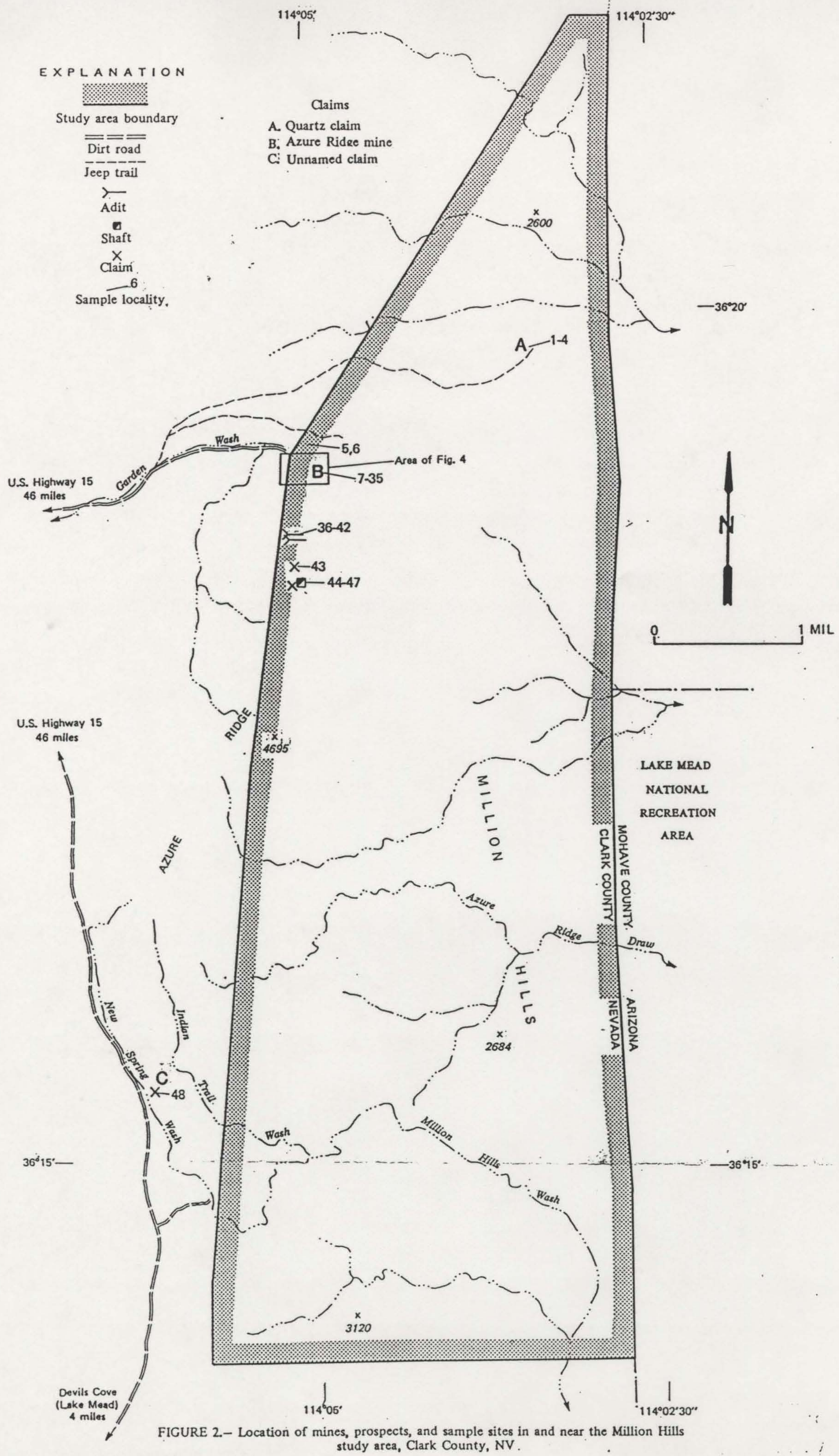


FIGURE 2.– Location of mines, prospects, and sample sites in and near the Million Hills study area, Clark County, NV.

Smith and Tingley (1983a, 1983b) reported the results of a sampling program which the Nevada Bureau of Mines and Geology undertook for the BLM that included rock samples taken from the study area. Great Basin GEM Joint Venture (1983) reported on a geology-energy-minerals study of several WSA's including Million Hills. Sandberg (1983) evaluated petroleum potential in wilderness lands of Nevada.

Present Study

The Bureau's mineral investigation of the study area included collection of information related to current and past mining activities. Library research included examination of USBM files and MILS (Mineral Industry Location System). Claim location data was taken from BLM mining claim recordation indices, BLM land status and use records, and Clark County claim records.

The field investigation, conducted during March 1987, required nine employee days. Forty-eight rock samples were collected (fig. 2). Rock samples were of three types: 1) chip - a regular series of rock chips taken in a continuous line across an exposure; 2) random chip - rock chips taken at random intervals over a given area of an apparently homogeneous exposure; 3) select - handpicked chips of the highest grade rock available collected from dumps or stockpiles.

Rock samples were crushed, pulverized, and split at WFOC (Western Field Operations Center). All samples were checked in the WFOC laboratory for radioactivity and fluorescence. The samples were then sent to a contract laboratory and assayed for gold using a combined fire assay-atomic absorption method with detection limits of 5 ppb gold. The samples were also analyzed for 32 additional elements 1/ using nitric acid/aqua regia digestion and ICP (Inductively Coupled Plasma) spectroscopy. All samples for which copper, lead, zinc, or manganese exceeded the upper detection limit for that method, were reanalyzed by atomic absorption spectroscopy. One sample was analyzed for thorium using neutron activation.

ACKNOWLEDGEMENTS

I would like to thank John Benham, geologist, and Bill Hale, Supervisory Physical Scientist, at WFOC for their assistance in the field.

1/ Aluminium, antimony, arsenic, barium, beryllium, bismuth, cadmium, calcium, chromium, cobalt, copper, gallium, iron, lanthanum, lead, magnesium, manganese, mercury, molybdenum, nickel, phosphorus, potassium, selenium, silver, sodium, strontium, titanium, thallium, tungsten, uranium, vanadium, and zinc.

GEOLOGIC SETTING

Basic geologic information on the area is extracted from Longwell and others (1965) and Bohannon (1978). This is supplemented with local observations of the author.

The study area is in the Basin and Range physiographic province. It is mainly underlain by Paleozoic sedimentary rocks, although the oldest rocks are Precambrian gneiss and schist (fig. 3). These are overlain by Cambrian dolomite, limestone, quartzite, sandstone, and shale. Overlying these rocks are the Devonian Muddy Peak Limestone, an unnamed Mississippian limestone, and the Mississippian- to Permian-age Callville Limestone. Some unnamed Permian red beds, the Kaibab Formation, and the Toroweap Formation constitute the rest of the Paleozoic section. The Paleozoic section is dominantly composed of dirty limestone and dolomite. The carbonates are mostly thin bedded, containing sand, silt, and chert. Thin interbeds of sandstone and shale are common throughout the section. The red beds generally are weak and weather to form topographic lows.

Unconformably overlying the Paleozoic rocks are Tertiary and Quaternary formations. The Tertiary Muddy Creek Formation, some unnamed basaltic volcanic rocks, and Quaternary deposits make up the rest of the rocks exposed in the study area. Small travertine occurrences including aragonite in a sinter occur in the Quaternary gravel which generally have a caliche layer near the surface.

The block of Paleozoic rocks, which makes up Azure Ridge and lower hills to the east, is tilted, dipping steeply to the east. Some movement has also occurred along bedding planes. Mineralizing fluids apparently utilized channels associated with the bedding plane faults. While the original ore minerals probably were sulfides, base-metal carbonate minerals constitute the bulk of the vein material seen in the workings. High-angle faulting has cut through these rocks in an easterly direction.

The Tertiary and Quaternary formations are essentially horizontal. There are no obvious faults in these rocks.

MINING HISTORY

The WSA is on the east edge of the Gold Butte mining district in the Southern Virgin Mountains.

> "The district is bounded on the west and south by Lake Mead; on the east by the Colorado River and the Nevada-Arizona State line; and on the north by an arbitrary east-west line through St. Thomas Gap" (Longwell and others, 1965, p. 126)

Mining activity began in 1873 with the discovery of mica about 3 mi west of the study area. Over 6 tons of sheet mica were produced before 1900. More recent industrial mineral interest has centered on a vermiculite occurrence near the mica mine. These minerals are in granitic rocks which are only exposed west of the study area.

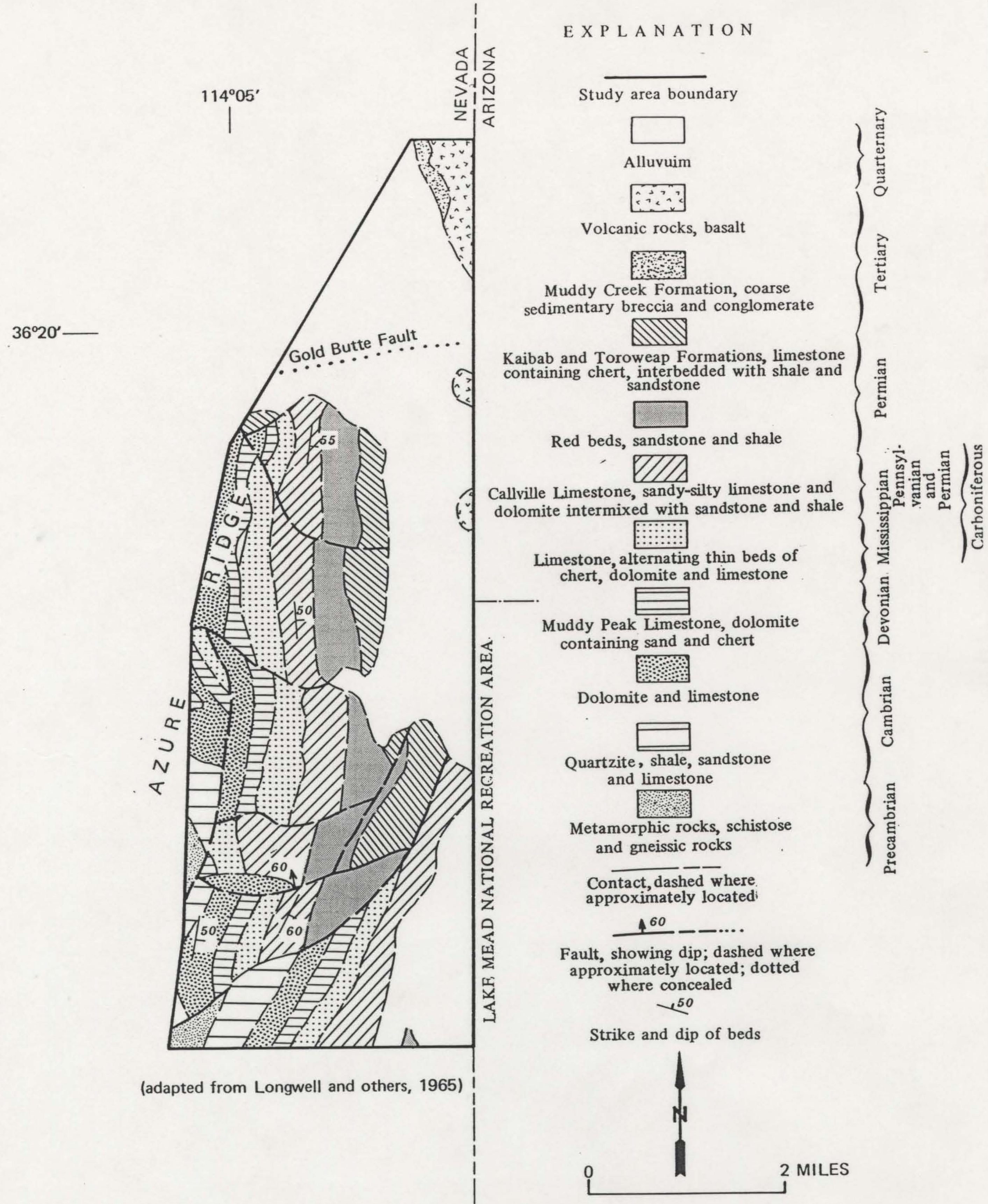


FIGURE 3.– Geologic map of the Million Hills study area, Clark County, NV

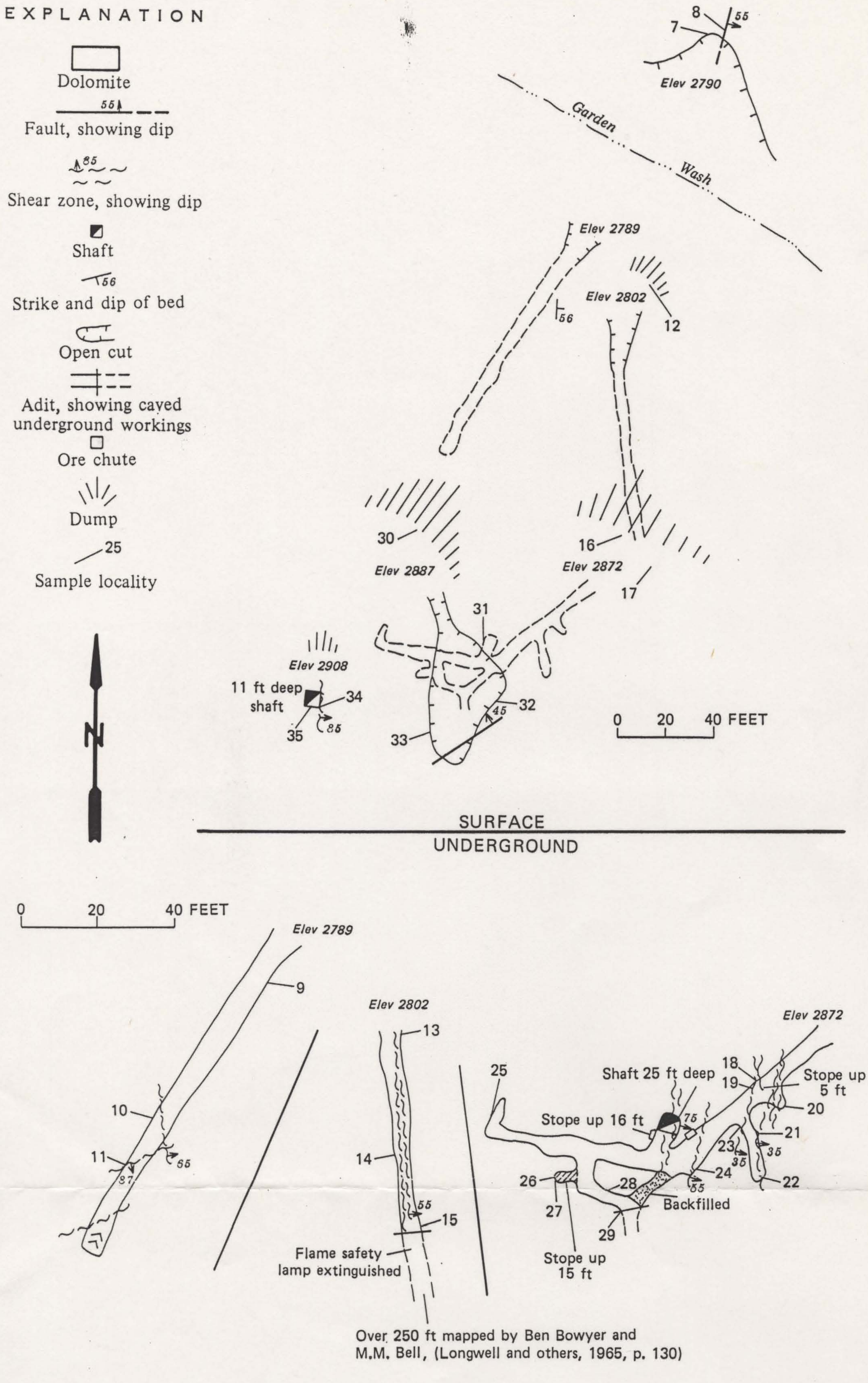


FIGURE 4.– Workings and sample sites at the Azure Ridge mine

In 1905, gold was discovered in metamorphic and granitic rocks west of the study area. In 1907, argentiferous copper and zinc ores were discovered in Paleozoic limestone, and a limited amount of mining occurred at three mines in the district. Total production of gold, silver, copper, and zinc ore from the three mines, one of which is in the study area, was less than $100,000 (Longwell, 1965, p. 126-128).

MINES, PROSPECTS, AND MINERALIZED AREAS

Three properties were examined in and near the Million Hills study area (fig. 2). The Azure Ridge mine and the Quartz claim are inside the area, while an unnamed claim is about 0.5 mi west of the boundary.

Azure Ridge (Bonelli) Mine

The Azure Ridge (Bonelli) mine (fig. 2, B) located at the northwest edge of the study area, and an associated group of workings extend south from Garden Wash about 1 mi. Access to the Azure Ridge mine is by a dirt road, that follows Garden Wash, from the Gold Butte Road. The area was located in 1934 as the Esperanta claims (nos. 1-4). These claims have been maintained to the present (1987) and are owned by Laura Gentry.

The only mention of production from this property is in Vanderburg (1937, p. 36). He stated that in 1918 two carloads of zinc ore averaging 40 percent zinc and one carload of copper ore averaging 35 percent copper were hand sorted and shipped from the mine. In Vanderburg's (1937) report mention is made of lead which the USBM assays show to be present in large amounts in some of the rock. Longwell and others (1965, p. 128) show that between 1912 and 1932 there was 10,206 lb of lead produced in the district although they do not mention which mine or mines produced it.

The main workings, situated mostly on the south side of the wash (fig. 4), include three adits (180+ ft, 60+ ft, and 97 ft long), two open cuts (one about 40 ft diameter and the other about 15 ft into a steep hillside), and an 11-ft-deep shaft. Other workings to the south on the Esperanta claims, which are as much as 1,100 ft higher in elevation than those in Garden Wash, include two short adits (15 and 25 ft long), and at least 10 small prospect pits ranging in size from 2 to 15 ft diameter.

The mine is in gray dolomite of probable Cambrian age situated nearby and south of the Gold Butte fault (Longwell and others, 1965). Bedding strikes nearly due north and dips 50° to 60° E. Mineralizing fluids appear to have been concentrated along a northerly trending bedding plane fault. Most of the ore mined was in lens-shaped bodies; the biggest one mined was about 40 ft by 40 ft by 4 ft thick. The fault zone along which these pods appear is as much as 9 ft thick in one exposure, although it commonly is only 1 to 2 ft thick in the workings. Minerals reported by Longwell and others (1965, p. 129-130) include malachite, azurite, smithsonite, aurichalcite, copper silicate, and limonite. Although not positively identified, realgar and chalcopyrite were suspected to constitute a few very minute mineral grains seen in the mineralized rock.

Forty-three samples were taken from this property (appendix, table A-1, nos. 5-47). While there are some rich copper-lead-zinc zones, they are not continuous or thick. The highest grade material found was collected from stockpiles on the dumps and probably represents rejects from a handsorting operation that mined pods of high-grade oxidized ore. Select samples contained as much as 8.99 percent copper, 33.0 percent lead, and 30.8 percent zinc.

While the original deposit was probably composed of base-metal sulfide minerals, the ore is now mostly carbonate minerals. Most of the mineralized rock is sooty, black, dense, iron-rich rock, commonly with some red hematite. Clayey, multi-colored gouge is commonly associated with the mineralized rock. Malachite is the generally observed copper-bearing mineral, although some aurichalcite is present. The main lead- and zinc-bearing minerals are probably cerrusite and smithsonite.

Exploration has occurred along the hillside south of the mine on a bedding plane fault with local outcrops coated with malachite and azurite. Cobalt found in brecciated dolomite was above expected normal distribution in sample numbers 36, 37, and 41 with 471 ppm, 238 ppm, and 179 ppm cobalt, respectively. Gold and silver occur sporadically throughout the zone with values as much as 3,300 ppb (0.096 oz/t) and 142 ppm (4.12 oz/t), respectively.

Quartz Claim

The Quartz claim (fig. 2, A) is located northeast of the Azure Ridge mine in an area covered by Quaternary alluvium. The area is accessed by an old road constructed by a bulldozer which connects to the Garden Wash road near the Azure Ridge mine. No information on ownership or previous exploration is available. The workings consist of three prospect pits and a 100-ft-long by 3-ft-wide by 3-ft-deep trench.

No bedrock is exposed on the claim. The alluvium mainly consists of pebbles and boulders of carbonate rocks in a sandy-silty matrix. A caliche horizon is near the surface.

In one of the workings, a manganiferous layer is on both upper and lower contacts with a massive aragonite cavity filling that is as much as 3 ft thick (fig. 5). Some siliceous sinter and travertine are also present. Below the aragonite are vertical veins of manganese-rich calcite-cemented breccia as much as 1 ft thick. The limited exposures make it difficult to determine all the relationships present, but it appears that metal-rich fluids rose through small channels in the alluvium and deposited the metals along contacts with calcareous rocks.

A probable projection of the Gold Butte fault underlies this claim. Although this fault is not exposed along much of its length, the offset is estimated to be 7 mi left-laterally (Anderson, 1973, p. 9). This fault is projected to extend from the study area west-southwest about 30 mi. It is unknown if the fault is exposed easterly from this area.

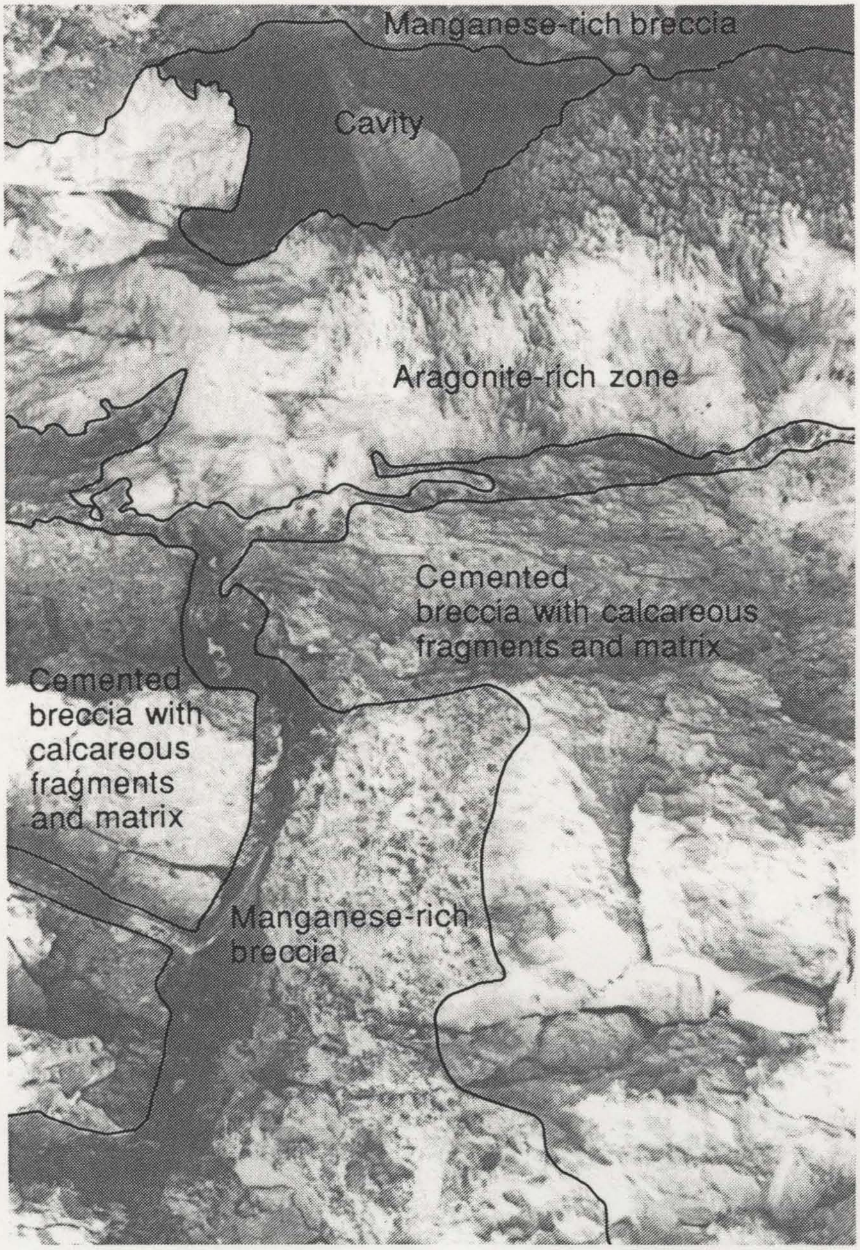


FIGURE 5. – Prospect pit on the Quartz claim showing aragonite layer and manganese-rich breccia

Four samples were taken on this claim (appendix, table A-1, nos. 1-4). Two of the samples were of the aragonite and did not have any elemental concentrations above those normally expected. However, two of the samples taken of the manganese-rich material, one from a small dump and one from a vertical vein, contained cobalt. Sample numbers 2 and 4 from manganese-rich bands within travertine contained 6,096 ppm (0.61 percent) and 1,329 ppm (0.13 percent) cobalt, respectively. Also associated with the manganese (as much as 9 percent Mn) are high concentrations of nickel (0.17 percent), lead (0.19 percent), zinc (0.37 percent), barium (0.49 percent), copper (0.05 percent), and molybdenum (0.01 percent). Also present are concentrations of thallium (30 and 80 ppm).

Unnamed Prospect

The unnamed prospect (fig. 2, C) did not have any distinctive characteristics with which to determine what element or mineral was of interest to whomever dug the workings. Slightly elevated scintillometer readings were encountered using a Geometrics Model 101 1/ scintillometer (75 to 120 cps), but no economic amounts of uranium or thorium were found in a sample of the rock (table A-1, no. 48, thorium content of 12 ppm).

Carbonate Rocks

A majority of the study area is underlain by Paleozoic carbonate units interbedded with sandstone and shale. The individual units are thin, commonly less than 2 ft thick and generally composed of dolomite, limestone, sandstone, and shale (fig. 6). The carbonate units are gray, usually containing sand and/or chert. The rocks are faulted, both across bedding and along bedding planes, and are intensely folded. The whole stratigraphic section has been tilted steeply to the east; dips are commonly 50^{o} to 60^{o} (fig. 3).

APPRAISAL OF MINERAL RESOURCES

The study area may contain many small high-grade copper-lead-zinc deposits along Azure Ridge on the Esperanta claims such as those reported mined (Vanderburg. 1937). Gold, silver, and cobalt are minor constituents, although they could have significant by-product value. Mining would require underground methods because the mineralized structure is narrow and steeply dipping. Because of the podlike nature of the mineralized structure and the lack of data as to the frequency, size, and distribution of the pods, no resource calculations were done. However, the mineralized rock is exposed over an area about 5,000 ft long by 1,100 ft high and is as much as 9 ft thick. The Esperanta claims are classified as containing an inferred subeconomic resource of copper-lead-zinc-gold-silver-cobalt.

1/ Names are used for descriptive purposes only and do not constitute a product endorsement by the U.S. Bureau of Mines.

FIGURE 6. -- Photograph showing typical thin bedded Paleozoic units present in study area

It would be necessary to define a large tonnage (probably greater than 1 million tons) before mining would reasonably be expected to occur on the Esperanta claims. However, the high grade ore reported by Vanderburg (1937, p. 36) would not be expected throughout the system since that material was handsorted from selected mining areas and mineralization did not appear continuous in outcrop or workings.

Because of the limited exposures, no resources could be quantified on the Quartz claim. However, the prospect probably overlies the Gold Butte fault. The information available shows that this property has many similarities to Upper Mississippi Valley-type deposits (Heyl, 1968 and 1982; Pratt, 1982). These similarities include the geologic association of faults, Cambrian dolomite and dirty limestone, aragonite, travertine, and sinter with manganese-rich encrustations containing unusually high amounts of cobalt, nickel, lead, zinc, barium, copper, molybdenum, and thallium. This property is classified as containing inferred subeconomic resources of cobalt-copper-lead-zinc.

Cobalt is of particular interest because it is a strategic mineral and is not being produced at U.S. mines. In 1987, the U.S. imported 86 percent of the cobalt used; the remainder was obtained by recycling. One of the last producers was a lead mine in Missouri where it was a by-product. Only in the Blackbird mining district, Idaho, is cobalt a primary commodity and the grade is 0.6 percent (Kirk, 1985, p. 3). All of the United State's cobalt resources (1.4 million tons) are considered subeconomic at the 1987 estimated price of $6.50/lb (U.S. Bureau of Mines, 1988, p. 41).

It is possible that mineralization at both the Azure Ridge mine and Quartz claim was a common event. While the Azure Ridge mine did not have as high concentrations of the elements as are found on the Quartz property, many of the high-grade samples showed enrichment in most of the same elements. This indicates a similarity between these properties. No large lead-zinc mines have been discovered in the region; however, exploration apparently has been limited to digging on surface exposures with little geophysical work and drilling.

Pelham (1988, p. 90) notes that lime sold for about $52 per ton FOB plant in 1987. Crushed limestone and dolomite suitable for most low end uses (e.g., cement, rip rap, filler, etc.) generally is worth less than $5 per ton. Because of the low value and high bulk of carbonate rocks, several criteria must be met before a mine could be developed. A deposit must be large -- over 20 years of reserves -- with thick, generally horizontal units, and a minimum of overburden. The carbonate unit should be continuous with little, if any, faulting. The physical and chemical properties should be uniform throughout, both vertically and horizontally in the deposit. Also rail or major water transportation facilities in close proximity to the deposit are highly desirable since they are the lowest cost hauling systems. The carbonate rocks in the study area are not considered resources because the above mentioned criteria are not met.

Indications of other mineral resources were not found in the study area. Sand and gravel, while widespread, is partly cemented with caliche. It is also remote from population centers and major transportation systems. It is not expected to be needed for road construction in the immediate vicinity and is not of a superior quality that would make it valuable for any other purpose. There is no indication of uranium or thorium in the vicinity. There are no oil or gas shows, but exploration has been too limited to draw any conclusions at this time. As of 1987, there was limited oil and gas leasing interest, mostly in the northern one-half of the study area.

REFERENCES

Anderson, R. E., 1973, Large-magnitude Late Tertiary strike-slip faulting north of Lake Mead, Nevada: U.S. Geological Survey Professional Paper 794, 18 p.

Bohannon, R. G., 1978, Preliminary geologic map of Las Vegas 1° x 2° quadrangle, Nevada, Arizona, and California: U.S. Geological Survey Open-File Report 78-670, scale 1:250,000.

_______, 1979, Strike-slip faults of the Lake Mead region of southern Nevada, in Armentrout, J. M., Cole, M. R., and TerBest, Harry, Jr., eds., Cenezoic paleogeography of the western United States: Pacific Coast Paleogeography Symposium 3, Pacific Section, Society of Economic Paleontologists and Mineralogists, Los Angeles, California, p. 129-139.

_______, 1984, Nonmarine sedimentary rocks of Tertiary age in the Lake Mead region, southeastern Nevada and northwestern Arizona: U.S. Geological Survey Professional Paper 1259, 72 p.

Bowyer, Ben, Pampeyan, E. H., and Longwell, C. R., 1958, Geologic map of Clark County, Nevada: U.S. Geological Survey Map MF-138, scale 1:200,000.

Brenner, E. F., and Glanzman, R. K., 1979, Tertiary sediments in the Lake Mead area, Nevada, in Newman, G. W. and Goode, H. D., eds., Basin and Range Symposium and Great Basin Field Conference: Rocky Mountain Association of Geologists, Denver, Colorado, p. 313-323.

Couch, B. F., and Carpenter, J. A., 1943, Nevada's metal and mineral production (1859 - 1940, inclusive): University of Nevada Bulletin, v. XXXVII, no. 4, 159 p.

Gianella, V. P., 1945, Bibliography of geologic literature of Nevada, in Geology and mining series no. 43: University of Nevada Bulletin v. 39, no. 6, p. 9-188.

Great Basin GEM Joint Venture, 1983, Lake Mead G-E-M resources area (GRA No. NV-35) technical report (WSA's NV 050-0231, 050-0233, 050-0235, 050-0236, and 050-0238): prepared for the Bureau of Land Management, Contract YA-553-RFP2-1054, 49 p.

Heikes, V. C., 1913, Nevada, in Mineral resources of the United States, calendar year 1912: U.S. Geological Survey, p. 773-818.

_______, 1914, Gold, silver, copper, lead, and zinc in Nevada in 1913, in Mineral resources of the United States, calendar year 1913, part I-metals: U.S. Geological Survey, p. 803-844.

Heikes, V. C., 1916, Gold, silver, copper, lead, and zinc in Nevada in 1914, _in_ Mineral resources of the United States, calendar year 1914, part I-metals: U.S. Geological Survey, p. 655-716.

_______, 1917, Gold, silver, copper, lead, and zinc in Nevada, _in_ Mineral resources of the United States, calendar year 1915, part I-metals: U.S. Geological Survey, p. 613-754.

_______, 1919, Gold, silver, copper, lead, and zinc in Nevada, _in_ Mineral resources of the United States, calendar year 1916, part I-metals: U.S. Geological Survey, p. 457-500.

_______, 1921a, Gold, silver, copper, lead, and zinc in Nevada, _in_ Mineral resources of the United States, 1917, part I-metals: U.S. Geological Survey, p. 253-298.

_______, 1921b, Gold, silver, copper, lead, and zinc in Nevada, _in_ Mineral resources of the United States, 1918, part I-metals: U.S. Geological Survey, p. 217-264.

Heyl, A. V., 1968, The Upper Mississippi Valley base-metal district, _in_ Ridge, J. D., ed., Ore deposits in the United States 1933/1967, v. 1: The American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., New York, p. 431-459.

_______, 1982, Mineral deposit occurrence model for the Viburnum Trend subregion of the Southeast Missouri base metal and barite district, _in_ Erickson, R. L., compiler, Characteristics of mineral deposit occurrences: U.S. Geological Survey Open-File Report 82-795, p. 158-171.

Hewett, D. F., Callaghan, Eugene, Moore, B. N., Nolan, T. B., Rubey, W. W., and Schaller, W. T., 1936, Mineral resources of the region around Boulder Dam: U.S. Geological Survey Bulletin 871, 197 p.

Hill, J. M., 1916, Notes on some mining districts in eastern Nevada: U.S. Geological Survey Bulletin 648, 214 p.

Kirk, W. S., 1985, Cobalt, _in_ Mineral facts and problems, 1985 edition: U.S. Bureau of Mines Bulletin 675, p. 171-183.

Lincoln, F. C., 1923, Mining districts and mineral resources of Nevada: Nevada Newsletter Publishing Company, Reno, Nevada, 295 p.

Longwell, C. R., 1974, Measure and date of movement on Las Vegas Valley shear zone, Clark County, Nevada: Geological Society of America Bulletin, v. 85, p. 985-990.

Longwell, C. R., Pampeyan, E. H., Bowyer, Ben, and Roberts, R. J., 1965, Geology and mineral deposits of Clark County, Nevada: Nevada Bureau of Mines, Bulletin 62, 218 p.

Morgan, 1968, Structure and stratigraphy of the northern part of the South Virgin Mountains, Clark County, Nevada: M. S. thesis, University of New Mexico, Albuquerque, New Mexico, 103 p.

Naramore, Chester, 1911, Nevada, in Mineral resources of the United States, calender year 1909, part I-metals: U.S. Geological Survey, p. 386-430.

Naramore, Chester, and Yale, C. G., 1909, Nevada, in Mineral resources of the United States, calender year 1908, part I-metallic products: U.S. Geological Survey, p. 462-506.

Pelham, Lawrence, 1988, Lime, in Mineral Commodity Summaries: U.S. Bureau of Mines, p. 90-91.

Pratt, W. P., 1982, A prospecting model for stratabound lead-zinc(-barite-fluorite) deposits ("Mississippi Valley-type" deposits), in Erickson, R. L., Characteristics of mineral deposit occurrences: U.S. Geological Survey Open-File Report 82-795, p. 155-157.

Sandberg, C. A., 1983, Petroleum potential of wilderness lands in Nevada, in Miller, B. M., ed., Petrolium potential of wilderness lands in the western United States: U.S. Geological Survey Circular 902-H, p. H1-H3.

Smith, P. L., and Tingley, J. V., 1983a, A mineral inventory of the Esmeralda-Stateline Resource Area, Las Vegas District, Nevada: Nevada Bureau of Mines and Geology Open-file Report 83-11, 176 p.

_______, 1983b, Results of geochemical sampling within Esmeralda-Stateline Resource area, Esmeralda, Clark, and southern Nye Counties, Nevada (portions of Death Valley, Goldfield, Kingman, Las Vegas, Mariposa and Tonopah 2^{o} sheets): Nevada Bureau of Mines and Geology Open-file Report 83-12, 176 p.

U.S. Bureau of Mines, 1988, Mineral Commodity Summaries: 193 p.

Volborth, Alex, 1962, Rapakivi-type granites in the Precambrian complex of Gold Butte, Clark County, Nevada: Geological Society of America Bulletin, vol. 73, p. 813-832.

Yale, C. G., 1906, Nevada, in Mineral resources of the United States, calender year 1905: U.S. Geological Survey, p. 259-275.

_______, 1907, Nevada, in Mineral resources of the United States, calender year 1906: U.S. Geological Survey, p. 287-300.

_______, 1908, Nevada, in Mineral resources of the United States, calender year 1907, part I-metallic products: U.S. Geological Survey, p. 337-398.

APPENDIX

TABLE A-1.--Analyses of samples from the Million Hills study area, Clark County, NV

[<, less than; >, more than]

Sample no.*	Au ppb	Al %	Ag ppm	As ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm
1	<5.	0.02	0.2	10.	100.	<0.5	4.	>15.00	<0.5
2	<5.	0.39	0.2	135.	4860.	<0.5	28.	>15.00	<0.5
3	<5.	0.09	0.2	10.	70.	<0.5	6.	>15.00	<0.5
4	<5.	0.10	0.2	50.	1540.	<0.5	10.	>15.00	<0.5
5	<5.	0.08	0.2	1265.	30.	0.5	6.	>15.00	3.0
6	<5.	0.06	0.2	290.	20.	<0.5	4.	>15.00	0.5
7	5.	0.45	0.2	<5.	10.	<0.5	<2.	>15.00	<0.5
8	<5.	0.29	0.2	<5.	<10.	<0.5	<2.	>15.00	<0.5
9	<5.	0.05	0.2	<5.	10.	<0.5	<2.	>15.00	2.5
10	<5.	0.09	0.2	10.	<10.	<0.5	<2.	>15.00	<0.5
11	<5.	0.07	0.2	<5.	<10.	<0.5	<2.	>15.00	<0.5
12	205.	0.38	42.0	655.	20.	<0.5	96.	1.08	>99.9
13	10.	1.34	0.2	5.	10.	0.5	<2.	11.07	5.5
14	<5.	0.31	0.2	5.	<10.	<0.5	<2.	>15.00	0.5
15	<5.	1.23	0.2	<5.	10.	0.5	<2.	8.70	0.5
16	40.	0.26	1.2	395.	50.	<0.5	<2.	0.48	76.0
17	5.	0.14	0.2	15.	<10.	<0.5	<2.	>15.00	>99.9
18	65.	2.15	4.2	200.	20.	<0.5	<2.	0.75	>99.9
19	60.	0.14	16.6	240.	30.	<0.5	<2.	0.11	>99.9
20	<5.	0.14	0.2	10.	<10.	<0.5	<2.	>15.00	>99.9
21	<5.	1.63	0.4	<5.	10.	0.5	<2.	11.54	>99.9
22	<5.	0.30	0.2	<5.	<10.	<0.5	<2.	>15.00	1.0
23	5.	0.57	0.2	5.	<10.	<0.5	<2.	14.64	10.0
24	5.	0.41	0.2	5.	<10.	<0.5	2.	12.84	>99.9
25	<5.	0.81	0.2	10.	<10.	<0.5	<2.	14.00	>99.9
26	30.	0.19	4.0	110.	10.	<0.5	2.	0.12	68.0
27	<5.	5.86	2.6	<5.	20.	<0.5	20.	0.27	>99.9
28	<5.	0.10	0.2	<5.	<10.	<0.5	<2.	>15.00	2.0
29	30.	0.18	1.8	40.	<10.	<0.5	<2.	>15.00	>99.9
30	135.	0.43	40.0	610.	10.	<0.5	22.	0.45	58.5
31	135.	0.37	7.6	690.	20.	<0.5	120.	0.86	>99.9
32	25.	0.09	0.2	80.	10.	<0.5	4.	>15.00	49.0
33	230.	0.42	142.0	585.	70.	<0.5	<2.	3.33	>99.9
34	50.	0.49	2.6	45.	30.	<0.5	<2.	0.32	51.5
35	5.	0.24	1.6	25.	<10.	<0.5	<2.	>15.00	>99.9
36	55.	0.20	0.2	220.	20.	<0.5	8.	12.73	2.0
37	50.	0.30	0.2	1300.	40.	<0.5	<2.	12.81	1.5
38	10.	0.03	0.2	300.	<10.	<0.5	<2.	>15.00	0.5
39	10.	0.28	0.2	85.	20.	<0.5	<2.	13.71	1.0
40	90.	0.21	0.2	70.	10.	<0.5	<2.	>15.00	0.5
41	3300.	0.64	0.2	1820.	<10.	<0.5	<2.	14.02	8.0
42	10.	0.19	0.2	15.	<10.	<0.5	<2.	>15.00	<0.5
43	<5.	0.04	0.2	15.	<10.	<0.5	<2.	>15.00	<0.5
44	240.	0.48	3.4	1425.	40.	<0.5	2.	2.38	3.5
45	35.	0.05	0.2	35.	<10.	<0.5	<2.	>15.00	0.5
46	30.	0.36	0.2	395.	30.	<0.5	<2.	0.83	7.0
47	40.	0.24	0.2	320.	30.	<0.5	4.	2.11	3.0
48	<5.	1.26	0.2	5.	150.	<0.5	2.	0.43	<0.5

TABLE A-1.--Analyses of samples from the Million Hills study area, Clark County, NV--Continued

Sample no.	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppm	K %	La ppm	Mg %	Mn ppm	Mo ppm
1	145.	5.	13.	0.05	<10.	<1.	0.01	<10.	0.07	1226.	1.
2	6096.	10.	546.	0.26	<10.	1.	0.27	<10.	0.84	9.07%	107.
3	42.	6.	7.	0.09	<10.	<1.	0.03	<10.	0.41	735.	7.
4	1329.	5.	210.	0.08	<10.	<1.	0.04	<10.	0.40	2.65%	29.
5	12.	18.	1.	7.10	<10.	<1.	0.02	<10.	0.28	102.	<1.
6	6.	4.	3.	2.28	<10.	<1.	0.01	<10.	0.12	130.	<1.
7	9.	7.	30.	0.40	<10.	<1.	0.28	<10.	7.70	110.	<1.
8	9.	10.	22.	0.34	<10.	<1.	0.18	<10.	9.02	122.	<1.
9	14.	4.	24.	0.21	<10.	<1.	0.02	<10.	9.79	183.	<1.
10	9.	5.	6.	0.12	<10.	<1.	0.04	<10.	9.81	68.	<1.
11	8.	6.	4.	0.12	<10.	<1.	0.03	<10.	9.34	56.	<1.
12	105.	113.	1.54%	>15.00	<10.	<1.	<0.01	10.	0.58	62.	53.
13	9.	18.	80.	0.98	<10.	<1.	0.87	<10.	6.10	86.	<1.
14	8.	12.	16.	0.28	<10.	<1.	0.20	<10.	9.58	84.	<1.
15	8.	18.	32.	0.77	<10.	<1.	0.78	<10.	5.00	68.	<1.
16	68.	<1.	2828.	>15.00	20.	<1.	0.02	<10.	0.27	16.	<1.
17	35.	8.	1.44%	0.72	<10.	<1.	0.02	<10.	8.76	154.	1.
18	102.	82.	8.99%	>15.00	<10.	1.	<0.01	<10.	1.21	96.	<1.
19	58.	<1.	3109.	>15.00	30.	18.	<0.01	<10.	0.13	5.	<1.
20	42.	6.	2.61%	0.41	<10.	<1.	0.02	<10.	8.24	145.	1.
21	31.	13.	356.	0.81	<10.	<1.	0.70	<10.	6.61	94.	<1.
22	9.	7.	38.	0.30	<10.	<1.	0.17	<10.	9.24	93.	<1.
23	8.	8.	57.	0.39	<10.	<1.	0.34	<10.	8.10	65.	<1.
24	36.	9.	1112.	0.26	<10.	<1.	0.02	<10.	7.02	125.	2.
25	11.	10.	104.	0.41	<10.	<1.	0.37	<10.	7.83	71.	<1.
26	58.	28.	447.	>15.00	30.	<1.	0.01	<10.	0.16	14.	5.
27	73.	11.	2604.	1.98	<10.	<1.	0.09	<10.	1.15	388.	3.
28	8.	6.	13.	0.15	<10.	<1.	0.05	<10.	9.47	86.	<1.
29	31.	20.	562.	2.32	<10.	<1.	0.05	<10.	8.52	206.	2.
30	59.	63.	2.66%	>15.00	10.	17.	0.04	<10.	0.18	15.	20.
31	103.	45.	2474.	>15.00	<10.	<1.	0.01	<10.	0.40	30.	52.
32	52.	8.	191.	3.64	<10.	<1.	0.02	<10.	8.16	234.	3.
33	25.	105.	8.19%	1.49	<10.	9.	0.01	<10.	1.85	81.	26.
34	52.	2.	579.	>15.00	<10.	<1.	0.15	<10.	0.33	8.	<1.
35	28.	19.	387.	2.13	<10.	<1.	0.04	<10.	7.79	147.	2.
36	471.	<1.	2284.	11.66	<10.	<1.	0.03	<10.	6.31	230.	<1.
37	119.	21.	2.30%	10.76	<10.	<1.	0.07	<10.	6.42	145.	1.
38	28.	6.	2854.	0.26	<10.	<1.	0.01	<10.	9.85	170.	1.
39	238.	32.	780.	5.64	<10.	<1.	0.10	<10.	7.46	698.	3.
40	74.	11.	442.	1.59	<10.	<1.	0.11	<10.	9.12	198.	<1.
41	179.	78.	5.77%	1.43	<10.	<1.	0.09	<10.	7.66	137.	5.
42	10.	6.	207.	0.16	<10.	<1.	0.11	<10.	9.77	136.	1.
43	9.	8.	10.	0.24	<10.	<1.	0.02	<10.	9.26	80.	<1.
44	118.	2.	1532.	>15.00	<10.	<1.	0.12	<10.	1.44	38.	23.
45	29.	15.	177.	2.23	<10.	<1.	0.01	<10.	9.63	114.	<1.
46	65.	15.	142.	>15.00	<10.	<1.	0.03	10.	0.40	75.	41.
47	44.	59.	126.	>15.00	<10.	<1.	0.02	<10.	0.77	80.	4.
48	10.	141.	49.	2.14	<10.	<1.	0.56	20.	0.48	245.	7.

TABLE A-1.--Analyses of samples from the Million Hills study area, Clark County, NV--Continued

Sample no.	Na %	Ni ppm	P ppm	Pb ppm	Sb ppm	Sr ppm	Ti %	Tl ppm	U ppm
1	0.02	40.	40.	56.	5.	3958.	<0.01	<10.	<10.
2	0.02	1698.	230.	1874.	<5.	504.	<0.01	80.	<10.
3	<0.01	13.	130.	156.	5.	144.	<0.01	<10.	<10.
4	0.01	465.	130.	1056.	5.	187.	<0.01	30.	<10.
5	0.02	4.	260.	50.	10.	135.	<0.01	<10.	<10.
6	0.01	1.	130.	10.	10.	147.	<0.01	<10.	<10.
7	0.01	5.	130.	12.	<5.	44.	<0.01	<10.	<10.
8	0.02	2.	40.	10.	<5.	49.	<0.01	<10.	<10.
9	0.01	3.	<10.	22.	<5.	38.	<0.01	<10.	<10.
10	0.02	1.	<10.	16.	<5.	74.	<0.01	<10.	<10.
11	0.02	2.	<10.	6.	<5.	64.	<0.01	<10.	<10.
12	<0.01	26.	260.	2.09%	145.	130.	0.01	<10.	30.
13	0.02	9.	260.	130.	<5.	41.	<0.01	<10.	<10.
14	0.03	1.	30.	28.	<5.	68.	<0.01	<10.	<10.
15	0.01	4.	270.	18.	<5.	33.	<0.01	<10.	<10.
16	0.02	5.	<10.	1824.	75.	55.	0.01	<10.	<10.
17	0.01	6.	10.	92.	<5.	44.	<0.01	<10.	<10.
18	0.02	21.	<10.	2596.	5.	35.	<0.01	<10.	40.
19	0.01	4.	<10.	5138.	45.	56.	0.01	<10.	<10.
20	0.01	8.	<10.	66.	<5.	41.	<0.01	<10.	10.
21	0.02	8.	200.	54.	<5.	75.	<0.01	<10.	<10.
22	0.03	<1.	30.	20.	<5.	85.	<0.01	<10.	<10.
23	0.02	3.	120.	26.	5.	74.	<0.01	<10.	<10.
24	0.01	6.	210.	198.	<5.	52.	<0.01	<10.	<10.
25	0.02	3.	140.	214.	<5.	77.	<0.01	<10.	<10.
26	<0.01	<1.	<10.	2.19%	15.	88.	0.02	<10.	10.
27	0.01	25.	370.	1196.	<5.	59.	<0.01	<10.	20.
28	0.02	1.	20.	12.	<5.	45.	<0.01	<10.	<10.
29	0.01	7.	200.	2702.	5.	84.	<0.01	<10.	<10.
30	0.03	16.	320.	4.01%	85.	443.	0.01	<10.	20.
31	<0.01	27.	350.	2.19%	130.	98.	0.01	<10.	20.
32	<0.01	9.	210.	478.	15.	56.	<0.01	<10.	<10.
33	<0.01	11.	480.	33.00%	<5.	1890.	<0.01	<10.	40.
34	<0.01	11.	110.	4732.	50.	119.	0.03	<10.	10.
35	0.01	10.	120.	1238.	<5.	50.	<0.01	<10.	<10.
36	0.04	141.	30.	74.	20.	93.	<0.01	<10.	<10.
37	0.03	27.	<10.	214.	15.	114.	<0.01	<10.	<10.
38	0.01	2.	<10.	56.	5.	22.	<0.01	<10.	<10.
39	0.01	34.	70.	26.	5.	65.	<0.01	<10.	<10.
40	0.01	9.	<10.	32.	5.	29.	<0.01	<10.	<10.
41	0.01	34.	<10.	674.	30.	226.	<0.01	<10.	<10.
42	0.02	2.	<10.	22.	<5.	42.	<0.01	<10.	<10.
43	0.02	3.	<10.	26.	<5.	53.	<0.01	<10.	<10.
44	0.15	58.	90.	278.	40.	92.	0.02	<10.	10.
45	0.02	20.	30.	44.	5.	21.	<0.01	<10.	<10.
46	0.06	17.	<10.	206.	20.	53.	0.02	<10.	<10.
47	0.01	21.	80.	132.	15.	69.	0.01	<10.	<10.
48	0.07	19.	290.	12.	<5.	20.	0.18	<10.	<10.

TABLE A-1.--Analyses of samples from the Million Hills study area, Clark County, NV--Continued

Sample no.	V ppm	W ppm	Zn ppm
1	1.	<5.	108.
2	97.	10.	3732.
3	5.	<5.	66.
4	32.	<5.	1292.
5	36.	55.	30.
6	11.	20.	26.
7	9.	<5.	40.
8	14.	<5.	32.
9	7.	<5.	210.
10	6.	<5.	50.
11	5.	<5.	48.
12	299.	130.	5.86%
13	21.	<5.	370.
14	8.	<5.	48.
15	16.	<5.	108.
16	170.	80.	8296.
17	23.	45.	4.40%
18	100.	125.	11.60%
19	276.	65.	7260.
20	24.	50.	5.38%
21	35.	25.	3.45%
22	8.	<5.	304.
23	14.	<5.	704.
24	49.	75.	14.80%
25	30.	5.	1.23%
26	202.	60.	5036.
27	18.	125.	30.80%
28	5.	<5.	244.
29	149.	20.	9696.
30	255.	165.	14.80%
31	245.	120.	4.39%
32	73.	20.	3116.
33	643.	130.	7.64%
34	65.	85.	9610.
35	48.	45.	5.02%
36	224.	60.	280.
37	433.	70.	252.
38	37.	5.	72.
39	203.	25.	136.
40	71.	10.	108.
41	459.	25.	3972.
42	12.	<5.	42.
43	7.	<5.	38.
44	659.	110.	180.
45	69.	10.	36.
46	757.	70.	268.
47	619.	60.	92.
48	75.	<5.	50.

* All samples had no detectable selenium (10 ppm detection limit) except sample no. 6 which had 10 ppm.

TABLE A-2.--Description of samples from the Million Hills study area, Clark County, NV.

(NA, not applicable)

Sample			
No.	Type	Length (ft)	Description
1	Chip	2.0	Nearly horizontal aragonite layer with minor manganese-rich encrustation on the bottom.
2	Select	NA	Manganese-rich fragments from dump.
3	Chip	2.0	Mixed aragonite and travertine. No manganese present in this working.
4	do	1.0	Manganese-rich band within travertine strikes N. 5^{0} E. with vertical dip. Sample from 100-ft-long by 3-ft-wide by 3-ft-deep trench.
5	Select	NA	Brecciated gray limestone with dark red silica-rich matrix.
6	Chip	0.25	Silicified, hematite-rich veinlet in limestone.
7	do	2.5	Dolomite with reddish-brown to ochre, limy gouge.
8	do	4.0	do.
9	do	2.0	Brecciated, silicified limestone with minor yellow iron oxides.
10	do	0.5	Calcite veinlet in limestone-dolomite.
11	do	2.0	Fractured gray to reddish-brown limestone.
12	Select	NA	Reddish-brown to black fragments from small stockpile containing malachite.
13	Chip	5.0	Fault gouge and dolomite fragments at portal. The fault strikes N. 5^{0} E. and dips 45^{0} SE.
14	do	1.8	do.
15	do	0.3	do.
16	Select	NA	Dark gray to charcoal black, sooty rock from stockpile.
17	do	NA	Malachite-azurite rich dolomite from stockpile.

TABLE A-2.--Description of samples from the Million Hills study area, Clark County, NV--Continued

Sample			
No.	Type	Length (ft)	Description
18	Chip	0.1	Malachite-azurite veinlet containing fine-grained realgar (?).
19	do	1.0	Charcoal-black sooty rock with hematite.
20	do	0.8	Vein of malachite, aurichalcite (?), and hematite strikes N. 65° W. and dips 30° SW.
21	do	0.7	Fault gouge and breccia fragments in zone striking N. 10° E. and dipping 35° NW.
22	do	2.0	Brecciated gray limestone.
23	do	3.0	Fault gouge with breccia fragments in zone that strikes N. 18° E. and dips 35° NW.
24	do	3.0	Fault gouge with breccia fragments in zone that strikes N. 5° E. and dips 55° SE.
25	do	12.0	Dolomite, slightly brecciated.
26	do	0.3	Green gouge in dolomite. Zone strikes N. 60° W. and dips 10° NE.
27	do	0.5	White gouge zone bordering black iron oxide.
28	do	0.3	Green gouge and dolomite fragments in shear zone striking N. 60° W., dipping 10° NE.
29	Random chip	NA	Yellow iron-oxide stained dolomite.
30	Select	NA	Dark gray to charcoal black massive iron-oxide rock from stockpile.
31	do	NA	do.
32	Chip	8.0	Dolomite coated with black iron-oxide.
33	Select	NA	Black iron-oxide and malachite from prospect pit.
34	Chip	2.0	Shear strikes N. 5° E, dips 85° SE. and contains white and green gouge, dolomite, and black iron-oxides.

TABLE A-2.--Description of samples from the Million Hills study area, Clark County, NV--Continued

Sample			
No.	Type	Length (ft)	Description
35	Chip	1.5	Dolomite coated with hematite and black iron-oxides.
36	do	6.0	Brecciated dolomite coated with hematite, black iron-oxides, and minor malachite.
37	do	6.0	Shear zone containing malachite, hematite, and black iron-oxides strikes N. 10° E., dips 65° SE. in dolomite.
38	do	6.0	Dolomite, bleached white with minor malachite-azurite and black iron-oxides.
39	do	8.0	Heavily hematite-coated dolomite with minor malachite strikes N. 15° W. and dips 75° NE.
40	do	3.0	Minor malachite in hematitic zone within dolomite The mineral-bearing zone is pod-like, about 4 ft by 6 ft and unknown depth.
41	do	1.3	Malachite and hematite coating brecciated dolomite in zone as much as 6 ft thick.
42	do	1.25	Green and pink gouge, brecciated dolomite, and malachite.
43	do	3.0	Dolomite with minor hematite coating.
44	do	5.0	Yellow and black iron-oxides and hematite within a pod in dolomite.
45	do	2.0	Hematite coated dolomite.
46	do	6.0	Vein striking N. 45° E. and dipping 45° SE contains massive black iron-oxide, hematite, and minor yellow iron-oxide.
47	do	9.0	Vein striking N. 70° E. and dipping is 45° NW. contains massive black iron-oxide, hematite, and minor yellow iron-oxide.
48	Random chip	NA	Gneiss with schistose layers, locally contains garnet; granitic layers or granite injections along foliation are present.